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National Conference on

Advancements in Electronics and Computer Applications (NCAECA - 2016)

4th - 5th February 2016

Organised by :
Department of Electronics & Department of Computer Science
Shaheed Rajguru College of Applied Sciences for Women
(University of Delhi)
Vasundhara Enclave, Delhi - 110096

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UGC and DeitY Sponsored

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Foreword by Patron

It's a matter of great pride and honor that Shaheed Rajguru College of Applied Sciences for Women is hosting the UGC and DeitY sponsored national conference on "**Advancements in Electronics and Computer Applications**" on 4th and 5th February, 2016. This conference is a unique opportunity for students to interact directly with the people from the academic and industry world and also to gather information about what is on the frontiers of all time changing technology. Conferences like this play an imperative role in apprising the students to the latest developments in technology.

The papers contributed for the conference are from the vast field of Electronics and Computer Science. Embedded Systems, Digital Communication, Control Systems, Signal Processing, Semiconductor Devices, Optical Computing and Storage, Big Data, Database System Optimization, Internet Security, Android Applications, Software Engineering, Artificial Intelligence, Data Mining, Parallel Computation, Digital Image Processing and Application Design are the topics touched in this conference.

The whole teams of our teachers and students have given hours of hard work and dedication so that nothing hampers the spirits of the young researchers who would present their papers in the conference. The conference will be graced by the presence of honorable chief guest**, Professor Mushahid Husain, Vice chancellor of M.J.P. Rohilkhand University, Bareilly.**

I commend the students and staff of Department of Electronics and Department of Computer Science for their dedicated efforts and wish all the best for a successful, insightful and engaging in NCAECA 2016.

Dr. Payal Mago
Principal

Foreword by Editors

It is our immense pleasure to welcome you to the National Conference on Advancements in Electronics and Computers Applications (NCAECA-2016). The prime agenda of this two day national conference is to provide an enriched platform to research scholars, academician, industry professionals as well as students at undergraduate and postgraduate level. This Conference will prove to be a knowledge hub for all its attendees to discuss the technological advancements, recent innovations and challenging attributes in various existing and emerging fields of Electronics, Computer Science and Information Technology.

We express our heartfelt gratitude to our Principal Dr. Payal Mago for giving her constant support and motivation in conceptualization, planning, implementation and execution of the conference. Our sincere thanks to the advisory committee members for guiding and directing us to move in the right direction for the progress of the conference. We extend our sincere thanks to Dr. Manoj Saxena, Dr. Punam Bedi and Prof. P. K. Bhatnagar for providing their unstinting support during all phases of the conference.

We would sincerely thank all the authors for their contributions for this conference. We also acknowledge the contributions of technical program committee for their efforts and support in selecting papers and laying up the technical programme.

A special mention to our honourable chief guest, Professor Mushahid Husain, Vice Chancellor of M.J.P. Rohilkhand University, Bareilly to deliver the inaugural address for the conference. Our distinctive appreciation to all our invited speakers who shall share their wisdom with all the participants.

Extending our chain of gratitude to our sponsors University Grants Commission (UGC) and Department of Electronics and Information Technology (DeitY) and NTPC for providing financial assistance for the conference.

Organising this conference would not be a reality without invariable and persistent support of our organising committee. Our team has done tremendous efforts to make this a success. We will be failing in our duties if we do not mention the significant contributions of Ms. Akanksha Dhingra for rendering unending assistance. Last but not the least we thank the remarkable efforts made by enthusiastic student volunteers.

Venika Gupta
Editor, NCAECA – 2016
Convenor

Deepali Bajaj
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National Conference on Advancements in Electronics and Computer Applications
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Flash ADC Design Employing FVF Based Current Comparator

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Abstract

A low voltage, low power, high performance analog to digital conversion (ADC) technique is presented. The structure comprises of a novel Flipped Voltage Follower (FVF) based current mode comparator design, followed by a high speed transmission gate encoder stage that employs thermometer code (TC) to binary code (BC) conversion logic. The novel current comparator uses FVF technique for the design of high-performance low-power/low voltage analog and mixed-signal circuits. Simulated in 0.18 µm mixed signal CMOS technology with 1.8 V supply voltage, the ADC consumes 400 µW. The 2-bit adaptation exemplified herein can be straightforwardly extended up to n-bits..

1. Introduction

VLSI technology is being widely harnessed for various applications covering analog, digital and mixed signal electronics. The central factors that fuel the research in VLSI technology can be summarized as increased functionality, higher reliability, small footprint, very low power consumption, increased speed of operation and low cost. To realize this, the current trend is to reduce the entire system design to a single chip solution called as system on chip (SoC), which has gained impetus in recent years. ADC is a key functional block in SoC applications which limits the performance and speed of the system. Nowadays, various ADCs have been developed for different applications, for instance successive-approximation ADC, cyclic ADC, interpolating ADC, folding ADC and so on. However, to attain high speeds, flash ADCs are most preferred. Flash architecture, illustrated in Figure 1, employs 2^{n-1} comparators for achieving an n-bit conversion.

This paper puts forth a design for low-power Flash ADC using current-mode circuit techniques [1]-[3]. This improves the sampling rate by reducing the time required for the voltage to settle on both the circuit capacitors and the parasitic capacitors at the various circuit nodes [4]. By using current instead of voltage to represent signal, one can exploit the inherent nonlinear *I- V* relationship of most active devices to reduce the required voltage swing for a given signal range.

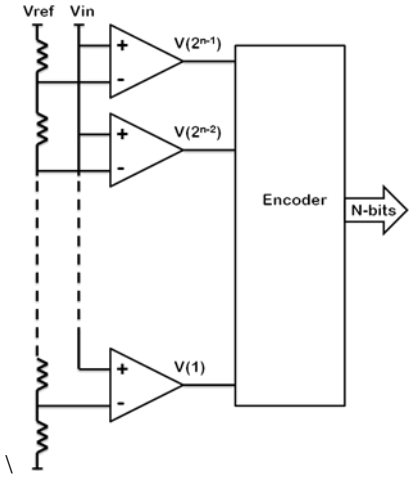


Figure 1 N-bit Flash ADC

Furthermore, the circuit implemented in current mode technique occupies small area, consumes less power dissipation and achieves high operation speed. Consequently this methodology has received mounting interest from researchers in the past decades [5]-[9].

2. Current comparator design

Current comparators are important building blocks within many analogue circuit designs, particularly for front-end signal processing applications [10]-[11]. With the quest for ever shrinking feature size of devices and call for high speed, designers are opting for current-mode implementations. The stimulus is lower power consumption and supply voltages as compared to its conventional voltage- mode counterpart [12]. The first high-speed, low input impedance current comparator was reported by Traff in 1992 [13]. Our work involves implementation of a novel current comparator with [13] as reference, trouncing its limitations.

2.1 Review of Traff's [13] comparator

This current comparator uses a source-follower (M1 and M2) as the input stage and a CMOS inverter (M3 and M4) providing a positive feedback to achieve sufficient gain for amplifying small voltage variations at the input stage node. This enables lower input resistance and shorter response time as compared with original current comparator based on current mirrors. One disadvantage of the approach concerns the input voltage to the positive feedback inverter. It does not slew from rail to rail, making neither M3 nor M4 totally shutoff. Thereby a quiescent current will flow, giving rise to a nonzero DC power dissipation. For the dynamic response of small input current, there exists a dead band region temporarily in which the two input transistors (*M*1 and *M*2) are both turned off and at this time the input resistance is high. So with the decrease of the input current, the dynamic response time of this current comparator will be dramatically increased.

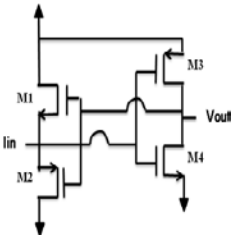


Figure 2 Traff Current Comparator

2.2 FVF based current comparator architecture

In order to accomplish both requirements of producing circuit designs with very low power consumption and with very low voltage supply, the industry is being coerced into developing new procedures for the same, in addition to, preventing oxide breakdown with decreasing gate-oxide thickness.

The most general expression of the threshold voltage V_T for MOSFETs can be written as follows:

$$V_T = V_{TO} + \gamma(\sqrt{|V_{SB} + 2\Phi_F|} - \sqrt{|2\Phi_F|}) \quad (1)$$

Where V_{TO} is threshold voltage at zero substrate bias, V_{SB} is source-to-substrate voltage, φ_F is Fermi potential.

And the substrate-bias (body-effect) coefficient is given by:

$$\gamma = (t_{ox}/\varepsilon_{ox})\sqrt{2q\varepsilon_{si}N_A} \quad (2)$$

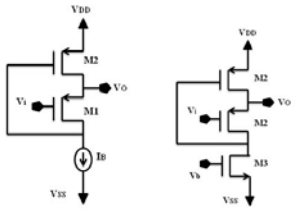
Wherein, t_{ox} is oxide thickness, ε_{ox} is permittivity of oxide layer; q is charge, ε_{Si} is permittivity of Silicon and N_A is acceptor concentration.

Equation (1) can be used both for n-channel and p-channel MOS transistors [11]. In order to decrease V_T, t_{ox} has to be decreased which can cause oxide breakdown after a certain limit. This limits the decrease in threshold voltage.

Several techniques have been proposed to reduce supply voltage requirements in analog and mixed-signals circuits [14]-[17]. The design demonstrated in this paper is one such technique. This paper employs a cell called Flipped Voltage Follower (FVF) which is a voltage follower circuit with shunt feedback, as can be seen in Figure 3. Application of the feedback extracts the complete circuit from saturation state to the active state. Thus it works independently of the supply voltage. Further, due to current biasing the current through transistor M1 is held constant. Thus change in output current does not affect the input current and V_{SG1} (which is a function of input current) remains almost constant across M1. This results in almost unity voltage gain or in other words output voltage follows input voltage. Unlike the conventional voltage follower, the circuit in Figure 3(a) is able to source a large amount of current, but its sinking capability is limited by the biasing current source I_B, the large sourcing capability is due to the low impedance at the output node

$$r_0 = 1/(g_{m1}g_{m2}r_{01}) \quad (3)$$

where g_{mi} and r_{0i} are the trans conductance and output resistance, respectively. This value is in the order of 20-100 Ω.



(a) (b)

Figure 3 (a) FVF using current bias **(b)** FVF using voltage bias [18]

The current comparator in [19] replaces the input stage in [13] by a FVF Source follower cell, as shown in Figure 4.The transistor pair MP2-MN1 ensures the transfer of smallest variation in the current input to the output stage. The novel structure employs two inverter stages at the output, for amplification purpose to obtain a complete rail-to-rail output swing. It works on single supply of 1.8V, exhibiting

low area product and a relatively small area occupation.

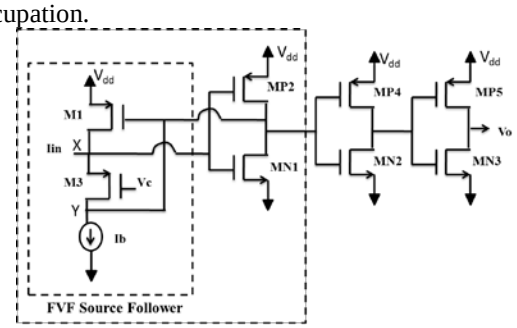


Figure 4 Proposed FVF based Current Comparator

The small signal analysis of the open loop gain model of the FVF based current comparator structure (Figure. 4) can be evaluated by grounding all the dc biases and eliminating the feedback loops. As a result, the impact of the cascaded CMOS inverter stages at the input stage can be neglected. The resistances at nodes X and Y are determined using following equations:

$$Iy = \frac{Vy - V_{SS}}{r_{OS}} + g_{m3}V_{GS3} + \frac{Vy}{r_b} \quad (4)$$

$$\frac{Vy - V_{SS}}{r_{OS}} + g_{m3}V_{GS3} = \frac{V_{SS}}{r_{o1}} + g_{m1}V_{GS1} \quad (5)$$

Also, $V_{GS1} = V_{G1} - V_{S1} = 0$

and $V_{GS3} = V_{G3} - V_{S3} = -V_{S3}$ (6)

From eq. (3), (4) and (5)

$Ry = rb||(r_{o1} + r_{o3} + g_{m3}r_{o1}r_{o3})$

Using approx. $g_{m3}r_{o3} >> 1$

And $g_{m3}r_{o1} >> 1$

$Ry = rb||g_{m3}r_{o1}r_{o3}$

Similarly, $Rx = r_{o2}\ (1 + {}^{r_b}/_{r_{o1}})/g_{m1}$

Where g_{m1} and g_{m3} are the transconductances of transistor M1 and M3 respectively, r_{o1} and r_{o3} are the output resistances of M1 and M3 respectively and r_b is the resistance of current bias I_b. Thus, the resistances at input nodes X and Y calculated are of very low value.

The superior performance of the novel comparator structure is avowed in Table 1 as compared to [13].

Table 1 Performance Comparison Of Current Comparators

Current comparator	**Traff [13]**	**Proposed FVF based comparator [19]**
Transistor count	4	6
Propagation delay (ns*)	9	2.4^
Power supply (V**)	5	1.8
Output swing (V**)	0.725	1.8
Area product	36	14.4

* ns is nanoseconds ** V is volts ^ maximum possible delay for comparator

3. Proposed Flash ADC

Flash ADCs that convert the analog input to a binary output, broadly encompass a single stage of 2^{n-1} parallel comparators, where 'n' is the number of bits in the output, followed by a digital encoder.

In the proposed current-mode approach, the comparator performs the comparison of input current with a reference current, to produce a logical voltage output depending on the outcome of the comparison, as discussed in the previous section. The output pattern of 2^{n-1} bits from this stage corresponds to thermometer code, which is subsequently translated to binary code by the digital encoder, i.e. the TC to BC encoder. The block diagram of 2-bit data conversion for the same is illustrated in Figure 5.

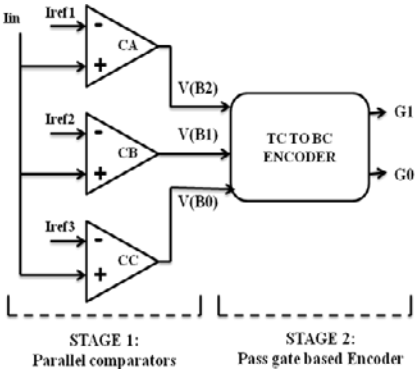


Figure 5 Block Diagram Of Proposed ADC

A. STAGE 1

For a comparator with input current in the range Imin-Imax, step size is calculated as follows:

$$Step = \frac{I_{max} - I_{min}}{2^n - 1} \quad (10)$$

The reference currents are given as:

$$I_{refn} = Step * i \quad (11)$$

where i= 1, 2,…….2^{n-1} is the bit number. Thus, for 2-bit ADC, $2^{n-1} = 3$, so we will have 3 values of reference current viz.

(12)

The relationship between the input and output of Stage 1 can be observed as:

Vout=1.8V, Iin > Irefi

0V, Iin < Irefi (13)

Where i=1, 2, 3 for 2-bit conversion

B. STAGE 2

The encoder design is based on the following relations:

$$G0 = B0 \oplus B1 \oplus B2 \quad (14)$$

$$G1 = B1 \quad (15)$$

Table 2 shows the truth table for the same.

Table 2. Truth Table For 3X2 Encoder

Input			Output	
B2	B1	B0	G1	G0
0	0	1	0	1
0	1	1	1	0
1	1	1	1	1

Encoder employs CMOS transmission (pass) gates instead of NMOS gates to form XOR gate as illustrated in Figure 6. The main advantage of the former is that it allows the input signal to be transmitted to the output without the threshold voltage attenuation. Minimum feature size PMOS (0.18 µm/0.18 µm) and NMOS (0.18 µm/0.18 µm) transistors are used for digital logic. Since each XOR gate consists of only six pass gates, there is a reduction in the transistor count as well as size, thereby, shrinking the chip area.

$$I_{ref1} = Step$$
$$I_{ref2} = Step * 2$$
$$I_{ref3} = Step * 3$$

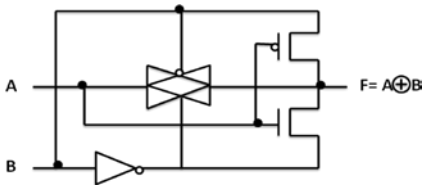


Figure 6 XOR Gate Design

4. Simulation Results

The proposed circuits have been simulated using PSpice for 0.18 µm technology. The reference current values for the three comparators have been set as follows:

Iref1=15µA (comparator CC)
Iref2=30µA (comparator CB)
Iref3=45µA (comparator CA)

The delay Vs current graph for the comparators is plotted below in Figure 7. The graphs attest the low delay performance of the three comparators.

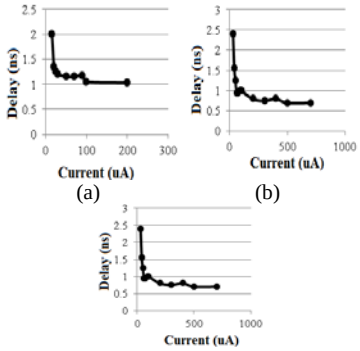


Figure 7 Delay Vs Current Plot for (a) Iref=15µA (b) Iref=30 µA (c) Iref=45 µA

The working of the ADC will be substantiated by taking three diverse input currents and exhibiting the simulation results. The following segment demonstrates the functioning of the comprehensive design by furnishing the input current, Iin and the response of encoder output bits G1 and G0 in Figure 8. It can be seen that the ADC delay essentially varies with the comparator delay.

CASE1: Iin=60µA

V (B2) =1.8V, Iin > Iref1
V (B1) =1.8V, Iin > Iref2
V (B0) =1.8V, Iin > Iref3
Delay: 1.3ns*

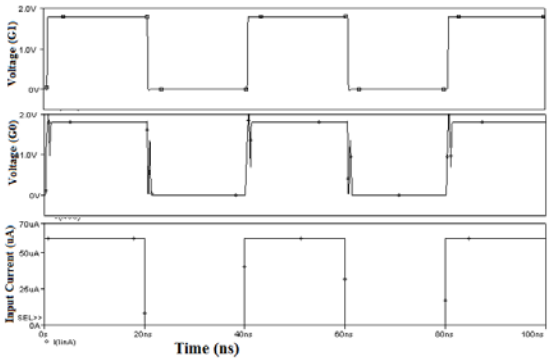


Figure 8(a) Iin=60µA

CASE2: Iin=35µA
V (B2) =0V, Iin < Iref1
V (B1) =1.8V, Iin > Iref2
V (B0) =1.8V, Iin > Iref3
Delay: 1.6ns*

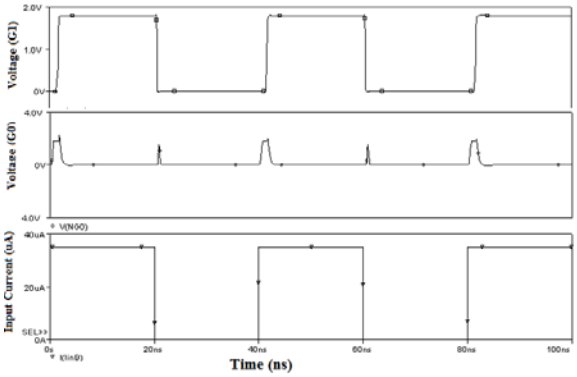


Figure 8(b) Iin=35µA

CASE3: Iin=25µA
V (B2) =0V, Iin < Iref1
V (B1) =0V, Iin < Iref2
V (B0) =1.8V, Iin > Iref3
Delay: 1.07ns*

* Maximum possible delay experienced by respective comparators

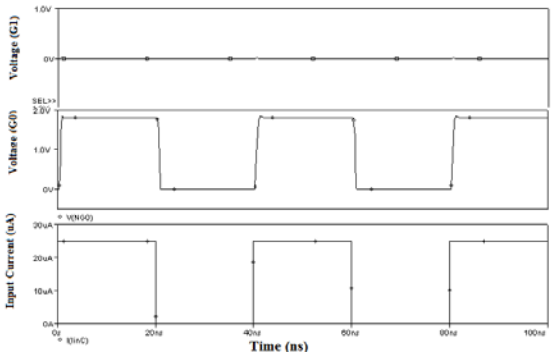


Figure 8(c): Iin=25µA

5. Conclusion

A consummate Flipped Voltage Follower based analog to digital converter has been effectively designed.

The low propagation delay verifies its fast conversion rate with a reduction in hardware attributable to the use of CMOS pass gates in encoder design. As the reference current value increases, the comparator experiences lower delay. The 2-bit converter is constructed in a manner that can be effortlessly expanded as the application demands. This bubble free structure simulated at 0.18µm using PSpice, 1.8V dissipates a modest power of 400µW.

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IIR Digital Low Pass Filter Design and Research and Simulation Result on SCILAB

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Abstract

"Filter" at first glance almost defines itself, which means pulling out the required information from a mixture. And when we tend to define it in technological term, filtering a signal means sifting out our data or removing the unwanted and noise signals. This paper deals with the designing of Infinite Impulse Response (IIR) Low Pass Digital Filter [1][2]. Low Pass filter is a device which passes frequencies lower than certain cut-off frequency and rejects frequencies higher than the cut-off. SCILAB is an open source software dealing with numerical computations and providing an environment for engineering and scientific application. It also provides different options for digital filter design both in Finite Impulse response (FIR) and Infinite Impulse Response (IIR). In this paper elliptical filter is designed and analysed for different filter parameters [3]. Limitations to order of filter and sampling rate are the results on the design of IIR filter.

1. Introduction

A circuit that passes a certain set of frequencies through it and attenuates or blockother frequencies is known as filter. For modern communication system digital filters are important in DSP, as compared to analog filters, they are desired in various applications such as data compression, speech processing and image processing [4]. Digital filters are essentially used to transform the characteristic of signals in time and frequency domain and have been recognized as primary digital signal processing [5]. Filtering is a basic phenomenon of signal processing which executes on the frequency band, removes undesirable part known as noise or extract some useful components. The designing of IIR digital filters include process of designing filter in analog domain and then converting back to digital domain. The system of analog function may be defined as:

$$H_a(s)=\frac{\sum_{k=0}^{M} b_k s^k}{\sum_{k=0}^{n} a_k s^k}$$

And also it can be defined by linear constant – coefficient differential equation:

$$\sum_{k=0}^{n} a_k \frac{d^k y(t)}{dt^k} = \sum_{k=0}^{n} b_k \frac{d^k x(t)}{dt}$$

where x(t) is the input signal and y(t) is output of the designed filter.

The type of impulse response of the system categorizes the digital filter as Finite-duration impulse response (FIR) filters or Infinite-duration impulse pulse response (IIR) filters.

2. Types of Digital Filter

In FIR system (non-recursive) the response is of finite duration i.e. it has finite non zero sequences. Such system

extract linear phase, are always stable, design methods are linear and efficiently realised in hardware.IIR system (recursive) has infinite number of non-zero sequence i.e. response sequence is of infinite duration. An IIR filter is preferred where some phase distortion is acceptable.[4]
Digital filters are mainly of four type. They are Butterworth, Chebyshev I, Chebyshev II and Elliptical or Cauer. This paper emphasises on the designing oflow pass filter in Elliptical form. Elliptical filter is also known as Cauer filter. It has equiripple pass and stop band. Moreover it has minimum transition bandwidth.[3][4]

3. IIR filter design

A. IIR filter design by Approximation of derivatives
An analog filter is converted into digital filter by approximating the differential equation by an equivalent difference equation. The equation after substitution of difference equation in derivative dy(t)/dt at time t=nT is given as:

$$\frac{dy(t)}{dx}|t = nT = \frac{y(nT) - y(nT - T)}{T} = \frac{y(n) - y(n-1)}{T}$$

Where T is the sampling interval.

B. IIR filter design by impulse invariant method
By uniformly sampling the impulse the desired response of digital filter is obtained by sampling the equivalent Analog filter's impulse response given by

$h(n) = h_a(nT)$

Considering a simple distinct pole case the Analog filter system can be defined as:

$$H_a(S) = \sum_{i=1}^{m} \frac{A_i}{S - P_i}$$

By uniformly sampling the impulse response h(n) of the equivalent digital filter is given as:

$$h(n) = h_a(nT) = \sum_{i=1}^{m} (A_i e^{P_i nt} u_a(nT))$$

By taking the Z transform the digital system response is:

$$H(z) = \sum_{n=0}^{\infty} h(n) z^{-n}$$

C. IIR filter design by transformation
The above two mentioned methods are applied to the designing of filter with low frequencies. For high frequencies are designed by method of transformations.

4. Low pass filter

Low pass filters is defined as a circuit that passes low frequencies and attenuates or stop high frequencies.
Magnitude of a low pass filter is given by the transfer function.

$$|H(j\Omega)|^2 = \frac{1}{1 + \varepsilon^2 U_N(\Omega/\Omega_c)}$$

Where $U_N(X)$ is the jacobian elliptic function of order N and ε is a constant related to the passband ripple.

5. Requirements to design the filter

The design procedure is as follows:

1. To determine the filter performance requirements;
2. By the operation to realize the filtering system designed;
3. By simulating the system to meet the given technical requirements.

Since the IIR filter response is for unlimited duration, filter is realized by using a recursive structure, known as recursive filter. Impulse response, a method for converting simulated filter to digital filter.

6. Design of IIR filter using SCILAB

With impulse response method a digital IIR low-pass filter is designed, with the design specification as:
Cut-off frequency or the central frequency,Fc = 3000Hz
Sampling frequency, Fs = 15000 Hz
Normalised frequency is 0.3
Order of the filter, n = 2
Peak deviation, δ_1 and δ_2 = 0.05, 0.05 (Pass bad peak and stop and peak respectively)
The original signal is, Fc1 = sin (2*%pi*f1*t), f1=1000
Noise signal is, Fn = cos (2*%pi*f2*t), f2 = 3500

After running in SCILAB the elliptical low pass filter response is

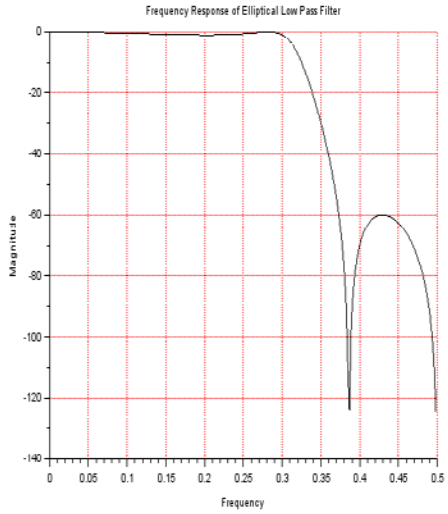

Fig 2(a) Magnitude Response In Logarithmic Scale

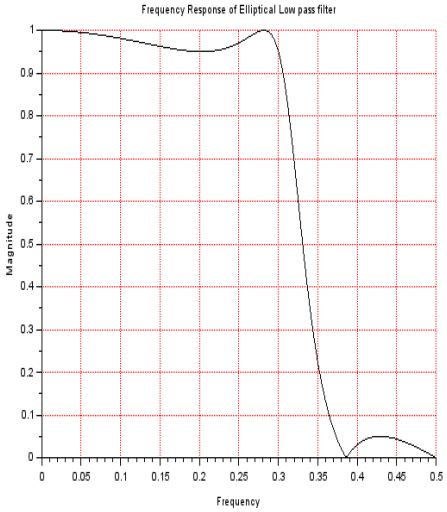

Fig 2(b) Magnitude Response In Linear Scale

It can be seen that at 0.3 Hz the attenuation is less compared to 3 dB but as the frequency is increased beyond 3 dB point the attenuation also increases. Also the transition band is fast as compared to Butterworth or Chebychev low pass filter. With the above mentioned specifications an arbitrary signal with noise presented is passed through the filter designed. The filter shows its filter action and recovered the original signal after filtering the noise signal.

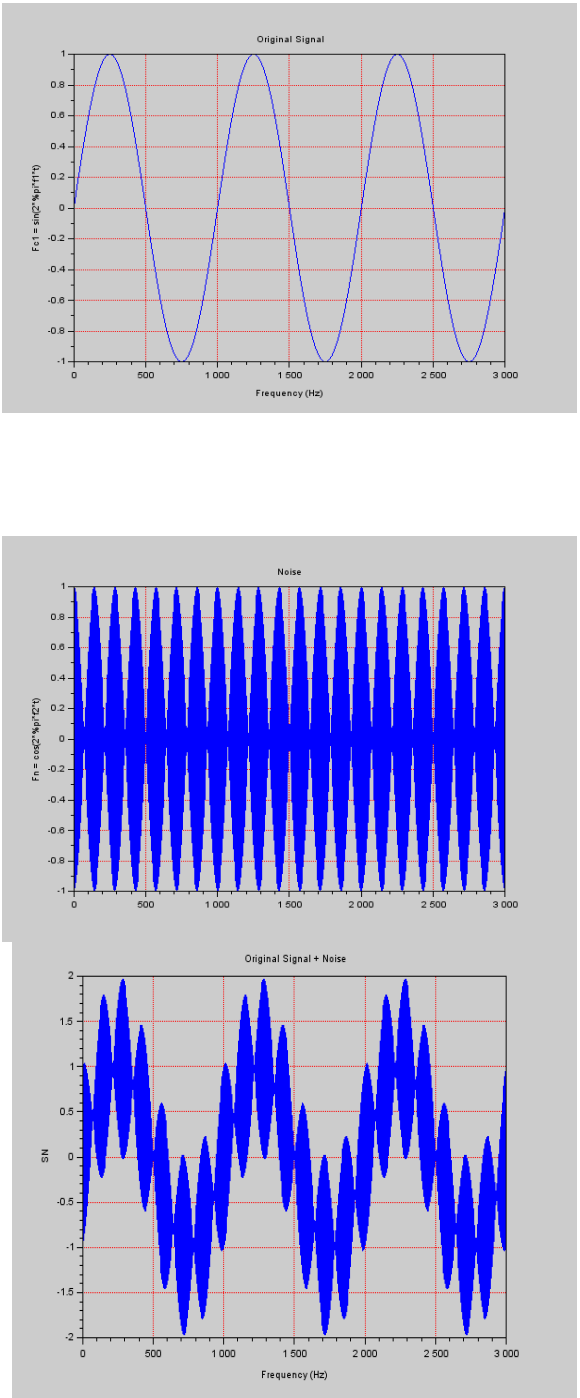

Figure 3 Original Signal and The Noise Signal

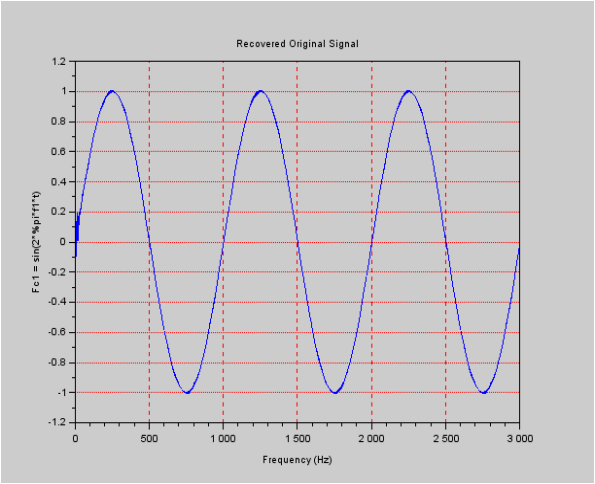

Figure 4 Signal with Noise and Reconstructed Signal after Filtering Action.

From the figure it can been that the original signal is recovered after passing through the filter without any phase change though some delay is present. The noise is filtered out by the filter without any alteration in the phase of the signal. When the order of the filter is changed the action of the filter on the signal also changes. IIR filters shows their inability to filter the noisy signal presented so as to recover the original signal from it.

Table 1: Effect Of Order Increased.

Order of the Elliptical low pass filter (n)	Effect on the filtering action on noisy signal
2	Signal recovered
10	Signal recovered with little noise
15	Signal recovered with little noise
>=18	No signal recovered. Only distortion present

7. Result and Conclusion

SCILAB, an open source software, can design the filter easily and very effectively. As the order of the filter is increased the selectivity of the filter becomes better. Since the transition band is very sharp as to some extent the order has to be restricted. From the findings of the simulations done with the help of SCILAB, after fifteenth order the filter shows instability to filter the noisy signal. In the pass band response with an increase in pass band ripples a flat loss when the order of the filter is increased beyond the fifteenth order. Therefore higher order filters not to be realised. Designing filters using SCILAB is easy and can be used in image processing, digital communication and other applications.

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Review of recent progress in Organic Solar cells

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Abstract

Organic materials have recently become of great importance for solar cell applications, due to their potential to utilize high throughput, solution phase processing, which will lead to low cost electricity production. Different recombination mechanisms are analyzed, including recombination of the charge-transfer exciton, Auger recombination, and recombination at interfacial localized states. This report reviews synthesis of the current state of the art for organic solar cells. Additionally, it covers key research areas which require attention to attain the future targets in this field and allow for the commercialization of this technology.

1. Introduction

The conversion of sunlight into electricity can be attained using a solar cell and is one of the most attractive future source of energy. Silicon-based cells, while quite efficient, are difficult and expensive to produce, a fact that drives up the cost of electricity produced using them[1]. The alternative, organic-based cells have the potential advantages of ease of processing and cheapness if their efficiency can be brought up to reasonable levels. Organic solar cells (OSC) are made of thin layers of organic materials with thickness in the 100-nanometer range. They are a cheap alternative to the expensive silicon in conventional photovoltaics. Additionally, organic solar cells can be prepared on foldable polymers and so they are ideal to be used as a flexible and portable system[2][3][4].

The development of new energy source is vital for stability and security of environment. Solar energy resources are abundantly available everywhere as more energy reaches our planet in one hour than community consumes during the whole year. The ultimate aim of organic solar cell research is to realize efficient solar energy conversion. In the past few years, OSC efficiency has been significantly enhanced through advanced approaches such as using fullerene electron acceptors and broadening OSC spectra within the solar absorption spectra. The total energy output of a fabricated solar cell equals the product of its efficiency and lifetime[5][6]. Therefore, stability is an important OSC property. Numerous structures have been developed to protect OSCs from degradation and the shelf lives of un-encapsulated organic solar cells have been improved to thousands of hours[7]. In addition, the working lifetime, of encapsulated organic solar cells under continuous irradiation, has improved. We cover the following topics in sequence: how OSCs work, how OSCs degrade including the effects of oxygen, water, and light irradiation, how to stabilize OSCs, and finally an overview of relatively stable OSCs appearing in recent literature.

2. Structure and Working principle

Organic solar cells offer a potential route to large-scale solar deployment based on the possibility of large cost reductions using earth-abundant materials and inexpensive production technologies. Nevertheless, despite recent advances in performance, organic solar cell efficiencies lag behind their inorganic counterparts, and new materials are needed to enhance performance[8][9]. Furthermore, existing performance limitations (traditional OSC circuit shown in Figure 1) are not completely understood and are a reason for organic solar cells not yet achieving the appropriate efficiency. In this Perspective, we consider key areas in which organic solar cell function differs from traditional models. Designing solar energy materials through effective models will help this new solar technology achieve high performance levels and enable solar technologies to achieve largescale energy production[10].

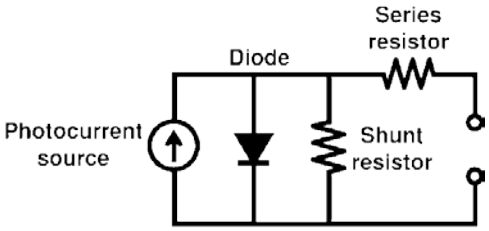

Figure 1. Circuit Model For Solar Cells

Also, the morphology of the photo active layer of BHJ-OSCs allows free charge carriers to recombine before extraction from the cell, creating another photocurrent loss mechanism. Interfacial layers play a vital role in BHJ organic solar cells; in addition to conventional functions such as photon transmission and charge injection, interfacial layers often act as ‘‘blocking’’ layers, ensuring that charge carriers are collected at their respective electrodes (i.e., electrons at the cathode and holes at the anode)[11]. Additionally, resistance effects in organic solar cells differ from traditional models in both field and cell area dependencies. Resistance losses are also sensitive to cell area, due to the limited conductivities of the transparent electrode materials used[12]. Therefore, accommodation of the above deviations from traditional models is imperative for the design and synthesis of new generation high efficiency organic solar cell materials.

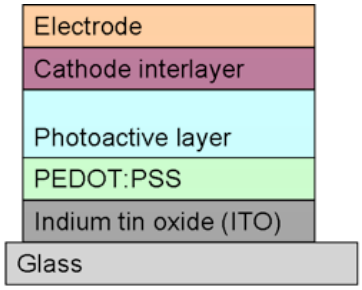

Figure 2: BHJ-OSC Structure

Bulk hetero junction (BHJ) OSC comprises five layers stacked on the surface of a supporting substrate, which is normally a piece of glass or transparent plastic (Figure 2). These five layers composed of a transparent conductive electrode (normally indium tin-oxide, ITO), a hole transport layer (HTL), photoactive layers (PALs) composed of an electron donor and an electron acceptor, an electron-transport layer (ETL), and a top metal electrode. The HTL is also called as an electron-blocking layer, and, the ETL also named as a hole blocking layer. An extra encapsulation film is sometimes employed to enhance the stability and lifetime of the cell [13][14][15]. In some cases, the PALs are doped or modified. OSCs must be able to absorb photons and should be able to generate tightly bound excitons instead of free charge pairs. To produce photocurrent, the recombination of excited charges at the (Donor-Acceptor) D/A interface must not occur [16][17].

3. Stabilization and Degradation of OSCs

Photocurrent generation mechanism in active layers of an organic solar cell can be explained as shown in Figure 3. A photon excites an electron to the higher energy level (LUMO), to form an exciton; exciton diffuses to the D/A interface; charge transfer at the interface forms a geminate electron-hole pair; delocalization of the interfacial electron-hole pair; separated charges diffuse to electrodes, driven by the chemical or electrical potential.

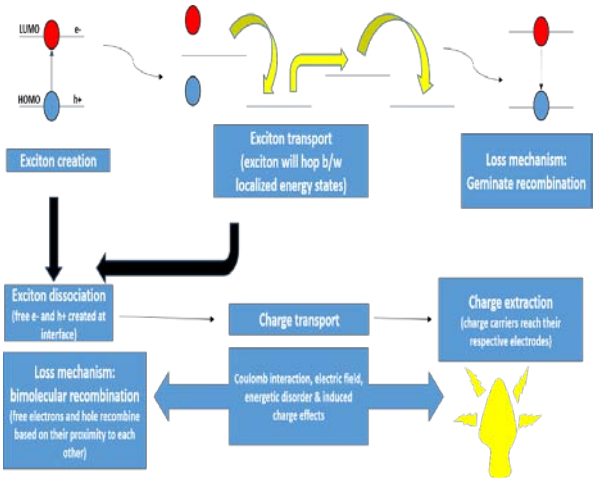

Figure 3 Mechanism of Charge Transfer in OSC

The degradation of OSCs means the degradation of device capability (particularly the PCE) and not necessarily chemical degradation of the composite materials. Depending on the significance of air exposure, the degradation of OSCs can be divided into intrinsic and extrinsic degradation[18]. The former is caused by the thermal inter diffusion of constituent species inside OSCs, while the latter is caused by the intrusion of air. Both types of degradation are mass-transport processes (diffusion)[13][19]. The metal-organic interfaces are the major interfaces where degradation occurs, even in OSCs that are stored in an inert atmosphere.

The significance of oxygen and water on the degradation of OSCs is situation-dependent. As a p-type dopant, oxygen generally causes degradation by affecting the acceptor materials and cathodes of active metals. Oxygen also occasionally enhances the device performance by modifying the work function of donor materials and anodes of inactive metals. The oxygen content in the photoactive layers increases linearly with the loss in device performance. On the other hand, as a polar solvent, water causes the degradation of OSCs mainly by corroding active cathodes. Hygroscopic materials like PEDOT: PSS accelerate this process. Besides, water induces morphological changes of constituent materials like BCP, forming undesirable voids, which impair interfacial charge transports[20].

The lifetimes of OSCs decrease exponentially with increasing RH in the ambient environment. Light irradiation may activate some OSCs in which metal oxides are used as the cathode buffer layers. However, it normally causes degradation by accelerating oxidation, or by accelerating the diffusion of oxygen and water. Light irradiation causes the reversible degradation of OSCs[21][22]. The light-induced degradation has little correlation with the light intensity.

4. Conclusions

We review recent developments of the degradation/stabilization study of OSCs. Up-to-date understandings of the degradation of OSCs caused by oxygen, water and light irradiation are described.

A few effective ways of stabilizing OSCs are reviewed.

Hence, the main focus is to optimize the various layers involved in fabrication of OSCs. It is required to find the optimal compromise among a combination of various energy materials characteristics that can work in opposite directions. Like, we mentioned that the presence of an interfacial dipole at the D/A interface can greatly decrease the driving force for exciton dissociation but will enhance/ increase the open-circuit voltage. Also, optimization of the D/A interface can increase the electronic coupling between the excitonic states, thereby enhancing the photocurrent (that needs to be maximized) but, at the same time, can also increase the coupling, leading to a larger reverse saturation current in the dark (which needs to be minimized to secure a higher *V*oc). Many efforts have been recently directed toward the design and synthesis of low-bandgap copolymers incorporating alternating donor and acceptor units, used as new Donor (D) materials to harvest the low-energy photon part of the solar spectrum.

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List and number all bibliographical references in 9-point Times, single-spaced, at the end of your paper. When referenced in the text, enclose the citation number in square brackets, for example [2-4], [2, 5], and [1].

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Electronic Gadgets – From Affection to Addiction: A Literature Review

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Abstract

In today's era, the advancements in technology have led to inventions of various electronic gadgets. The usage and dependency on electronic devices have been increasing rapidly which has lead to their addictive usage which often overrides and creates hindrance in daily activities especially in young adolescents. Due to the increasing trend of such devices several small scale studies in and outside India were conducted to know the behavioral addiction of such devices, effects on physical, mental and psychological health, daytime screen usage, smart phone's addiction, and effects on academic performance of children and so on. Although many studies were conducted but there is no such large scale study that aims at the usage pattern and health risks on adolescents and school going children. Out of the nine concerned research studies, this paper has reviewed the four most appropriate ones and our study has tried to explore all the major factors and broaden them to categorize together in one for better conclusions and results. **Key words: Addiction, Adolescents, Electronic devices, Health problems.**

1. Introduction

Addiction means craving or dependency. And the terms electronic devices and addiction related to adolescents have been continuously used to describe the addictive behavior of adolescents. Adolescents are the group of people of age between 10-19 years as per the WHO criteria.[1] 20% of the world population are adolescents (1.2 billion). In India, there are around 243 million adolescents according to the UNICEF report. Addiction is the dependence, as the continuous use of something for the sake of relief, comfort which often causes cravings when it is absent.[2]

Internet has continued to grow from more than a decade. About 32.7% of the world's population has access to the social networking sites like Facebook, Twitter, Linked-In, blogs, wikis and man more which has let people of all age groups to connect with almost anyone in the world.[3] The growing use of electronic devices has led to their overuse which in turn results in various health problems such as headache, insomnia, depression, low concentration level and many more. While the gadget industry has been growing enormously, the smart phone is the latest and most sold gadget these days. Also, adolescents are most vulnerable to the overuse of gadgets because the use of electronic devices for them is generally not just limited to communication and entertainment but also to education and surfing the internet and they are relatively free from the social roles and expectations of the society. In addition, the smart phone adoption rate in young adults is very high.

From surveying the literature on addiction of electronic gadgets among adolescents, a number of problems may be identified. Researchers have found close relationship between the overuse of such devices and poor mental health (eg. Sleep deprivation and attention deficits).

Moreover, the complexity of addiction towards electronic gadgets is reflected by the level at which study was carried out and the methods that were used for analysis. Most of the studies focus on time spent on gadgets, purpose of using them, number of gadgets possessed by an individual and many such.

2. Methodology

This literature review is based on research studies during the period 2005-2012. The original research papers included in this literature review were taken from various search engines like Google Scholar, Pubmed, Researchgate etc. Initially, the symptoms and levels of the affection and addiction towards electronic gadgets will be clarified. Afterwards, the underlying problems and methodological issues raised in the literature will be touched upon. The review will focus on discussing the gaps known from the studies about the following:

i) Discussing the addiction factors and symptoms of smart phone among adolescents.

ii) Understanding the variations of Smartphone addiction according to age, gender, field of study, usage pattern and sleeping disorders.

Also, literature review will focus on diminishing the gaps and co-relating the previous studies to help better understand the problems of overuse of electronic gadgets.

2. Effects On Sleep

The use of electronic gadgets has been increasing day by day. Earlier, there were only three basic needs of life: Food, Clothes and Shelter but now gadgets have become our fourth basic need. These gadgets have become an integral part of the daily lives of many individuals and one cannot simply imagine the life without them.

From Electronic devices- The real ruler of the World, a study that showed 20.6% of the population suffered sleep disturbances due to the usage of electronic devices.[4]

An US based study explored the association between television viewing and sleep disturbance in just over a thousand children aged between four and ten. This study also found increased amounts of television viewing were associated most significantly with difficulty getting to and staying asleep.[4] Unsurprisingly, the amount of television watched was positively related to daytime sleepiness.[4]

From another study in which around 9846 participants of age 16-19 were considered, it was found that the use of electronic devices is very frequent in adolescents during the day as well as at bedtime. The screen usage of electronic devices across various range of platforms which also includes newer technology, are related to several sleep parameters. The continuous exposure to bright light of gadgets may interfere with sleep. Media is commonly used as the sleeping aid nowadays by adolescents. They use the electronic media to overcome the boredom when not being able to sleep.[5]

These days young adults have to face many negative aspects of gadget overuse and one of the major aspects is sleep deprivation. A study was conducted over 95 college students. It was found that the addictive behavior sometimes disturbed their sleep patterns. One student acknowledged that they don't sleep well because of excessive use of smart phones.[6]

Another study was conducted in Indore in which around 300 students participated. About 60% of the respondents who are using electronic devices for more than 6 hours have accepted that they face difficulty in falling asleep. On the other hand, respondents who used gadgets for a limited time had sound sleep.[7]

3. Impact On Health

Nowadays, children as young as four years of age also use electronic gadgets. These gadgets may include television, video games, computers etc. Adolescents being most prone to gadget addiction, face many health problems. It is important to understand the negative impacts gadgets can have on a person's health.

Previous studies on Internet addiction shows that excessive use of online communication and games occurs often leads to various psychological factors, including social anxiety, depression, impulsivity, self-esteem/identity deficits, and situational stress during life changing events.

In a study of 316 adolescents in Chennai, India, a significant number of them faced the problems of headache (46.2%) followed by problems of watering of eyes (28.8%), neck pain (23.4%), sleep disturbance (20.6%) and fatigue of hands and fingers (9.8%).[4]

Similarly, a study of New York adolescents identified that adolescents who watched three or more hours of television per day during adolescence were at a significantly elevated risk of frequent sleep problems by early adulthood. Further studies have suggested that high use of electronic media was associated with

lack physical activity which in turn results in increased chance of obesity and cardio-respiratory fitness.

The researches reveal that excessive use of electronic devices is associated with unfavorable mental, physical and social health characteristics for children and adolescents.

In another study of 300 people, a positive relationship was found between Internet addiction and psychiatric disorders like depression, bipolar disorder, obsessive-compulsive disorder, attention deficit disorder etc. Interestingly, people who used their devices for more than six hours a day had hearing problems (72%), regular headaches (79%) and sleep problems (60%). Based on the use of gadgets per day a common trend was observed, more be the number of hours of usage per day more is the impact on health such as problems in logical thinking, problem of depression, mental stability and level of consciousness. The respondents who used gadgets for more than 6 hours a day were most prone to health risks and those who used gadgets for 1-2 hours were on a comparatively very low level of health risks.[7]

The addiction of gadgets deeply affects the social and personal skills of children. It is noticed that a youngster may be expert at texting but poor at real communication with someone face-to-face. We may find a child holding full grip on a computer game but not at any other outdoor game. This is really a considerable issue attached with the future security of our young generation that are addicted to gadgets.[8] The overall development of a child is necessary for him to emerge as a bright citizen.

4. Usage Pattern

Today an electronic gadget such as a smart phone is not only used as a source of communication or entertainment but also for fulfilling the desires of texting and as a symbol of fashion amongst adolescents. As a result their love for these gadgets unknowingly turns to be addiction and they end up using them for hours longer than what is necessary.

In a study in which the change in lifestyle was observed after the arrival of electronic gadgets it was seen that a significant number of adolescents 48.7% accepted that the time spent in outdoor playing was reduced after they started using these devices. Invariably 67.4% of the participants got scolded by their parents because of frequent use of these devices, so to avoid scolding 32.3% of them used to wait for their parents to sleep for using the devices and 22.2% of them accepted that their academic performance has gone down or became poor. Several number of the study participants got disturbed when their devices were confesticated and that they suffered emotions like being sad, depressed, irritated, restless, and/or angry. Some of them even tried outdoor playing, take the devices without their knowledge, tried learning or studying and borrow from others from neighbors. Approximately 26.6% and 43.7% of them self reported that they used their devices in between the class hours and in between study time respectively.[4] Surprisingly, a significant proportion of study population used the devices while driving/travelling, while eating and also while using restroom.

Carbonell et al. reported that the excessive use of mobile phones by teenagers is attributable to text-messaging and mobile games. Hwang et al. showed that it is also related with various psychological factors such as social anxiety, depression, and impulsivity.[6]

In another literature that was entirely based on studying the pattern of usage of electronic devices, the smart phone usage pattern for 95 college students was investigated using surveys, logged data and interviews. Frequently checking mobile phones for updates weakens self regulation which leads to their overuse. In this study, participants were divided into two groups based on the rating score: a risk group and a non-risk group. The risk group was more prone to smart phone overuse and they spent more time using smart phone per day compared to the non-risk group. The aggregated usage, session-level usage, and temporal usage patterns were analyzed to identify the differences in the specific usage levels of the risk and non-risk groups.

The risk group users tended to use smart phones more frequently and to engage in longer usage sessions. Their app usage was highly skewed toward a small number of frequently used apps. In addition, diurnal usage differences were observed, where the risk group used their smart phones for more time during the morning/evening than the non-risk group.[6]

The app-specific usage pattern analysis was also performed, the two major apps being communication and web-browsing. The results were not very surprising as the risk group received more number of notifications (MIM and Facebook) in a day than the non-risk group. And the risk group browsed the web more frequently and had the tendency to search for content updates more often.

The overall usage behavior revealed that the participants used their smart phones for various

purposes ranging from managing personal information and building social relationships, to passing time and managing moods. The various comments of the participants were: "*In general, I use it to check news and updates. I can easily satisfy all of my curiosities with smart phones.*"; *"When I have nothing to do like waiting for someone, or if I feel bored during a class, I check Facebook."*; *"I frequently check my smart phone if there are new messages or alarms. I check it in every 5 to 20 minutes. I don't use it for a long time unless I play a game"; "Unless I'm really tired, I always check my smart phone before going to bed. When I get up, I check my smart phone. Lots of updates [like Facebook] happen overnight."*[6]

These comments are enough to justify the increasing trend of gadgets usage and hence, addiction.

5. Factors Affecting Addiction

This literature review aims to explore the factors affecting addiction, such as gender, age, more than one device at a time and average usage per day among adolescents.
Many studies were conducted in developed countries which showed that expanding behaviors of latest devices including video and computer games, the use of personal computer, smart phones and some hand-held devices which were introduced over the last couple of decades is contributing to increase the total usage of these electronic devices and as evidenced in one of the studies that identified 11-12 year old reported daily average screen usage of 5 hours.

A study which was conducted in Australia showed that the average total screen usage is far exceeding the two hours. In US, the daily average usage of screen was 5 hours to 7.5 hours. There are many factors which are responsible for this increasing extent of electronic devices use. Some of them are marketing, popularity, accessibility and purchasing capacity of the population. Nowadays people are not bothered about the amount spent in buying a particular gadget. They just focus on two things while buying these gadgets. They either check whether the gadget will fulfill their requirements or see if it is enough according to their status in the society. These days gadgets have become the status symbol of many people.
It was very surprising to know that in Australia in the year 2008, children aged 5 to 14 owned a mobile phone. The data collected recently showed that the personal gadget ownership by youth has increased disastrously in the last five years. Like in US, adolescent IPod/Mp3 ownership increased from 18% to 76%.[4]

Some prior studies have found some factors which contribute in making digital media attractive and often addictive. The first and foremost point which was identified was that the digital media give easy and convenient ways of accessing a large amount of online data which includes music, news and games.[6] It also helps in maintaining social relationships. So as the use and benefit increases, the addiction towards gadgets will go on increasing. Such access offers instant gratifications to users (e.g., interpersonal utility, pastimes, information seeking, and entertainment), successively reinforcing continuous usage of it. Excessive usage may follow later, possibly because of deficient self-regulation or maladaptive thinking.

6. Summary And Conclusion

Survey includes primary and secondary data. Through sampling primary data is collected to make our study purposive one. On other hand secondary data is collected through various secondary sources viz. websites, magazines, etc. Briefly, some studies reveal the positive impacts on the adolescents with this hi – tech use of technology while some reveal negative impacts. It is reported that almost every adolescent uses one or more electronic gadget during the last hour before bedtime. The study shows that daytime and bedtime use of electronic gadgets with varied range, including advance technology, are related to several sleep yardsticks, making a negative relation between the hi – tech gadgets and sleep. Studies also show that a healthy media can eliminate and restrict the continuous use of hi tech electronics gadgets. We suggest that further studies might be carried out and may consider different demographics, mobile devices/platforms, social activities, and cultural backgrounds by analyzing and extending the investigation on additional contextual factors e.g., location and activity and content categories e.g., social networking and play stations.

7. Acknowledgment

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NI MULTISIM Implementation of Memristor Based Secured Communication System

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Abstract

Communication can simply be defined as the process by which energy is transmitted from one place (transmitter) to another (receiver). The energy can be a signal that contains valuable information which needs to be transmitted securely so that only the desired user can use it. In this paper, the signals obtained from the chaotic systems are used for modulating the binary data so as to provide the necessary security. A complete schematic of communication system is thus presented along with simulated results using NI Multisim.

Keywords: Chaos Theory, Jerk Circuit, Aliasing Effect, Quantization, Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK).

1. 1. Introduction

Chaos theory is a branch of mathematics which deals with nonlinear dynamical systems [1] which are sensitive to the initial conditions and over a period of time can produce totally unpredictable and wildly divergent behaviour which is also known as chaotic behaviour [1]. Simply put, chaos theory says that given a system, its behaviour initially is predictable, but as the time passes its behaviour becomes completely random and thus unpredictable. Due to this 'random' behaviour of chaotic systems, they can be employed in communication systems to provide security to the information that we are trying to transmit.

In this paper we make use of the simple chaotic systems given by Sprott [2] and modification of Jerk equations used in them into a system of simple quadratic equations by Pandey et al [3,4].

Furthermore, the schematic of jerk circuit employed in [5] is used, and the resulting chaotic signals are used for modulation purposes.

2. Chaotic System – Jerk Circuit using Matlab

System of simple quadratic equations given in [4] are the three ordinary differential equations of state variables given as:

$$\dot{x} = y$$
$$\dot{y} = z$$
$$\dot{z} = -ax - by - cz - x^2$$

The jerk equation has been simulated using MATLAB [6]

```
functionjerkeqn=jerk(t,x);
a=0.5;     % Using a = 0.5
b=0.25;    % Using b = 0.25
jerkeqn=[x(2);x(3);-x(1)-x(2)-a*x(3)-b*(x(1)).^2];
```

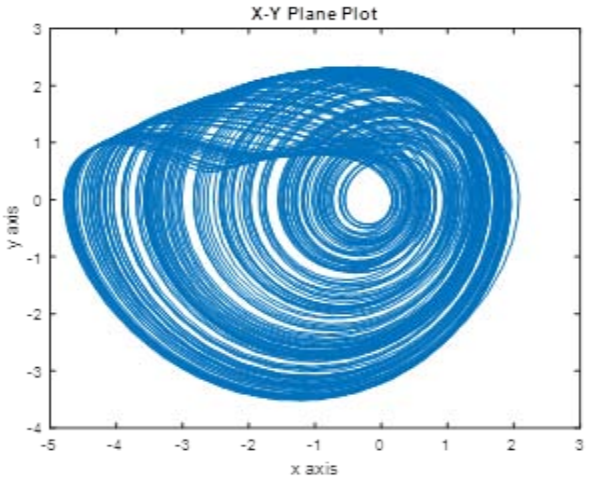
Where, x is denoted as x (1), y is denoted as x (2), and z is denoted as x (3). Let us use the following initial conditions:

$$x(0) = 1$$
$$y(0) = 1$$
$$z(0) = 1$$

In the MATLAB command window type the following commands:

```
x0=[111];                % Initial Conditions
t=[0,1000];              % Time Span
[t,x]=ode45(@jerk,t,x0); % Solving the ode
plot(x(:,1),x(:,2));     % Plotting rows, columns
figure                   i.e. x-y plane
plot(x(:,2),x(:,3));     % Plot of y-z plane
figure
plot(x(:,1),x(:,3));     % Plot of x-z plane
```

This would result in the following plots:



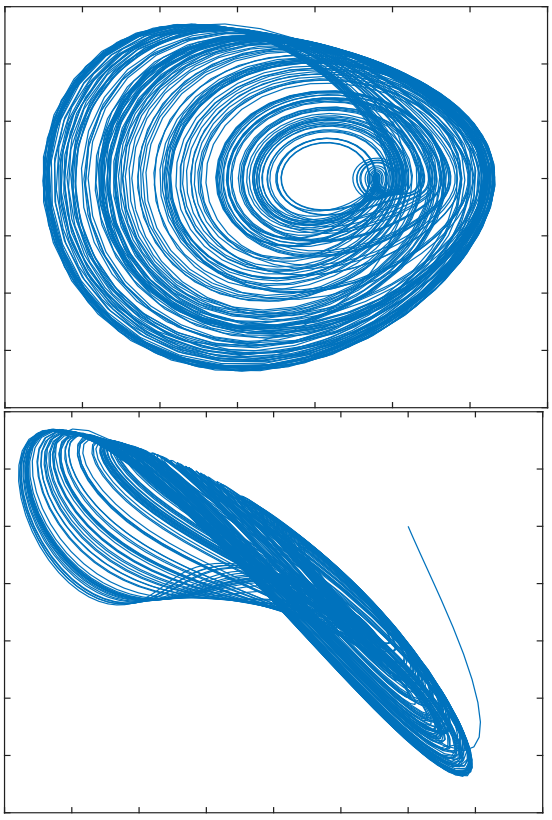


Fig.1. Plot of the simplified jerk equations using MATLAB with coefficients a=0.5, b=0.25**.**

In order to observe the components for the jerk equations, following program was executed in MATLAB command window:

(a)

```
subplot(3,1,1)
plot(t,x(:,1))          % Plot of x wrt t
subplot(3,1,2)
plot(t,x(:,2))          % Plot of y wrt t
subplot(3,1,3)
plot(t,x(:,3))          % Plot of z wrt t
```

(b) This would result in the following output: *(Note that the time span has been changed to t= [0,200] for easy viewing)*

(c)

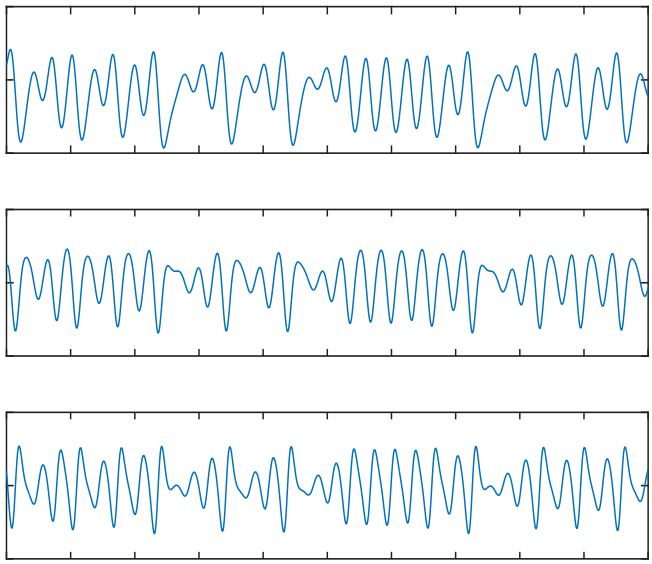


Fig.2. Components of jerk equations as a function of t (time) using MATLAB.

3. Processing of Information Signal

The analog signal which is to be transmitted is first band limited using an anti – aliasing filter to avoid the aliasing effect. The band limited analog signal is then sampled using a sample and hold circuit. Since the amplitude of sampled signal can take any value in the continuous range, this gives us a signal which is discrete in time but not in amplitude. Thus the signal needs to be fed to a quantizer. The signal resulting from quantizer is discrete in both time and amplitude, and this process is known as discretization in time and amplitude. The discretized signal can now be encoded using a binary encoder using any of the desired line codes. In the present paper, we have assumed the signal to be encoded as NRZ(L) Unipolar line code.

4. Using Chaos for Modulation

To provide security to information on course of its transmission from transmitter to receiver simplified Jerk

circuit [5] has been employed. The resulting chaotic signals have been used for the process of modulation and demodulation.

For the modulation of binary data using chaotic signals, we will make use of the Digital Modulation Techniques namely Amplitude Shift Keying (ASK) and Frequency Shift Keying (FSK). For implementing these techniques, multiplier (IC AD633) has been used for the purpose of modulation and demodulations.

The chaotic signal x along with the binary data to be transmitted is fed to the inputs of a multiplier.

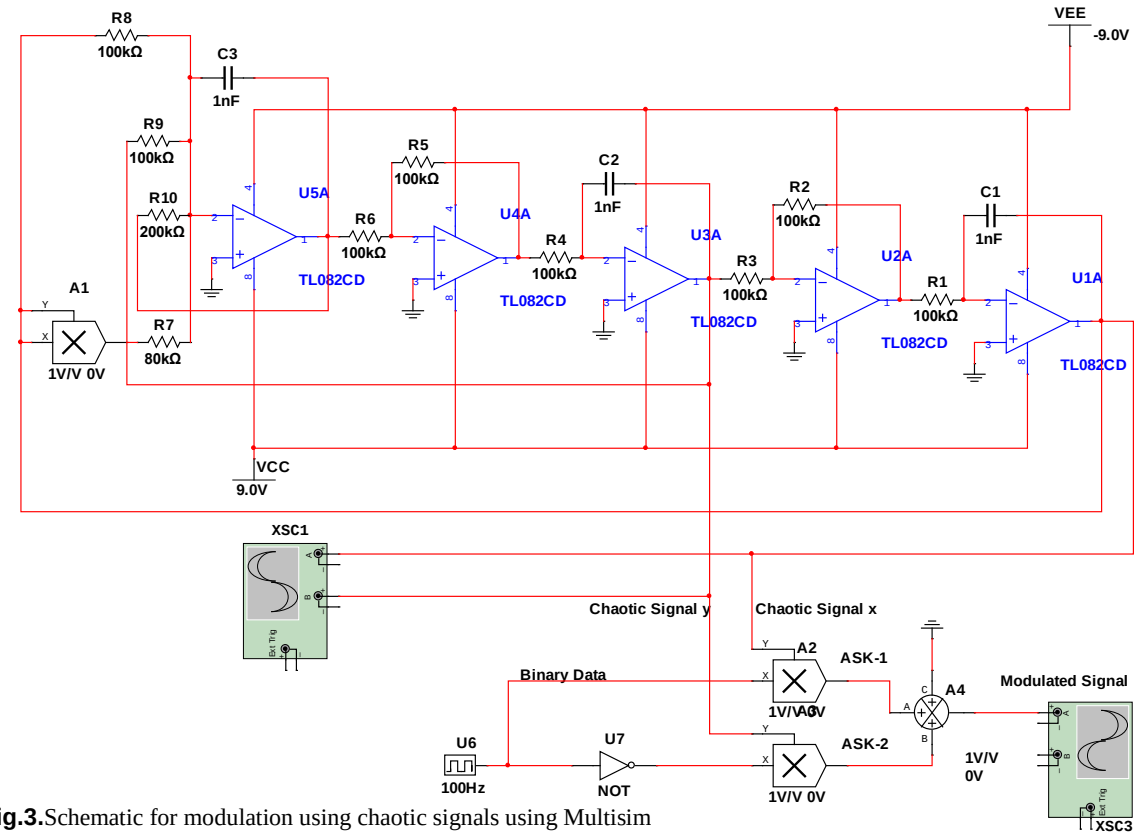
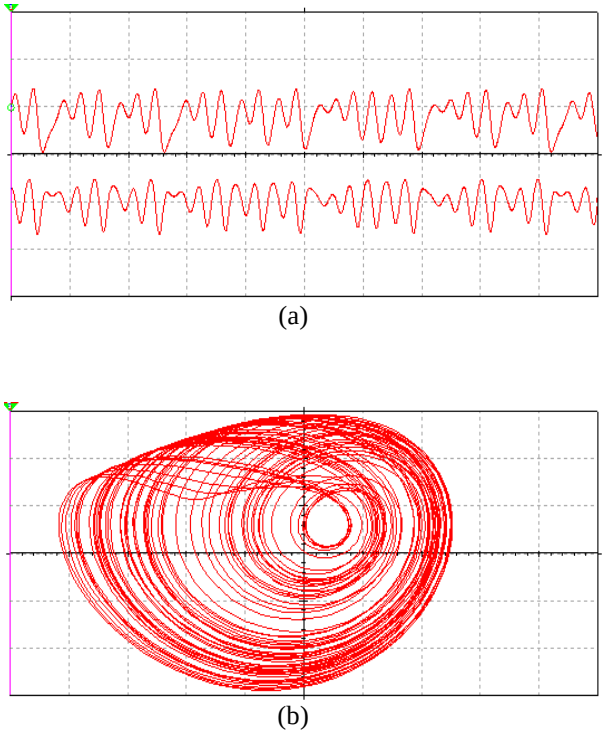


Fig.3. Schematic for modulation using chaotic signals using Multisim

Since the data is in binary form, when data '1' is to be transmitted, a part of chaotic signal x would be seen at the output of multiplier. When data '0' is to be transmitted, there will be no output at the output terminal of multiplier. This waveform obtained at the output of multiplier is similar to that of an Amplitude Shift Keying (ASK) signal denoted as ASK-1.

Now the chaotic signal y along with the inverted data is fed to the inputs of another multiplier. The output of this multiplier will again be similar to that of an Amplitude Shift Keying (ASK) signal denoted as ASK-2. It was observed that when ASK-1 is zero, ASK-2 is transmitting some part of chaotic signal and vice versa. These waveforms are then added together using a summer to obtain the final modulated waveform. The proposed circuit for this kind of modulation (or more appropriately shift keying) is shown in fig.3.

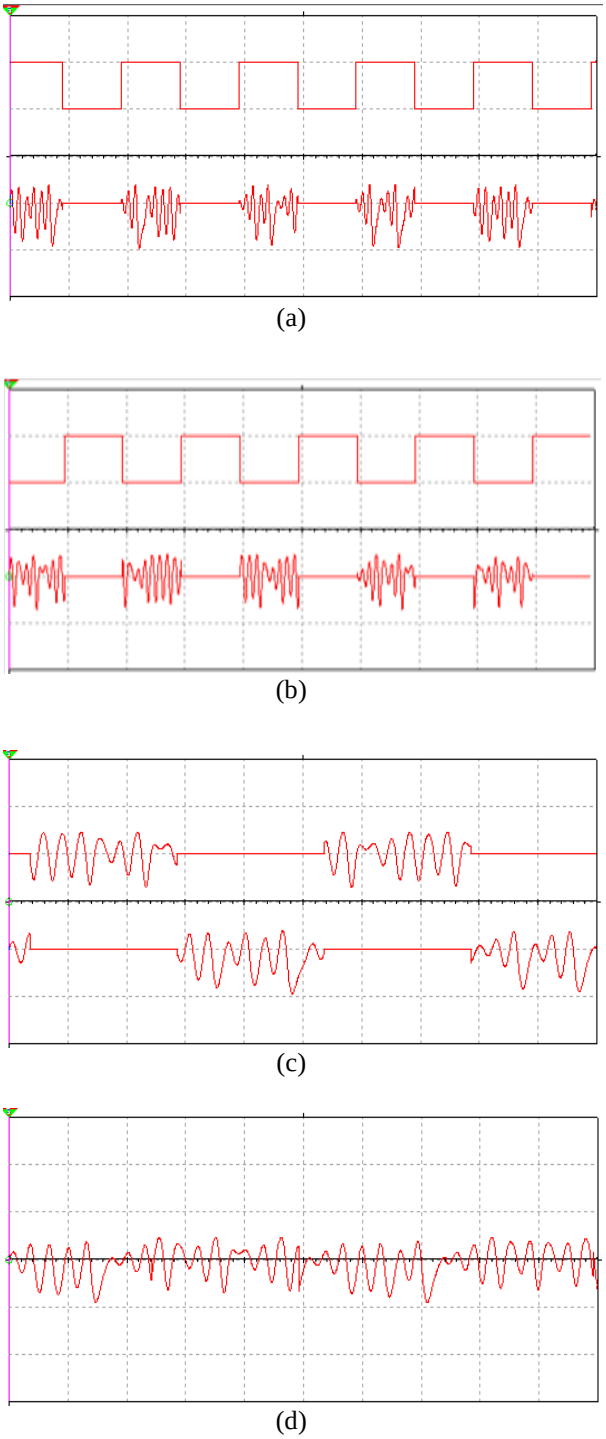
Associated waveforms with this circuit are as follows:



(a)

(b)

Fig.4. (a) Chaotic signals x and y, (b) x-y mode plot



(a)

(b)

(c)

(d)

Fig.5. (a) ASK-1 waveform, (b) ASK-2 waveform, (c) Simultaneous display of ASK-1 and ASK-2, (d) Final modulated waveform

5. Demodulation

Assuming that the transmission channel is distortion less (i.e. no noise is added to the signal

while transmission) the demodulation is carried out in the similar fashion as of a Frequency Shift Keying.

Two correlators are used for the reception of modulated signal. Each correlator uses a multiplier followed by an integrating device. The received signal is fed to both the multipliers. The other input to multipliers are the chaotic signals x and y which need to be generated at the receiver side for successful reception.

As same Chaotic signals were used during the modulation, so this is a synchronous type of detection. The outputs of both multipliers are fed to a smoothening device such as the integrator. This is then fed to a decision device whose output is symbol '1' when the input at non-inverting terminal is greater than the inverting terminal. The output is symbol '0' otherwise. Using a LM7805 voltage regulator at the output, transmitted data was successfully obtained. The proposed circuit for this kind of demodulation is given in fig.6.

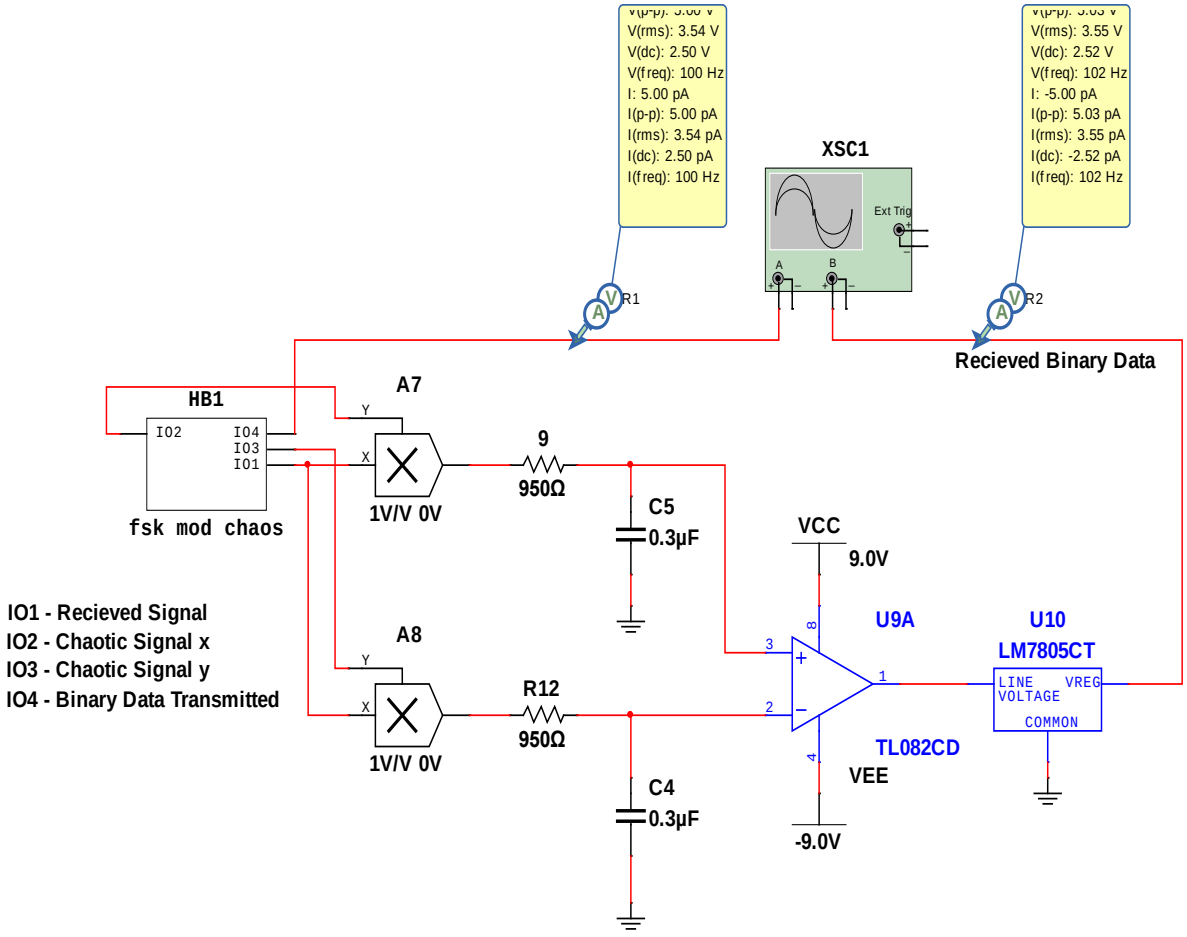


Fig.6. Schematic for demodulation of received data**.**

Associated waveforms with this circuit are as follows:

(a)

(b)

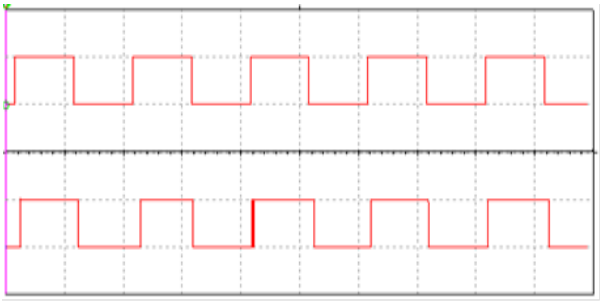


Fig.7.(a) Original binary data which was transmitted (b) Received data

6. Results and Conclusions

The simulations carried out using Multisim show that the communication can indeed be secured by using chaotic systems. From the simulations, it can be concluded that the modulation of data using chaotic signals and their subsequent demodulation is indeed possible using the digital modulation techniques. Furthermore, the coefficients a and b which were set to a particular value for obtaining chaotic behaviour can be tuned to some other value for obtaining chaotic behaviour and if these coefficients are known only to the desired user, it will add to the security of the communication system. The communication model presented in this model makes use of synchronous detection method, that is chaotic signals x and y at the receiver end must be phase and frequency synchronized with the ones used at transmitter end. The limitation of the model presented in this paper is that the communication model makes use of the binary data stream which is set at 100Hz, since we know that the audio signal can range from 20Hz to 20Khz, so the binary data stream cannot be limited to 100Hz only. Also the transmission of the modulated signal has been assumed to be in a noiseless channel, so when the signal will be transmitted using actual channel, there will be noise interference which cannot be neglected. Further work is being carried out in this regard to eliminate all the possible limitations.

7. Acknowledgement

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The Evolution of the "BOW-HEADED Tribe"

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ABSTRACT

In recent years various kinds of consumer electronics have been increasingly popular worldwide. The youth constitute a major portion of this "bow-headed tribe". A research based innovation project titled "Effect of Electronic Gadgets on the Contemporary Youth" has been taken up to investigate the usage and impact of all sorts of electronic gadgets upon adolescents and young adults. The idea was conceived owing to our observation of the alarming growth in the number of gadget addicts across the globe and associated impacts on the physical, social and mental health, especially in the age group of 13-20.The number of mobile addicts has grown by 123 percent over the past year, according to Flurry, which looks at data from 500,000 applications across 1.3 billion mobile devices. The idea is to communicate with the actual effected population and determine the extent of the effect on them in their terms and design a solution accordingly. The whole idea would be put in action by a survey to be conducted in schools and colleges over sample strength of 1500 youth in the target age group.

1. Introduction

The prevailing era is of technological advancements and amelioration of machinery. Encompassed by gadgets and gizmos we judge the odds and ends on a scale defined upon the plenitude of gadgets owned. Every gadget has extended its arms of prominence from needs to desires and even obsession, for that matter.

Among all bull's eyes the one most vulnerable to be shot reprehensibly is the Youth.

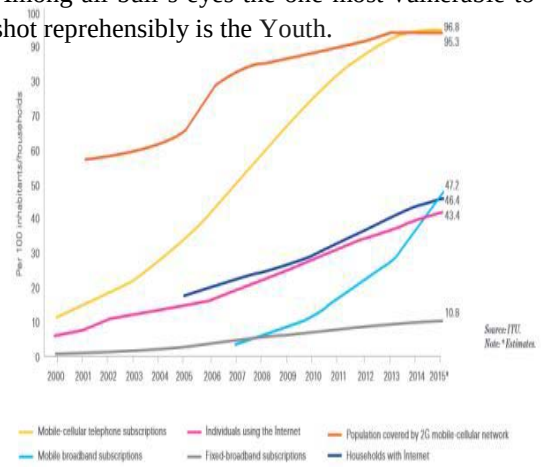

Figure 1 Demonstration of increase in usage of various gadgets over the years 2000-2015*[5]

The study thus considers the severe gadget fever among the contemporaneous youth and the correlated chattels. The research extends its scope to all the aspects, namely physical, mental, social and biological repercussions of the extravagant engrossment in gadgets. The study shall be conducted upon a sample size of 2000 students of Vasundhara Enclave belonging to the age group of 13-24.

Gadgets, all of which have been refined for the amelioration of the human race have both pros and cons. The objective of the inquest is to figure out a clear picture of which of the two is dominant in the accustomed scenario. We aim at not merely

analyzing the situation but also adduce a quick-fix to the botheration

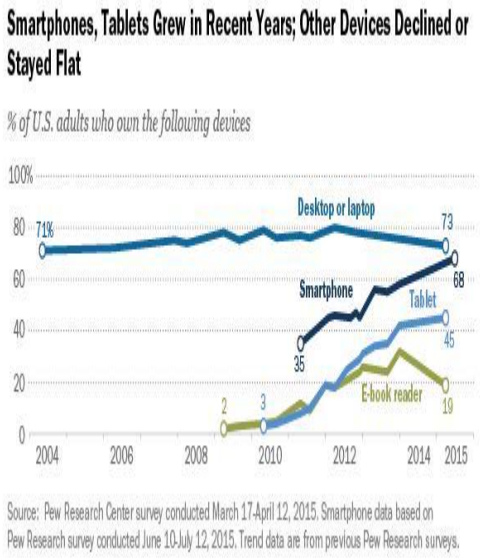

Figure 2. Demonstration of ownership of various gadgets and gizmos [4]

2. Related Works

(a) A research conducted by the University of Maryland on 1,000 university students, interviewed at 12 campuses in 10 countries, including various countries like Britain, America and China described the thoughts of the students in intricate detail, in which they admit to cravings, anxiety attacks and depression when forced to refrain from the usage of gadgets. A study was further published by the university's International Centre for Media & the Public Agenda (ICMPA) and the Salzburg Academy on Media & Global Change which concluded that more than 50% of the students failed to go the complete 24 hours without media. The research pointed out behavioral changes which included emotions such as being fretful, confused, anxious, irritable, insecure, nervous, restless, crazy, addicted, panicked, jealous, angry, lonely, dependent, depressed, jittery and paranoid. The study found that one in five reported feelings of withdrawal subject to addiction. More than one in 10 admitted being left confused and feeling like a failure. Mere 21 per cent said they could feel the benefits of being unplugged from media. "Technology had changed the students' relationships", said Professor Susan Moeller, who led the research [1].

(b)Watching television remained the most crowd-pleasing personal activity, exhausting about three hours of an average adult's day, the 2014 Ofcom's (Communications regulator in the UK) research said. The research also showed that the most tech-savvy people lie in the age group of 13-19. Ofcom, which surveyed nearly 2,000 adults and 800 children found that people reach a peak of digital understanding at 14 to 15 years, while children aged 6 show the same knowledge of new technology as the average 45 year-old[2].

(c)Researchers at Ohio State University gave a ball-parked figure that more than 1,500 pedestrians were admitted to emergency rooms in the year 2010 for injuries caused by gadgeting while walking [3].

3. Methodology

The research is established upon the real time survey conducted upon the youngsters so as to be in direct touch with their thought process and their reasons of prioritizing the gadgets over personal relationships. The study shall be conducted upon the people belonging to the age group of 13-25 years.

The survey operated has been filtered on various standard scales so as to analyze the outcome and ascertain appropriate inferences. The acceptance and adoration of gadgets worldwide can be laid down upon three independent scales:

a) Usage Intensity: The constancy of the gadget's usage irrespective of the reason behind

b) Usage Breadth**:** The circumambient crowd affected by and affected from the usage of these gadgets.

c) Usage Variety: Regardless of the frequency of usage, emphasizing on the argument behind.

The scrutiny shall be studied further with the help of a software package used for statistical analysis, SPSS.

4. Limitation

The particular study is bound to many constraints because of the research been completed halfway. The inclination of the results till now is a result of manual analysis done on 200 individuals' filled survey forms. The test rats are all under-graduation

students of Shaheed Rajguru College, Delhi University or Maharaja Agrasen College, Delhi University. Special heed been paid to have an unbiased involvement of opinions from both, the male and the female gender. Also being confined to the two colleges for the time, the age-groups being scrutinized are that between 18-20 and 20-24. However the teenage has been categorized to be different from the 20+ aggregation because of the crucial contrast in the observed trends.

5. Observations

The research conducted till date and the manual analysis of the same has led to conclusions that are discussed in detail further with the help of pictorial analysis.

(a)The graph has been drawn taking the scales of monthly expenditure on the owned gadgets into consideration. The x-scale gives the expenditure, in thousands while the y-axis depicts the number of participants.

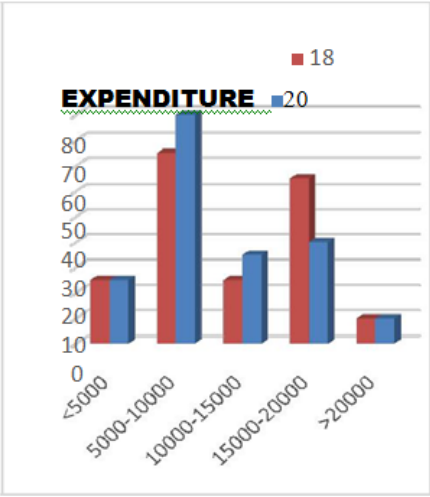

Figure 3 Monthly expenditure on Gadgets by the youngsters

The graph suggests that on an average the 20+ and the 18+ age-group spend equally to the maintenance of their gadgets.

b) The graph evaluates the average time the participants spend in involvement with their gadgets and gizmos. It is evident that the number of hours remain confined to two-three in case of the teenagers, while the addiction is consuming a major part of the day in case of the participants above the age of 20 years. The age-difference not being much, the difference in inclination towards the gadgets is alarming.

Figure 4 Average Time Spent on Gadgets by the youth

c) The above graph shows the "usage vâriety prevalent among the youth.

The 18+ age-group falls prey to entertainment whereas the 20+ is a victim to social media, as per the major inclination of the graph. This further justifies that the major reasons for gadget addiction remain: Entertainment, Education and Social Media Applications.

d) The above graph shows the "usage vâriety prevalent among the youth.

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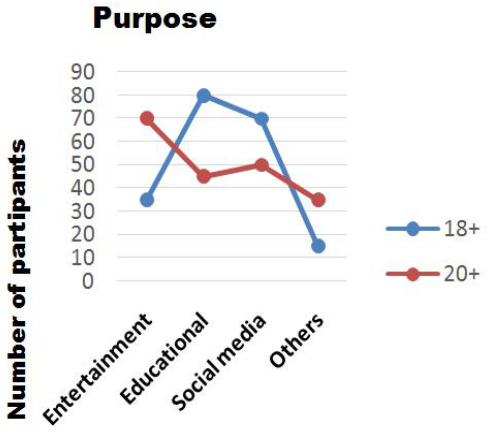

Figure 5 Purpose for gadget usage

(d)The graph below describes the "gadget fever" effects the sleeping habits of the youngsters in today's time. The world of gadgets is certainly captivating. And once caught in the vicious cycle of gadgets and applications, it's hard to step out. This suggests that the sleeping habits of the 20+ and the18+ generation don't differ much.

Also it exhibits the trend of 4-6 hours of sleep among the major part of the under consideration age-group.

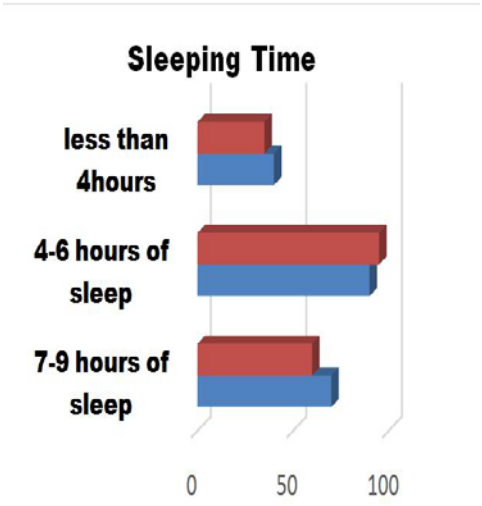

Figure 6. Trends in sleeping hours

6. Conclusion and Future Scope

The study conducted till date shows the alarming impact of gadgets upon the youth. The excess usage of such products of science has social, psychological, mental as well as biological disadvantages which shall only increase in the future if not taken proper care of now. The idea remains intact: Created for benefit, over-used to destroy.

The research has six upcoming months of rigorous study and analysis of the changing behavioral trends among the youth under the influence of Gadgets. The analysis would be over a larger set of people. At the end of the study, we expect to come up with the exact facts and figures to express the impact of "Gadget fever upon the Bow-Headed Tribe".

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7. Acknowledgements

The project is a part of Delhi University's innovation scheme and has been funded by the same.

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[3]http://www.telegraph.co.uk/technology/ news/8436831/Student-addiction-to-technology-similar-to-drug-cravings-study-finds.html

A Novel Technique for Query Suggestion in Long Tail Queries

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Abstract

Query suggestion for input query is an attempt to make search experience easier and faster without putting the burden on the user to manage his information need. A search engine provides query suggestion technique that handles the explosive growth of web information and large scale of data. Search engines have big challenge to provide suggestion for long tail queries. Long tail queries are rare or infrequent queries which are not previously seen. In this paper we discussed query recommendation technique by matching based model in which the suggestion for long tail queries is provided by matching the input query with query log queries based on keywords and content. In our previous paper we proposed a framework to provide suggestion for long tail queries. In this paper we have given the algorithms for matching and ranking of proposed technique to provide query suggestion for long tail queries. We also analyzed the results of matching based model by two ways. First we compare the result of our system with previous models such as query flow graph and second we compare proposed model with the query suggestion of search engines such as Google, Yahoo and Bing.

Keywords: query suggestion, query log, query session keywords match count, ranking, keywords matching, content matching,

1. Introduction

Query recommendations are an important tool for search engines, as they help users in refining their initial queries towards a better expression of their information needs [7]. Suggestion of the query is semantically related to the original query of the user, and obtained by clustering of query, modelling of query log and query rephrasing or reformulations [7]. In most of the queries few keywords are common and remaining keywords that are unseen or rare comes under the long tail. Long tail queries have rare and unseen keywords that are called long tail keywords. Long tail keywords are beneficial for providing more targeted, and specified results as user's need. To recommend these long tail or unseen queries we proposed an algorithm in which two matching techniques are used to query suggestion for long tail queries.

In the proposed algorithm matching is done by two techniques. First technique is content based matching in which typed content by user in search engine is directly matched with query log database queries. Content based suggestion works same as previous model such as Query recommendation using query logs in search engines [4] and query suggestions using query-flow graphs [6]. Previous techniques depends directly seen or previously known queries. If related query present in database for input query directly then previous techniques give the suggestion otherwise no suggestion is provided. For the content based suggestion, mining of the query log is done frequently as user typed each character in search engine space dynamically. If typed content is in the query log database then suggestion is provided by content matching. Otherwise second matching technique, keywords matching works in which we split whole input query into keywords on the basis of spaces and matches that keywords to the query log queries. Our strategy is to provide query suggestion for long tail query is that find common keywords from the long tail queries and mines the related result on behalf of these common and known keywords. The long tail queries that are rare but still have probability to have some common keywords within it. The Keyword matching is based on keyword searching in database searches using same record [11].

Our keyword matching strategy starts matching in database from first to last keyword and the results of matching keywords ranked on the basis of keyword match count. To provide related and precise queries suggestion we provide the ranking into the queries on the basis of keywords match count and weighted score (hit score) of the keywords. The database queries having more keywords match count with input query

has higher rank. Other ranking technique is provided by counting the weighed score of keywords in database which have same keywords match count. These ranking techniques provide precise and related result for long tail queries [2].

2. Related Work

The Many researches are reported to recommend an input search query. Some query suggestion techniques are discussed below which relate our work.

Idan Szpektor et al. (2009) proposed a technique to address the long-tail problem by leveraging query templates, which are query constructs that abstract and generalize queries [10] by reasoning about rules between query templates rather than individual query transitions, as done in query-flow graph models. The approach was based on the fact that many individual queries share the same query intent while focusing on different entities. Hence, their related queries also share similar structures [1].

D. Beeferman et al. (2000) proposed a new technique for mining the collection of user transaction with an internet search engine to discover clusters of similar queries and similar URLs. They stated that According to each record consist user offered query in search engine and related URL comes into the search engine volume [5, 9].

Qiaozhu Mei et al. (2008) proposed a novel query suggestion algorithm based on ranking queries with the hitting time on a large scale bipartite graph. The method holds the semantic consistency between the suggested query and the original query and stated that every query is connected with a number of URLs, on which the users clicked when submitting the query to the search engine. The weights on the edges presented how many times the users used this query to access this URL. There is no edge connecting two queries, or two URLs [3].

The labelled query in graph indicates the query for which user want to generate suggestions. If for all URLs that used a query to access, and some other people exclusively use another query to access, that query is a good suggestion to the original query [12].

3. Implementation Strategy

Author For implementation of proposed framework, a query log of almost 127 thousands queries has been taken and these queries are converted into the database table form for the database connectivity. SQL Server 2008 is used as database and its advance feature data transportation services **(**DTS) is used for data conversion in one form to SQL Server format.

.NET Framework 2010 is used as a programming environment. It is most powerful programming environment where many inbuilt tools are available such as Web controls, Ajax control, user control, data control and many other which are helpful to make user interface and writing the program for implementing approach.

We have created a procedure to insert the new input query into databases table directly. So that new query, after getting suggestion directly inserted into query log.

4. Proposed Algorithm

Matching technique is based on contents and keywords of the input query. First, content of input query in which the information typed by the user is matched with database queries and if the exact content is not matched then keywords matching technique is performed. In keywords matching the input query broken into keywords based on spaces and matched these keywords with database queries keywords. In this research work, a concept is assumed that every long tail queries must have some common keywords with database queries. The algorithm for matching the input query or query keywords with the database queries is given below:

Algorithm

Step1: Give input query Q to search engine.

Step2: Input query or sub query, typed by user is matched with database queries. If these are directly present in database then suggestion is provided by content matching.

Step3: If input query or sub query not present in database then keywords matching is done. In which, **s**plit input query into keywords ki where i=0 to K. Length-1 in input query. Stop meaningless keywords of input query Q.

Step5: Making all combinations of keywords of input query from higher to lower number of keywords.

Step6: Matching all the possible arrangements of each group or combination of keywords with database queries one by one.

Step7: Ranking of query is done by two methods; keywords match count and weighted score of keywords.

a. Ranking Algorithm

Ranking algorithm provides related result for the input query by the user. By the ranking algorithm the desired result for user come on the top position in the suggestion list. The algorithm for ranking of queries is given below:

Algorithm

Step1: Calculate keywords match count in each combination of keywords and set rank in database queries on the basis of keywords match count. Database queries having higher keywords match count have high rank followed by lower match count.

Step2: Calculate weighted score (hit score) of keywords on the basis of occurrence of keywords in each query session. Weighted score of keywords is calculated to rank those queries which have same keywords match count. Frequently used keywords having queries in database, have high rank for query suggestion.

5. Result Analysis

We compared the implementation results with previous model for query suggestion using query flow graph by making a bar chart between keywords length and percentage of related suggestion for input query in a particular query session of ten queries. Also we compared our result with the suggestion outputs of the Google, Yahoo, Bing by making a comparison table and graph between number of keywords up to which the suggestion provided by them.

5.1 Comparison with Suggestion provided by Query Flow Graph Technique

The bar chart is plotted between the keywords length and top related suggestion percentage (%) out of top ten input query in particular session as shown in Fig.1. This bar chart shows that the proposed framework has more percentages of related suggestion in comparison of query flow graph technique.

For plotting bar chart we have taken keyword length at x-axis and related suggestion percentage out of ten input query at y-axis. We take 5 different query sessions in which we have done at least ten queries. In each session we made test set of first and last queries and put one of the ten queries as an input again to the search engine. The query flow graph provides suggestion for the query which is seen or previously stored in query log database or sub string (pretext) of input query exactly having same string present in the database. But the proposed framework provides suggestion on the basis of keywords and if the input query is unseen or long tail. Keywords based suggestion provides more related result to the input query which has some common keywords in database. The percentage of top related query out of ten results in proposed system is more than the previous model.

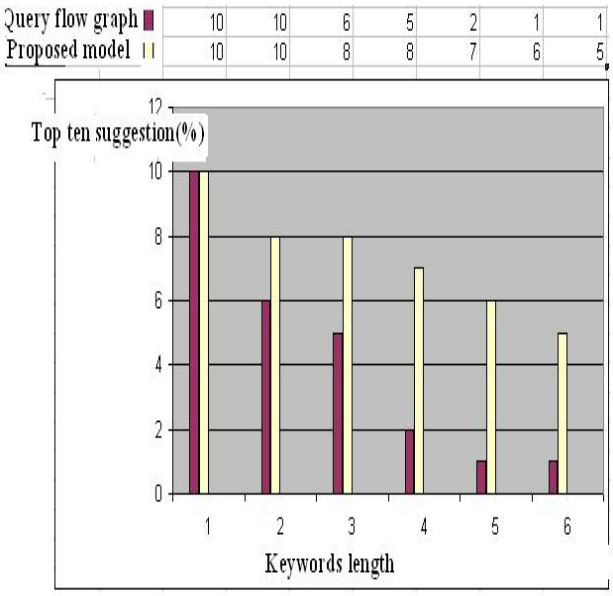

Fig. 5.1: Bar chart for the comparison between QFG and proposed model

5.2 Comparative Analysis with Suggestion Results of Google, Yahoo and Bing

The Comparative analysis of proposed framework with Google, Yahoo and Bing is done on the basis of query suggestion provided by these up to how much keywords length. We have taken 9 long tail queries and 9 query sessions. Each long tail query has own session of 10 related queries. Each long tail query is the rare query in each session and we give these long tail queries of each session as input to proposed suggestion technique and Google, Yahoo and Bing

suggestion technique. Results show that Google, Yahoo and Bing suggestion technique stops giving suggestion to the input query after limited number of keywords. Although search engines suggestion techniques have common keywords within it. But proposed technique provides suggestion on the basis of common keywords and gives better result than Google, Yahoo and Bing.

Table 5.1 and Fig. 5.2 show the comparative result for five queries. Results show that proposed technique gives better result than the Google, Bing and Yahoo. Comparative table and comparison graph is shown in Table 5.1 and Fig. 5.2 given below:

Table 5.1: Comparison table among proposed framework, Google, Bing, and Yahoo

Serial no.	QUERIES	No. of keywords in query	No. of keywords up to which suggestion provided			
			Our frame work	Google	Bing	yahoo
1	Raman ieee paper acceptance status	5	5	1	1	1
2	m.tech thesis submission guidelines	4	4	2	2	2
3	Job profiles in Indian navy	4	4	3	2	2
4	Fci recruitment notification 2013 in PDF	5	5	4	2	3
5	Match fixing in world cup 2011 news	6	6	5	2	4
6	Mobile computing project source code in java on check pointing	7	7	5	3	3
7	How to write source code in php for information retrieval project	8	8	5	2	2

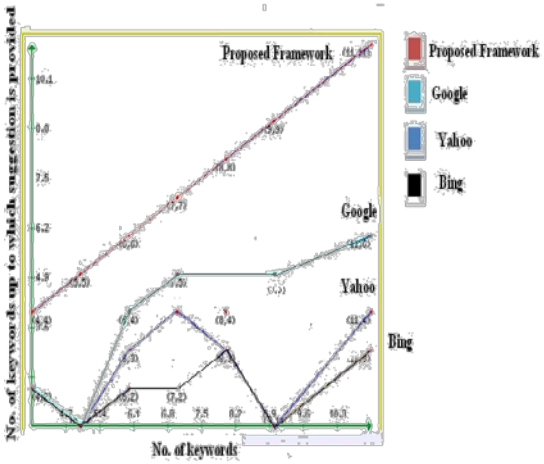

Fig. 5.2: Comparison graph among proposed model, Google, Bing, Yahoo

The analysis of all 9 long tail queries by their suggestion results given by proposed technique and Google, Yahoo and Bing are summarized in the graph shown in Fig.6-2. Graph shows that the Google, Yahoo, Bing stops giving suggestion up to limited number of keywords but our proposed technique provides suggestion on the basis of common keywords for all the queries. In graph straight line of proposed technique shows that it gives suggestion for all the long tail queries.

6 Conclusion and Future Scope

For Query recommendation based on clicked documents, based on the query-click graph, query flow graph have one limitation that they do not provide query recommendation for queries that were not seen before. Additionally, the quality of recommendations declines for infrequent queries because these models based on query log and query log leads the known query only, not recommends unseen queries. Based on the analysis on search behaviours, rare queries are very important, and their effective satisfaction is very challenging for search engines. Therefore, it is even very important to provide good recommendations for long-tail queries.

This proposed framework recovers these limitations by matching of keywords and content of input query to the query log database queries. The strategy in keywords based matching is to find out most popular and known keywords of input queries in the database queries. On the basis these common keywords, proposed system provides query suggestion for infrequent or rare queries. Every possible arrangement from higher to lower number of keywords is matched with database queries one by one. A ranking strategy is also included in proposed system to provide most related queries as a query suggestion for input query. The proposed query suggestion technique is useful for the users who do not know the way of query representation in search engine by providing suggestion on the basis of common keywords.

The proposed framework provides suggestion on the basis of common keywords in input query with query log queries. So it's still depends on the query log queries. A off line database are used for implementation so queries are limited for providing suggestion. Inserting each new query in off line mode increases the record in database. Bulk amount of

records may decrease the accessing or speed of database.

There are few ways on which this research can be improved in future. The query log database can be made online instead of offline database by daily input query of users. A generalization hierarchy can be used in proposed system to remove dependency on query log. In future a framework can be proposed to generate query suggestion on the basis of keywords as well as meaning of the keywords of input query.

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Designing a Mobile Application with OTP technique as an enhancement to e-attendance

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Abstract

We all are familiar with the process of manual attendance which is carried out across all educational institutions every day. It is a cumbersome and time consuming process. With advancement in technology like Smart classes our educational system is on the way to digitization. Thus there is a need to digitize the manual attendance system. Smartphone is a basic gadget that students have as soon as they enter the college. In this paper we propose to design a system for attendance using Bluetooth along with one time password (OTP) technique to limit proxy in attendance. This system helps the faculties to take the attendance through android based Smartphone and keep attendance records of students. Hence, this application helps to save the paper work and time.

Keywords: Android studio, JDK, Bluetooth, smart-phone, Paper saving

1. Introduction

It is not a surprise that smart phones are easily available these days. It seems like nearly everyone has one. Having a smartphone seems to be the trend in the future of wireless communication. The smartphones have entered the life of students too especially in higher education. Smartphones are based on various operating systems like blackberry, IOS, android. A mobile application is a software application developed specifically for use on small, wireless computing devices, such as smartphones and tablets, rather than desktop or laptop computers. Mobile apps are designed with consideration for the demands and constraints of the devices and also to take advantage of any specialized capabilities they have.

2. Present system of Attendance in Colleges

In the current scenario the entire work of attendance is done on paper. The present conventions followed for taking attendance are very tedious task and require a lot of paper work and thus are associated with various drawbacks like proxy attendance etc. For the whole academic session attendance is stored in register and at the end of the session, the reports are generated. All calculations to generate report are either done manually or using calculating software which involve prior data entry. This manual affair leads to greater chances of errors. Also existing methods of attendance requires lot of paper work. Damage of even a single register/record leads to complex situations. The process is not only time consuming but also sometimes inefficient resulting in the false marking of attendance. The existing system is not user friendly as retrieval of data is very slow and data is not because the maintained efficiently.

3. Proposed system for Attendance in Colleges

As To overcome the limitations of the existing methodology of attendance, there came a need to automate the attendance system. Taking the attendance on mobile phones instead of traditional approach is one of the ways to automate it. Doing the same work on mobile phones not only saves our resources but also enables the user to get easy and interactive access to the attendance records of student [1,2]. In this paper we propose to make an application that can help the faculties to take attendance of the students through their own smartphones. We also propose to use the method of one time password to overcome the limitation of proxy attendance. In the

attendance system through mobile devices, the faculty takes the attendance which is stored in the mobile database. The faculty generates a random OTP number and distributes in class and then students send a message back to teacher via Bluetooth which teacher can detect and update the attendance sheet with in the mobile. At the time of submission of attendance report the faculty directly uploads the attendance in the server with no paper work involved and utilizing the precious time in delivering their lectures rather than spending it on attendance.

Our approach towards this application will be using Bluetooth technology and utilizing SQLite database technology [3,4] of smart phones. The application will be installed on the faculty's smartphone which will search for student's mobile via Bluetooth. This will transfer the student's mobile MAC address to the faculties' mobile and intimate the presence of the student. Then using the information of MAC address the database of class attendance is updated. At the end of every session attendance of students can be uploaded on web server.

4. Requirements

Our mobile application development have both software and hardware requirements.

The software required are Android operating system, primarily designed for mobile platforms by Google and Android Studio which is an official IDE for Android application development. Android application framework is supported by number of open source libraries like OpenSSL and SQLite. SQLite is an open source SQL database that stores data to a text file on a device. Android operating system comes with built in SQLite database implementation.The hardware required are Smart Phones based on android.

5. Implementation and Results achieved till now

The project is still in the execution phase. Till yet the devices are scanned via blue tooth. The teacher's mobile has the database of students with their roll number, Names and Device MAC address of the mobile which is unique to every mobile. The scanned MAC addresses are compared with the database and then the present devices correspondingly are used to update the attendance of the student. We are in process of generating a random number OTP which will be received from various devices via Bluetooth before updating the attendance. The context diagram for the app is shown in figure 1 in which the entire system is treated as a single process and all its inputs, outputs, sinks and sources are identified and shown.

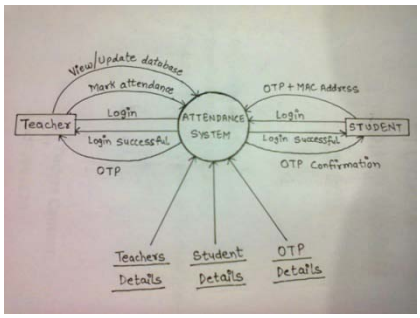

Figure 1 Context Diagram

The snapshots of various pages of app are shown in Figures 2-9.

Figure 2 Front screen

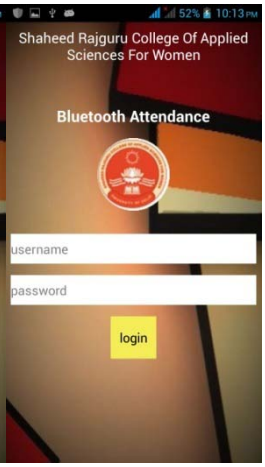

Figure 3 Authentication Screen

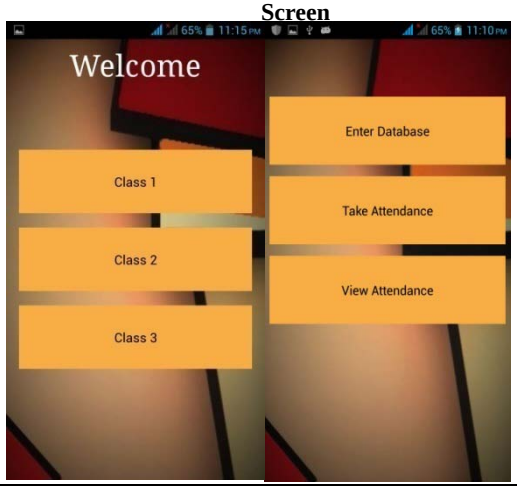

Figure 4 Classes page **Figure 5 Action page**

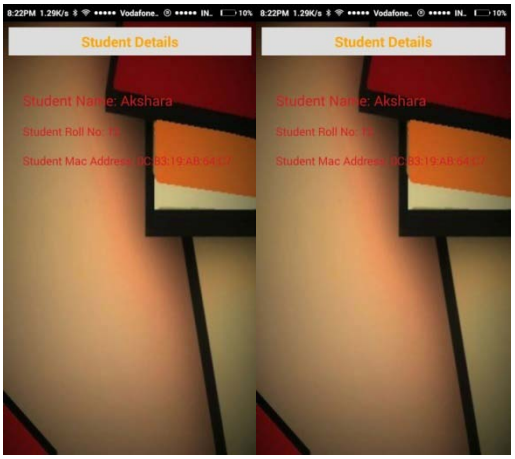

Figure 6 Database entries. **Figure 7 Database entries**.

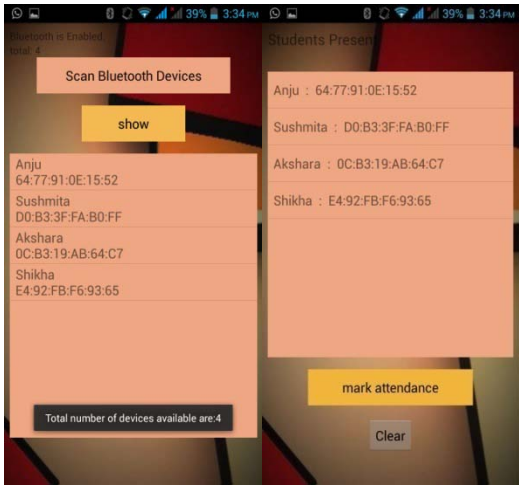

Figure 8 Device scan by Blue tooth **Figure 9 mark attendance page**

6. Extensions planned for the Mobile Application

We are still on the way of implementation of this mobile application wherein there is scope of further enhancements. We plan to integrate it with the centralized server of the college so that the attendance can automatically be send to server. We are in process to introduce use of one time password (OTP) technique to remove the limitation of proxy attendance. We plan to add on the feature of generation of sms to the guardians of the absentee's students and also informing of short of attendance [2]. These are some future works which can be implemented further to make a robust mobile application.

7. Conclusion

In this paper, we have looked over the issues related to conventional method of attendance in colleges. We proposed a system for monitoring attendance of the students using android platform. The technique of one time password is proposed to remove the limitation of proxy attendance. This application offers reliability, saving of time and paper work and act as an easy way for generating reports automatically. The proposed technique will indeed help faculty members to utilize their precious time imparting knowledge.

8. Acknowledgements

This is a project under scheme of Innovation Projects under University of Delhi. We are thankful to University of Delhi for giving us financial support for this project.

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Visualization of Big Data: Tools and Techniques for Data-Driven Decision Making

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Abstract

In this paper, we review about one of the challenges of big data that is big data visualization, which is referred to presentation of data in a pictorial or graphical format and how it simplifies complex issues and develops mutual understanding.
As the amount of data increases, visualizing data and making sense from it becomes difficult. Data visualization software enable the decision makers to see results visually and extract important information easily as human mind can easily relate to charts and graphs than reading pages and pages. Also using visualization we can easily compare results based on big datasets which is not that feasible otherwise.

We have first discussed about what basically big data is and why working with it is a major problem. Then we mentioned the importance of visualization-based data discovery tools and how these help in deriving value from big data.

Key Words: Big Data, Visualization, Para View, Hadoop.

7. Introduction

These Big data is watching you each time you go to a website, every minute you spend on the internet and a huge amount of data is captured and analyzed every second. Thus, Big Data plays crucial role for increasing productivity growth in the whole world. Since, it is affecting many diverse domains like education, health field, administrative sectors, etc apart from software intensive industry. When the size of data grows beyond Exabyte (10^{18}) and it surpasses the available technologies capability to be stored, managed and processed efficiently, it enters the world of Big Data. "Big Data" is a term encompassing the use of techniques to capture, process, analyze and visualize potentially large data sets in a reasonable time frame not accessible to standard IT technologies. By extension, the platform, tools and software used for this purpose are collectively called "Big Data technologies" [1].

Big data help businesses to achieve deeper and faster insights of the large valuable data, thus improving customer experience and increasing the overall throughput of the business. But, with the ever increasing size and variety of data gathered Big Data is proving to be a tricky challenge for many organizations to achieve desired outcome. The velocity with which data flows in makes it difficult to handle and access simultaneously.

Big Data represents a fast-growing multibillion-dollar worldwide market. The adoption of Big Data solutions outside of high-performance computing (HPC) is continuing at a rapid pace. IDC expects the Big Data technology and services market to grow from $6 billion in 2011 to $23.8 billion in 2016. This represents a compound annual growth rate (CAGR) of 32%, or about seven times that of the overall information and communication technology (ICT) market [2].

The solutions to such problems are the visualization-based data discovery tools. These tools promote self-service business intelligence making it easier for users to integrate data, analyze and present it in a way which can be easily understood. So, visualization-based data discovery tools are worth exploring by businesses that seek to derive more value from big data

8. Visualization Challenges

All The well-known 3v's of big data Volume, Variety and Velocity pose a great challenge on the visualization forms that can be used to depict the insights of the data. While the extraction of valuable information for decision making via Big Data majority depends on reducing the latency time from data capture to action that explain the data to the management. The Big Three V's of Big Data are explained as below:

Volume: Using visualization-based data discovery tools, businesses can work with an immense number of datasets turning their attention from managing data to gaining rich insights that is, enabling businesses to

derive meaning from large and growing, volumes of data.

Velocity: With visualization-based data discovery tools, businesses can replace batch processing with real-time processing of continually updated data streams, making more people to access, analyze and view real-time data.

Variety: Using visualization-based data discovery tools, we can combine as many data sources as needed helping businesses derive more meaning from structured data as well as semi-structured and unstructured data.

The data tend to become unstructured as business activities and complexity of big data increases (see Figure 1). Increasing availability of mobile devices is another challenge leading to rise of visualization-based data discovery tools. Businesses that depend on centralized creation of reports are missing the opportunity to adapt a faster, cost-effective and more democratized Business Intelligence Model which combines the advantages of big data and mobile workforce to speed insights and improve collaboration.

According to big data- the next Big thing, a joint report by NASSCOM and CRISIL Global Research and Analytics, "The Indian Big Data Industry is expected to grow from US$200 million in 2012 10 US$1 billion in 2015 at a CAGR of 83%...In India, Big Data analytics and related IT services will create an estimated 15,000 to 20,000 specialist jobs by 2015." [3].

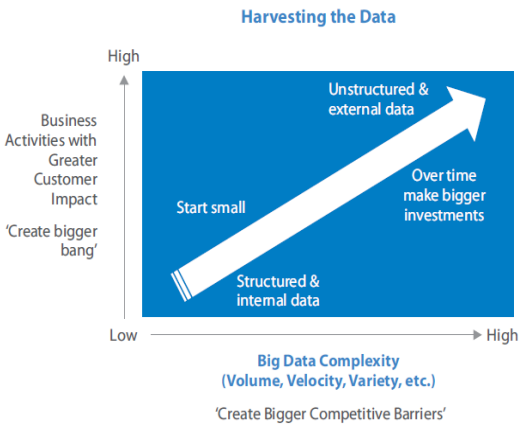

Figure 1. Big Data Complexity [4]

Thus, the smart data intensive processes require tools that can provide quick and deep access to the hidden ice-berg of information.

9. Visualization Based Data Discovery Tools

The "By visualizing information, we turn it into a landscape that you can explore with your eyes, a sort of information map. And when you're lost in information, an information map is kind of useful."- David McCandless (author, data journalist & information designer). [5]

The tools that can be used to visualize the information for fast and accurate decision making used the data heuristic available. Some technologies are supporting back-end concerns such as storage and processing but visualization-based data discovery tools focus on the front-end of big data such as helping explore the data easily and understand it completely.

Visualization-based tools used for data discovery allow the business users to crush frantic data sources to produce routine analytical views that can be customized with flexibility and ease of use. These tools have a democratizing effect on business because of their ease of use and intuitive interfaces. Also data analysis and visualization can be done by a large number of users with minimal training.

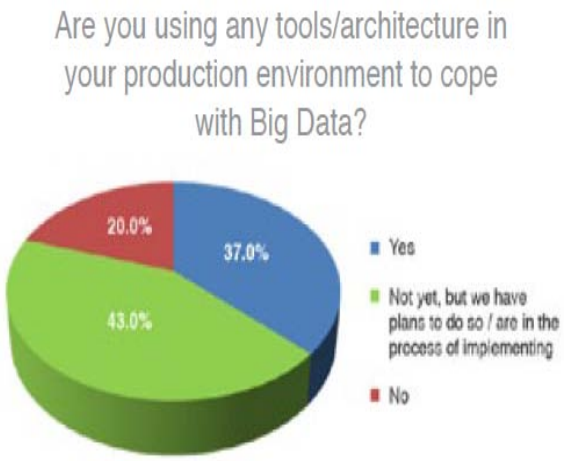

Figure 2 Industry-Based Usage of Big Data Tool [6]

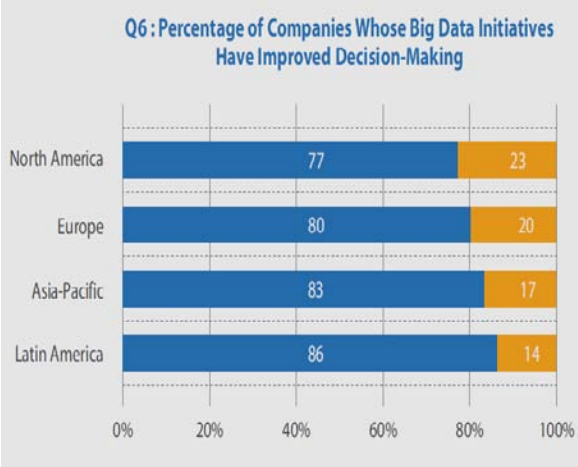

Figure 3 Percentage of companies whose big data initiatives have improved decision making [4]

80% of the companies are already using or planning to use visualization-based tools to cope with big data (see Figure 2), and how these tools have improved their decision making (see Figure 3).

10. Features of Visualization Tools

Below are some of the major features the visualization tools must have so that the end users can analyze and visualize data with ease:

- Interactive graphics (including charts, graphs, tree maps, maps, etc.) so that the data can be visualized in the best possible way.
- Should require little or no any programming skills because to visualize data, code does not play any role.
- Data should be presented using data structures easy-to-understand by non-technical users too.
- Should produce a quick summary for each variable and display it in an easy-to-read format.
- Should support analytics of the big data.
- It should support creation of reports in real-time and with ease.
- Should have the ability to isolate errors or fix simple data problems.
- Should be able to filter data by values or categories.
- For fast access to big data, it should hold data in-memory.
- It should allow users to share answers and insights easily.

Along with these features, the tools should be easily brought in action by the users in line with their existing tasks, and should maintain control and security over the data.

11. Overview of Existing Tools

Wherever ParaView: This is an open-source, multi-platform data analysis and visualization application. The application is build on the Visualization Tool Kit (VTK) libraries, which provide visualization services for data so that data can be analyzed using qualitative and quantitative techniques [7]. It can run on supercomputers to analyze big datasets and also on personal computers for small amount of data and is widely used in many organizations, universities, and industries. The application is very easy to use, the users just need to open data files and start visualizing them.

Some of the features of ParaView are: the capability to visualize large datasets, supports a variety of input/output and file formats, have interactive user interface, can run on different machines using client-server approach, and it is scripted in the python language.

Hadoop: Hadoop is a framework of tools which supports running of application on big data. It uses the MapReduce algorithm, where the data is processed on different computers connected over a network, to run the applications and a storage part known as Hadoop distributed file system (HDFS) [8]. There is a master computer, consisting of job tracker, name node, task tracker and data node and salve computers, consisting task tracker and data node. Job tracker divides the big task into smaller once and gives these tasks to different task trackers. And the name node keeps track of which data is residing where.

The application can analyze huge amounts of data. Some of the key features are: scalable storage platform as the number of slave computers can be increased, cost-effective storage as the slaves are not the supercomputers, can derive useful insights from data, fast data processing, and fault tolerance as different copies of data reside in the same computer and also keep a backup of the table maintained by the name node. 56% companies are using NoSQL data store instead of RDBMS, 30% use Hadoop processing platform and only 12% use real-time event processing tools (see Figure 4).

Figure 4 Products used in companies for big data. [6]

12. Conclusion

The paper discusses about big data and big data visualization. The paper also provides a deep understanding of various challenges that prove as a hindrance to data visualization. Further we have discussed about visualization tools and the desirable features of visualization tools for data discovery and how these tools help in deriving value from big data. At the end two famous visualization tools ParaView and Hadoop are discussed, listing some of their features too.

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Particle Swarm Optimization

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Abstract

Particle Swarm Optimization is nature-inspired algorithm developed by Kennedy and Eberhart (1995) which aims at solving continuous and discrete optimization problems. This paper comprises of a study of the originally developed algorithm, the advancements, applications, variants and future of PSO.

Abbreviations used: PSO (Particle Swarm Optimization), SI (Swarm Intelligence), CSI (Computational Swarm Intelligence), FIPS (Fully Informed Particle Swarm).

1. Introduction

Particle swarm optimization belongs to the class of swarm intelligence (under soft computing) techniques that are used to solve optimization problems. A brief introduction to these areas is presented below.

a. Soft Computing

Soft Computing is an area of study in Computer Science where it uses inexact solutions to computationally hard tasks such as NP Complete problems, for which there doesn't not exist any algorithm that can provide a solution to it in a reasonable (polynomial) time. It is tolerant of imprecision, uncertainty, partial truth, and approximations which makes it different from conventional computing. The main model for Soft Computing is the human mind. This field came into existence in the early 1990s.

b. Swarm Optimization or Intelligence

Firstly, a swarm is defined as a group of generally mobile elements that share knowledge with each other through direct or indirect communications by acting on their local environment. This sharing of knowledge by acting on the local environment leads to collective problem solving strategies with a common goal (optimum). Swarm intelligence (SI) hence refers to this collective problem solving that emerges from the inter-agent communications and Computational swarm intelligence (CSI) refers to the algorithmic models of such strategies. SI has also been referred to as collective intelligence.

Particle Swarm Optimization

Particle swarm optimization was introduced by Kennedy and Eberhart (1995) [4] and has its roots in the simulation of social behaviors using tools and ideas taken from computer graphics and social psychology research.

14.

PSO is a population-based stochastic approach for solving continuous and discrete optimization problems. It is based on the simulation of the social behavior of birds within a flock (or fishes in a school). The initial intent of the particle swarm concept was to graphically simulate the graceful and unpredictable choreography of a bird flock, which was first presented by Reynolds [10] and Heppner and Grenander [3] presented simulations of bird flocking.

The aim of discovering patterns that govern the ability of birds to fly synchronously, and to suddenly change direction with a regrouping in an optimal formation led to the discovery of PSO. From this initial objective, the concept evolved into a simple and efficient optimization algorithm. In PSO, individuals, referred to as particles, are "flown" through hyper-dimensional search space. Changes (updations) to the position of particles within the

search space are based on the social and psychological tendency of individuals to emulate the success of other individuals. The changes to a particle within the swarm are therefore influenced by the experience, or knowledge, of its neighbors. The search behavior of a particle is thus affected by that of other particles within the swarm (PSO is therefore a kind of emergent and not an inherent algorithm). The consequence of modeling this social behavior is that the search process is such that particles stochastically return toward previously successful regions in the search space.

15. Basic Working

The algorithm is initialized with a group of random particles (also called solutions) and then the search for optima by updating generations is done. In each iteration of the loops used, the position of each particle is updated by following two "best" values. The first one is the best solution (fitness) it has achieved so far. (The fitness value is also stored.) This value is called pbest i.e. the particle-best. Another "best" value that is tracked by the particle swarm optimizer is the best value obtained so far by any particle in the population. This best value is a global best and called gbest. When a particle takes part of the population as its topological neighbors, the best value is a local best and is called lbest. particle-best. Another "best" value that is tracked by the particle swarm optimizer is the best value obtained so far by any particle in the population. This best value is a global best and called gbest. When a particle takes part of the population as its topological neighbors, the best value is a local best and is called lbest.

a. Parameters used

[6] Fitness Function: Fitness Function is the function used to find the optimal solution. It is usually the objective function to be optimized.

[7] Particle Best(pbest): It is the best position of the particle among its all positions visited so for

[8] Global Best(gbest): The position where the best fitness is achieved among all the particles visited so for

[9] Velocity Update(v[]): Velocity is a vector to determine the speed and direction of the particle

[10] Position Update(current[]): All the particles try to move toward the best position for optimal fitness

[11] c1 and c2: Learning factors$_{1=}$ or$_{2}$ $_{=}$acceleration$_{2}$ parameters; usually (from experiments)

7. rand(): Any random number between (0,1)

b. Equations used

After finding the two best values, the particle updates its velocity and positions $a^{\text{with}}.[^{\text{following}}+1]=$ $_{\text{equations:}}[]+1 * () * ([] - []) + 2 * () * ([] - []) \; b. \; [] = [] + [+ 1]$ where, equation a) is the velocity update equation and equation b) is the position update equation

16. Basic Flow of PSO Algorithm

1. Initialize swarm from solution space.
2. Evaluate fitness of individual particles.
3. Modify gbest, pbest and velocity.
4. Move each particle to a new position.
5. Go to step-2 and repeat until convergence or a stopping condition is achieved.

17. PSO Pseudocode

```
for each particle
      initialize particle
end
do
    for each particle
    calculate fitness value if the fitness value
    is
    better than the best fitness value (pbest) in
    history
    set current value as
    the new pbest end
    choose the particle with the best fitness value
    of all the particles
    as the gbest
    for each particle
    calculate particle velocity according equation
18.
    a)  update particle position
    according equation
    b)  end-
```

5. Applications of PSO

The first practical application of PSO was in the field of neural network training and was reported together with the algorithm itself (Kennedy and Eberhart (1995)) [4]. Many more areas of application have been explored ever since, including telecommunications, control, data mining, design, combinatorial optimization, power systems, signal processing, and many others. A number of research directions are currently pursued, including:

- Theoretical aspects
- Matching algorithms (or algorithmic components) to problems
- Application to more and/or different class of problems (e.g., multiobjective)
- Parameter selection
- Comparisons between PSO variants and other algorithms.

6. Variants of PSO

The original particle swarm optimization algorithm has undergone a number of changes since it was first proposed. Most of these changes affect the way the velocity of a particle is updated. Few variants are discussed briefly as follows:

a. Binary PSO

The first variant proposed for discrete domains was the binary particle swarm optimization algorithm (Kennedy and Eberhart 1997) [6]. In this algorithm, a particle's position is discrete but its velocity is continuous. The *j*th component of a particle's velocity vector is used to compute the probability with which the *j*th component of the particle's position vector takes a value of 1.

b. Constriction coefficient

The *constriction coefficient* was introduced as an outcome of a theoretical analysis of swarm dynamics (Clerc and Kennedy 2002) [2]. The velocities in this variant are constricted; hence the name of this coefficient is constriction coefficient**.**

c. Bare Bones PSO

The *bare-bones particle swarm* (Kennedy 2003) [5] is a version of the particle swarm optimization algorithm in which the velocity- and position-update rules are substituted by a procedure that samples a parametric probability density function.

d. Fully-informed PSO

In the standard particle swarm optimization algorithm, a particle is attracted toward its best neighbor. A variant in which a particle uses the information provided by all its neighbors in order to update its velocity is called the *fully informed particle swarm* (FIPS) (Mendes et al. 2004) [7].

Versions of PSO:

There are two versions of PSO [1], namely gbest PSO: It is the global best PSO where each particle in the swarm collects information/ communicates from every other particle in the swarm.

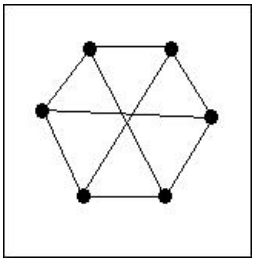
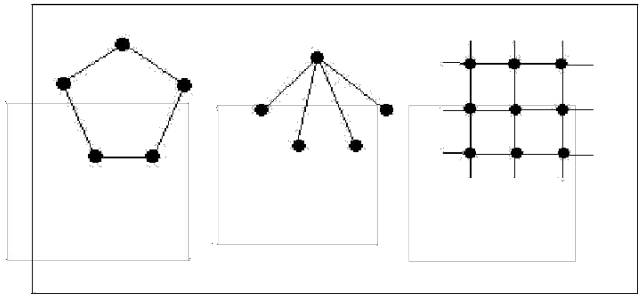


Fig.VI.1 gbest-PSO

lbest PSO: It is the local best PSO where every particle communicates with its neighboring particles to attain the optimum. It has many topologies for communication and knowledge sharing as shown below.



Ring Wheel Von-Neumann

Fig. VI.2lbest-PSO

[12] Future of PSO

Despite its apparent simplicity, the PSO presents formidable challenges to those interested in understanding swarm intelligence through theoretical analyses. So, to date a fully comprehensive mathematical model of particle swarm optimization is still not available. This makes PSO a good option as a research area for scholars as there still exist many unvisited aspects in the algorithm.

[13] Conclusions

Particle swarm optimization is an extremely simple algorithm that seems to be effective for optimizing a wide range of functions, is nature-inspired and emergent, and has various applications in today's evolutionary world. The algorithm basically models the social behavior of bird flocks or fish schools, it can find good applications in the field of automation and optimizations. The original version of PSO is extremely simple and contains very less lines of code. As stated by Eberhart and Kennedy (1995): "Once again nature has provided us with a technique for processing information that is at once elegant and versatile", PSO has wide applications in the current evolutionary world of increasing intelligence.

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Sentiment Analysis: A New Paradigm in Natural Language Processing

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Abstract

This paper elucidates the process of sentiment analysis with an emphasis on classification, applications and challenges in this recent research area. With the explosive growth of the social media content on the web in the past few years, sentiment analysis has become very important as more and more people are getting involved in social media in order to share their views and opinions. Sentiment analysis, also referred as opinion mining, combines natural language processing with artificial intelligence capability and text analytics to assess reviews found across various social networking sites to determine whether they are positive or negative with respect to a particular brand. A firm might track sentiment analysis over time to determine whether their actions improve or damage sentiment, keep track of brand reputation, to test how marketing efforts affect attitudes toward the brand and attitudes toward new products. Thus sentiment analysis is confluence of natural language processing, text analysis and computational linguistics in order to identify and extract subjective information in a given text like a document, a sentence, or a feature.

Keywords- Sentiment Analysis, Sentiment Classification, Sentiment Polarity, Lexical Affinity.

1. Introduction

With the growing popularity of Internet, people have accepted it as a convenient source to share their views and to understand views of other individuals. As a result, people are now sharing their views on varied subjects ranging from political issues to movies using numerous social networking services like twitter, facebook, blogs, review sites and other interactive websites. Independent third party views have always been important for any decision making process. Before the era of Internet, we usually took advice of our friends before going for a movie, dining at a new restaurant or buying consumer durable goods. With the advent of technology, Internet has conveniently connected millions of people and has made it possible for them to share their views even with strangers. Nowadays people look at the reviews even before downloading an application in their phones. According to a survey, it has been noted that while purchasing goods online, people prefer those items which are rated better irrespective of the price issues and concerns. As more and more people are using social networks to share their views, opinions and experiences of goods and services they have bought, the vendors/companies are getting more alert and sincere about the reviews. Since the feedback of their goods and services, either positive or negative, can have a potential influence on other prospective consumers, vendors are constantly analyzing and monitoring these feedbacks and are improving their services, changing their marketing strategies and improvising other activities accordingly to increase their profit[1].

Formal definition of process of sentiment analysis: Let us first gain an insight of *Opinion* [2]. An opinion is defined as a quintuple (e_j, f_{ik}, so_{ijkl}, h_i, t_l) [3] where,

e_j: is an entity on which an opinion is expressed.
f_{ik}: is the feature of the entity under consideration.
so_{ijkl}: is the sentiment value of the opinion expressed by the opinion holder on the feature of the entity. It may be positive, negative or neutral.
h_i: is an opinion holder
t_l: is the time when the opinion was expressed.

Sentiment analysis is defined as the computational treatment of opinion, sentiment and subjectivity in text. It is a process which involves analyzing the opinions, identifying the sentiment expressed in the opinions and then classifying their polarity which may be positive, negative or neutral. Consider an example:

"I had recently bought a DELL laptop. It has long battery life and is reasonable but is tightly designed "

In the above review, the entity is the laptop and its features under review are battery, cost and design. The review for battery and cost is positive while the review for the design is negative.

Figure 1 represents the process of sentiment analysis which involves collecting the opinions, identifying the entity and its features followed by identifying the sentiment expressed in the opinion and lastly finding its sentiment polarity.

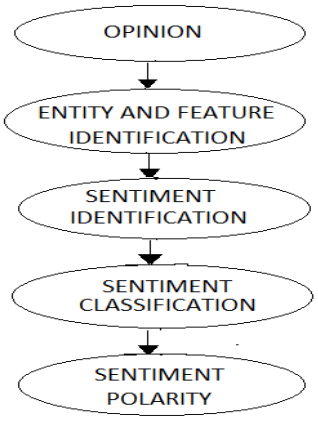

Figure 1: Sentiment analysis process

2. Background

Initially sentiment analysis was of little use to people as not much data was generated and thus no significant information was deduced from that available data. With the explosive growth of Internet, social networks became popular and therefore sentiment analysis became an imperative field for research. The year 2001 saw an increase in the awareness of the research problems and uses of sentiment analysis. It is being used in different fields like business, politics consumer electronics and entertainment [1]. With more than 1.2 million posts every day. It is impossible for traditional methods like ad-hoc research, clipping services and field agents to analyze and monitor all the collected data. Further the information deduced from opinions is required frequently so as to be familiar with people's views, new technologies are required which can automatically and swiftly analyze consumer sentiment. Algorithms like Naïve Bayes, Max Entropy, Boosted Trees and Random Forest have been designed and are being used currently to classify the opinions.

3. Classification Levels of Sentiment Analysis

Sentiment analysis can be done on three different levels namely document level, sentence level and aspect or entity level [3] as shown in figure 2.

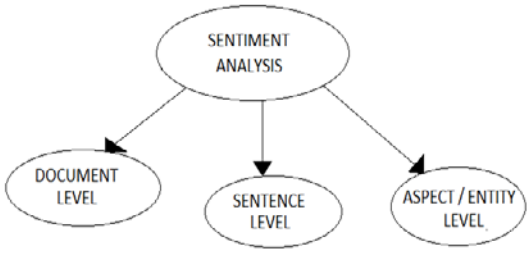

Figure 2: Classification levels of sentiment analysis

At **document level**, we analyze the whole document and then conclude the sentiment expressed by the document – positive or negative.

Sentence level targets each sentence and decides the sentiment expressed in each sentence – positive, negative or neutral. There is not much difference between sentence level and document level sentiment analysis because each sentence can be considered as a short document [4].

Sometimes sentiment analysis done at the document level or sentence level does not provide all the information provided in the opinions. To obtain all the information we analyze at the **aspect level**. In this case, sentiment is classified for each feature of the entity [5].

4. Existing Approaches

Author There are mainly four categories of existing approaches to sentiment analysis [6].

- **Keyword spotting**: This is the most basic method among all and is very simple and pretty economical. In this method, text is classified on the basis of unambiguous affect words like 'wonderful', 'bad', 'worse' and 'good'. But keyword spotting fails in those cases where negation is involved or where affect words are not present. For example consider this sentence 'I did not like the food'. Keyword spotting fails in the above example as it classifies the sentence as positive. Consider another sentence 'I spent 1000 bucks on my tuition only to fail the exams again'. This sentence does not contain any affect words and hence cannot be classified using keyword spotting.

- **Lexical affinity:** Lexical affinity rather than just simply detecting affect words assigns random words with probabilistic affinity for a particular emotion. For example the word accident has ¾ probability of representing a negative effect. This method is better than keyword spotting but has two disadvantages.

First, lexical affinity operating on word level fails when sentences like 'I met her by accident' are encountered. Secondly, it is difficult to develop a reusable, domain-independent model as lexical affinity probabilities are often biased toward text of a particular genre.

- **Statistical methods:** These methods accurately classify text on the page or paragraph level but do not work well on smaller text units. Methods like Bayesian inference and support vector machine have become popular for affect classification of texts. This method enables the system to learn about the valence of other arbitrary keyword, punctuations and word co-occurrence frequencies along with the valence of affect keywords.

- **Concept-level techniques:** Concept based approaches focus on semantic analysis of text. Such an approach relies on the implicit features associated with natural language concepts instead of blind use of keyword and word co-occurrence count. Unlike purely syntactical techniques, concept-level approaches are able to identify semantics that are expressed in a subtle manner, e.g., through the analysis of concepts that do not explicitly convey relevant information, but which are implicitly linked to other concepts that do so. For example consider the sentence 'Go watch the movie' is negative for book review but positive for movie review.

5. Applications

The Sentiment analysis is becoming popular gradually and is being used in different fields. Some of its applications are [1]:

- We can create a review and opinion aggregation website which gathers opinions and reviews from other sites. The topics may vary and may not focus on one issue only i.e., product reviews.
- Sites which can summarize user reviews and correct the errors in reviews can also be created. Many a times user selects a rating which contradicts his/her review of the item. In such cases ratings can be fixed.
- Sentiment analysis and opinion mining can be used as sub component technology in other systems :
  - We can combine this technology with recommendation systems so that it does not recommend those items which have negative reviews and lower ratings.
  - Sentiment analysis can be used to detect abusive language in emails and other communication methods.
  - In online systems we can use this technology to place advertisements appropriately on the WebPages i.e., removing product advertisements from those sites which have negative reviews and placing them in those sites which have positive reviews regarding the product.
- Sentiment analysis is quite useful in business intelligence.

Consider a case where the manufacturer wants to know the reason behind the low sale of one of its product. In such cases sentiment analysis can be used to collect public reviews and opinions about the product and bring changes in the product accordingly. Misperceptions about the product can also be cleared using this method.

- It is also useful in predicting the sale of the product by analyzing the sale trends in the past and the public viewpoints on the product.
- In elections, sentiment analysis and opinion mining can be used as a technique in understanding the thought process of the voters and providing them with relevant information about the candidates.
- Government can get access to public viewpoints on pending policies and other debatable government issues.

6. Challenges

An opinion or review application capable of processing subjective information effectively is faced with a number of challenges. It should be able to overcome these challenges. Some of the notable challenges are as under:

- Uncertainty in query classification. It is not certain whether the user is indeed looking for subjective information.
- Difficulty in determining which documents contains information related to the opinion

query and subsequently which part of the selected documents contains the reviews and opinions.

- How to summarize the sentiment information gathered by the system. This includes highlighting selective opinions, representation of points of disagreement and consensus, identification of communities of opinion holders and accounting for different levels of authority among opinion holders.
- Determining what the nouns and the pronouns in the reviews refer to. For example: "we went for lunch and then watched a movie. It was boring". Here it is confusing to guess what 'it' refers to.
- Also if we don't know the author, we cannot be sure whether the review written is sarcastic or not.
- Poor grammar, abbreviations, wrong punctuations can become a hindrance in analyzing opinions and reviews.
- There are yet no proper ways to identify fake and duplicate reviews [7].
- On filtering generally popular reviews are extracted and innovative or out of the box thinking reviews are overlooked.

7. Conclusion

Sentiment analysis intends to conclude the attitude of a speaker or a writer with respect to some domain ad to assess the overall contextual polarity of the text. Additionally, sentiment analysis has become vital in today's scenario as an exorbitant amount of data is being generated every day on social networks or social relations amongst people who share related interests, activities or backgrounds. It is an upcoming research area and a lot of investigations can be done in this field. New algorithms can be designed to assess the sentiments correctly, accurately and rapidly. Sentiment analysis plays a pivotal role for businesses and companies in giving new ideas to invent and create innovative goods after analyzing what people intend, need, demand and wish.

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RMart: A Digi-Campus

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Abstract

The Smart phones have changed the definition of mobile phones by being a powerful communication tool inevitable in our daily life along with varied options for fun and entertainment. It has now become a very common tool because of the popularity of android system in the electronics market.

Today's student generation is mobile, online and Internet-savvy. They are all computer gurus, and they often engage better with their electronics than they do with paper and pencil.

As the saying goes, when you can't beat 'em, join 'em: charge into the information age as a 21st century teacher. Use online tools and resources to power your lesson-planning and engage your students. Internet-based tools that promote collaboration and information sharing can be used in academic settings to promote student engagement and facilitate better student learning.

In this paper, we have introduced the concept of an open cross-platform for teachers and students for sharing their knowledge, collaborating for innovations and entrepreneurship ideas, webcasting.

1. Introduction

Education can do wonders to humans, a well stated quote those points to importance of education. Only classroom teaching is not the only way to educate. In fact, Education has emerged as an amalgamation of knowledge sharing, innovation, collaborative learning and much more. With the advent of internet, the scenario has drastically changed, everything is going to be paperless and available at anytime and anywhere. As said by Satyan Gajwani(CEO of Times Internet, India's largest digital product co) -"Don't think of the Internet just as a service, it is a platform on which a whole range of innovation can be launched."[1].

Teaching through Internet allows educators and students to remain on the cutting edge of technology. Using Internet as a reference resource in teaching classes has the immediate advantage of allowing quick access to vast resources. Internet has proved to be superior to the conventional educational methodology. The benefits that Internet has brought to the classroom are undeniable. Internet growth is mainstreaming among the young population of India and the mobile access is growing in leaps and bounds. More and More people are going online in India, with more than 200 Million people connected as on December 2013. This indicates that digital content that they use is playing an ever-growing role in their lives.

The proposed Intranet portal Rajguru-Mart is an idea of developing a digital mart specifically tailored for the need of students of SRCASW (Shaheed Rajguru College of Applied Sciences for Women). It would be a versatile intranet portal which will provide meaningful revolution to life of students in their academic as well as career related areas. This cross-platform environment can be used by students for sharing their knowledge, collaborating for innovations and entrepreneurship ideas, webcasting; alumni contact centre, internship and placements details etc. It would be a one stop shop for all their college related needs.

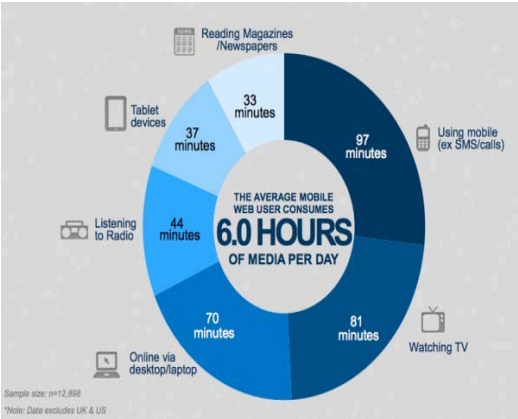
2. Related Work

All The prevalence of Internet has drastically affected many areas of society in positive ways, including education. Modern-day undergraduates not only have computers to help them with their studies, they also use the Internet for research while teachers use the same to enhance their lessons. For college students Internet is as vital as air, water and food.

As of 2013, India was the third-largest online market with more than 154 million Internet users. According to the student online behaviour report, 93% of the student's community access the Internet everyday and 73% of the students uses mobile device to access the Internet [2].

Asking any questions in hail of Internet is just like finding needle in hay. So instead of Internet, we require an Intranet portal where the participants are less and more authentic. Thus this type of portal will

prove to be highly popular and acceptable among youth. This idea also serves as miniature of Digital India and Go Green revolution. In fact, this cradle step will help us to be a part of Digital India Initiative.



3. Proposed Application

The proposed application is reminiscent of resource pool for the students, alumni and teachers of Shaheed Rajguru College of Applied Sciences for Women. The intention of the project is multifold. Initially, an Intranet website would be developed. Thus this portal will provide a unified platform for its users.

The prime objective of project is to develop a portal with following key features:

- **Knowledge Sharing Platform:** This portal will facilitate sharing of study material, tutorials, and question bank and research papers. Even if a student is not able to attend classes due to some medical problem, she should not compromise on her studies.

- **Job Opportunities:** College has a strong Alumni base. Many of the existing alumni are constantly in touch with college regarding job opportunities in their companies. It can eventually be used to apprise young female undergraduates about authentic part-time or full time job offers and summer jobs. Also information about various On/Off campus placement, internship offers will be readily available on site.

- **Entrepreneurship Ideas:** Innovation ideas of students can be shared and discussed for further entrepreneurship collaborations. Students can easily get in touch with likeminded people which are otherwise not possible with one to one communication in college.

- **E-commerce:** New product development is a major highlight of the college as food technology students prepare new products every year. This feature can be exploited as marketing platform where students can advertise their products. Students can also sell their old books, gadgets, etc to other college community by posting advertisement on the portal there by getting more trusted and genuine buyers.

- **Application Development:** Students can develop their own apps and put on website for free beta testing by other students. Thus they get free enhancement suggestions.

- **Mentorship:** This portal will also accomplish the task of discussion forum where any user anonymously discusses their social or mental problems. This will not only help them to cope up with stress but also to build a strong persona for future. Such things will help them to connect themselves spiritually and build a strong moral character.

- **Add-ons:** This feature will act as information hub to notify lost and founds upcoming events and college activities, scholarship notices, entrances deadlines etc.

The techniques and methods used in the app are as follows:

- **Android:** Android is a mobile operating system which offers a unified approach to application development. Developers need to develop applications using Android and these applications can run on numerous different devices, as long as the devices are powered using Android.

- **PHP:** PHP is a server side scripting language that is embedded in HTML. It is used to manage dynamic content, databases, session tracking, even build entire e-commerce sites and it is integrated with a number of popular databases.

- **MySQL:** MySQL is a fast, easy-to-use RDBMS being used for many small and big businesses. MySQL works on many operating systems and with many languages including PHP, PERL, C, C++, JAVA, etc. MySQL works very quickly and works well even with large data sets

- **Apache:** Apache is web server software. Any web server is either hardware (a computer) or software (the computer application) and thus

it helps deliver content which is accessed through the computer. It is the back end that provides the support for scripts to work, databases to seamlessly integrate with the web application. Apache played a vital role in initial phases of development of World Wide Web. It helps in implementing core modules for handling server side programming language, authentication schemes, socket transactions & layer securities. While supporting FTP, it has inbuilt HTML authorizing tool & inbuilt search engine. The large public library of add-ons helps one to customize the server end. WAMP Server is used to run a local server on PC or laptop [4].

4. Research Design and Methodology

The website will be developed using RAD (rapid application development) model of software engineering. It is a type of incremental model [3]. in which the components or functions are developed in parallel as if they were mini projects. The developments are time boxed, delivered and then assembled into a working prototype.

- **Software Requirement Analysis**: The requirements of the portal will be freeze and documented in SRS.

- **Software design document:** Once the requirements are documented, students will start working on designing phase of the project. It will contain the full details of dataflow flow diagrams, ER diagrams, UML, screen design, state transition diagrams and time line chart (GANTT) depicting milestones to be achieved in the specified time to track the progress of the project. This document will act as a reference during the whole development phase for various modules of the portal. This phase will identify the screens to be developed for a user friendly portal having all the above stated features.

- **Coding, Testing and Implementation:** Once designing phase is over, the project will enter coding phase wherein students will design the front end using PHP, implementation using C# language and backend tool will be Oracle 10gi with WAMP (Windows, Apache, MySQL and PHP) server. The design approach is entirely modular i.e. unit testing is performed for each module. When all modules will be coded, they will be interfaced and integrated with each other. Afterward integration testing and project testing is done.

- **Deployment:** The full version of website will be deployed on college intranet for testing using private IP addressing scheme. This will be equivalent to beta testing. Project's maintenance phase is also straightforward as students are always available and accessible in the college to rebuild the changes.

5. Conclusion

The proposed app provides a platform for students to interact with the teachers, share their knowledge, collaborating for innovations and entrepreneurship ideas, webcasting; alumni contact centre, internship and placements details etc. It would be a one stop shop for all their college related needs. Moreover, this application only focuses on students as the user base.

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"Persistent Interoperable GIS"-An Ontological Solution

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Abstract

Interoperability is an ancient problem. Basically it is now a crucial issue in geographical information systems (GIS). Many researchers tried to solve it by different techniques such as semantic translator, mediators, integrators and ontologies. But persistent interoperability has added a new dimension in interoperability problem. This research is trying to build a persistent interoperable GIS using ontologies as a tool. To describe entities, classes, properties and functions related to a certain view of the world ontologies are used, which are theories and use a specific vocabulary. The first step is to specify ontologies specified in a formal language. The ontology editor can generate a set of classes from the specified ontologies that are available to be browsed by the end user and provide metadata about the available geographic information and thus satisfy a persistent interoperable GIS.

Keywords: Persistent; Interoperability; Ontology.

1. Introduction

Interoperability would seem to be a straightforward concept. It is simply a measure of the degree to which various organizations or individuals are able to operate together to achieve a common goal. According to IEEE, Interoperability is the ability of two or more systems or components to exchange information and to use the information that has been exchange [8]. However it requires full exchange of data between the systems heterogeneous data models [3].

Interoperability problem arises when different heterogeneous nature of geo-data poses disagreement amongst information sharing. There are several types of heterogeneity such as structural, syntactic and semantic heterogeneity.

Structural heterogeneity means that different information systems store their data in different structures. For example, same data is stored in different structure or format such as .mdb (Microsoft access format) .ora (Oracle format), .dbf (dBase format) etc. Syntactic heterogeneity means that different database systems use different query languages [SQL (Structured Query Language), OQL (Object Query Language), QBE (Query By Example) etc]. Semantic heterogeneity considers the content of an information item and its meaning [2]. In this paper designing of a persistent Interoperable GIS (PIGIS) taking ontologies as a tool discussed since PIGIS satisfies Interoperability problem after banishing heterogeneity of different data model and also persist the information system.

The following sections organized as follows, section 2 gives an overview of persistency and significance of Interoperability in GIS, section 3 gives Solution attempts taken to address the interoperability issue in GIS section 4 emphasizes an architecture of PIGIS, and section 5 conclude the paper.

2. Persistency

Non-computer expert users can access and direct the processing of large scale datasets utilizing distributed high performance computing and storage resources. The implementation of this system can benefit from many of the attributes of persistence, however the wide variety of target system, target languages and the need to support legacy codes make a truly persistent system infeasible.

The two basic principles [1] behind persistence are:

i) That any spatial object such as point, line and area may persist for as long, or as short, a period as that object is required, and also

ii) May be manipulated in the same manner regardless of this longevity.

Persistent Interoperable GIS is a vital issue while widespread use of spatial data in information systems. Some heterogeneity problem as stated before could overcome by using interoperable GIS. But this can't satisfy proper longevity of spatial objects. This paper is trying to introduce an ontological solution that satisfies persistency. Here description of ontology introduce as engineers point of view. There two types of ontology in the real world, R-Ontology and E-Ontology. [6] suggests a terminological distinction between the referent-based or reality-based ontology (R-ontology) and elicited or epistemological ontology (E-ontology)[11]. R-ontology is a theory about how the whole universe is organized and corresponds to the philosopher's point of view. An E-ontology fits the purposes of software engineers and information scientists and can be

defined as a theory about how a given individual (or group or language or science) conceptualizes a particular domain. It can be observed that the ontology of a particular domain is different to various Geographical Information Communities (GIC). Consequently, this causes an issue of interoperability, in various organizations.

2.1. Significance of Persistent Interoperability in GIS

The traditional paradigm for the development of databases and applications using their data is based on the cycle modeling-design-implementation, and considers a single database framework under one data model and with one schema. The advent of heterogeneous systems and, more recently, the Web, is changing this picture. Large amounts of data are available in distinct formats and systems, varying from structured DBMS repositories to unstructured files and home pages. Some data are structured according to well-established data modeling techniques, such as the relational or object-oriented data models. Other data, such as data maintained in various information systems, spreadsheets, or Internet repositories, are in proprietary formats, semi-structured or unstructured. This situation of multiple models and schemas, combined with the intrinsic difficulties for communication and establishment of agreement for data representation in the application domains, makes the interoperability problem very complex.

To integrate data the problem can be decomposed into that of extracting data from the sources to feed the warehouse, and integrating these multiple source data into the warehouse. The emphasis of this work is on the second step. This decomposition allows us to focus on representational and semantic issues, and the fundamental data integration problems. Afterwards, results from the research on data integration in warehouses may be useful to achieve persistent interoperability in a wider sense.

3. Solution Attempts Taken to Address the Interoperability Issue in GIS

The first attempts to obtain persistent GIS interoperability involved the direct translation of geographic data from one vendor format into using persistent glue such as java. The motivation of this practice turned to use a standard file format. These formats can lead to information loss, as is often the case with the popular CAD-based format DXF. This problem can be avoided by using an alternative solution like the spatial data Transfer Standard (SDTS) and Spatial Archive and Interchange Format (SAIF). A modernization proposal for SDTS using and object profile that integrates a dynamic schema structure, an OpenGIS interface, and the Common Object Request Broker Architecture Interface Definition Language (CORBA IDL) is presented in [2] One important initiative to achieve GIS interoperability is OpenGIS Consortium.

Since widespread use of heterogeneous data not accepted initiatives like SDTS, SAIF and OpenGIS and thus cannot banish interoperability [2,3,4,5,6,7,10]. Moreover existing solution cannot satisfy persistency. It is mentioning that Persistence means continue to existence [8]. However there is a similar concept in information system. [6] Quoted two basic principles behind persistent information system [8]: that any object may persist for as long, or as short, a period as the object is required, and that objects may be manipulated in the same manner regardless of this longevity.

4. Architecture of PIGIS

This architecture consists of a Global Community (GC)- and a number of Geographical Information Communities (GIC) as illustrated in Figure 1. Each GIC (for example, WASA, T & T, PDB, BGS) contains a GIS application constitutes a persistent glue here in java and corresponding spatial database (DB). GIS application is used to retrieve, share, manipulate spatial database (DB) through local schemas or data definitions as shown in Figure 1.

Global Community (GC) contains an integrator, a global schema and a common ontology. The role of integrator is to develop the global schema by taking similar attributes from the local schemas. For example, national highway and regional highway are a kind of highway and hence they inherit the attribute of the highway. Therefore, the role of integrator is to find the commonality from the local schemas, which in turn becomes global schema. Common ontology consists of global schema, which is called global data definition, along with methods/rules, necessary to retrieve the information in an efficient way. For example, T&T requires information from WASA but the constraint is that both can't communicate with each other directly. In this case common ontology,

consisting of global data definition and rules, is used to retrieve the requested information of T&T from WASA. In this way, each GIC (WASA, T&T) can share information through GC. In addition, GC maintains all shared/common geo-spatial data, which are publicly available and could be used by all GIC. Thus the architecture, presented, enabling an intelligent integration of information from multiple heterogeneous GIC data sources.

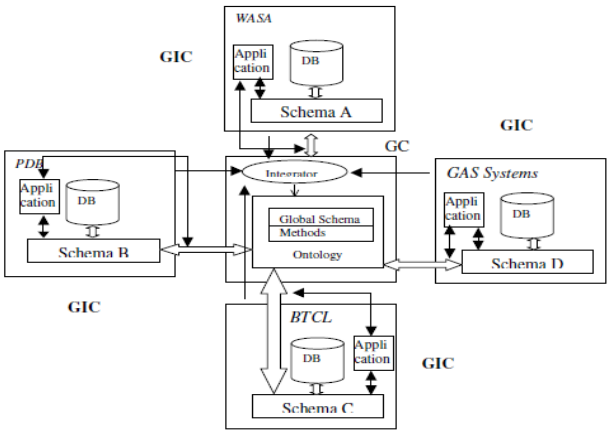

Figure 1: An Ontological Architecture for PIGIS

It is interesting to note that when GIS application of a GIC is looking for a data, which is different from local spatial database, in that case, the request is directly sent to the common ontology. Common ontology contains necessary rules for data retrieval purpose but it needs classes and objects definition from global schema. Now common ontology gathered all resources of information including location of data and rules for how and what data should be retrieved.

5. Discussion and Conclusion

One of the crucial issues in GIS, particularly in the study of spatial databases is the sharing of knowledge. In this context persistent interoperability is considered as the vital issue. This paper presented an ontology-based architecture, which can be used to assist persistency, enabling the tackling of interoperability issue, faced by the various local communities. When different community uses different local ontologies, the architecture translates it into a common ontology. Therefore, for each query related to the local ontology it does not need to process every time. Finally, the proposed architecture has been applied taking a case study area into account. This in turn could play an important role to address the interoperability problem, faced by these communities of Chittagong city.

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Development of an Electronic Voting System

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Abstract

The term "Electronic Voting" refers to the use of computer to cast votes in an election process. Electronic Voting System aims at conducting voting in any democratic election. It is a system that is meant to computerize the work performed in voting like casting or counting of votes. It substantially decreases the amount of effort required in comparison to manual voting system, increases the individual participation and improves the accuracy of voting results. This paper proposes the analysis, design and application of electronic voting system, using which multiple voters can vote concurrently.

keywords: Electronic voting system, Database schema, Unique Identification Number, LAN connection, ER Diagram, Data Flow Diagram, Primary Key.

1. Introduction

Elections are an important and integral part in any democratic country. For an election to be successful, it must be done in an unbiased environment with more and more people actively participating in it. If not conducted in a proper manner, its result can have adverse effects on the society and its people, with a non-deserving candidate winning the election. Due to inconvenience of manual votingpractice, elections have suffered declining participation over the years. The manual voting system which is being currently used is extremely laborious and quite inadequate, since whole system is maintained manually. The process of keeping, maintaining and retrieving the information is very tiresome andextensive. If any information is to be retrieved later, it requiressearching all the records manuallywhich is even moredistressing.Another problemwith the existing manual system is that it is difficult to detect errors once the records are entered. Also, it is inconvenient to update the records.

The problems of manual voting system led to the motivation for the development of thiselectronic voting system. Since the entire system is automated, it is easy to maintain, rectify and update the records. Also, it gives accurate and immediate results to its administrators just with an ease of button click.

2. Related Works

Nowadays, elections are conducted using Electronic Voting Machine. The proposed project will implement the same concept in institutional/organisational elections, such as elections of student governing bodies, to avoid significant flaws that compromise the secrecy of ballot and integrity of results[1]. Various electronic systems have been proposed for elections, Computer Countingsystem requires the voters to mark their votes on ballot cards. The cards are then scanned to calculate the total votes of each candidate [2]. In Direct-recoding electronic voting machine (DRE), voters cast their vote using keyboard or touch screen on a computer terminal, directly connected to a stand-alone polling-station-located computer [3]. On-Voting, uses Internet or a private network for the voting process. It is of three types, namely: Poll site, Kiosk and Remote e-voting system.

3. Proposed System

The proposed system has many striking features like:

- Authenticity, which will beprovided by allowing only college students who have valid college enrolment number to cast their votes in the election.
- Once the vote has been casted, no alteration or spoofing is allowed. Only valid votes will be counted.

- A vote can't be tampered with or viewed by anyone, throughout the voting process thus ensuresprotection and security of the proposed system.
- Multiuser environment will allow multiple users to cast their vote simultaneously.
- The system will have high availability during the election process.
- Users will be provided with a unique Id (UID) just before the election process via e-mail.
- List of students who have not casted their votes can also be generated.
- To implement the electronic voting system, three database tables will be created: Student, Candidate and Administrator which will contain the details of the students, candidates and the administrators respectively.

3.1 Advantages of the Proposed Approach

EVS facilitates multiple users to exercise their franchise simultaneously, thereby reducing time to a great extent, in contrast to the traditional voting system. By using EVS, analysis of data will become easier and at the same time less time consuming. Since the users will be given a UIDjust before voting process, the chances of proxy voting can be theoreticallyeliminated completely and only the genuine authentic voters will be able tocast their vote. Counting of votes will be fast and the results will be declared instantaneously. The proposed project emphasizes on paperless activity that reduces the overall expenditures incurred as compared to manual voting system.

3.2 Disadvantages of the Proposed Approach

Since the entire system will run on a local area network with a single server loaded with complete application database and multiple client machines having JAVA based application installed on them. All voters execute their franchise concurrently; there might be chances of server breakdown, which may crash the whole application. Sincethe uptime of the server and LAN is almost 99.99%, it is a rare situation unless some catastrophe happens. Further, there may be a possibility of serious computer threats like viruses, worms, Trojansetc. compromising system security and integrity thus making the system more vulnerable. Butthese threats can further be preventedby ensuring anti-virusessoftwarewhich are upgraded timely.

4. Design Methodology

Methodology for the proposed system starts with the design of DFDs. A DFD shows the flow of data through a system. It views a system as a function that transforms the inputs into desired outputs. The DFD aims to capture the transformations that take place within a system to the input data, so that eventually the output data is produced [4].

1) CONTEXT LEVEL DIAGRAM (Level 0)

In a **context level diagram,** the entire system is treated as a single process and all its inputs, outputs,sinks, and sources are identified and shown [5].

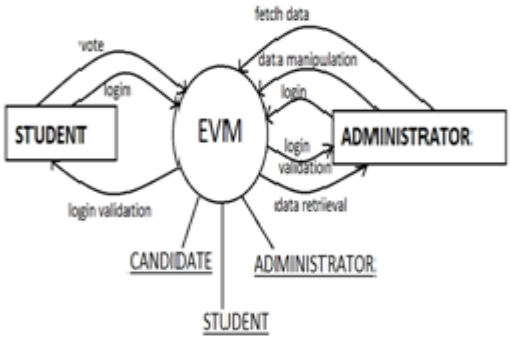

Figure 1: Context level DFD

2) Level 1 DFD

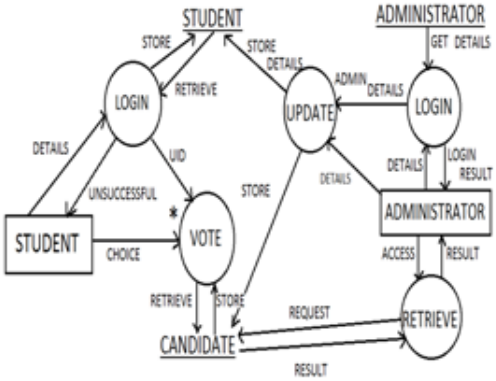

Figure 2: level 1 DFD

Data Bases Chemas

Once the data requirements have been collected and analyzed, the next step is to create a conceptual schema for the database using a high- level conceptual data model. This step is called conceptual design. The conceptual schema is a concise description of the data requirements of the users and includes detailed description of the entity types, relationships and constraints; these are expressed using the concepts provided by the high level data model. Because these concepts do not include implementation details, they are usually easier to understand and can be used to communicate with non- technical users**.** All database tables defined above must have an attribute to identify each tuple uniquely. A **primary key**, also called as PK, is a key in a relational database that is unique for each record. A relational database must always have one and only one primary key [6].

Candidate Schema

Roll_No	**Name**	**Post**	**Count _votes**	**Ballet _No.**

There will be five attributes in the candidate table: Roll_No, Name, Post, Count_Votes, Ballet_No, where Ballot_No is defined as the primary key and Count_Votes is the derived attribute.

Student Schema

Roll_No.	**Marked**	**Uid**	**Stream**	**Email_id**

The student table will also contain five attributes, namely Roll_No, Marked, Uid, Stream and Email_id, where Roll_No is the primary key and Uid is the candidate key. Marked is used to ensure that the voter can vote only once.

Administrator Schema

User_id	Password

In this table, the User_id is the PK.

ENTITY-RELATIONSHIP DIAGRAM

An entity-relationship diagram (ER Diagram) is a graphical representation of

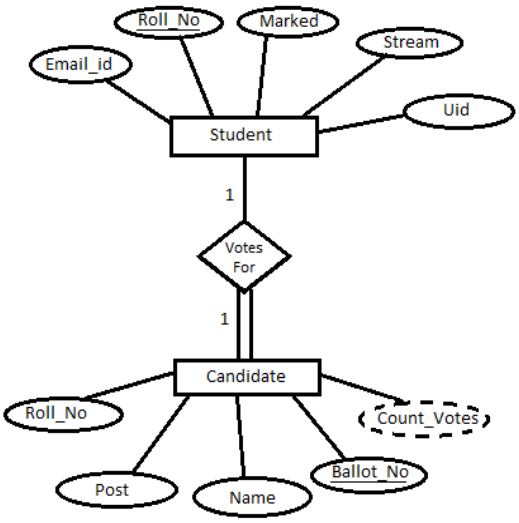

Figure 3 : ER Diagram

a n information system that shows the relationship between people, objects, places, concepts or events within that system [7]. Figure 3 indicates an ER diagram for the proposed system which shows a binary relation between candidate and students with a cardinality ratio of 1:1. This specifies the maximum number of relationship instances that an entity can participate in the relation. One student can vote for only one candidate. Participation constraints denote whether existence of an entity depends on the existence of the other entity. If all the entity instances participate in the relation, then total participation and otherwise, partial. The diagram indicates that all students may not participate in the election process, so partial participation but candidate entity has total participation.

5. Future Works and Conclusion

The proposed project is local area network based application, but in future it can be extended and adapted to an internet based environment. The online voting system will eliminate long line-ups at polling stations and will enable students with disabilities, suffering from illness or away on personal travel or any individual who cannot turn-up to the polling booth to cast their vote.Thus the proposed system is a direction towards green computing and green IT that points to environmental sustainable computing by greatly reducing the need of paper for the election process[8].

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Holographic Data Storage: A Review

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Abstract

Holographic Data Storage is a promising technology for storage. Research is going on in this field to make it commercialize and realizable. In this article the journey of Holographic Data Storage has been discussed in brief. Also, the type of materials used has been discussed here. In this review there is an insight into the future prospects of the technology.

***Keywords*— Spatial Light Modulator, Holographic Data Storage, Optical Interference Pattern.**

1. Introduction

Holographic data storage is an approach that can store information at high density inside crystals or photopolymers. The ability to store a lot of information in some kind of media is of great importance, as many electronic products include storage devices.

It has been found out by Hao Ruan [1] that optical storage offers long lifetime (above 50 years), low power consumption (about 1/15 of that of hard drives) and low cost. But the commercialized optical discs have low capacity as compared to hard drives. The largest capacity of Blu-ray Disc (BD disc) is 128GB now. In 2003, Burr [2] from IBM gave a full scale review of volumetric optical storage that had been proposed and developed in the last ten years of 20 century and the beginning of this century.

The research of HDS (Holographic Data Storage) commenced in the 1960s and went on up to 1970s [3-7], but no commercial success was achieved out of this because of the significant technical challenges, including poor media performance and a lack of input and output devices such as spatial light modulators (SLMs) and cameras.

In the 1990s, the Defense Advanced Research Program Agency (DARPA) of United States established a consortium of companies and universities, led by IBM and Stanford University, to develop high performance holographic storage systems [8]. The main aim of the consortium was to exhibit high density and transfer rate by developing the necessary technology and components, such as custom high speed cameras and SLMs. Research in data channel modulation and detection stratagem was also undertaken. A multiple page fully digital HDS system was developed [9].

In this review paper, we have reviewed the research and developments that has happened in the past five decades in the field of HDS and also we have considered the future aspects of this technology as to what else can happen as compared to the surface storage technologies. This paper also contains the information about the research in the area of materials used for recording the hologram and it concludes with a discussion on future aspects and advantages of holographic data storage and the factors which are majorly responsible for stopping of the commercialization of this technology till yet.

2. Phenomenon

In HDS, a whole page of data is stored directly as an optical interference pattern [10] inside a thick, photosensitive optical material. It happens when two coherent laser beams meet inside the storage material. The first beam is called the object beam. It contains the data to be stored. The second beam is called the reference beam. It is designed to be easy to reproduce—for example, a simple collimated beam with a planar wave front. The ensuing optical interference pattern results in chemical and/or physical alterations in the light-sensitive medium: a duplicate of the interference pattern is stored as a modification in the absorption, refractive index, or thickness of the light-sensitive medium. When the stored interference grating is irradiated with one of

the two waves that were used throughout recording, some of this incident light is diffracted by the stored grating in such a way that the other wave is reconstructed. Irradiating the keep grating with the reference wave reconstructs the thing wave as shown in fig.1, and the other way around. An extensive number of these interference gratings or patterns can be superimposed within the same thick piece of media and can be accessed independently, as long as they are discernible by the direction or the spacing of the gratings. Such separation can be achieved by changing the angle between the object and reference wave or by changing the laser wavelength. Any specific data page can then be read out independently by irradiating the stored gratings with the reference wave that was used to store that page. Owing to the thickness of the hologram, this reference wave is diffracted by the interference patterns in such a way that solely the coveted object beam is significantly reconstructed and imaged on an electronic camera. The information to be stored is etched onto the object.

A SLM is an important device for controlling light in two directions, consisting of an address part and a light modulation part. The optical attributes of the light modulation part are modified by the data written into the address part, and the readout light is then modified in keeping with that change, manufacturing associate degree optical output that reflects the written data. The abstraction distribution of light such as the phase, polarization state, and intensity and the direction of propagation can be changed according to the written data.

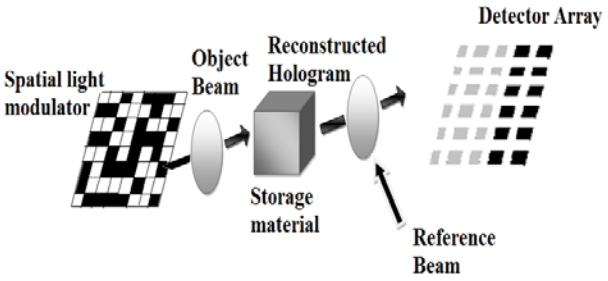

Figure 1 Phenomenon of holographic data storage [1]

3. Holographic Recording Materials

The architecture of holographic storage system is largely determined by the type of recording medium. Generally, holographic data storage materials are categorized into two classes [12]: systems based on thin (a few hundred μm thick) photosensitive organic media and thick (a few mm to cm), inorganic photorefractive crystals. The broad, bulky crystals of photorefractive media are perfect for recording geometries in which a reference and object beam are incident on the medium at 90°. A conventional photorefractive crystal used to examine this configuration is iron-doped lithium niobate. Complete demonstration systems have been established by Stanford University, Stanford and Siros [13], IBM [14] and Rockwell, Thousand Oaks, CA [15], as part of the photorefractive information storage materials (PRISM) and holographic data storage systems (HDSS) programs. The researchers at the California Institute of Technology, Pasadena (Caltech) [16], and at Lucent [17] and at other organizations around the world have eventually made system demonstrations as well. The Psaltis group at Caltech and the group at Northrop have demonstrated notably analog recordings of large numbers of holograms [18-19].

3.1 Photographic materials

The first materials used to record holograms were High-resolution photographic plates and films. They are still in demand because of their quite high sensitivity when compared to other hologram recording materials [20]. Moreover, they can be dye sensitized in order to match their spectral sensitivity to the most frequently used laser wavelengths.

Because of the low diffraction efficiency of amplitude holograms, holograms produced for displays using photographic materials are usually processed to obtain volume phase hologram which has much higher diffraction efficiencies. The most common procedure is to use a re-halogenating bleach bath, without fixing, to convert the developed silver back into a transparent silver halide with a high refractive index. The regenerated silver halide goes into solution and is redeposited on the adjacent unexposed silver halide grains.

Material transfer through diffusion is effective only over a very limited distance. As a result, the

diffraction efficiency of the hologram drops off rapidly, for fringe spacing greater than a critical value corresponding to the diffusion length of the silver ion in the bleach bath [21].

Until a few years ago, the most commonly used photographic plates and films were Kodak 649F and Agfa 8E75HD and 8E56HD [22]. After the manufacture of these materials was discontinued, their place has been taken by the BB emulsions produced by Holographic Recording Technologies and the Slavich emulsions marketed by Geola.

3.2. Dichromated gelatin

A volume phase hologram can be recorded in a gelatin layer containing a small amount of a dichromate, such as $(NH_4)_2Cr_2O_7$, by making use of the fact that dichromated gelatin becomes locally hardened on exposure to light, due to the formation of cross-links between the carboxylate groups on neighbouring gelatin chains. This effect is used to obtain a local modulation of the refractive index.

After exposure in the holographic system using blue light from an Ar laser (488 nm), the gelatin layer is washed in water at 20–30 °C for 10 min, so that it absorbs water and swells. The swollen gelatin layer is then immersed in two successive baths of isopropanol, to extract the water, and dried thoroughly. The volume phase holograms with high diffraction efficiency and low scattering can be produced with care in processing [23-24].

3.3. Silver-halide sensitized gelatin

In this technique, it is possible to combine the high sensitivity of photographic materials with the high diffraction efficiency, poor scattering and high light-stability of dichromatedgelatin.

The exposed photographic emulsion is evolved in a metol-hydroquinone developer and then bleached in a bath containing Ammonium Dichromate $(NH_4)_2Cr_2O_7$. The oxidation products of the developer, as well as the Cr3 ions formed by reduction of the bleach, constitute cross-links between the gelatin chains in the domain of the oxidized silver grains, producing local hardening of the gelatin [25]. With the help of this technique, it is feasible to obtain diffraction efficiencies up to 80% with transmission gratings and 55% with reflection gratings [26-27].

3.4. Photoresists

In positive photoresists, the areas exposed to light become soluble and are washed away during progress to create a relief image [28].On a photoresist, the recorded holograms can be replicated, using a thermoplastic. Also, multiple copies of holographic optical elements can be made.

3.5. Photopolymers

Due to photo polymerization, various organic materials can be triggered by a photosensitizer to produce refractive index changes, when exposed to light [29]. A commercial photopolymer is also available, coated on a polyester film base (DuPont OmniDex) that can be used to generate volume phase holograms with high diffraction efficiency [30].

The film is supplied with a polyester cover sheet, laminated on to the tacky photopolymer layer. By removing the cover sheet and laminating the tacky film to the master hologram, close contact is ensured .The film is then exposed to UV light in order to cure the photopolymer, after which it can be separated from the master hologram. Finally the film is baked at 100–120 °C for 1–2 hours to obtain increased index modulation [30].

A multilayer structure comprising of a glass or Mylar substrate coated with a transparent, thin, conducting layer of Indium Oxide (In_2O_3), a photoconductor, and a thermoplastic can be used to record a hologram [31-32].

3.6. Photorefractive crystal

If a photorefractive crystal is exposed to a spatially varying light pattern, electrons are discharged in the illuminated areas. These electrons move to adjoining dark regions and are trapped there. The spatially varying electric field produced due to this space-charge pattern modifies the refractive index through the electro-optic effect and produces the equivalent of a phase grating. By uniformly illuminating the crystal, the

space charge pattern can be removed; after which another recording can be made.

The photorefractive crystals usually used for recording holograms are Fe-doped $LiNbO_3$ and $Bi_{12}SiO_{20}$ (BSO), which has a higher sensitivity. The best results are obtained with BSO with the recording configuration in which an electric field is applied at right angles to the hologram fringes [33].

4. Latest Developments

Holographic data storage allows the information to be arranged in data pages, that is, at least one data page that contains N bits can be stored in each volume element of the medium ("pagewise").

Furthermore, multiple data pages can be stored in the same volume element of the medium ("multiplexing"). For multiplexing photopolymers are currently preferred as the photoactive material for 'Write Once Read Many' (WORM) or R media [34]. Integrated solutions of drive and disc are close to commercialization [35]. Attempts have been made to realize rewritable and erasable holographic optical data storage. The main focus of such investigations is on the use of photorefractive crystals and the first work dealing with this approach was published in 1968 [36].

For several years, the use of holographic techniques for the "bit-wise" principle has also been explored. In this, diffraction-limited large reflection holograms, known as "micro-mirrors", can be written by two counters propagating, coherent light beams in their common focus in a photoactive medium. In this case, the hologram is written only within the focusing depth of the objective lens, that is, in the beam waist. The "micro-mirrors" act as the optical equivalent of (virtual) pits. The potential advantage is the possibility of having many layers of information without having to use reflection layers [37-38]. This scheme is part of the "multilayer" approach. This approach can use established data encoding and error correction and may allow a similar optic as today's BDs. However, in this case the data-transfer rate per layer will not be higher than that of the current BDs [39].

A team comprising of American and Russian researchers have created a new holographic storage device that would in the future offer "unprecedented" increase in the electronics' storage capacity and process power. The researchers' holographic system uses spin waves rather than optical beams to browse knowledge. created from oscillating magnetic material, spin waves are ideal to be used in physical science, as they are each compatible with current devices and might operate in smaller areas than optical beams. A laptop using spin-wave technology might doubtless work a TB of knowledge into an area the scale of a sugar cube. However the dream of a quick, high-capacity holographic storage system remains elusive. Khitun and his team's holographic memory system might mark a turning point; however their device remains substantially an experimental model [40].

Holographic storage is a bright candidate for next-generation storage. Recent analysis has shown that holographic storage systems with fascinating properties may be designed. The next step is to make these systems at prices competitive with those of present technologies and to optimize the storage media. If appropriate recording materials become accessible from the analysis efforts presently afoot, we envisage a major role for holographic storage [41].

Even though photographic silver-halide emulsions have been a major part of the traditional holography, they fail to meet many of the requirements, and a host of more suitable materials have been found and developed for holographic storage. None of the candidate for holographic storage media considered so far, however, has been able to fulfil all the requirements, and instead of a single material, an array of possible materials, each with a unique set of strengths and weaknesses has emerged. Among these are photopolymer films (available from DuPont and Polaroid), photorefractive crystals such as iron-doped lithium-niobate (Fe: LiNbO3), and photochromic films such as those made from dichromatedgelatin and the light-harvesting protein Bacteriorhodopsin.

5. Advantages of Holographic Data Storage

The essential technique for holographic storage was proposed in 1963 by Pieter van Heerden, who worked on holographic technologies at Polaroid's labs in Cambridge, Massachusetts [42]. The technology permits storage densities that can exceed those of traditional recording as it goes beyond the 2D approaches of traditional storage technologies and writes data in 3D. Such memories are rewritable [43] and have high capacity [44] to store at least 1 TB of data per square inch of storage medium. Moreover, the holographic data storage disk can last for at least 50 years. By reading out and storing millions of bits at a time, a holographic disc could hold a whole library of films. Location-based services (like interactive maps); video games and movies could be put on postage-stamp-sized chips and carried around on cell phones. An entire medical history of a person, including diagnostic images like x-rays, could fit on an ID card and be rapidly transmitted to or retrieved from a database. The technology also allows fast random access to data compared to magnetic drives that generally take minutes to access data and has incredibly high transfer rates – up to 1GB per seconds which is 40 times faster than a DVD [45].

6. Discussion and conclusions

Certainly the theoretical promise of holographic storage has been talked for about 40 years but boosts in cheaper and smaller lasers, projector technologies, digital cameras and optical recording materials have ultimately pushed the technology to the edge of the market and the ability to pack exponentially more bits into minute spaces could open up a realm of new applications. Previously, the realization of holographic data storage has been frustrated by the complexity of holographic multiplexing strategies, the lack of availability of suitable system components, and above all, the absence of recording materials that satisfy the stringent requirements of holographic data storage. Recently, the expansion of practical components for holographic systems has revived interest in this technology. The recording sources have the required features for holographic storage and are attractive due to their small size, low cost and ruggedness. The InPhase Technology team has invented various multiplexing techniques that yielded a simple, easily implementable architecture for holographic storage systems [45]. If the future holographic memories have erasable write-once, read-many drives and support terabytes of storage, 1 Gbit/second readout rates, and fast access to data in blocks of 50–100 GB, then they can be applied in videos on demand and large Web servers [1].

However, as a promising storage technology that has been worked on over the past 40 years, HDS has not yet attained commercial success. For the commercial products, preferable features might include input and output data rates, capacity, cost, latency, system volume, and power consumption. The key factor that prevents the commercialization of holographic disks is the lack of a photopolymer material with adequate thickness. Currently available materials have 100 microns thickness, yielding a surface density of only 10–20 bits per square micron that is of the same order as a DVD. Researches in material development assure to increase the thickness to 1 mm, increasing the achievable storage density. The primary competitor of holographic archive storage is magnetic tape. By 2013, a magnetic tape had achieved 5 TB capacity and 240 MB/s transfer rates [1]. This left HDS at a competitive limitation to magnetic tape archive solutions in spite of other strengths such as random access, robustness and longer-term archive lifetime.

Nevertheless, HDS technology is an attractive candidate for big data centre. Looking into the future, HDS must be extremely competitive with tape in three crucial areas: capacity/footprint, cost/TB and transfer rate. If this is accomplished,

HDS would become a superior solution to propel it into being the front-runner in big data centre storage.Moreover, on a larger scale, corporate and government data centres could replace their enormous storerooms of server racks and magnetic-tape reels with the holographic disc drives.

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Advanced Communication in Digital World

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Abstract
The recent adoption of semiconductor fabricated LED has created a whole new world of opportunities for a technology like visible light communication to see success. Talking in layman's language, visible light communication simply means, a light source which is transmitting the data through illumination, hence communicating. But when it comes to technical terms, Visible Light Communication can be defined as the transmitting of data signals using visible light as the signal carrier and air as the medium of transmission. It is comparatively new and safer way of transmitting signals using visible light spectrum rather than the conventional radio wave transmission. The paper is particularly based on transmission of data signals using LEDs as transmission source and air as communication medium and photoreceptor at the receiving end to capture light and retrieve the transmitted data.
Keywords: Audio Signal, LED, Photoreceptor

1. Introduction

In the field of Optical Wireless Communication, Visible light communication is an emerging technology that implements the transmission of signal using the visible light. The signal which is analog in nature travels through LED in the form of fluctuations of LED at such a high frequency that it is subtle to human eye. There are several benefits of using this technology such as larger bandwidth than radio spectrum, and also due to vigorous growth in semiconductor technology the LEDs are present everywhere at cheap cost.

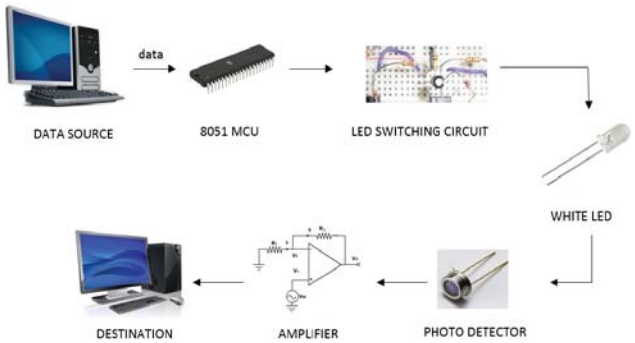

Fig 1: Transmitter and receiver section

The basic implementation of this technology is transmitting and receiving data through serial communication. This is done by using 8051 microcontroller, which is apt for our requirement, at present; available and also much familiar to us. The data which is fed to 8051 from source (Computer) is converted into continuous form of pulses which is then, through analog circuitry transmitted through LED. Finally at receiver's end, the photoreceptor senses the change in incoming frequency of signal and using the analog circuit the incoming light signal is converted to electrical signal and is fed to 8051 which retrieves the original signal and further transmits it to its destination (Computer). This small working confirms the transmission of signals through visible light. For the Practical work, the analog circuits were first simulated using Multisim. It is an advanced, industry-standard, best-in-class SPICE simulation environment. In the world, educators use it to teach electronics theory and engineers use it in various industries to design and prototype circuitry. The circuits were first simulated using Multisim and then were implemented in hardware.

VLC has the capability to bring 5G data transmission in picture within few years, till then we are taking a step further for improving the results of VLC to an extent that it can be implemented in real world.

2. Experimental Work

To start with the basic idea of VLC which is transmission of data due to fluctuations of LED, first step is to check the analog schematics for the transmission. Before reaching the analog part, Fig 2 shows the digital data which is being converted to analog waveform and hence for testing it is demonstrated as a square wave type input (pulse or data bits). The LED fluctuates with the input pulse accordingly hence transmitting the data.

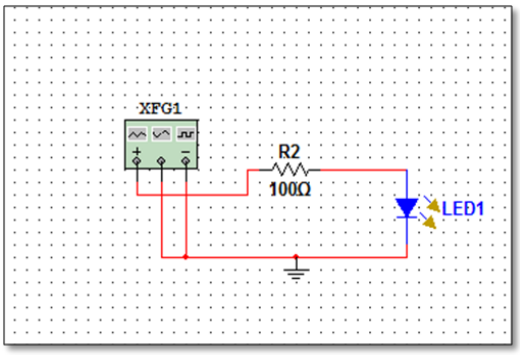

Fig 2: LED fluctuation

This design can be replaced by the design of an amplifier to which the signal (data bits) is fed shown in Fig 3.

This is done by using a simple non-inverting feedback configuration of an Op-Amp (Operational Amplifier) with a particular gain.

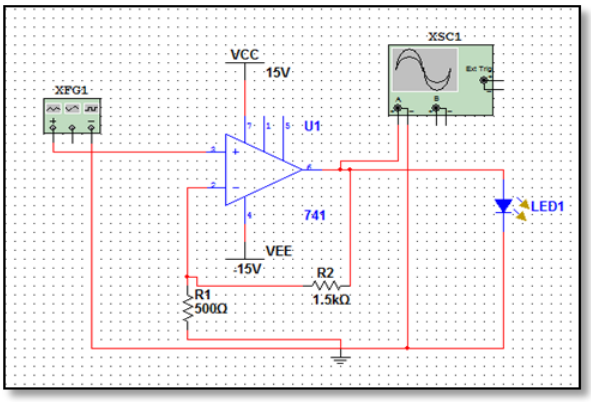

Fig 3: Proposed design for transmitter

But after implementing this circuit it was found that rather than amplification, a LED switching circuit is required which would turn the LED 'on' for bit '1' and 'off' for bit '0' according to the data. This was done using a transistor along with a buffer. With certain changes in the analog design, the finalized design for transmitter is shown in Fig 4.

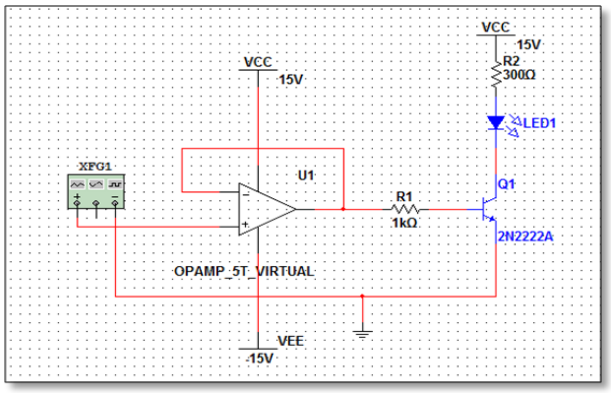

Fig 4: Transmitter Design

The output of this circuit is the fluctuating LED which is needed to transmit data.

Moving further to the hardware implementation of the Transmitter, which includes 8051 for transmission of data is shown in Fig 5.

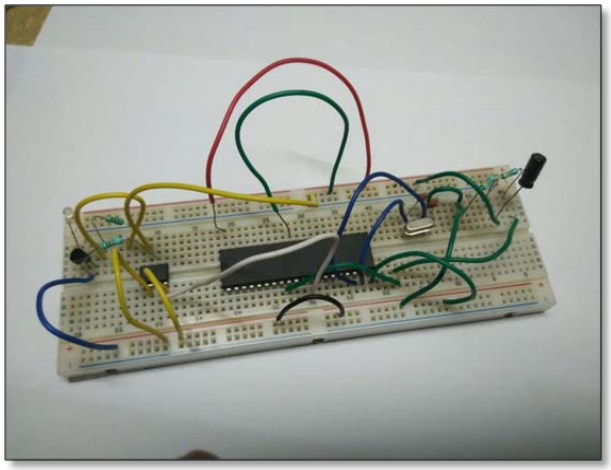

Fig 5: Hardware implementation of the analog circuit design

Further, looking forward to the receiver analog design, the photodiode receives the incoming signal and by using Op-Amp light signal is converted into electrical signal. Here in the Fig 6, the photodiode is represented by source (function generator) and also the pulse output is seen in analog form through LED fluctuation again.

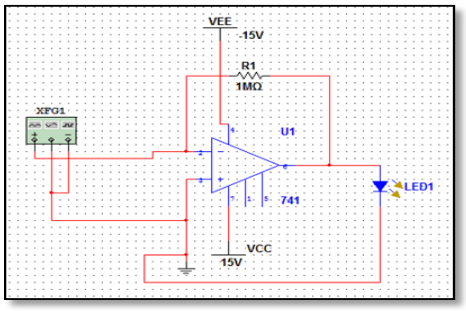

Fig 6: Receiver design

Looking at the complete working of the system, it is done by using a basic microcontroller 8051. The data is taken as an input from the PC system (using HyperTerminal software) through its USB pin and then fed to USB to TTL converter adapter which converts the computer logic (+12 and -12 V) to TTL logic (+5 and -5 V). Microcontroller then processes the data and transmits it in a pulse form to analog part of circuit which further communicates through LED which in turn defines the Visible Light Communication. At the receiver end, once the signal is recovered into pulse form, microcontroller processes the data into original form and sends it to TTL to USB adapter by which the data can be seen on the HyperTerminal software of another PC system. Hence linking the two PC systems using Visible Light Communication.

3. Results

Using the above circuit, there was successful completion and demonstration of transfer of signals through visible light using the most basic microcontroller (8051). The aim of this project is to showcase the phenomenal increase in the data rate transmitted without any compromise on the fidelity of communication and also to show the most cost effective system ever made for transmitting textual data. Fig 7 shows output of the transmitter section when the data is being transmitted.

Fig 7: Transmitter Section Output

The signal received by analog part of the receiver is shown in Fig 8.

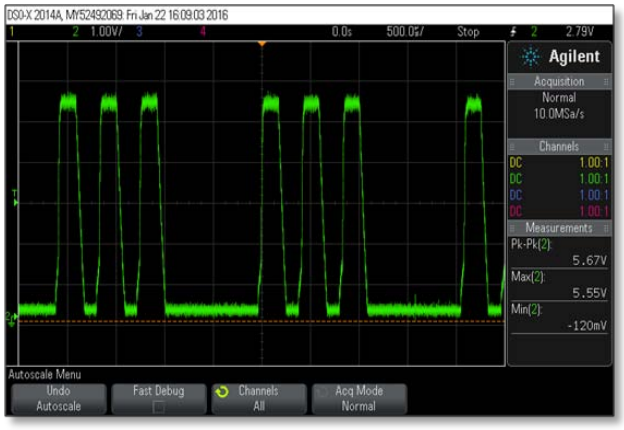

Fig 8: Receiver Section Output

This shows the transmission of data and its reception in the form of waveform without much effect of noise. As we can see that the amplitude of received signal has a bit distortion but our data is not Amplitude Modulated but works on OOK (On-Off Keying) modulation. We have already seen that optical wireless communication system is a very good replacement for the regular communication systems. A safer mode of transmission, economical set up with so many benefits and usage in real word.

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Wind velocity profiling at Delhi metro stations: Modelling of micro wind turbines

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Abstract

We are overburdening the nature in order to meet our needs or rather requirements converted into needs, the solution also lies within nature. India is facing a grave problem to meet the electricity needs for all. The wind velocity conversion in electrical energy is one step towards making our environment clean and green. The effort to convert wind velocity generated by metros into electrical energy is economically feasible and viable. This can be made possible by installing wind turbines at suitable places at different metro stations. Till now purchased turbines were being used for experimentation, as a result of which it was realized that tailor made turbines are required. Modelling of such wind turbines requires profiling of wind velocity at each metro station using an anemometer. Wind velocities at different metro stations have been measured. All the different metro lines (red, yellow, blue etc.) have been investigated at different heights for each particular position of the platforms. This wind velocity profiling will be used to simulate the air flow dynamics at different metro stations. Subsequently the wind turbine modelling appropriate for metro stations will be performed.

Keywords—wind energy; wind turbines; velocity profiling; modelling**.**

1. Introduction

Extensive use of non-renewable resources like coal, petroleum etc. is a major concern for today's world as we are not only depleting them, but also depriving our future generations from its use. So, we should try to preserve and conserve our natural resources for future use, and also depend more on renewable sources of energy which are easily available. No doubt, wind energy is one of the cleanest forms of energy present. In the recent past years, a keen interest in the use of renewable energy resources has been observed. Unlike many other sources of renewable energy, wind energy has given a huge competition to the conventional sources of power generation and therefore, the application of wind turbine generators has shown the highest growth among all the other sources.

Wind blowing at high speed in underground metro stations, is one of the sources of mechanical energy which hi us immensely. Because of the high speeding metro trains, there occurs a pressure difference at the ends of the tunnel which gives rise to the strong wind currents. This wind has high kinetic energy which, by means of a wind turbine, can be converted into electrical energy. Conversion of kinetic energy in the wind into rotational energy and then electrical energy is the work of a wind turbine. So, it is necessary to know the expected power and energy output of each wind turbine just to calculate its economic viability.

The type of wind turbine to be used further depends upon various parameters. For the optimum generation of electricity, a wind turbine should always be able to extract the highest possible power from the wind energy used and generation of energy should be more than the loss of energy due to air drag. This requires designing and modelling which in turn depends on wind profile at the location where turbine has to be installed.

2. Theoretical Calculations Of Wind Velocity And Power Generation

Wind energy is the kinetic energy of air in motion. Total wind energy flowing through an imaginary surface with area A during time 't' is,

$$E = \frac{1}{2}(mv^2) \quad (1)$$

where, v=velocity of wind (m/sec) and m=mass of the air /object passing through A (kg).

Now,

Mass (m) = Density * Volume

$$m = \rho * (\text{Area} * \text{Distance})$$
$$m = \rho * A * vt$$
$$m = \rho Avt \quad (2)$$

Substituting value of 'm' from (2) in (1)

$$E = \frac{1}{2} \rho A t v^3$$

where, ρ = Density of air (kg/m^3) and Avt = volume of air passing through area 'A' (m^3). Now, as power is defined as rate of doing work hence,

$$P = E/t = \frac{1}{2} A \rho v^3 \quad (3)$$

According to the law of conservation of mass and energy, not more than 16/27 i.e., 59.3% of the kinetic energy of wind can be captured. (Stated by Albert Betz, known as the **Betz law/ Betz limit [**1]**).** Hence, the theoretical maximum power efficiency of any wind turbine is 59%. This is called the power coefficient.

The C_p value is a function of the wind speed that the turbine is operating in. The real world limit for C_p is 0.35 - 0.45. Therefore the power coefficient needs to be factored in (3).

$$P_{avail} = \frac{1}{2} \rho A v^3 C_p \quad (4)$$

where, P_{avail}= Power generated (W), A= Swept area by turbine blades (m^2), C_p = Power coefficient. This relation, however does not account for the power losses due to friction, air drag, etc. It can also be observed that $P \alpha v^3$, i.e. the power generated increases as the wind velocity increases. C_p max=0.59.

A. Air Drag Factor / Aerodynamics

Air drag is nothing but "air resistance". Wind blows in a direction opposite to the motion of the moving vehicle (here a metro) which exerts an opposing frictional force. The vehicle's fuel consumption to maintain a constant velocity, depends totally on air friction. Air drag force is directly proportional to the square of the free stream velocity. So, the air drag increases if the speed of the vehicle increases. Fuel efficiency can be achieved only if vehicles experience minimum drag. Hence, it is important to reduce the air resistance on a vehicle as much as possible. An auxiliary turbine is useful only when its energy loss is less than the energy gain from the turbine [2].

3. Methodology

A. Initial Steps

After completion of the literature survey and our survey of metro platforms and tracks, some positions were shortlisted for the installation of wind turbines. A three bladed HAWT (Horizontal Axis Wind Turbine) (Fig.1) with blade length of 30 cm was installed at one of the proposed sites (given by DMRC). It was found that the blade length was too small and the rotor too heavy to move. Hence a five bladed HAWT (Fig.2) with lighter rotor was purchased for further measurements.

Fig. 1: The initial three bladed HAWT

B. Experiments with the five bladed HAWT

When the five bladed turbines, with cut in speed of less than 1.5 m/s, was tested at different metro stations, it yielded results and was estimated that we might be able to generate about 0.35 kWh of energy by one turbine per day. The multi-blade turbine is expected to give better results with more RPM (Rotation per Minute) and less loss of energy. It was surveyed and experimented at 3 different metro stations, namely Kashmere Gate, Chawri bazaar and Chandni Chowk in December 2014 and it was observed that the wind jetting in due to fast moving metro trains made multibladed fans to rotate with a good speed at a height of about 5 feet. Estimated energy that can be harnessed with 5 bladed HAWT at a wind velocity of approximately 5 m/sec will be 0.35 KWh and about 0.026 kWh for 2.5 m/s wind speed.

Fig. 2: The five bladed new HAWT

4. Challenges

For the periodic assessment and availability of wind velocity, we installed a wind data logger kit (Fig. 3)

with sensor analysis software at Chawri bazar metro station in the month of July 2015. The data logger records the wind velocity at frequent intervals over a period of two days. The power prediction on the basis of this data can be predicted through their website www.powerpredictor2.com. As per the data collected at 2-3 metro stations we concluded that average available wind velocity is only 2.5 m/s at most of the metro stations. Although our present 5 bladed turbine is able to work there yet it is not compatible enough with such a low wind speed to generate more power than power loss. Theoretical calculations reveal that power generation for a turbine of blade length 30 cm (assumed that the turbine is able to rotate) at this velocity is quite low. We still need a turbine with a lighter rotor [3] which can generate higher power at such a low wind velocity.

Fig. 3: The wind data logger kit

5. Wind Velocity Data Recorded

1. Observations

In order to find the appropriate metro station for the installation of wind turbine, the team carried out a detailed study of wind velocities at 66 metro stations covering all the lines of Phase1. The parameters for the calculations are: length of the platform along the movement of metro(x), length of platform perpendicular to the movement of metro (y) and height (z). Readings have been taken with the help of an anemometer by varying these parameters.

Origin

An origin is required for plotting the graph representing the curve of wind velocity on the platform. The origin is taken from the entry wall of the platform (the side from which the metro enters).

Orientation

Orientation of the anemometer is of great significance. The readings have been taken for a single orientation. The anemometer fan is kept in such a way that the axis of the anemometer is horizontal with respect to the platform for all the positions.

2. Optimal position for installation of turbines

The metro stations with maximum wind velocities were found to be as below:

TABLE I.

S.No.	Name of the station	Metro Line	Maximum velocity (m/s)
1	Race Course	Yellow	11.8
2	AIIMS	Yellow	11
3	Jor Bagh	Yellow	8.4
4	JLN	Violet	7
5	Janpath	Violet	6.3

6. Designing, Simulations and Modelling

For the designing and modelling of a wind turbine blade, a lot of parameters have to be taken care of such as the average velocity of the region where wind data is calculated, the type of wind turbine required i.e. Horizontal Axis Wind Turbine (HAWT) or Vertical Axis Wind Turbine (VAWT), pitch of wind turbine (fixed Pitch or variable pitch wind turbine), torque characteristics of wind turbine [4], wind utilization coefficient (Cp) to name a few.

While measuring the wind velocities at metro stations it was observed that a variable pitched wind turbine blade is best suited for metro stations. A variable pitched wind turbine [5] is the one that has varying angle of incidence of wind turbine that is used to generate power. So while performing the simulations of the wind turbine certain key points must be kept in mind:

- The cut-in velocity of the wind turbine: Keeping in mind the minimum velocity of the wind that prevails over the platform, wind turbine must be so designed that it always keeps rotating.
- Orientation of turbine blades: Since the orientation of the wind with respect to the blade of the turbine should be such that maximum amount of energy is produced for optimal use of wind enrgy hence a variable pitch wind turbine must be used. The aerodynamic power produced by turbine can be managed by adjusting the pitch angle of the turbine [6].
- Structure of the tunnel: The gush of wind that is being used to generate aerodynamic power is directed towards the platform of the station from inside the tunnel. It was also noted during the wind profiling that the tunnels with maximum curves like race course provided best results. Hence we can infer that the structure of the tunnel affects the amount of aerodynamic power.
- Simulations can be performed using MATLAB or other professional software which provide built in functions for calculations involved in simulations.

7. Results: Wind Velocity Profiling

In order to do the wind profiling inside the metro stations, we have measured the wind velocity at various positions along the length, breadth and height of the platforms at various metro stations of different lines (red, yellow, violet etc.). A total of 37 metro stations of different metro lines have been covered this way. Graphs have been plotted for the same. As an example we discuss two metro stations below:

A. Patel Chowk Metro Station

A detailed analysis was done at Patel chowk metro station. Fig. 4 below shows that there is an increase in the wind velocity as we move from the wall at one end of the platform from where the metro enters towards the exit wall.

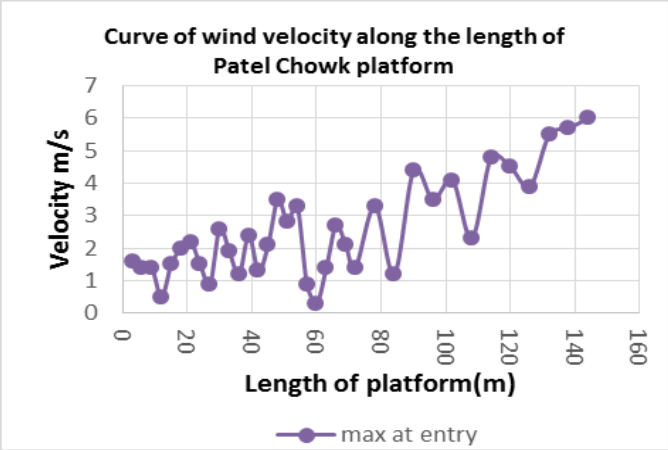

Fig.4 : Velocity Along The Length Of Patel Chowk.

B. AIIMS Metro Station:

Three positions along the length of the platform were chosen along which various measurements were taken varying the breadth of the platform and height at each position. As per our survey, the maximum wind velocity has been obtained at AIIMS metro station, the value being 11 m/s. Fig.5 shows variation in the wind velocity versus the spatial positions at the AIIMS metro station.

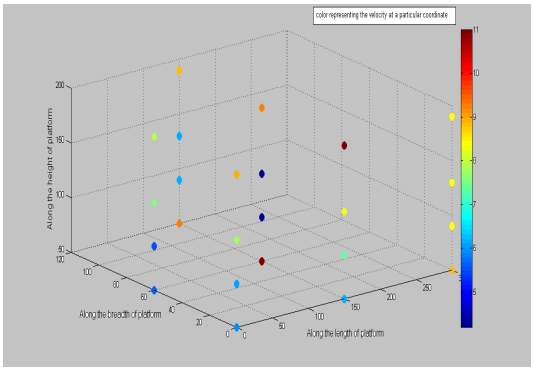

Fig.5: Four Dimensional Plot Of Velocity Along Length, Breadth And Height Of The AIIMS Platform. Red Colour Depicting Highest And Blue Colour Lowest Wind Velocity.

8. Acknowledgements

Authors are thankful to University of Delhi for financial support. Authors thank Mr. S. A. Verma, the mentor of the project for his suggestions and

guidance. Authors are also grateful to Delhi Metro Rail Corporation (DMRC) for their active cooperation in collaboration.

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Intelligent Crane

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Abstract

This paper briefly introduces the concept of Artificial Intelligence being used in Industrial Applications. The intelligence feature is nothing but a set of interlocks established so as to extend crane's structure life and reduce accidents. For intelligence feature, data from a VFD (Variable Frequency Drive) is fetched via MODBUS.
Keywords: *Industrial Applications, Intelligence, MODBUS*

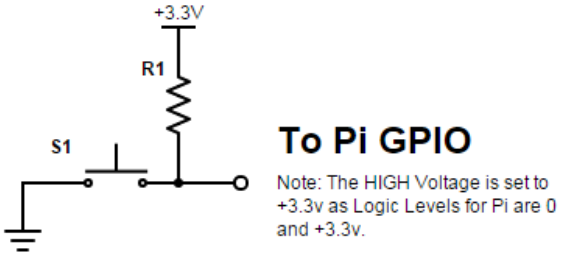
1. Introduction

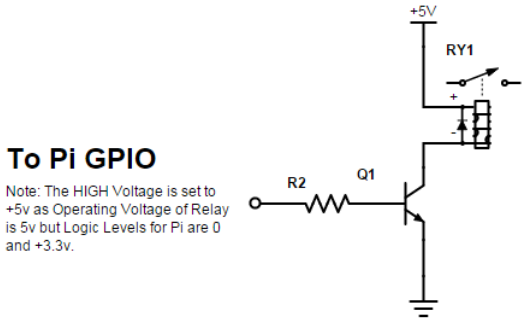
MODBUS is a communication protocol developed by Modicon in 1979. This protocol operates in three modes i.e. RTU (Remote Terminal Unit), TCP/IP (Transfer Control Protocol/Internet Protocol) and ASCII (American Standard Code for Information Interchange). VFD uses RTU technology to transmit the relevant therefore MODBUS-RTU is used to fetch data. The brain of the system is Raspberry Pi Model 2. Raspberry Pi is a credit card sized single board computer developed by Raspberry Pi Foundation. It's powered by ARMv7 (Broadcom BCM2836) Quad Core Processor clocked at 900MHz, VideoCore IV 3D graphics core and has 1GB of SDRAM (Synchronous Dynamic Random Access Memory). It is also equipped with 4 USB ports, 1 Ethernet Port, HDMI Output, Combined 3.5mm audio jack and composite video, CSI (Camera Interface), DSI (Display Interface). For general interfacing, it is equipped with 40 PIN GPIO (General Purpose Input/Output). Primary OS (Operating System) for Raspberry Pi is Raspbian (Based on Debian) and compiler used is Python IDE (Integrated Development Environment).

Pin#	NAME		NAME	Pin#
01	3.3v DC Power		DC Power 5v	02
03	GPIO02 (SDA1 , I2C)		DC Power 5v	04
05	GPIO03 (SCL1 , I2C)		Ground	06
07	GPIO04 (GPIO_GCLK)		(TXD0) GPIO14	08
09	Ground		(RXD0) GPIO15	10
11	GPIO17 (GPIO_GEN0)		(GPIO_GEN1) GPIO18	12
13	GPIO27 (GPIO_GEN2)		Ground	14
15	GPIO22 (GPIO_GEN3)		(GPIO_GEN4) GPIO23	16
17	3.3v DC Power		(GPIO_GEN5) GPIO24	18
19	GPIO10 (SPI_MOSI)		Ground	20
21	GPIO09 (SPI_MISO)		(GPIO_GEN6) GPIO25	22
23	GPIO11 (SPI_CLK)		(SPI_CE0_N) GPIO08	24
25	Ground		(SPI_CE1_N) GPIO07	26
27	ID_SD (I2C ID EEPROM)		(I2C ID EEPROM) ID_SC	28
29	GPIO05		Ground	30
31	GPIO06		GPIO12	32
33	GPIO13		Ground	34
35	GPIO19		GPIO16	36
37	GPIO26		GPIO20	38
39	Ground		GPIO21	40

(Pin Out of Raspberry Pi Model 2 – element14.com)

MODBUS-RTU Communication is achieved via USB to RS485 Converter and the library used is MinimalModbus developed by Jonas Berg. The Input and Output Connections are made according to the following table. At Input side, generic Push Switch is connected and at Output side, Inductive Relays are connected to Pi GPIO.





INPUT LIST	OUTPUT LIST
Emergency Switch	Main Contactor Relay
Main Contactor Switch	Up Relay – Main Hoist
Up Switch – Main Hoist	Down Relay – Main Hoist
Down Switch – Main Hoist	Speed Increase – Main Hoist (Relay)
Speed Increase – Main Hoist (Switch)	Speed Decrease – Main Hoist (Relay)
Right Switch – Cross Travel	Right Relay – Cross Travel
Left Switch – Cross Travel	Left Relay – Cross Travel
Speed Increase – Cross Travel (Switch)	Speed Increase – Cross Travel (Relay)
Shutdown Switch	Sync Mode Relay
Restricted/Sync Mode Switch	-
Sync Feedback	

listed below. The crane is divided into 2 parts: Main Hoist and Cross Travel. Main Hoist is responsible for the lifting
action whereas Cross Travel is responsible for movement actions along one defined axis.

HARDWIRED INPUTS
Gravity Limit Switch – Main Hoist
Up Limit Switch – Main Hoist
Down Limit Switch – Main Hoist
Right Limit Switch – Cross Travel
Left Limit Switch – Cross Travel

Emergency Switch: It is a generic kill switch which when activated sends Emergency Kill Signal which disables the main contactor which in-turn cuts the power from drive thereby disabling any further action.
Main Contactor Switch: When activated by the operator, sends the Main Contactor ON Signal to the processor.
Up Switch – Main Hoist: When activated by the operator, sends the UP movement Signal to the processor.

The above mentioned inputs are of Remote Control of the crane. There are few additional Hardwired Inputs which are
Down Switch – Main Hoist: When activated by the operator, sends the DOWN movement Signal to the processor.
Speed Increase Switch – Main Hoist: When activated by the operator, sends the Speed Increase Signal for main hoist to the processor.
Right Switch – Cross Travel: When activated by the operator, sends the RIGHT movement Signal to the processor.
Left Switch – Cross Travel: When activated by the operator, sends the LEFT movement Signal to the processor.
Speed Increase Switch – Cross Travel: When activated by the operator, sends the Speed Increase Signal for cross travel hoist to the processor.
Main Contactor Relay: It activates main contactor provided Emergency Switch and Gravity Limit Switch are not activated.
Up Relay – Main Hoist: Initiates the UP movement of main hoist provided UP Limit Switch is not activated.
Down Relay – Main Hoist: Initiates the DOWN movement of main hoist provided DOWN Limit Switch is not activated.
Right Relay – Cross Travel: Initiates the RIGHT movements of cross travel hoist provided RIGHT Limit Switch is not activated.
Left Relay – Cross Travel: Initiates the LEFT movements of cross travel hoist provided LEFT Limit Switch is not activated.
Speed Increase – Main Hoist (Relay): Increases the speed of the current action of the main hoist.

Speed Decrease – Main Hoist (Relay): Decreases the speed of the current action of the main hoist.
Speed Increase – Cross Travel (Relay): Increases the speed of the current action of the cross travel hoist.
Gravity Limit Switch: It has the highest priority and is activated when Up Limit Switch fails. As a consequence, Main Contactor is shut off and it has to be realigned manually in order to start the crane functionality again.
Up Limit Switch – Main Hoist: When activated, sends a UP Maximum Position Signal to the processor indicating to stop up motion on main hoist.
Down Limit Switch – Main Hoist: When activated, sends a DOWN Maximum Position Signal to the processor indicating to stop down motion on main hoist.
Right Limit Switch – Cross Travel: When activated, sends a RIGHT Maximum Position Signal to the processor indicating to stop right motion on cross travel hoist.
Left Limit Switch – Cross Travel: When activated, sends a LEFT Maximum Position Signal to the processor indicating to stop left motion on cross travel hoist.
Shutdown Switch: When activated by the operator, gives the Power-off Signal to the processor which in-turn shuts down the processor.
Intelligent/Manual Switch: It is a selector switch which gives the operator the freedom to switch between Manual Hoist or Intelligent Hoist feature.
Restricted/Sync Mode Switch: It is a selector switch which gives the operator the freedom to choose between the 2 operating modes of the hoist that is Restricted/Sync Mode.
Sync Mode Relay: This gives the signal to activate Main contactor of another hoist so as to enable it to Sync with the first one. Its connections are common to all the command relays.
Sync Feedback: The Synced Hoist continuously gives a HIGH signal to this Input so as to make sure there is no lag between the hoists.

2. Intelligent Hoist Framework

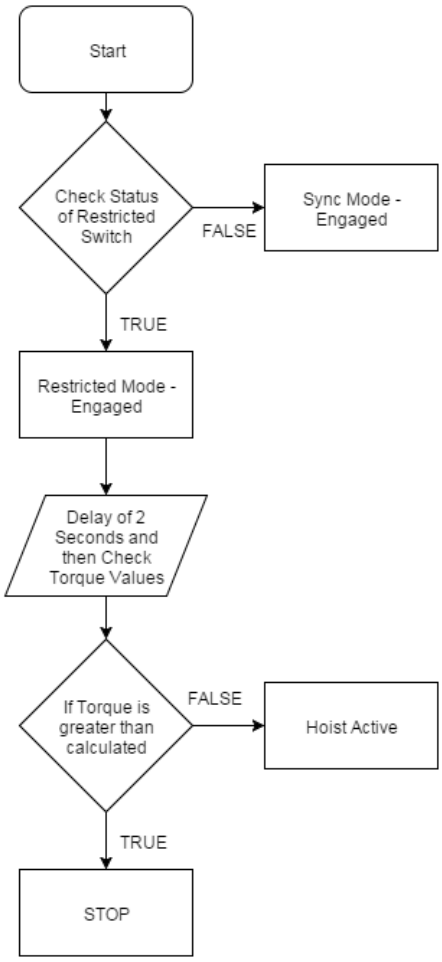
Intelligent Hoist Script contains some interlocks based on TORQUE values and TIME, in which TORQUE values are fetched through VFD via MODBUS-RTU. The idea behind this is to make hoist intelligent so that it can sense situations which are difficult for the operator to recognize in time which leads to either damage in crane structure or even accidents in some cases. Despite additional interlocks, the original interlocks like ESP (Emergency Switch) and GRL (Gravity Limit) still come into play.

2.1 Restricted Weight Mode

In this mode, the user can set a maximum weight limit of operation for the hoist. If the operator lifts a load heavier than the maximum load limit specified by the user, the crane stops and UP function disabled so that operator can lower down the load. This interlock is based on relative torque readings. Since Induction Motors have stalling torque or starting torque, all torque values are noted 2 seconds after the hoist's motor has started.

Let maximum load capacity of hoist is 2 Ton
And user wants to restrict it to 0.5 Ton

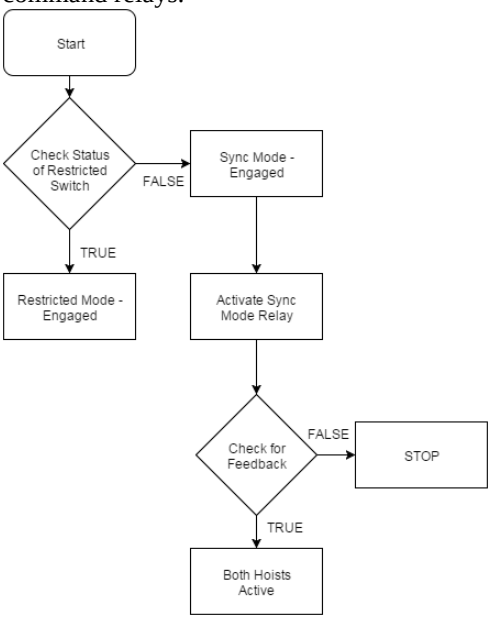
Therefore maximum torque = (0.5/2)*100 = 25%
Hence if the torque reading is 25% or less, the hoist remains active.



2.2 Sync Mode

In this 2 hoists work in parallel and are fed with same commands so that a synchronized working is obtained. When this mode is active, it activates Sync Mode relay which gives the signal to activate Main contactor of

another hoist so as to enable it to Sync with the first one. Synced hoist connections are common to all the command relays.



3. Acknowledgements

The author would like to thank Mr. Sharad Bansal for his constant help and support during the development and implementation of the project.

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Validation of end effector matrix for robotic kit owi-535 using Matlab and Robo analyzer

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Abstract

This paper presents the validation of the end effector matrix having D-H parameter of the 4 DOF educational manipulator OWI-535 by MAT-LAB and Robo Analyzer. Transformation matrix of order 4x4 which describes end effecter's position and orientation with respect to the base reference frame. MAT-LAB programming which gives details about the translation steps of the manipulator simultaneously. Forward kinematics of OWI 535 robotic kit has been calculated by Mat-lab as well as Robo Analyzer. We had calculated the End effector matrix in both software and compare it. We found that the results are similar up to three digit in some elements and up to two digits from decimal in few elements and it was different after three digit from the decimal in end effector matrix.

Key words: Educational robotic Kit OWI 535, MAT-LAB, Robo Analyzer Software

1. Introduction

The kinematic of the manipulator refers to how to calculate a position and orientation of the end effector and to get the desired configuration of the manipulator. Dynamic properties, such as weight, inertia etc., are not considered as part of the kinematics [1]. Kinematic model describes the spatial position of joints and links, and position and orientation of the end-effector [2, 3, 4].The representation of the robot's end-effector position and orientation through the geometries of robots (joint and link parameters) are called Forward Kinematics. Using Forward Kinematics, the mathematical model is developed to compute the position and orientation of end-effector's based on the given Robot joint position. Each Robot joint is considered as revolute joint. The homogenous transformation of end-effector related to the base frame is formulated using Denavit-Hartenberg (D-H) method [5]. A robotic manipulator is designed to perform a task in the 3-D space. The tool or end-effector is to follow a planned trajectory to manipulate objects or carry out the task in the workspace. This requires control of position of each link and joint of the manipulator to control both the position and orientation of the tool. To program the tool motion and joint link motions, a mathematical model of the manipulator is required to refer to all geometrical and/or time-based properties of the motion [6]. This paper adopted a forward kinematics model predicated (DH) analytical scheme for robot arm position placement. The developed model aims at predicting and recovering the end-effecter position of OWI 535 Robot manipulator for different joint variables; finally in the environment of Mat-lab, the forward kinematics model is built to take kinematics iteration by using MAT-LAB.

2. Robot Description

OWI- 535 Robot manipulator used in the work is a 4 DOF robot arm manipulator shown in fig. (1). It is a four articulated coordinate robotic manipulator that uses DC motors with worm gear for joint actuators, and its motion are controlled by wired remote. OWI- 535 Robot manipulator has a stationary base, shoulder, elbow and wrist in corresponding with human arm joints, each of these joint has a single DOF. Wrist can move into planes, this making the end-effector move smoothly in terms of object manipulation.

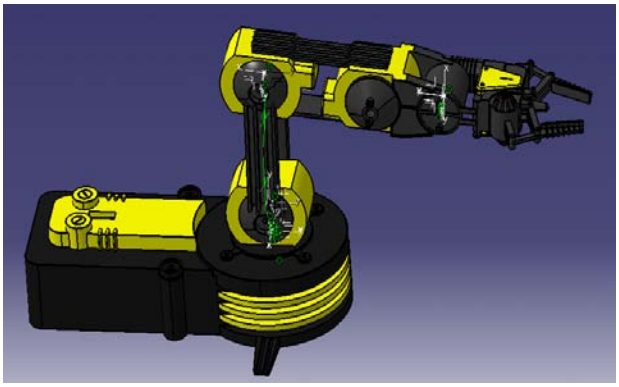

Figure. (1) CAD Model of Four axis robotic Kit OWI- 535

OWI-535 is the 4 DOF educational serial manipulator which can be utilize to pick-place & hold the commodities with in the working volume. All the four joint movements are rotary which make the model of configuration 4R or R-R-R-R type.

2.1 Forward kinematics of robotic kit OWI-535

In this paper we are using four link robot shown in fig. 3. In order to find relation between first link and last link we fixed the base. This can be obtained from the description of the coordinate transformations between the coordinate frames attached to all the links and forming the overall description in a recursive manner. For this purpose, the position and orientation of the rigid body is useful for obtaining the composition of coordinate transformations between the consecutive frames. As a first step, this method is to be derived to define the relative position and orientation of two successive links. The problem is to define two frames attached to two successive links and make the coordinate transformation between them. It is convenient to set some rules for the definition of the link frames.

The DH parameters corresponding to this 4 DOF OWI- 535 robot manipulator are shown in Table 1. Here θi is the joint angle, bi is joint offset, ai is link length, and αi is the twist angle. The limits of each of the joint angles have also been given in the table and these limits are also used in the Mat-lab programming. The Denavit-Hartenberg (DH) convention and methodology is used to derive its forward kinematics.

We used the above mention set of joint off-set 'b', joint angle '', link length 'a', twist- angle 'α'only varying the joint angle from minimum value to maximum value with the two intermediate values.

Table 1. D-H Parameters of OWI- 535 robotic kit

Revolute Joint	b (mm)	θ_{min} (deg.)	θ_{max} (deg.)	a (mm)	α (deg.)
Joint1	0	0^o	270^o	44	90^o
Joint2	0	0^o	300^o	91	0^o
Joint3	0	0^o	180^o	120	0^o
Joint4	0	0^o	120^o	94	0^o

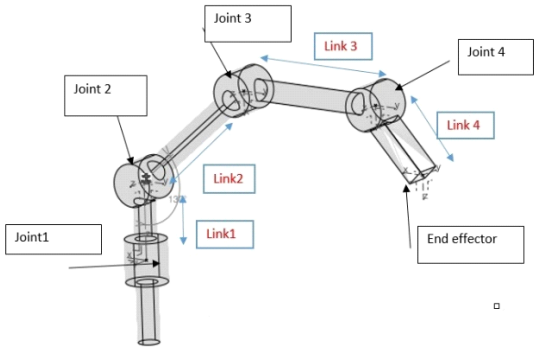

Figure 3 Kinematic schematic diagram of the Robotic Kit OWI- 535

As per as the skeleton kinematic figure 3. we can see that the twist angle " α " i.e orientation of z-axis of two joints along x direction (we can say that angle between z-axis) of owi-535model is 90^o , 0^o , 0^o , 0^o respectively for the joint 1, joint 2, joint3, joint 4 .

The working links may only alter the joint angle so we select joint angles for the different

joints as a variable parameter to perform the analysis to obtain the transformation matrix.

- **Transformation matrix**

After establishing (D-H) coordinate system for each link, a homogeneous transformation matrix can easily be developed considering frame {i-1} and frame {i} transformation consisting of four basic transformations. There four parameters are respectively joint angle θi, link offset bi , link length ai and the twist angle αi , So, the link transformation matrix between coordinate frame i-1 and coordinate frame i. Matlab code for transformation matrix has been given in appendix.

3. Verification Of Mathematical Model Using Mat-Lab 10.0 Program With Robo Analyzer Software

The simulation results as presented are for the forward kinematic analysis of the OWI 535 Robot as modelled using the (D-H) concept. Simulations were conducted using Mat-lab coding on an Intel (R) CPU T2080 @ 0.99GHz, 1.00GB Memory (RAM), 32bit Operating System. The Mat-lab coding was used to do mathematical iterations of the serial link manipulator. The variables θ1, θ2, θ3, and θ4 respectively represent the joint axes 1 through 4. Kinematics equations from the overall transformation matrix were developed using the Mat-lab R 10.0. An code has been developed to generate the forward kinematics equations and calculate the robot Manipulator position and orientation in terms of joint angles and its output is compared with Robot software (which is the simulate program supplied with the robot system) for four sets of joint parameters. The result of end-effecter's position from Mat-lab iteration was then compared with experimental result generated from inbuilt Robot Analyzer software. For different keyboard values entered on the Robo Analyzer software, the corresponding joint angles, simulation and experimental positions for the end-effecter are presented.

3.1 Input sets of D-H values:

We have link length, off sett and twist angles for the manipulator are fixed so we can vary the joint angle hence these are the different input sets of D-H parameters to Mat-lab and Robo Analyzer for different values of joint angle are as follows

Table 3: D-H set1 Parameters of different joints for $_{min}$

Revolute Joint	b (mm)	$_{min}$ (deg.)	a (mm)	α (deg.)
Joint 1	0	0^o	44	90^o
Joint 2	0	0^o	91	0^o
Joint 3	0	0^o	120	0^o
Joint 4	0	0^o	94	0^0

Table 4: D-H set2 Parameters of different joints for $_{intermediate1}$

Revolute Joint	b (mm)	$_{min}$ (deg.)	a (mm)	α (deg.)
Joint1	0	60^o	44	90^o
Joint2	0	60^o	91	0^o
Joint3	0	60^o	120	0^o
Joint4	0	60^o	94	00

Table 5: D-H set3 Parameters of different joints for $_{intermediate2}$

Revolute Joint	b (mm)	$_{min}$ (deg.)	a (mm)	α (deg.)
Joint1	0	100^o	44	90^o
Joint2	0	100^o	91	0^o

Joint3	0	80°	120	0°
Joint4	0	80°	94	0°

Table 6: D-H set4 Parameters of different joints for $_{max}$

Revolute Joint	b (mm)	$_{min}$ (deg.)	a (mm)	α (deg.)
Joint1	0	270°	44	90°
Joint2	0	300°	91	0°
Joint3	0	180°	120	0°
Joint4	0	120°	94	0°

Putting these above mention sets of values and obtaining results for transformation matrix in MAT-LAB.

- **Output From The Sets Of D-H Values**

4.1 Mat-lab results

For the set 1 for $_{min}$

```
1.0000         0         0    0.3490
     0         0   -1.0000         0
     0    1.0000         0         0
     0         0         0    1.0000
```

For the set 2 $_{intermediate1}$

```
-0.5000    0.0000    0.8660   -0.0323
-0.8660    0.0000   -0.5000   -0.0559
-0.0000   -1.0000         0    0.1827
      0         0         0    1.0000
```

For the set 3 $_{intermediate2}$

```
 0.0302   -0.1710    0.9848    0.0188
-0.1710    0.9698    0.1736   -0.1065
-0.9848   -0.1736         0   -0.0030
      0         0         0    1.0000
```

For the set 4 $_{max}$

```
      0         0   -1.0000         0
 0.5000   -0.8660         0    0.0175
-0.8660   -0.5000         0   -0.0563
      0         0         0    1.0000
```

- **Robo Analyzer configuration sets:**

For the set 1 $_{min}$

Joint No	Joint Type	Joint Offset (b) m	Joint Angle (theta) deg	Link Length (a) m	Twist Angle (alpha) deg	Initial Value (JV) deg or m
1	Revolute	0	Variable	0.044	90	0
2	Revolute	0	Variable	0.091	0	0
3	Revolute	0	Variable	0.12	0	0
4	Revolute	0	Variable	0.094	0	0

For the set 2 $_{intermediate1}$

Joint No	Joint Type	Joint Offset (b) m	Joint Angle (theta) deg	Link Length (a) m	Twist Angle (alpha) deg	Initial Value (JV) deg or m
1	Revolute	0	Variable	0.044	90	0
2	Revolute	0	Variable	0.091	0	0
3	Revolute	0	Variable	0.12	0	0
4	Revolute	0	Variable	0.094	0	0

For the set 3 $_{intermediate2}$

Joint No	Joint Type	Joint Offset (b) m	Joint Angle (theta) deg	Link Length (a) m	Twist Angle (alpha) deg	Initial Value (JV) deg or m	Final Value (JV) deg or m
1	Revolute	0	Variable	0.044	90	0	100
2	Revolute	0	Variable	0.091	0	0	100
3	Revolute	0	Variable	0.12	0	0	80
4	Revolute	0	Variable	0.094	0	0	80

For the set 4 $_{max}$

Joint No	Joint Type	Joint Offset (b) m	Joint Angle (theta) deg	Link Length (a) m	Twist Angle (alpha) deg	Initial Value (JV) deg or m	Final Value (JV) deg or m
1	Revolute	0	Variable	0.044	90	0	270
2	Revolute	0	Variable	0.091	0	0	300
3	Revolute	0	Variable	0.12	0	0	180
4	Revolute	0	Variable	0.094	0	0	120

- **Robo Analyzer results**

For the set 1 for $_{min}$

$$\begin{bmatrix} 1 & 0 & 0 & 0.349 \\ 0 & 0 & -1 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

For the set 2 $_{intermediate1}$

$$\begin{bmatrix} -0.5 & 0 & 0.866025 & -0.03225 \\ -0.866025 & 0 & -0.5 & -0.055859 \\ 0 & -1 & 0 & 0.182731 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

For the set 3 $_{intermediate2}$

$$\begin{bmatrix} 0.030154 & -0.17101 & 0.984808 & 0.018776 \\ -0.17101 & 0.969846 & 0.173648 & -0.106482 \\ -0.984808 & -0.173648 & 0 & -0.002954 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

For the set 4 $_{max}$

$$\begin{bmatrix} 0 & 0 & -1 & 0 \\ 0.5 & -0.866025 & 0 & 0.0175 \\ -0.866025 & -0.5 & 0 & -0.056292 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

4. Conclusion & Discussion

The output of the transformation matrices from the varied D-H parameter joint angles for the educational OWI- 235 manipulator for the result of Mat-lab had come out to be same as for result transformation matrices from the Robo-analyzer .But point to be noted that the Mat-lab results are same with Robo Analyzer results up to only two places after decimal the third digit after decimal varied in some elements of the Mat-lab matrices obtained & the Mat-lab gives the result components of the transformation matrices up to four places after decimal but as for same configuration of manipulator Robo-analyzer gives result and matrix elements has digital up to six places from decimal in transformation matrices. That means if researcher had D-H parameters values and need to evaluate the transformation matrix they should be prefer Robo-analyzer rather than the Mat-lab for accuracy point of view.

As the above conclusion states that there is variation starts from the third place after the decimal in the above used software's result values, so for precision work there is need to define the correct value form the third place of decimal obtained from different software's. We need another software or another coding platform to find more accurate results.

respective names. Affiliations are centered below each author name, italicized, not bold. Include e-mail addresses if possible. Follow the author information by two blank lines before main text.

5. Appendix

mat-lab program

For estimating the transformation matrix the general code for a 4R configuration manipulator is

```
syms b1 theta1 a1 alpha1;
Qb1= [1 0 0 0;0 1 0 0;0 0 1 b1;0 0 0 1];
Qtheta1= [cos(theta1) -sin(theta1) 0 0;sin(theta1) cos(theta1) 0 0;0 0 1 0;0 0 0 1];
Qa1= [1 0 0 a1;0 1 0 0;0 0 1 0;0 0 0 1];
Qalpha1= [1 0 0 0;0 cos(alpha1) -sin(alpha1) 0 ;0 sin(alpha1) cos(alpha1) 0;0 0 0 1];
Qdh1= Qb1*Qtheta1*Qa1*Qalpha1

syms b2 theta2 a2 alpha2;
Qb2= [1 0 0 0;0 1 0 0;0 0 1 b2;0 0 0 1];
Qtheta2= [cos(theta2) -sin(theta2) 0 0;sin(theta2) cos(theta2) 0 0;0 0 1 0;0 0 0 1];
Qa2= [1 0 0 a2;0 1 0 0;0 0 1 0;0 0 0 1];
Qalpha2= [1 0 0 0;0 cos(alpha2) -sin(alpha2) 0 ;0 sin(alpha2) cos(alpha2) 0;0 0 0 1];
Qdh2= Qb2*Qtheta2*Qa2*Qalpha2

syms b3 theta3 a3 alpha3;
Qb3= [1 0 0 0;0 1 0 0;0 0 1 b3;0 0 0 1];
Qtheta3= [cos(theta3) -sin(theta3) 0 0;sin(theta3) cos(theta3) 0 0;0 0 1 0;0 0 0 1];
Qa3= [1 0 0 a3;0 1 0 0;0 0 1 0;0 0 0 1];
Qalpha3= [1 0 0 0;0 cos(alpha3) -sin(alpha3) 0 ;0 sin(alpha3) cos(alpha3) 0;0 0 0 1];
Qdh3= Qb3*Qtheta3*Qa3*Qalpha3

syms b4 theta4 a4 alpha4;
```

```
Qb4= [1 0 0 0;0 1 0 0;0 0 1 b4;0 0 0 1];
Qtheta4= [cos(theta4) -sin(theta4) 0 0;sin(theta4)
cos(theta4) 0 0;0 0 1 0;0 0 0 1];
Qa4= [1 0 0 a4;0 1 0 0;0 0 1 0;0 0 0 1];
Qalpha4= [1 0 0 0;0 cos(alpha4) -sin(alpha4) 0 ;0
sin(alpha4) cos(alpha4) 0;0 0 0 1];
Qdh4= Qb4*Qtheta4*Qa4*Qalpha4

Qdhdof4= Qdh1*Qdh2*Qdh3*Qdh4
```

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Cyber War: An Open Challenge to Our Nation

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Abstract

The Cyber war is one of the most concerning issue of every nation in present age. India is one of the most vulnerable countries to cyber-attacks. Around 85 percent of websites either public or private complained of being hacked at least once still our country is not paying much attention toward this field. As a result confidential information, of Indian governments is frequently breached and compromised.

The purpose of this paper is to make the cyber war a familiar term to readers, and discuss the reason why our country is one of the most targeted country towards cybercrime and what should be done to prevent our country against accelerating rate of cyber-attacks.Using data and statistics from different sources, we have tried to discover the cybercrime trend, penetration methods and efforts towards curtailing Cybercrime in India. Our research show that the number of Internet users and cybercrimes are increasing exponentially in past few years. Most of the cybercriminals are of the age group18-30 and what motivates them to do this. Our government needs to be adequately equipped to combat Cybercrime.

A deep study of the subject therefore, would definitely facilitate the development of highly effective offensive and defensive strategies of an organization to meet the future challenges of cyber warfare threat.

1. Introduction

This is a very basic question arising in the mind of every person who hears about the term cyber war. As the term suggests it is war related to computers. A war may be defined as the attacking and defending methods with the goal to survive. So cyber war is associated to the attacking and defending of information in cyber space.

Online Oxford University described cyber war as – "The use of computer technology to disrupt the activity of a state or organization, especially the deliberate attacking of computer system by another state or organization" [12].

In other words we can say Cybercrime is an illegal digital activity or set of illegal digital activities conducted by some state, nation or organizations; aimed at causing harm to another nation state or organizations by disrupting its activities. Apart from damaging and disrupting the target, cyber war also involves espionage like military warfare. This term can be used for wide range of targets and methods for illustration it can range from web site defacements to grave activities such as service disruptions that impact business revenues to e-banking frauds [7].

To understand cyber war we must know about the term cyberspace-a space or a field where cyber war is taking place. The US Department of Defence (DOD) defines cyberspace as

"The national environment in which digitized information is communicated over computer networks."

Cyber War is a reality of the present time and it is believed that next world war would be fought in Cyberspace. In brief we can describe that cyber war is conflict between two objects in which cyberspace acts as battlefield. "The economic growth of any nation and its security whether internal or external and competitiveness depends on how well is its cyberspace secured and protected"

2. Challenges of Cyber War

"The very technologies that empower us to lead and create also empower those who would disrupt and destroy." - 2010 National Security Strategy [11].

We when run a lookup finally realize that cyber war is a way more complex phenomenon than a

normal war. The main reasons behind this are as follows-

2.1. No physical boundaries or frontline

Cyber space has no physical boundaries its scope is not restricted to a single nation it is just a group of similar minded people and they affect a very large numbers of individuals. Also there is no general frontline as it could be anywhere. It just brought the war to our rooms.

2.2. No Difficult to detect

It is very crucial point about cyber war is that it is very difficult to detect that where the attack came from, who the attackers were**,[8]** and what was the purpose of attack. Attacker may make the victim fool in the way that he might thought that attack was done from different nation even though actual attack point was next to his door.

2.3. Easy and inexpensive to organize

Cyber war is much easier to conduct, organize and it costs much less than any conventional war. Cybercriminal and hacker just need few computers to launch attacks from any corner of the world. Sometimes protecting devices, such as antivirus and firewall, cost more than the cost of launching attacks [8].

2.4. No Physical Present

Interesting fact is that attackers need not to enter physically in the domain of defender with weapons and soldiers they just need to access their computers. And biggest issue is that it is very difficult to detect and eliminate the likelihood of occurrences of war.

Threats Included in Cyber War

3.1. Military Threats

Cyber technology has clear military applications which can be exploited in conflict situations. From the very small communication to the very sensitive satellite positioning and GPS all are based on computers and thus is a subject of threats under cyber-attacks. A single or slight miss of information can result in vast conflicts

3.2. Non Military Threats

Just as the targets of physical warfare are the machinery of state, financial institutions, the national energy and transport infrastructure and public morale, so too are they the prime targets in cyber warfare. Once they are affected they can cause a chaos around a number of personnel. And by the time they are uncovered they had created a lot of damage.

3.3. Cyber Espionage

Cyber espionage is one of the most prevalent of cyber activities. Whether used to uncover sensitive government information, steal trade secrets or commercial data or as part of intelligence or reconnaissance work, it fits into the doctrine of using 'information superiority to achieve greater victories at a smaller cost'.

3.4. Economic Cyber-attacks

There is increasing potential for financial institutions to be the target of digital attacks. Yet when these attacks are persistent they could arguably pose a risk to the national balance sheet and be detrimental to industry and society a whole, consequently affecting the security and stability of a state. The main purpose of these attacks is financial gain.

3.5. Psychological Cyber Attacks

There can be a psychological dimension to cyber- attacks. The infiltration of what are assumed to be secure systems and critical infrastructure highlights national vulnerabilities and weaknesses. This can provoke feelings of insecurity. Also by placing sensitive objects on public websites can create a psychological disturbance.

4. Statistics of Crime in India

Every year, cybercrime in India is increasing by 50 per cent and from 2011 to 2015; around 9,000 Indian websites including those of various government departments were hacked. Report of Norton's Cybercrime 2011 showed that India loses approximately INR 34,110 Crores annually due to cyber related crimes. According to IC3"s annual report 2012, India, ranked among the top five nations for the maximum complaint of cybercrime and it ranked 6th in terms of complainant loss to the tune of $3,740,736.53. Information and Cyber insecurity has been ranked at third position in India Risk Survey 2013 to which companies are most vulnerable. Norton cybercrime report 2012 reveals that 66 percent of Indian online adults have been victims of Cyber Crime in their lifetime [2].

Figure 1 Cyber crime cases in India

The statistics that have been demonstrated and observed show the seriousness of Cyber Crimes in India. Nearly 13,301 Cyber Crimes cases were registered in 2011. The number increased by almost

50 percent in the following year, reaching 22, 0601.

5. Policies and Operations to Counter Cyber Attacks

In order to deal with cybercrimes, India has established Computer Emergency Response Teams (CERT) with an objective to coordinate and respond during major security threats. The Indian Computer Emergency Response Team (CERT-In) scans the Indian Cyber Space to detect traces of any untoward incident that poses a threat to the cyber space.

CERT-In performs both proactive and reactive roles in computer security incidents prevention, identification of solution to security problems, analysing product vulnerabilities, malicious codes, web defacements, open proxy servers and in Carrying out relevant research and development [2] and there are many strict laws also -

According to the Section: 43 of 'Information Technology Act 2000' whoever destroys, deletes, alters and disrupts or causes disruption of any computer with the intention of damaging of the whole data of the computer system without the permission of the owner of the computer, shall be liable to pay fine up to 1 crore to the person so affected by way of remedy. According to the Section:43A which is inserted by 'Information Technology(Amendment) Act, 2008' where a body corporate is maintaining and protecting the data of the persons as provided by the central government, if there is any negligent act or failure in protecting the data/ information then a body corporate shall be liable to pay compensation to person so affected. And Section 66 deals with 'hacking with computer system' and provides for imprisonment up to 3 years or fine, which may extend up to 2 years or both [1]. India has also formulated the National Cyber Security Policy of India 2013 (NCSP

2013) and projects like For instance, India has launched Projects like Aadhar, National Intelligence Grid (NATGRID), Crime and Criminal Tracking Network and Systems (CCTNS), National Counter Terrorism Centre (NCTC), Central Monitoring System (CMS), Centre for Communication Security Research and Monitoring (CCSRM), Internet Spy System Network And Traffic Analysis System (NETRA) of India, etc [10].

6. Recent Cyber Attacks

6.1. Cyber war between India and Pakistan

In September 2015 the official website of Kerala government that is *kerala.gov.in* was hacked by a person named Faisal Afzal suspected to be from Pakistan. There was a picture on the homepage of hacked website of the national flag being burned.And there was a message on homepage saying "Official website of the RC Office, Govt. Of Kerala- New Delhi Hacked! Pakistan Zindabad." And he also mentioned, "We Are Team Pak Cyber Attacker. Security is just an illusion."

After few hours of attack an Indian hacking group took revenge by hacking around 46 Pakistani official govt Websites [6]. And they also mentioned their name "The Mallu Cyber Soldiers". They also posted a message on their Facebook page**,** "!!Message to Script Kiddies of Pakistan .Do not touch Indian Websites!!! Now your 46

Pakistan government websites got crashed and 4 educational websites got defaced. This is a small payback for hacking kerala.gov.in. Faisal 1337 go home kiddo, you are F***ed [4].

6.2. Hacking of ISIS website from anonymous

After the terror attacks in Paris November 2015, Islamic-supporting website has been recently hacked by some anonymous hackers. And hackers replaced the website with an advertisement and the advert was for an online pharmacy selling impotence pills Viagra and anti- depressants such as Prozac. Anonymous claims to have disabled atleast 5,500 pro-ISIS Twitter accounts and exposed thousands of the terror group's supporters who use the social media site. They also left the message alerting them "Enhance your calm. Too many people are into this ISIS stuff and they challenged the Islamist group that "Anonymous from all over the world will hunt you down "[5].

7. Conclusion

Security is one of the fundamental needs of human beings, societies, and states, and a significant portion of human in all natural spaces have security issues. Due to the properties of cyber space, cyber warfare makes it possible to attack tactical and strategic targets with little risk to attack. Cracking of various government official sits exposes the vulnerability of our official websites although it is bitter truth that ensuring 100% cyber security is not possible. However, we can minimize Cyber Attacks. Cyber Security in India needs improvement keeping in mind the growing cases of Cyber Attacks and Cyber Espionage attacks against India.

Hackers don't target individuals or small groups of users, but rather prefer large organizations, governments or communities that store personal information of thousands or millions of users. On the one side, while the government talks about digitizing India, incidents such as these highlight the importance for improved cyber security.

An individual can do their best to protect themselves simply by being cautious, knowledgeable and careful. Internet users need to watch suspicious emails, think twice before giving any personal information, use unique passwords, and run anti-virus and anti-spyware software. Do not open any email or run programs from unknown sources.

After ISIS (the Islamic State in Iraq and Syria) claimed responsibility for murdering at least 129 people and injuring more than 300 in various locations throughout Paris. The hacking group released a video that shows painful images of the Paris attacks. Halfway into the video a person wearing mask announces that the group is tracking down ISIS members and supporters and then proclaims, "We'll not give up. We will not forgive. And we'll do all that is necessary to end their actions."

8. Future Work

After seeing the scenario of increasing cyber related threats we can say a dedicated cyber security law of India is need of the hour. India needs a sophisticated and robust Technological Command Centre to defend its global network of computer systems**.** India must develop both offensive and defensive cyber security capabilities under one roof. And there is a lack of coordination among government cyber security

policies; this gap needs to be bridged. There is no E-Surveillance Policy of India framed by Indian Government so far. Obviously, the Cyber Law of India is weak and ineffective and deserves to be repealed.

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Quantum Key Distribution
Applying Principles of Quantum Physics to Ensure Secure Transmission of Keys

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Abstract

Information is perhaps the most valuable resource that an individual possess in today's time and this becomes more apparent when mismanaged or ill guarded files and reports turn out to be a bone of contention between individuals and sometimes even nations. In fact, information has even been known to start wars. As such, information security becomes a dominant concern for most organization and countries across the world. The practice of storing information in form of codes that appear gibberish to a third party, also called cryptography, has been followed for ages. Several mathematical techniques have been tried and tested but most of them have also been shown to possess fatal weaknesses. Quantum cryptography, on the other hand, is fairly recent technology that relies heavily on principles of quantum physics to promise building an infallible protective shield around critical information.

1. Cryptography – The cryptic science of codes

Cryptography, in simplest terms, is the practice of writing, reading, and studying secret codes and transmitting them securely to the targeted party in presence of adversaries. Ciphers are the codes that are used to encode a message or a file written in plain language into a language that is intended to be understood only by the concerned parties, thereby helping to keep the real message a secret. The encoded text produced using codes (or ciphers) is called cipher text. Humans are known to practice cryptography for more than a thousand years now. The first ciphers found were Greek. Julius Caesar used codes to send messages to his army and the Enigma codes of World War II are now world renowned.

Until now only mathematics and numbers were exploited to create an algorithm that could provide a strong encryption technique, and then hopes were made for the algorithm to be so complicated that it may take a very long time for a third party to decipher the original plain text. In practice, these algorithms are used along with certain keys to encode a message and later decode it. Of all the possibilities of keys in cryptology, the two that are most well-known and abundantly used are - public key cryptology and secret key cryptology. However, since these algorithms are, ultimately mathematical in nature, there is a possibility of breaking them, no matter how little it may be.

This is where Quantum Cryptology, or as experts prefer to call it, Quantum Key Distribution (QKD) rolls in with its advantages. Unlike the traditional cryptography techniques, QKD exploits properties of quantum physics to generate and securely distribute random bits instead of relying on complexities of mathematical algorithms that can eventually be solved someday. QKD, thus promises to put the security experts years ahead in terms of technology than the malefic.

2. For Problem Solved by QKD

The security of an encryption algorithm boils down to how securely the key was distributed. Thus, key distribution is the central problem in transmission of confidential data. While other algorithms use mathematics to send keys to the target parties, which, as has been proven a couple times, breakable, Quantum Cryptography transmits a sequence of random bits across an optical fiber to check if somebody intercepted the network and read the bits.

In practical applications QKD is used in conjunction with a more traditional technique of dual key agreement to synthesize a key that is as strong as the strongest key produced by either of these techniques individually. Thus the security offered by QKD is a long-period one, especially when compared to that offered by its contemporaries.

3. The Principle of QKD

QKD uses photons to transmit keys. Photons are mass less, smallest unit of light that exist in all possible states at once. This means that they spin in all directions (diagonally, horizontally, vertically, etc.) simultaneously. Light composed of such photons is called unpolarized light.

QKD uses LED (Light Emitting Diodes), a device that is capable of emitting photons one at a time, to shoot out photons one by one. These photons carry binary information on top of them. The unpolarized photons are passed through a filter that forces the photons to spin in only one direction. For example, all the photons emerging out of a vertical polarizing filter placed in-front of the LED, will spin in the vertical direction.

Quantum physics states that it is impossible to measure these polarized photons once again without changing its properties, except when a filter that is similar to the one that initially polarized them is deployed to measure the photons. As an example, if we use a horizontal

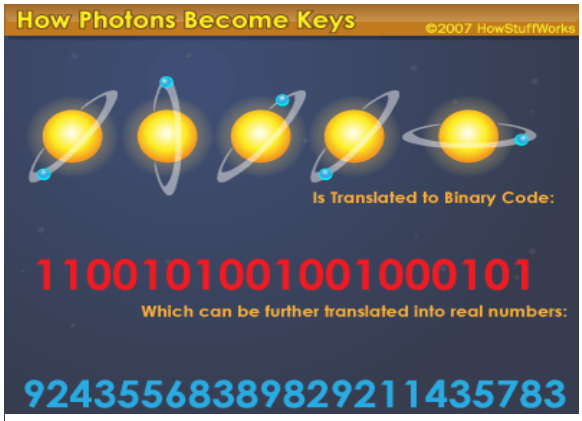

Figure1. Translation of photons' spins into keys http://s.hswstatic.com/gif/quantum-cryptology-4.gif 23 October, 2007

polarized filter to measure the photons that were polarized using a vertical filter, then the photons will either change its spin to horizontal, or it will fail to pass through the filter altogether. This process will, in turn change the properties as well as the information that the photon was carrying. Thus, it is possible to detect if someone measured the bits on these photons during the course of their transmission from one station to the other.

The photons are utilized to transfer bits by assigning a value to each type of spin they can have. The transmitting station that is sending the key can use any filer to polarize the photons. These polarizations are then recorded by the sending station so that it knows what photons should be received by the station that it is intending to send the key to. The sending station does not announce the type of filter it used to polarize the photons. It could have used the X polarizer (that polarizes in either the / or \ direction) or the + polarizer (that polarizes to | or– direction).

Once the photons are delivered to the receiving station, it guesses the kind of polarizer that the sending station used and uses it to measure the photons. Now, both the stations can communicate about the kind of polarizer the sending station used to polarize them. This communication can occur over public networks, since the communicating parties are only going to discuss whether a + or an X polarizer was used, i.e., they do not talk about the specific kind (|, --, /, \) of polarizer that was used. Thus, if the receiving station asks the sending station if it deployed a + polarizer, and the latter replies in affirmation, an eavesdropper listening to their conversation will have no way of knowing whether a | or a – polarizer was used. The receiving station, on the other hand, will have the knowledge of the exact kind of polarizer used since, a | polarizer will remain | after passing through a + polarizer. After this, both the stations will be left with a similar sequence of unintelligible symbols which are translated into binary language after the stations agree upon a code (say, 0 for – and \ photons and 1 for | and / photons). This binary text can later be converted into a human-understandable language.

During the course of transmission of the key, if an eavesdropper will have to set up a filter if he/she wants to measure the photons in order to find out the bits that they are carrying. However, the receiving party and the eavesdropper are both unaware of the filter that the sending station deployed to encode the key and, in this respect, they are both sailing in the same boat. While setting up the filter to measure the photons the eavesdropper will inadvertently modify some of the photons due to the Heisenberg Uncertainty Principle1. They will have to pass the photons through a similar kind of filter they used to measure the photons in the first place. However, since this process will have definitely modified the spins of the photons, the presence of a malefic third party will be detected.

For instance, if the sending party polarized the photons to the vertical spin (|), and the eavesdropper made an incorrect guess and used an X filter to measure the photons, then, on receiving the photons, if the receiving party correctly decides to use a + filter, then they will observe that the photons were instead polarized to a / or \ direction. During their communication with the sending party, the latter will inform the former that they (the receiving party) had correctly guessed the type of filter to use. This will lead the receiving party to conclude that the key had been intercepted during its transmission and, in such a scenario they will abort the process and send a new key, this time taking better precautions. The two parties that have to exchange confidential files can further strengthen the security of transmission by using parity checks.

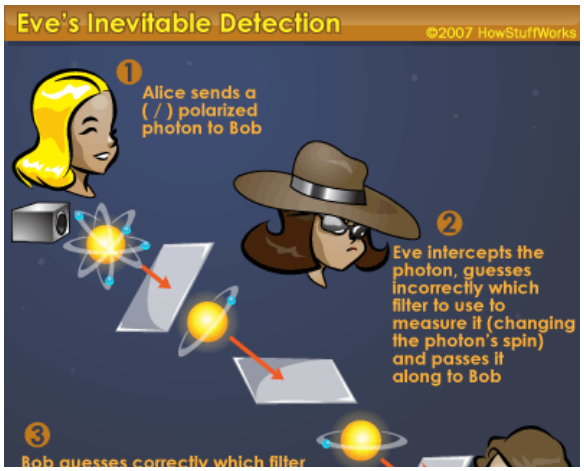

Figure2 Detecting an eavesdropper. http://s.hswstatic.com/gif/quantum-cryptology-6.gif 23 October, 2007

It is essential to note here that, whether or not an interception occurred during the transmission of key is found after the key has been received by the recipient. Hence, this technology is only used to transfer keys and not crucial information.

4. Method of Transfer of Keys

The sender and the recipient are connected together by two channels – the quantum channel (that is made up of optical fibers) and a conventional channel. Quantums are emitted, polarized and sent as qubits over the quantum channel. The conventional channel is used by the two stations on opposite ends of communication stream to discuss the kind of filter used to polarize the quantums and hence find out if someone has tried to listen to their communication. If the correlation between the bits sent and those is detected then the key generation process is aborted and restarted.

5. The Three Phases of Quantum Key Distribution

The keys go through three different phases during Quantum Key Distribution, which are:

1. Raw Key Exchange – The phase during which a key is exchanges between the sender and the receiver.

2. Key Sifting – A process in which only a certain cases are selected. After the completion of this phase a sifted key is generated.

3. Key Distillation – The sifted key is processed to distill a secure combination of bits called the secret key. This step is further broken down into three processes:

i) Error Correction

ii) Privacy Amplification iii) Authentication

Out of the three, only the first two processes (Raw Key Exchange and Key Sifting) are defined by the QKD protocols. The two most prevalent and efficient Quantum Cryptography protocols are the BB84 and the SARG protocols. The two protocols are essentially the same; they only differ in the bit values that they associate with the quantum states for the RKE (Raw Key Exchange) and the Key Sifting processes. SARG is the latest of the two. It received is high enough then a secure symmetric key can be generated using the bits on the two ends. If however, the presence of an eavesdropper is also more efficient than BB84 in terms of distance and secret key rate. Needless to say, it is the protocol preferred by most QKD networks.

6. Raw Key Exchange (RKE)

The RKE occurs as follows:

1. A bit is associated with the quantum states. For example, 0 could be assigned to the – and the \ state and a 1 could be assigned to the | and the / state. Now for each bit that is to be sent, the sender (who is also referred to as Alice in cryptography) chooses a filter randomly to polarize the photons. She maintains a list of orientation of each quantum that she sends.

2. The photon travels along the quantum channel that consists of the transmission equipment and the optical fiber.
3. Bob randomly chooses one of the two types of filters for each photon that he receives. He records the value of the photons measured and the kind of filter used in a list.

The raw bit lists of the sender and the receiver are almost always different and have different lengths since some qubits are lost during their transmission. A raw key is extracted from these bit lists when the receiver announces the indices of the qubits for which he had detection. This announcement, as mentioned in previous section, is made using the conventional channel. In the

next step, a sifted key is obtained from this raw key.

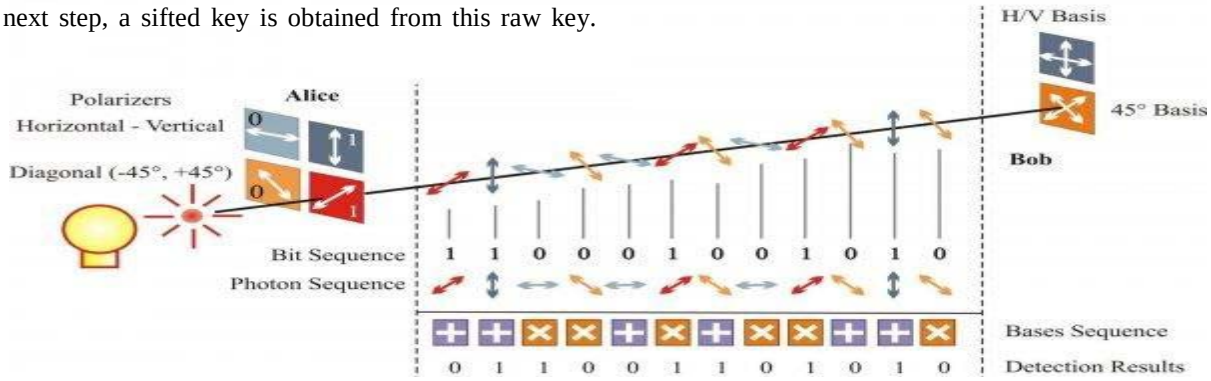

Figure3 Illustration of RKE http://swissquantum.idquantique.com/local/cache- vignettes/L600xH292/bb84_RKE-78ede.jpg 11 June, 2009

7. Key Shifting

Once Bob has successfully received the qubits, he announces the kind of filter he used to measure each bit over a conventional channel. Alice responds by telling him if the filter that was used to measure a certain bit was similar to the one she deployed to polarize that photon. The bits that do not have a perfect correlation between Alice and Bob are discarded and the rest of them combine to form the sifted key. Their sifted keys have the same length.

8. Key Distillation

The raw key could have some errors due to the presence of an eavesdropper, imperfect components, and environmental impacts on the communication channel. In order to free the keys of these errors, amplify its privacy, and authenticate it, a post processing step, called Key Distillation is carried out.

In the first part of the process, all the error is corrected using the classical error correction algorithm and an error rate is calculated. This error rate is used to find out how much information an eavesdropper may have acquired during transmission. In the second part, called privacy amplification, the corrected key is compressed by a factor that is directly proportional to the error rate in order to reduce the information that the adversary party may have on the key. Above a certain threshold, however, the eavesdropper is considered to have too much information and thus the key generation process must be stopped. The pre-established secret key on the sender and the receiver's system is used to authenticate the communication on the conventional channel.

9. Applications and Commercial Uses of QKD

Despite what many might think, QKD is incredibly easy to deploy and it can be managed using standard network administration tools. Owing to its ease of installation and use as well as the high level of security that it provides, several companies have started using it. In its first application, QKD product was deployed along with layer 2 Ethernet Encryption to conduct secure elections in Geneva, Switzerland.

The SECOQC (Secure Communication based on Quantum Cryptography) made first practical network demonstration of trusted node architecture, while the SwissQuantum Project engineered the longest running QKD network that ran for two years in Geneva, connecting CERN, University of Geneva, and Engineering School of Geneva. In 2013, Battelle, USA's largest research and development organization was using the 'trusted node' architecture' to create US's first quantum secure network.

10. Conclusion

At this point in the digital age, when the most pivotal documents and information on our lives is digital, it becomes imperative to stay ahead of the malicious hackers and protect the files from every damage that they may bring to information. QKD has emerged as our strongest allegiant in this respect. It is a technology we can truly count on.

Although, there is enough proof to state that Quantum Cryptography is doing well in several real networks, it does have a few unpolished ends that need to be worked on. Cryptographers are working hard to

increase the amount of data that can be encrypted, the number of users that can be connected, and the speed of key generation. Efforts are also on to make space optical communication and cryptography possible. It has been demonstrated by a team that quantum keys generated at high rates would not require a dedicated fiber and could share the same fiber as the data signal. This would be very useful to secure telecoms networks everywhere.

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Permission Analysis for Android Security and Case Study

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Abstract

Android Smart phones and tablets are very popular these days, making Android the most widespread mobile operating systems. However the open nature and flexibility of installing apps from unknown sources (other than play store) makes it prone to malware and other threats.
Applications request permissions to access several system resources at the time of installation. Research has been done on this, including static analysis of APK byte-code to determine the suitability of these permission sets for such applications. In this paper, we have utilized this work to present a detailed study of android application security followed by case study. Also we provide the implications of our analysis and recent solutions offered by Google for application security.

Keywords: APK, Android, ePub Reader, permission, Android API, vulnerabilities.

19. Introduction

The rapid growth of smart phones over the past few years has led to mobile service renaissance. Applications now support various social, corporate and economic services and hence are widely used by users with cellular data plan.
The Android platform has emerged as the most widespread operating system (OS) for mobile handsets such as smart phones and tablets. It has over 82.8% of market share [1]. There are currently 1.6 million applications available for this operating system.[2] However, the open source nature of the Android OS, the variety of (unofficial) application markets, and the ease with which the apps can be created have all influenced its

security aspects. Such devices are likely to have sensitive information of a company which is to be used for business purposes. In case of hacking, data can leak out leading to severe loss. Therefore securing personal data is becoming a challenge in today's world. Hence it becomes crucial to study security of android applications to get appropriate information about how sensitive data is used and flows through the application and what are the vulnerabilities associated with it.

20. Android Platform

Android was initially developed along with the founding of OHA (Open Hand-set Alliance), an association of 80 hardware, software and telecom companies, for advancing the open standards for smart phones led by Google [3]. It is a Linux-based open source mobile operating system (MOS), a Java software development kit (SDK), an application middleware layer, and a collection of system applications [3].
The core functionality of Android is written in Java, C++ and C. Compilation of the applications to DEX byte-code format is done by the Dalvik interpreter and then executed on the device. The applications run in their own process using the Linux sandboxing model and none has the permission to run as root. Each application has its own instance of the interpreter. Applications communicate through Inter-Process Communication mechanism [4]. Each application package includes an XML file, called Android Manifest which contains all the required permissions.

3. Detailed Model

The three possible sources of private data in the Android framework are: device hardware, default Android software, and user added Applications. Data from device hardware can be the user's GPS coordinates, information

from the accelerometer and the current state of the wireless connection. Default Android software like phone book have private data like contacts, calendar, browser history, calls, and system messages. User added applications downloaded by user can provide information like a user's preferences in an E-commerce application, or a to-do list in an organizer application [4].

In the Android security model, permissions restrict the flow of information (1) from hardware to applications,

Table 1 Custom permission protection levels

Constant	Value	Description
normal	0	A lower-risk permission that gives an application access to isolated application-level features, with minimal risk to other applications, the system, or the user. The system automatically grants this type of permission to a requesting application at installation, without asking for the user's explicit approval (though the user always has the option to review these permissions before installing).
dangerous	1	A higher-risk permission that would give a requesting application access to private user data or control over the device that can negatively impact the user. Because this type of permission introduces potential risk, the system may not automatically grant it to the requesting application. For example, any dangerous permissions requested by an application may be displayed to the user and require confirmation before proceeding, or some other approach may be taken to avoid the user automatically allowing the use of such facilities.
signature	2	A permission that the system is to grant only if the requesting application is signed with the same certificate as the application that declared the permission. If the certificates match, the system automatically grants the permission without notifying the user or asking for the user's explicit approval.
signatureOrSystem	3	A permission that the system is to grant only to packages in the Android system image *or* that are signed with the same certificates. Please avoid using this option, as the signature protection level should be sufficient for most needs and works regardless of exactly where applications are installed. This permission is used for certain special situations where multiple vendors have applications built in to a system image which need to share specific features explicitly because they are being built together.

(2) Between applications and the network, (3) among applications through an API call and (4) outside the model [4]. Permissions for these accesses can be default Android permissions, or custom permissions created by developers specified in the manifest. No new permissions

can be obtained by an application after installation. The application is not installed if the user does not give the consent to any of the requested permissions. The protection level of custom permissions is assigned one of the four values (normal, dangerous, signature, signatureOrSystem) which specify how hazardous the permission is. Table 1 shows the differences between these four categories [4].

A) From hardware: If an application wants to talk to the network, call a component of another application, or access a piece of hardware, it is required to do so through an API call, and have the corresponding permissions.

B) For network flow, network sockets can be opened by using the Android API only. Access to all these APIs requires the INTERNET permission.

C) Flows among Applications: The four components of applications (activities, services, content providers, and broadcast receivers) can communicate with each other

through IPC by either sending intents or by exported field which is to be set true.

D) Flow outside the Model: Since Android is built on Linux, and applications are actually just Linux processes, any exploit in the Linux IPC model can potentially lead to security threats in Android.

4. Android Threats

The number of threats and vulnerabilities in mobile operating system are on the rise presenting security risks to the users. These are some of the exploitable vulnerabilities:

A) Remote Control System Android (RCSAndroid)[5], the malware suite which was being sold as a target monitoring tool got leaked out online. The RCSAndroid code can be considered one of the most sophisticated and highly developed malware ever exposed [6]. RCSAndroid is capable of penetrating and installing itself on android OS to gain access to user's sensitive data. It can capture screenshots from mobile, collect data from SMS, email accounts, record voice calls, use phone camera and get hold of passwords of Whatsapp, Skype, Gmail, Facebook, Twitter and other accounts. It can also access details of contacts in phone book, increasing the vulnerability of those contacts too. The default browsers of Android versions 4.0 (Ice Cream Sandwich) to 4.3 (Jelly Bean) are more vulnerable.

B) Stagefright is an android component that manages media playback. It resides in mediaserver, and is exploitable to allow the malware installation via multimedia messageauthor name, italicized, not bold. Include e-mail addresses if possible. Follow the author information by two blank lines before main text. allowing remote attackers to undermine the devices. The complication with Stagefright is its over-privileged settings which provide it with system access on some devices, enabling privileges analogous to apps with root access and its implementation in C++ code, making it easily exploitable. These flaws have been there since earliest versions of Android and older versions are prone to more risks as they are deprived of mitigations incorporated in newer versions. The seven are collectively known as the Google Stagefright Media Playback Engine Multiple Remote Code Execution Vulnerabilities (CVE-2015-1538, CVE-2015- 1539, CVE-2015-3824, CVE-2015-3826, CVE-2015-3827, CVE-2015-3828 and CVE-2015-3829) [7]. An attacker could become well equipped with remote code execution authorities by exploiting any of these seven, enabling installation of malware and stealing of data.

C) A vulnerability was found in Samsung devices associated with the swiftkey app on playstore [8]. New language packs are occasionally checked by the swiftkey app. The hitch is that the retrieval of new language packs is not secure and malicious code could be installed in the phone. A man-in-themiddle attack can take place by someone in control of a fraudulent Wi-Fi access point.

D) A vulnerability was discovered by Trend Micro researchers in the Apache Cordova app framework with which attackers have the power to change the operations of the apps by clicking on a URL.[8] These modifications

could be as minor as causing inconvenience to the users or as major as complete failure of the app.

5. Security Features

Some of the already existing core security features that help you build secure apps include:

A) Android attempts to achieve security through an architecture that is cross-layered: the Android Security Framework (ASF) [9], Using access control mechanisms offered by the elemental Linux kernel.

B) A unique user ID (UID) is assigned by the Android system to each application and it is run as the corresponding user in an independent Linux process. An *Application Sandbox i*s set up by this. This method uses the native Linux isolation.

C) By using permissions the sensitive behavior of the phone can be protected. The program state strict permissions that the application should include as per its purpose to be true to the principle of least privilege [10]

D) Reviews of applications is made available in Google Play for potentially malefic behavior and current protection for apps downloadable from Google Play.

E) Technologies like ProPolice, ASLR, NX, safe_iop, OpenBSDcalloc, OpenBSDdlmalloc, and Linux mmap_min_addr to reduce risks related with common memory management errors.[11]

F) An encrypted file system that enables protecting data that is on lost or stolen devices. In 2014, the Android made several noteworthy improvements in platform security, including full disk encryption deployment, widening the hardware protected cryptography usage, and also enhancing the Android application sandbox with an SE Linux based Mandatory Access Control system (MAC).[12]

6. Existing Frameworks

The following are some existing frameworks proposed by researchers

6.1. ASIMS

In [3], ASIMS (Application Settings Integration and Management Scheme) is a framework suggested to improve the security of private data on Android. Android OS consists of many layers: the Linux kernel, C/C++ libraries, the Android runtime, the application framework and the applications. We could include an application, which maintains the settings of other applications and which are synced with the Internet, to the application layer. ASIMS can be realized by the following

Method:
1.) Column names of the SQLite database are defined
The column names are as follows:
application_id
application_name
created_date
modified_date settings

2.) Implement the Content Provider In this application ContentProvider class has been extended and onCreate has been overridden for creating the database and implementing insert ,delete, update ,query and getType methods.

3.) Enhancement of the uninstallation system prompting users to remove the records related to an application that is being uninstalled

4.) Adding features for synchronization of Google accounts can be used to authenticate the users

5.) Development of the UI (user interface).

6.2. TaintDroid

TaintDroid was developed in order to track the flow of personal and secure data in Android devices.[4] Conceptually TaintDroid applies labels to protect data, such as user's private messages, confidential emails or contact list. TaintDroid logs whenever information leaves the device. The main limitation of TaintDroid is that its ability is restricted to the tracking of data flows, and not the control flows. This limits the information that can be logged.

7. Case Study

In [14], mapping of the Android API calls to permissions was done to check if the permissions requested by an application are appropriate.

The results were based on running a program developed for the static analysis of 141,372 Android applications as shown in Table 2.[14] Many applications were found to have the permissions that were inconsistent with the actual requirement.

	Number of applications	Percent
Extra permission(s)	76,366	54.01%
Lacks permission(s)	70,618	49.95%
Exact permission(s)	28,199	19.95%
Reflective method invocation	67,958	48.07%
ClassLoader usage	15,580	11.02%
Total	141,372	100%

Table2. Absolute number and proportions for characteristics and behaviors of Android Applications

For the case study, we considered the ePub Reader application. It is an open source ePub format book reader written in Java. It has over 1,000,000 downloads and according to its functionality, it has access to the phone's storage as shown in figure 1. Since this application is an open source application, we were able to download all the Java files and examine them in Android Studio. The main goal of our analysis was to determine how the information

flows throughout the application, and to be sure that there is no flow of any private data beyond what is needed.

A.) Sources of private data On examination of the code, we found no indication of any of the permissions being used inappropriately. Although ePub reader can write on to an SD card (since it has the WRITE EXTERNAL STORAGE permission) it does not have permission to read from the SD card, so we do not have to worry about it accessing the private information in that manner.

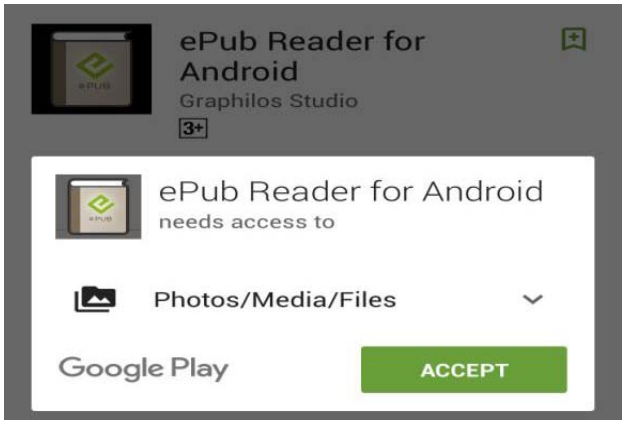

Figure 1 Permissions requested by ePub Reader

B.) Network Flow

ePub Reader requests the INTERNET permission which allows it to communicate with the network. In this section we consider how information flows to the network. In particular, we want to ensure that no additional information is passed to the internet. The network activity is modularized to only the DataView.java and BookView.java.

They have two imports
android.webkit.WebView;
android.webkit.WebViewClient;

This creates a View that displays all web pages. This class is the basis upon which some online content can be displayed in the activity. It uses the WebKit rendering engine to display the web pages and includes methods to navigate forward and backward through zoom in and out, history and perform text searches and more [13]. Hence, there are no other exchanges with the network present in this application.

C.) Flow through Activities

In order to inspect the flow through various activities, manifest.xml file was analyzed. A list of activities was made and for each one it was examined whether it could be invoked externally or not. This was done by checking for intent filters which determines the capabilities of that particular activity. Five activities were there in total and except the launcher activity none of them could be accessed externally. Based on this analysis, we concluded that ePub Reader sends no private data to any other application and hence this application is secure.

8. Conclusion

In context of our study of Android security analysis, it was concluded that though Android ensures security to a great extent, still there were possible threats that can leak our private information. We presented here the analysis of security of an application ePub Reader and a similar analysis has been carried out by researchers for millions of other applications. There are many existing security features that have been given by Google, many frameworks have also been suggested for the same. In the newly released android version 6.0(Marshmallow), changes in the permission model have been incorporated allowing users to grant permissions during run time of the application instead of install time. This has given users a better understanding of the permissions and more control over the functionality of the application increasing its security.

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Analysis of Collaborative Application's Implementation at College Level

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Abstract

Working in team has always been efficient as far as the professional work or the casual college work is considered. Collaborative application has given the human race to use the caliber of this quality. The word itself gives the perfect applauding introduction, 'Collaborative', two or more parties or individuals working together to achieve a common goal, 'Application', the software that helps the user to accomplish a specific task. IT companies are already benefiting by these applications which provide the environment for the employees to work on a common project. In this paper, we have presented a way to ameliorate the working of the present application to be implemented in the colleges. As a known fact college education is the building stone of the career , executing the collaborative applications on the graduation level a student will be able to get an outlook that how professional projects are worked on.

Keywords— Collaborative; application; professional; project

1. Introduction

Collaborative applications are the ones which contribute to build an environment for individuals to work together to achieve common goal. These applications provide beneficial assistance in IT companies. In these companies, large scale projects are given to many teams .To accomplish the success of the project, the team members have to work collaboratively and fulfill the task given to them. Here comes the role of these applications which creates a workspace where the employees interact and share the progress of the project while sitting in their offices or homes. There are various collaborative applications that are implemented. Even now every project on the professional level runs on these applications.

College projects are integral part of student's life. They are the first glimpse of the professionalism that's about to knock the door of student's present. In college, we learn our subjects which is concentrated on the theory more than practical. Only the real life projects teach us something that will help us to gain practical knowledge. The subject maybe of Computer Science or any other field, projects always contribute to the exposure and implementation of the theoretical knowledge. The idea of the research paper is to merge the two different concepts of college projects and professional projects into a single one. The collaborative application discussed in the research paper will be able to provide the work space to the students to process the projects and store the data. A new level of technique will be defined. Students now will be able to set their hands before they step into the real life projects in the companies where the money of client and the reputation of the company will be at stake. Like it's said, 'Practice makes the man perfect', a student by working on the collaborative application will be trained and the knowledge will assist him to produce excellent results ahead in his career. The application will succour the coming batches as well. The saved projects in the database of the application will be the guiding map for the juniors to implement, alter and experiment with the new ideas on readymade projects. The application will not be limited to computer science field only. The functionality of the application will render the opportunity to the student with different background to utilize it efficiently in every way. In the modern times when the computers have become the need for every possible field whether its commerce or arts, the students from these backgrounds will definitely gain profit in learning a new and expeditious technique that will aid them to embellish the credibility of their resumes.

2. Existing tools market

There are various software products in the market that have implemented collaborative applications for the professionals engaged in various fields.

S.no	Name of Tool	Year of release	Founders	

a. ASANA:

Founded by co-founder of Facebook Dustin Moskovitz and ex-engineer Justin Rosenstein in 2008, Asana is a web based SaaS designed for the betterment of the results coming out from the people working in collaborative environments by allowing them to manage the tasks online without the use of e-mail. Each team having a workspace can create its own projects, mention tasks, and add notes, comments, attachments as well as tags. Users can follow the projects and when the status of the projects changes, users get a notification regarding it. Moving on from the no-email strategy, later, in 2012 a new feature known as Inbox (a post-email application) was announced wherein "updates to tasks, comments, due date changes, and other status updates people would normally reserve for email" are employed. Among others, it is also integrated with productivity tools like Dropbox, Evernote, Google Drive, etc.

b. Redbooth:

Formerly called Teambox, it is written in Ruby on Rails and is built for cross-platform. It is a web based and on-premises workplace collaboration tool and a platform for communication. Its most popular features include role based permission to access to projects, real time communication, task management, chat, contacts on the project, time tracking, language support for various languages, etc.

c. Base camp Classic:

It is a web based project management cross platform tool released in 2004 and offers to-do lists, wiki-style web based text documents, milestone management, file sharing, time tracking, and a messaging system. Also available in various languages.

2.4. eXo Platform:

It is an open source, standard-based, Enterprise Social Collaboration Platform developed in Java that has extremely evolved since 2002. Since 2013, it is strongly focusing on social network and integration capabilities and by December 2013, it went a step ahead in this direction by offering a cloud based intranet.

2.5. Confluence:

Developed and marketed by Atlassian and written in Java, this team collaboration software is available in the market as either on-premises software or as a SaaS since 2004. It was built to fulfil the requirement of an enterprise knowledge management system along with the simplicity and ease employed in wiki. Later, it evolved and adapted to work in conjunction with other Atlassian software products like Clover, Crucible and JIRA etc. Some news items say that the software is quite comparable with Microsoft's SharePoint and also emphasize that it's a great tool to be used for social business collaboration. From version 4.0, the support of wiki markup language is discontinued in place of which Atlassian has provided a source code editor as a plugin.

2.6. Bitrix24:

Launched in 2012 by Bitrix, Inc., it is cross-platform collaborative software that is developed in PHP

2.7. Collabtive:

It is web-based project management software published as free software and provides an open source alternative to proprietary tools like Basecamp. Its first stable release was on 13 March, 2015. It's written in PHP5 as well as JavaScript. The use of AJAX in user interface has made it most suitable to be used as an

internet application. It facilitates it users well because of its feature of creating lists of to-do work, setting milestones for the tasks included in the project, time tracking of the work done on the project can be done, multilingual interface, etc.

3.

2.8. Eclipse:

ECSS Compliant Toolset for Information and Projects Support of Enterprises in Space is a software application initially developed for utilization in aero space projects, intended for use by aerospace project and mission teams. It was initially released on December 2009. It comprises of various modules like Database Application Builder, Risk Management, Project Administration Module etc.

2.9. Google Drive:

Google Drive is a file sharing software launched by Google. It allows file sharing on the cloud with the characteristic of synchronization service. It's very efficient and easy to handle. Google Drive was released on April 24, 2012

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3. Features

The collaborative application that will be developed can include the following features to assist the college students.

3.1. Easy inter-group communication*:*

The virtual social environment created will handle different projects under different groups and there will be an account for each group. So if two different groups (accounts) want to interact with each other to get some needed help for the project then they can do so via email because each person will be recognized with his name along with the email id. Also groups can share segment of their project depending upon their choice and can customize the access to it.

3.2. Access to Google Scholarly Articles:

The application will interact with Google Scholar which will help in providing the links to relevant literatures that match the keywords of the title of the project.

3.3. Endorse your work:

If team 1 has already worked on a project that team 2 is currently working on and also team 1 has endorsed that project then it would mean that it is willing to help team 2 in its project and hence an automatic notification will be sent to team 2 stating that team 1 is willing to help it in its project.

3.4. LinkedIn Interaction:

The LinkedIn accounts of all the members of the group can interact with their project account so that they can share the desired information about their project on their LinkedIn profiles which can help them in getting better jobs.

3.5. Planners:

In-built planners can be used to create different activities to be involved while working on the project, tasks within each activity, and daily milestones set for each individual which can be marked as done/undone.

3.6. Access to the work done by a member:

Only creator member can edit his/her work, rest of the team mates can just provide suggestions about the changes to be done. If anyone else wants to edit someone else's work he/she needs to send a request to the creator.

3.7. Interaction with other applications:

Other applications like notes, Drive, etc. can also interact and create sync with this application.

3.8. No Project Duplication:

The project can be sorted and saved according to the batches .The junior could gain profit by going through the work done by their seniors. Moreover, the duplication of the projects is out of the questions as it can easily be checked through the database to confirm the authentic maker of the project.

3.9. Suggestions:

There will be a suggestion area in different segments allotted the project members. If a member has any advice or idea he wants to give to other member, then he'll just have to write it in the suggestion area.

4. Conclusion

Once a college student steps out in the real world where a person's work is his identity, he faces massive hurdles. In the training period, companies provide generally 6 months to train a new employee to learn about the company's working system and policies. If one has an experience to work in that kind of level then surely he will get a good start. The difficulties faced by the new ones will sustainably decrease. Looking over to this point, the future is very bright for this collaborative application. As the companies spend a lot for the training freshers, it will be advantageous for them to hire the one who has a good experience of working on a project in executive environment. The training period as well as the capital spent by the companies will be shortened. The implementation of this application is plain sailing too. As the applications are already implemented on a corporate level with the features mentioned in the paper, the software can easily be applied on the college level too. With the internet facilities in most of the college premises, it will be feasible to gain the access of the software through cloud.

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VoLTE- An Evolution over Voice & Data

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Abstract

VoLTE is Voice over Long Term Evolution. It is the evolution of voice and data in a single call without quality compromise. Unlike previous networks, it concentrates on data transmission, rather than voice. It means the shift from voice focused mobile networks towards data-focused mobile networks. As like before we can make calls to any person results in the consumption of cost. So the concept of VoLTE has been introduced. It is the technology in which you can make HD voice calls without any additional charges that is by paying only for the internet charges. It provides benefits to both communication providers and their user bases as it offers better user experiences, greater cost efficiencies and high performance. This technology plays an important role in developing future business modes and ensures rapid and booming deployment, as well as high performance. So, this concept has emerged as a revolution in mobile network industry now a day.

1. Introduction

In 3G link speed is 3.6 mbps to 21 mbps but the actual speed is much slower, this results in buffering and lags. Also the purpose of voice call is not fulfilled, as the voice transfer rate is slow, with data recharges only. We need different plan for browsing and voice calls.

In everyday situations, people use voice together with other types of communications activity. In the world of mobile operators, the voice telephony call has however remained a single isolated exchange between sender and receiver. Part of the evolution for this interaction should naturally be the mixing of voice and data in a single call, and this evolutionary path is what we see today as Voice over LTE. [1]

Now for both browsing and voice calls we only need the data recharge. The choice is yours whether you use the data for browsing or for calling purpose. VoLTE scheme was devised as a result of operators seeking a standardized system for transferring traffic for voice over LTE. VoLTE benefits both communication providers and their users bases through spectral efficiency, simplicity and reliability, it offers better user experiences, greater cost efficiencies and accelerated technology paths. This will illustrate new opportunities and potential revenue streams helping companies to remain competitive as it ensures quick and successful commercial deployment, as well as high performance.

Section 2 describes how VoLTE is based, how this approach results in the voice service. Section 3 tells the VoLTE formation. Section 4 contains the basics of VoLTE. Section 5 specifies the codecs used for VoLTE. Section 6 presents the benefits of VoLTE that is the reasons of using VoLTE instead of separated voice/data solutions. Section 7 tells the voice quality we get in VoLTE. Section 8 tells the version of IP is required to operate VoLTE devices. At last section 9 tells why this concept has emerged as revolution in mobile industry now a day.

2. VoLTE

VoLTE is based on the IP Multimedia Subsystem (IMS) network, with specific profiles for control and media planes of voice service on LTE defined by GSMA in PRD IR.92 [2].

This approach results in the voice service (control and media planes) being delivered as data flows within the LTE data bearer. This means that there is no dependency on the legacy circuit-switched voice network to be maintained.

VoLTE has up to three times more voice and data capacity than 3G UMTS and up to six times more than 2G GSM. Furthermore, it frees up bandwidth because VoLTE's packets headers are smaller than those of unoptimized VoIP/LTE [3].

VoLTE itself has developed through the complementary efforts of the 3rd Generation Partnership Project (3GPP) and the GSMA. Between 2002 and 2007, 3GPP Releases 5-7 introduced the IMS which was later become a key VoLTE component. Nonetheless, it was not until 2010 that the GSMA (in IR 92) defined IMS-based VoLTE, using the session Initiation Protocol (SIP). This marked a turning point ith subsequent updates addressing VoLTE internetworking, roaming and video services. [1]

For end to end full HD voice calls to succeed however, the caller and the recipient's handsets as well as networks have to support this feature.

3. VoLTE formation

Originally the concept for an SMS and voice system over LTE using IMS had been opposed by many operators because of the complexity of IMS. They had seen it as far too expensive and burdensome to introduce and maintain. However, the One Voice profile for Voice over LTE was developed by collaboration between over forty operators including: AT&T, Verizon Wireless, Nokia and Alcatel-Lucent.

At the 2010 GSMA Mobile World Congress, GSMA announced that they were supporting the One Voice solution to provide Voice over LTE.

To achieve a workable system, a cut down variant of IMS was used. It was felt that his would be acceptable to operators while still providing the functionality required.

The VoLTE system is based on the IMS MMTel concepts that were previously in existence. It has been specified in the GSMA profile IR 92.[4]

4. VoLTE Basics

VoLTE is an IMS based specification. Adopting this approach, it enables the system to be integrated with the suite of applications that will become available on LTE. In order that IMS was implemented in fashion that would be acceptable to operators, a cut down version was defined. This not only reduced the number of entities required in the IMS network, but it also simplified the interconnectivity – focusing on the elements required for VoLTE.

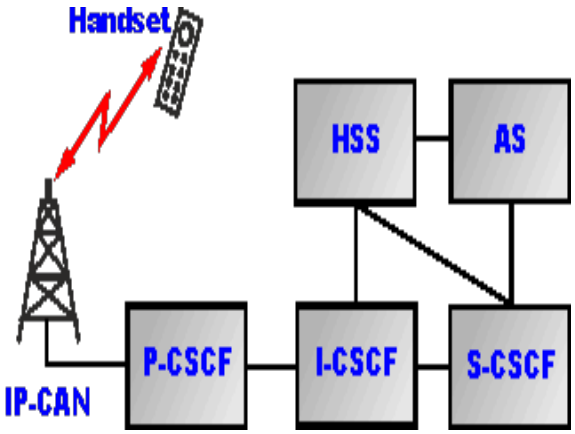

Figure 1 Reduced IMS network for VoLTE [4]

As can be seen there are several entities within the reduced IMS network used for VoLTE:

a. IP-CAN IP, Connectivity Access Network: This consists of the EUTRAN and the MME.

b. P-CSCF, Proxy Call State Control Function: the P-CSCF is the user to network proxy. In this respect all SIP signaling to and from the user runs via the P-CSCF whether in the home or a visited network.

c. I-CSCF, Interrogating Call State Control Function: the I-CSCF is used for forwarding an initial SIP request to the S-CSCF. When the initiator does not know which S-CSCF should receive the request.

d. S-CSCF, Serving Call State Control Function: The S-CSCF undertakes a variety of actions within the overall system, and it has a number of interfaces to enable it to communicate with other entities within the overall system.

e. AS, Application Server: It is the application server that handles the voice as an application.

f. HSS, Home Subscriber Server: The IMS HSS or home subscriber server is the main subscriber database used within IMS. The IMS HSS provides details of the subscribers to the other entities within the IMS network, enabling users to be granted access or not dependent upon their status.

The IMS calls for VoLTE are processed by the subscriber's S-CSCF in the home network. The connection to the S-CSCF is via the P-CSCF. Dependent upon the network in use and overall location within a network, the P-CSCF will vary, and a key element in the enablement of voice calling capability is the discovery of the P-CSCF.

An additional requirement for VoLTE enabled networks is to have a means to handing back to circuit switched legacy networks in a seamless manner, while only having one transmitting radio in the handset to preserve battery life. A system known as SRVCC-Single Radio Voice Call Continuity is required for this [4].

5. Voice Codecs

As with any digital voice system, a codec must be used. The VoLTE codec is that specified by the 3GPP and is the adaptive multi-rate, AMR codec that is used in many other cellular systems from GSM through UMTS and now to LTE. The AMR-wideband codec may also be used.
The use of the AMR codec for VoLTE also provides advantages in terms of interoperability with legacy systems. No transcoders are needed as most legacy systems now are moving towards the AMR codec. In addition to this, support for dual tone multi-frequency, DTMF signaling is also mandatory as this is widely used for many forms of signaling over analogue telephone lines [4].

6. VoLTE Benefits

The reasons of using VoLTE instead of separated voice/data solutions are numerous.

6.1. Volte is simple and reliable

With its guaranteed QOS, Volte offers an operator's subscribers a robust substitute to OTT VoIP in an easy-to-use mechanism. Users know that they can reply and enjoy carrier-grade services without disruption or uncertainty.

6.2. Volte exceeds OTT VoIP and even 3G voice quality

Through the use of Adaptive Multi rate Wideband (AMR-WB) codecs (12.65 Kbps or 23.85 Kbps) and QoS Class Identifier (QCI) SIP signaling, VoLTE provides "HD Voice" for a noticeably better end user experience compared to OTT VoIP and even 3G.

6.3. VoLTE reduces the work to provide rich media services

As explained previously in VoLTE, operators have a foundation for using RCS to enable video and file sharing, presence, instant messaging and enhanced phonebook services. An operator who has already implemented VoLTE is closer to implementing RCS than a non-VoLTE operator.

6.4. VoLTE is spectrally efficient

Because of LTE's all IP architecture and new features in 3GPP release (such as MIMO antenna technology), voice requires less bandwidth in LTE spectrum than it does in 2G/3G networks. Consequently operators have more available data capacity in their bands for a given voice load.

6.5. VoLTE reduces operator Opex

VoLTE simplifies the network by providing data and voice services on the same IP network, allowing operators to integrate network resources, optimize network and service management, and simplify service delivery.

6.6. VoLTE accelerates evolution to LTE

With VoLTE, an operator can offer voice service in its LTE spectrum while harvesting its 2G/3G spectrum for re-deploying additional LTE bandwidth. This migration process is easier for subscribers and limits operator upgrade costs [1].

7. Voice Quality

To ensure compatibility, 3GPP demands at least AMR-NB codec (narrow band), but the recommended

speech codec for VoLTE is Adaptive Multi-Rate Wideband, also known as HD voice. This codec is mandated in 3GPP networks that support 16 kHz sampling [5].

Fraunhofer IIS has proposed and demonstrated "FULL-HD Voice", an implementation of the AACELD (Advanced Audio Coding- Enhanced Low Delay) codec for LTE handsets. Where previous cell phone voice codecs only supported frequencies up to

3.5 kHz and upcoming wideband audio services branded as HD voice up to 7 kHz, Full-HD Voice supports the entire bandwidth range from 20 Hz to 20 kHz [6].

8. VoLTE IP versions

With the update from IPv4 to IPv6, the version of IP used in any system is of importance.

VoLTE devices are required to operate in dual stack mode catering for both IPv4 and IPv6.

If the IMS application profile assigns and IPv6 address, then the device is required to prefer that address and also to specifically use it during the P-CSCF discovery phase.

One of the issues with voice over IP type calls is the overhead resulting from the IP header. To overcome this issue VoLTE requires that IP header compression is used along with RoHC, Robust Header Compression, protocol for voice data packet headers. [4]

9. Conclusion

VoLTE has emerged as the chief standard for flawlessly combining voice telephony and data connections without quality compromise. VoLTE represents the evolutionary path for voice Communication in the LTE era, and is highly accessible to operators at different stages.

By poignant towards VoLTE, carriers and their users can seize pleasure in instant and longer term benefits of ubiquitous, consistent and high quality service, together with the immersiveness of affluent media. [1]

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Future Architecture of General Purpose Computing on Graphics Processing Units (GPGPUs)

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Abstract

The Graphics Processing Units (GPUs) have been used extensively since their origin because of their high accuracy and speed in processing visual data. The primary reason for their success is the extensive use of parallel processing which has improved their performance and made them more efficient and effective than a Central Processing Unit(CPU).Through this review paper, we intend to present the application of Moore's Law in the development of GPUs over the years, review the recent developments in the General Purpose Computing on Graphics Processing Units(GPGPU), present an outlook for their future architecture and also comment on the performance of such systems in today's era. Another important objective of this paper is to highlight the prospects of integrating the GPU and the CPU, thereby forming a GPGPU.

1. Introduction

Nvidia Corporation scientifically defines Graphics Processing Unit (GPU) as "a single chip processor with integrated transform, lighting, triangle setup/clipping, and rendering engines that is capable of processing a minimum of 10 million polygons per second."[1]Initially, the GPUs were introduced to improve the gaming experience in the virtual world by producing realistic replicas of real world images on the virtual screen. However, the advent of 3D and animation movies called for superior quality GPUs that have exceptionally high computational capabilities.

2. Present Architecture of A Modern Gpu

Generally speaking, the architecture of a GPU consists of a number of small processing cores. A large number of threads increase the throughput to a good level. Memory latency is also concealed because of the switching that takes place between multiple threads. The framework of the GPU consists of two level hierarchy with vector processors constitutingthe first level. These processors are also called streaming processors(SMs) for Nvidia GPUs and Single instruction, Multiple data (SlMD) cores for Advanced Micro Devices, Inc. (AMD) GPUs. A set of simple processing cores termed streaming processors (SPs) is present in every vector processor.Each of the processing cores present inside one vector processor can communicate via a memory that physically exists on the microcontroller itself, often called the on chip user managed memory.GPUs are in their novice stage. Although sufficient work has been done in terms of application progress but not much development has been seen as far as its architecture is concerned. Improvements in this direction can make them as a good option as far as multi-processing is concerned.

3. Moore's Law

Moore's Law states that the count of the transistors used in complex ICs doubles almost after every two years.
Applying Moore's Law to the development in the GPUs produced by Nvidia and AMD over the years, we observe that the growth rate in transistor count has been more than what had been predicted by Moore's law, i.e., it is more than double(in table below). The increasing number of transistors in the GPUs is an indicative of rapid developments going on this field to improve the GPU architecture with each passing year. In this paper, we will shed some light on architecture of consolidating the GPU and the CPU and the possibility of replacing them with a GPGPU.

[1] http://www.nvidia.com/object/gpu.html

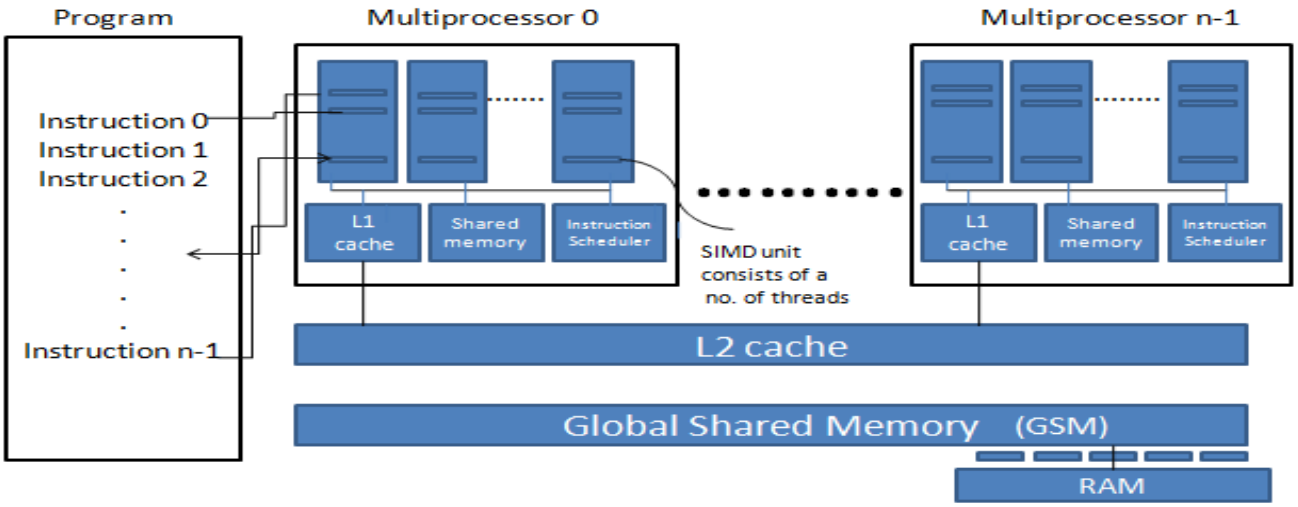

Fig. 1: Hardware framework of a GPU: The figure shows that instructions are executed in parallel by SIMD units. Alongside, the threads are associated into thread groups. Each multiprocessor has L1 cache and also interfaces with global shared memory.

Table 1. Moore's law

R580	384,000,000	2006	AMD
G80	681,000,000	2006	NVIDIA
R600	700,000,000	2007	AMD
G92	754,000,000	2007	NVIDIA
RV790	959,000,000[33]	2008	AMD
GT200 Tesla	1,400,000,000[34]	2008	NVIDIA
Cypress RV870	2,154,000,000[35]	2009	AMD
Cayman RV970	2,640,000,000	2010	AMD
GF100 Fermi	3,200,000,000[36]	Mar 2010	NVIDIA
GF110 Fermi	3,000,000,000[36]	Nov 2010	NVIDIA
GK104 Kepler	3,540,000,000[37]	2012	NVIDIA
Tahiti	4,312,711,873[38]	2011	AMD
GK110 Kepler	7,080,000,000[39]	2012[40]	NVIDIA
Hawaii	6,300,000,000	2013	AMD
GM204 Maxwell	5,200,000,000	2014	NVIDIA
GM200 Maxwell	8,100,000,000	2015	NVIDIA
Fiji	8,900,000,000	2015	AMD

4. Gpu Architecture In Power Limited Era

Moore's Law has reduced the size of the semiconductor devices whereas the use of parallel processing has been a result of impressive clock scaling and enhanced CPU performance. The parallel architecture, today, uses numerous cores with each having more computational capability and more energy. GPUs are used in devices ranging from mobile phones to personal computers and even server systems.

In such systems, model of computation is not-uniform. There are some latency optimized CPU units and hundreds of throughput GPU units. In complex systems these two are separate whereas in cheaper versions they are integrated to some extent.

In both these cases, the key characteristics of the GPUs are the simple but energy efficient computational cores, a massive number of simultaneously-active fine-grain threads, and large available off-chip memory bandwidth. This trend of non-uniform computational model coupled with parallel processing on GPU cores will become even more popular in the coming future.The focus of the future architecture should be on reducing the power consumption of the increasing throughput optimized cores since this area will be the major power consuming component.

5. What is Gpgpu?

Innovative idea of implementing the massive processing power of a GPU for other applications appears to be quite appealing. This is now termed as General Purpose Computing on GPUs (GPGPU)."GPGPU mainly finds use in supercomputers, autonomous vehicles, software routers

etc.
Considering the present popularity of the GPUs and their future scope, a critical question to be focused upon is how can the architecture of the processors be modified so as to increase their efficiency and at the same time not affect their power consumption pattern substantially. Scientists and engineers working in this direction can gain fruitful information by analyzing the current architecture of the GPUs and then forming possible prospects for the future GPGPU architectures.
Cedric Nugteren, Gert-Jan van den Braak, and HenkCorporaal in their study titled 'Future of GPGPU Micro-Architectural Parameters'talk about three key parameters of the GPU architecture the vision for the future.

5.1. Active Thread Count:

A GPU is capable of hiding pipeline and off-chip memory latencies through zero overhead thread switching. GPU's large register file along with extensive use of parallelism helps to hide latencies to a large extent.
Two ways to achieve performance and energy efficiency with respect to the number of active threads are **dynamic register file sizing and latency-aware scheduling**. Which part of the register file can be used to store a large amount of active threads, instruction sequences (e.g. at kernel-level) can be analyzed statically, if possible, or dynamically otherwise. Switching the complete register file ON will only be possible if another component is switched OFF, e.g. a cache. Such a register file will benefit from power savings for workloads that only require a low amount of active threads. Also, an efficient latency-aware scheduling algorithm can decrease the number of active threads that are required.

5.2. Compute-Memory Ratio:

The GPU is widely used in applications where high performance is expected. The two means of accomplishing high performance in GPUsare as follows: 1)providing a large number of high clock frequency processing elementswill ensure a high instruction throughput, typically measured in giga-floating point operations per second (GFLOPS), and 2)providing a high bandwidth to off-chip memorywhich will enable a high data throughput, measured in gigabytes/s (GB/s). The ratio between the two, the *compute-memory ratio*, is an important design parameter for GPUs.

To furtherimprove GPGPU architectures, a variable compute-memory ratio is suggested which can either be discrete, i.e. the GPU switches to fixed operation points, or continuous. The two techniques to create a variablecompute memory ratio are**roofline-aware dynamic frequency and voltage scaling(DVFS) and a dynamic cluster count**.

Dynamic frequency scaling can be used to reduce the clock frequency of the GPU core or off-chip memory, which has a linear impact on either the compute or the memory. Furthermore, dynamic frequency and voltage scaling (DVFS) might be applied to lower the voltage as well as the frequency for cubic gains in power. Therefore they have proposed a compute-memory ratio aware DVFS scheme to create a dynamic ratio, saving power while maintaining performance.On similar lines, linear power gains can be achieved by powering down complete clusters of PEs for some time for memory-intensive works which can be achieved through GPU's modular architecture. This should lower the compute ratio and at the same time reducing power consumption without deteriorating performance.

5.3. Cluster and Warp Sizing:

Cluster and warp sizing refers to the number of processing elements (PEs) in a compute cluster and the number of threads grouped for executing together. PEs in GPUs are typically clustered into smaller groups. The G80 architecture for example can scale up to 16 clusters. On each cluster, instructions are executed as *warps*: groups of threads executing in lock-step.

The two suggested techniques to address the trade-offs for cluster and warp sizing for future GPGPU architectures are**runtime cluster fusion and dynamic warp formation and sizing.**

Because a large cluster size has many advantages, namely in terms of area and energy savings, it is appealing to design a GPU with such a configuration. However, such a large cluster can result in a severe penalty in case of divergent workloads. To still be able to accommodate such workloads, we propose to split a larger cluster in several smaller clusters at run-time, creating an adaptive configuration which can be changed at kernel-granularity. To enable run-time cluster fusion, the hardware needs to be able to accommodate the smallest cluster size and thus include for example an instruction fetch and decode stage for every cluster. Secondly, we believe future GPGPU architectures will allow dynamic warp formation and sizing at run-time either to improve memory coalescing or to reduce branch divergence. On current GPUs, warps are formed statically based on thread indexing.

6. Conclusion

Several key points surface on analyzing and evaluating the ongoing research in the field of GPGPU Systems. Examining these themes gives us a hint about the direction

in which the future of GPGPU architecture is heading.

1. GPGPUs cannot handle double point precision which implies that they cannot be used in certain scientific applications. GPGPUs can process enormous amount of data quickly and therefore they can be used in supercomputing but supercomputing requires high accuracy too. The inability of GPGPUs in handling double precision therefore means that we will have to work on approximations, which is not suitable. This drawback is a clear contradiction with respect to this application.

2. Another important challenge that arises is regarding the requirement of GPGPU systems on various platforms. For example, in mobile phones where such high usage of graphics is not required, there the implementation of these systems would be inappropriate. Alongside, the GPUs main purpose was image processing. Therefore, a GPGPU system should be designed such that the entire potential of the CPU and the GPU can be exploited to the maximum if the two are integrated together.

3. The third critical challenge is the cost factor in integrating CPU and the GPU and replacing them by a GPGPU.

However, the development faces many challenges and

4. Another crucial factor is power consumption of such systems. Integrating more chips and processors to deliver efficient performance would increase the power consumption of the circuit that can lead to more energy losses and would also require proper cooling mechanisms.

The three techniques seem apt, atleast theoretically, for the future advancements in the GPGPU architecture. However, their hardware implementation practically requires a comprehensive analysis of the finer details.

Extensive knowledge of GPU based systems is thus mandatory for software developers of such systems, as well as for architecture designers.

10. References:

[1] Cedric Nugteren, Gert-Jan van den Braak, HenkCorporaal, "Future of GPGPU Micro-Architectural Parameters"

[2] Kai Hwang, NareshJotwani, "Adavnced computer Architecture: Parallelism, Scalability, Programmability (2nd Edition)"

[3]Stephen W. Keckler, "GPU Computing and the Road to Extreme-Scale Parallel Systems.

A Software Engineering Approach to Design the Alferdo - A Home Security System

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Abstract

Home Automation refers to the use of computers and Electrical circuit to control home appliances (it could be windows or any other appliance). It can be simple remote control of lightning and appliances used in a house (A simple example of Home Automation is automatic ON and OFF of lights when you walk in and walk out of the room) and can be as complex as network of micro-controllers (security system like biometric safe lock) .So it's a system to provide more comfort, convenience and Security and most importantly "Energy Saving". This can provide quality life to elderly and differently disabled persons. Security system integrated with the Home Automation system provide the user to watch out each and every corner of house (where the CCTV are installed) remotely. Also detect the intruder in the home i.e. if the alarm is set and no one is supposed to be at home then the security system will call the owner about the presence of that person. In this paper software designed approach has been used to govern the functions of Home Security System like ***Platform to control gadgets remotely, Gesture Control, Automation, Power Management etc. The Alferdo - Home Security System also works like a sensor viz. heat sensor, floor sensor, Monitor sensor, biometric lock.***

Keywords*: Process Model, Function Point Metrics, Cyclometic Complexity, Test Cases,*

1. Introduction

Alferdo is software designed to govern the operation of embedded systems in motor vehicles, robots, office machines, complex medical devices, mobile radio transceivers, vending machines, home appliances, and various other devices. A typical microcontroller includes a processor, memory, and peripherals. Software called Alferdo performs so many functions as it gives a **Platform to control gadgets remotely, Gesture Control, Automation, Power Management etc. Alferdo also works like a sensor like heat sensor, floor sensor, Monitor sensor, biometric lock** *(See figure 1).* The software Alferdo Microcontroller is also used in Home Security System.

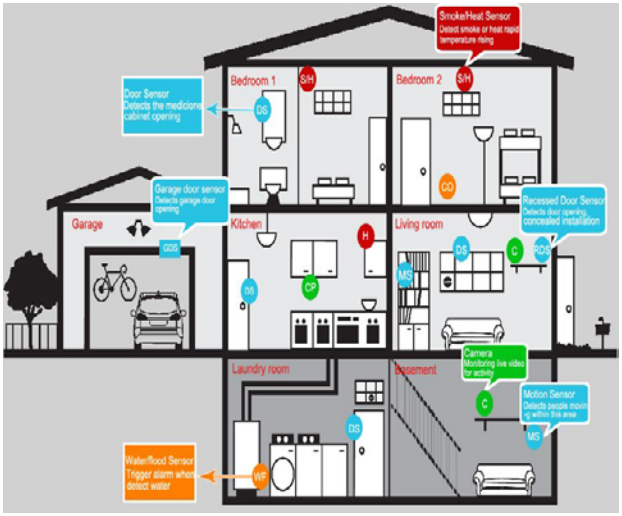

Figure -1: Home Security System
Source: *(https://lh5.googleusercontent.com/-6C27tXzxO-I/VDOG0ExR0bI/AAAAAAAAAJ8/ijVCWIhEOO0/ w930-h531/home-security-system.jpg)*

2. Requirement Analysis of Alferdo

Some specific capabilities include for the Analysis of the Home Security System are as follows:

1. **Heat Alarms for Kitchens and Garages**
   Places that are filled with a lot of smoke can result in a false alarm if you use a smoke alarm. In this situation these alarms came in use. This will detect the rapid increase in the temperature from the normal day temperature and raise the alarm accordingly.

2. **Water Leak/Overflow Detection**
   Water leak/overflow detection equipment is designed to reduce to wastage of water to minimal and in fact to zero. If the overhead water tank if full and water is overflowing, then this will detect it and automatically turn off the switch of motor. It can also be in the laundry room, if the tap is left opened or water is leaking from any tap then alarm will be raised. Detects even a small crack in plumbing line or sewage tank before it's too late.

3. **CCTV Camera**
   Records everyone whosoever visited the house. It will be installed at the front door as well as at back door. Who so ever is at the front door will be displayed on the motion inside and open door as per wish.

4. **Biometric Lock**
   Biometric lock is designed to provide the access control over the valuable or highly confidential things at home.

5. **Door Lock Sensor**
   Door sensors (sometimes known as photoelectric or infrared beam, electric safety door edges, door detector, electric proximity edges, or electric doorman) are a device that detects a people or an object on the doorway which prevents the doors from closing. If a person or an object blocks the doorway and the sensors detects the person or object, the door will reopen then stays open and will not closed until the person moves away or the object is removed from the doorway. If the doors are being held open for a more than the specified period, the elevator will go into nudge mode and the doors will close slowly with a continuously beep. The door sensors will not work on the fire service mode, hence the fireman's elevator still need mechanical safety edges when the sensor not working.

6. **Motion Sensor**
   It is designed to restrict the person in particular area and to save the electricity. Whenever a person walks in the area, motion sensors detect the motion and automatically lights up the area and as soon as the user leaves, lights are turned off.

2.1 Process Model

A regular interaction with the customer we came to know that he wants software that can be used to program the above mentioned things and we also came to know that he might want to add some new features to the software later. That's why we used prototypic model for our software

"*The Prototyping Model is a systems development method (SDM) in which a prototype (an early approximation of a final system or product) is built, tested, and then reworked as necessary until an acceptable prototype is finally achieved from which the complete system or product can now be developed."* Using the prototyping model we are providing a basic model of our system that would be more refined over the period of time *(See figure 2).*

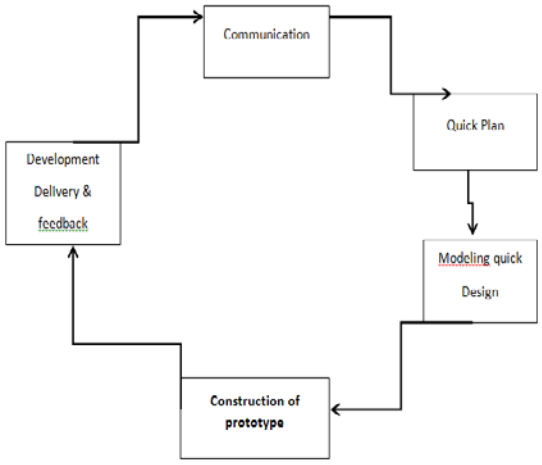

Figure 2: Flow chart of prototypic model

2.2 LEVEL 0 DFD (Figure 3.1)

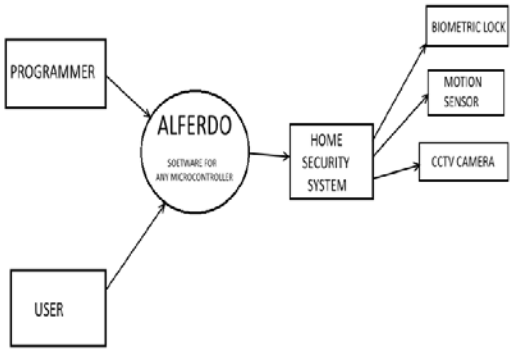

Figure 3.1: Level 0 DFD of Home Security System

2.3 DFD: level 1

- Alferdo PRP is multi-purpose security system that is capable of 24x7 servallence and secures from every possible threads.
- Sensors from every entity continuously sense every event and report it to micro-controller.
- Whenever any interrupt/trigger occurs at any entity, the sensor creates an error message and sends it to the system (microcontroller) and then the system interprets the error and raises an alarm.
- All the information is stored at the database. (See Figure 3.2)

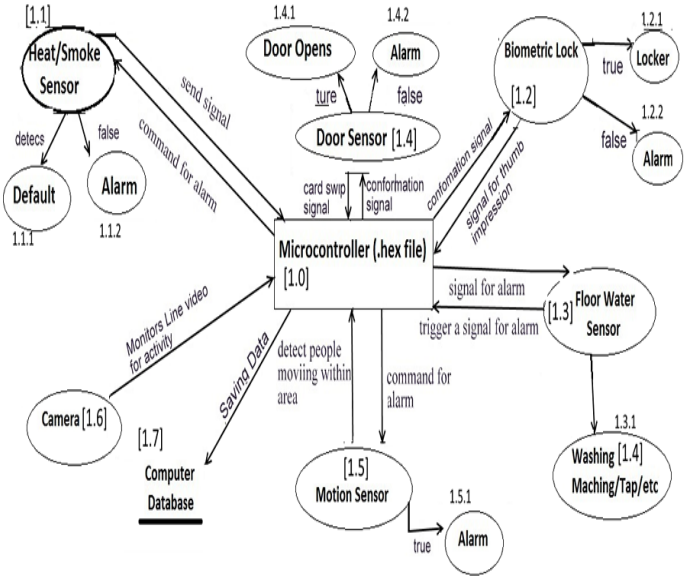

Figure 3.2: level 1 DFD of Home Security System

2.4 Entity Relationship Diagram (figure 4)

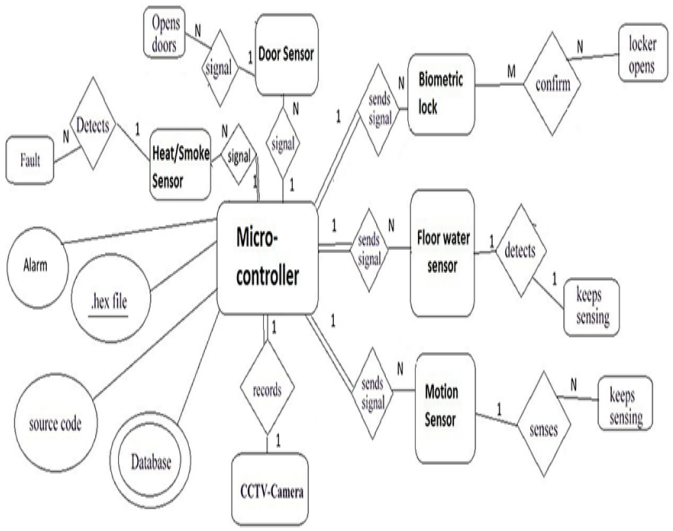

Figure 4: E-R diagram of Home Security System

2.5 DATA DICTIONARY

Table1: Data Dictionary

Name	Data type	Constraints	Description

Biometric lock	BIOB	NOT NULL	To open the main door of home user have to give his thumb print
Video recording	BIOB	NOT NULL	Cameras are installed at the main door. Whosoever visit home will be recorded
Heat Sensor	INT(.C)	NOT NULL	Whenever temperature exceeds this limit alarm arises
Floor water sensor	Bool	NOT NULL	Trigger alarm when detect water in laundry room
Programs	CLOB		Users can use our system predefined programs
Motion sensor	INT(11)	NOT NULL	When a person is detected where he/she should not be, then the alarm will be triggered.

3. SYSTEM REQUIREMENT SPECIFICATION (SRS)

The Alferdo Support Knowledgebase is a database of technical support questions and answers. When a new question arises, it is added to the database and is published to the world-wide web. That makes it easier for you to get technical support at times when our support staff is unavailable.

3.1 Software Requirement

Your computer must meet certain minimum system requirements for the evaluation software to function properly.

- Windows XP SP3, Windows Vista or Windows 7
- Mouse or Similar Pointing Device
- Available Hard Disk Space
- 1GBytes of RAM (2GB recommended)
- Pentium Class PC

3.2 Hardware Interfaces Workstation

- User workstation shall have keyboard input.
- User workstation shall have roller ball mouse input.
- User workstation shall have minimally a 19-inch monitor.
- All interfaces on user workstation shall be scalable in information display size.
- User workstation shall have appropriate hardware for network connection.

- The C/C++ compilers provided by Alferdo are leaders in code generation and
  Produce highly efficient code.

3.3 User Requirements of Software

- Efficient
- Reliable
- Cheap
- Synchronizable
- Safety

3.4 Network Requirement

All the systems like fire sensor, motion sensor, etc. should be connected to one main system that would have Alferdo installed in it.

4. RISK

It is general agreement that involves two characteristics: Uncertainty- the risk may or may not happen and Loss- if the risk becomes a reality, unwanted consequences or loses will occur.

There are several risk associated in our project. Some are mention below:-

1) **Project risk** – It threaten the project plan. That is, if project risks become real, it is likely that the project schedule will slip and that cost will increase.

Project risks identify potential budgetary, schedule, personnel, resource, stakeholder and requirement problems and their impact on a software project.

2) **Technical risk** - *Technical risks* threaten the quality and timeliness of the software to be produced.

If a technical risk becomes a reality, implementation may become difficult or impossible.
Technical risks identify potential design, implementation, interface, verification, and maintenance problems
3) **Business Risk** - *Business risks* affect the organization developing or procuring the software.

4) **Product Risks** – *Product* Risks affect the quality or performance of the software being developed.

Risks associated towards its implementation:

1) **Funding will be lost –** There is a very high risk that the funding will be lost during the implementation of the project due to purchase of lot of micro-controllers which in turn can affect the project deadline.

2) **Delivery Deadline will be tightened –** When implementing it there is a chance that project might not be completed on Time which in turn affects the developing organisation as well as the client.

3) **Document Risk-** If the document is not properly filed, then it would create problem for the user as well as the maintenance team. So it should be well documented.

4.1 Risk Table

* CU - Customer Characteristic Risk

BU - Business Risk

ST - Staff Size and Experience Risk

PS - Product Size Risk

PD – Process Definition Risk

TE – Technology to be build Risk

** 1-catastropic

2-critical

3-marginal

4-negligible

S.No.	Risks	Category*	Probability	Impact**	Mitigation
1)	Funding will be lost	CU	50%	3	Regular supervise whether we are not running out of the funding
2)	Staff inexperienced	ST	30%	2	External resources , conducting seminars and lecture might help
3)	Delivery Deadline will be tightened	BU	40%	2	Working within the time period schedule ,cross checking mean while
4)	Lack of Training on tools	ST	30%	2	External resources and guidelines can be provided before working on new tools.
5)	Document Risk	PD	20%	4	Define documentation standards and regularly supervise that Documents are developed in timely manner
6)	Technology will not meet the expectations	TE	30%	1	Executing tasks while keeping the technology to be used in mind

Table 2: Risk table

5. USE CASE DIAGRAM

A **use case diagram** at its simplest is a representation of a user's interaction with the system that shows the relationship between the user and the different use cases in which the user is involved. A use case diagram can identify the different types of users of a system and the different use cases and will often be accompanied by other types of diagrams as well.

We make our use case using the software STAR_UML

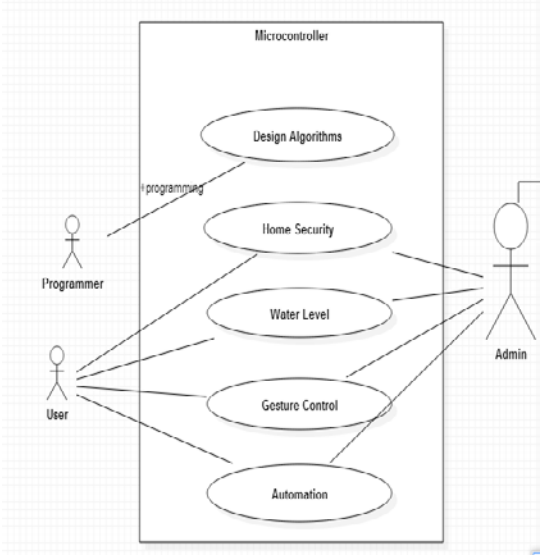

Figure 5: Use Case Diagram

6. Architectural Mapping

It is a set of design steps that allows a DFD with transform flow characteristics to be mapped into a specific architectural style. To map these data flow diagrams into a software architecture,
you would initiate the following design steps:-

Step 1. Review the fundamental system model. The fundamental system model or context diagram depicts the Alferdo as a single transformation representing the external producers and consumers of data that flow into and out of the function

Step 2. Review and refine data flow diagrams for the software: Information obtained from the requirements model is refined to produce greater detail. (See figure 6.1)

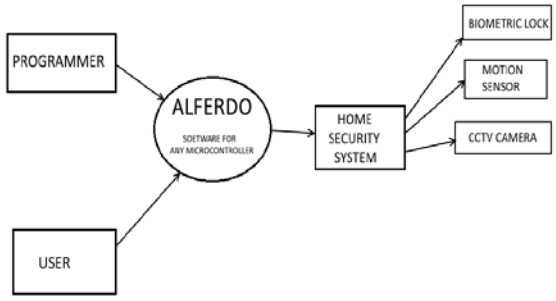

Figure 6.1: Level 0

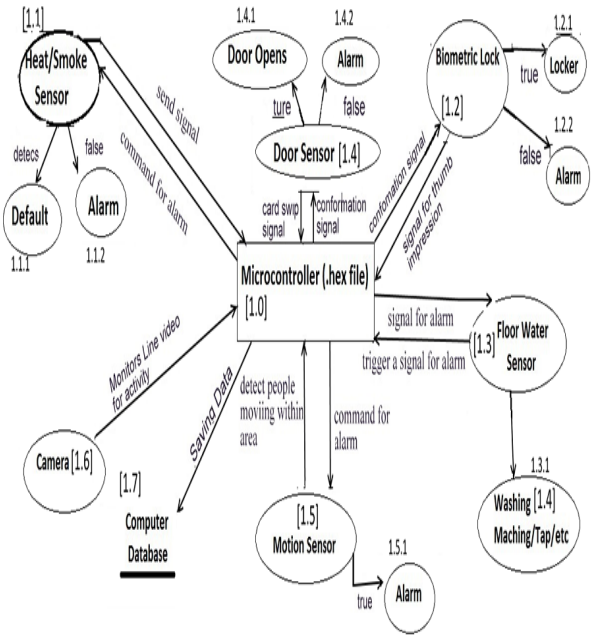

Figure 6.2: Level 1

Step 3. Determine whether the DFD has transform or transaction flow characteristics.

Evaluating the DFD we see data entering the software along one incoming path and exiting along three outgoing paths. Therefore, an overall transform characteristic will be assumed for information flow. (See figure 6.2)

Step 4. Isolate the transform centre by specifying incoming and outgoing flow boundaries.

Incoming data flows along a path in which information is converted from external to internal form; outgoing flow

converts internalized data to external form. Incoming and outgoing flow boundaries are open to interpretation.

Step 5. Perform "first-level factoring."
The program architecture derived using this mapping results in a top-down distribution of control. *Factoring* leads to a program structure in which top-level components perform decision making and low level components perform most input, computation, and output work. Middle-level components perform some control and do moderate amounts of work (See figure 6.3)

Step 6. Perform "second-level factoring." Second-level factoring is accomplished by mapping individual transforms (bubbles) of a DFD into appropriate modules within the architecture. Beginning at the transform centre boundary and moving outward along incoming and then outgoing paths, transforms are mapped into subordinate levels of the software structure.

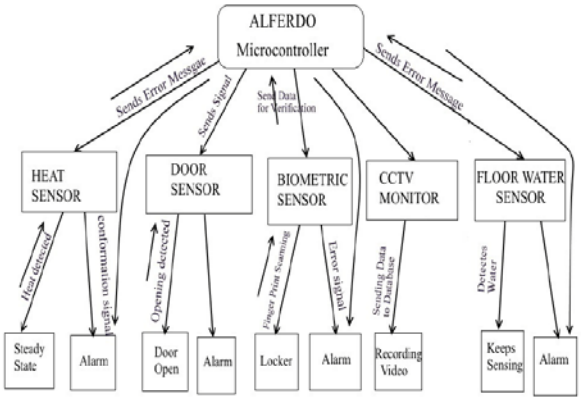

Figure 6.3: First Iteration Structure for Microcontroller OR Structure Chart

7. COMPONENT LEVEL (PSEUDO CODE)

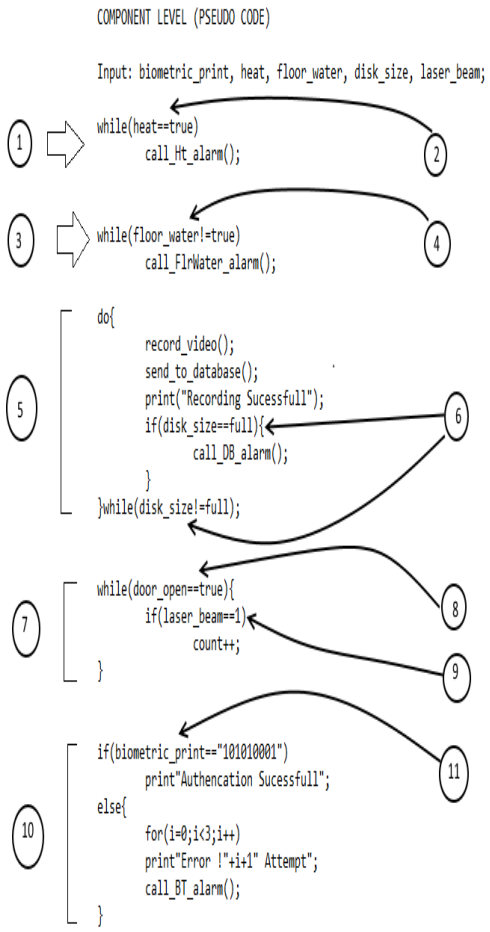

Figure 7.1: PSEUDO CODE of Alferdo

STEP 1: FLOW GRAPH

Node 1,3,6,7,10,12 are the entity respectively, Node 1 represent heat sensor, it continuously senses since any interrupt it moves to node 2 where it calls call_ht_alarm(). The execution is done at stage 0 and send signal to raise an alarm stage 12. Similarly and henceforth for all other entities.

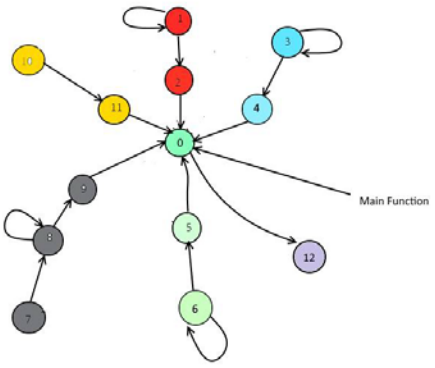

Figure: 7.2: Flow Graph

STEP 2: CYCLOMATIC COMPLEXITY

Cyclomatic complexity: It is software metric that provides a quantitative measure of the logical complexity of a program. Cyclomatic complexity can be computed in three ways:
1) The number of regions of the flow graph corresponds to the Cyclomatic complexity.
THE REGIONS ARE 5 (R1 – R2).
So CYCLOMETIC COMPLEXITY = 5.
2) Cyclomatic complexity V (G), for a flow graph, G, is defined as:
V (G) = E-N+2
Where
E: the no. of flow graph edges.
N: the no. of flow graph nodes.
V (G) = E – N + 2
=15-12+2
V (G) = 5
3) Cyclomatic complexity V (G), for a flow graph, G, is also defined as:
V (G) = P+1
Where
P: no. of predicate nodes in the flow graph G.

- A *predicate node* is a node containing a condition

V (G) =P+1
=>4+1
=>5
=>V (G) =5
Therefore, the Cyclomatic complexity of the flow graph is 5.

8. TEST CASES

8.1 BASIS SET OF LINEARLY INDEPRNDENT PATHS

The value V (g) provides the number of linearly independent paths through the program control structures.
PATH 1: 1-2-0-12(i)
PATH 2: 3-4-0-12(ii)
PATH 3: 5-6-0-12(iii)
PATH 4: 7-8-9-0-12(iv)
PATH 5: 10-11-0-12(v)

8.2 TEST CASES

PATH 1: 1-2-0-12(i)
When the heat detector detects the heat presence, it sends a request to raise an alarm.
PATH 2: 3-4-0-12(ii)
Since the water detector detects the water on the floor, it will send a signal for alarm.
PATH 3: 5-6-0-12(iii)
Sends an alarm for low memory in the database.
PATH 4: 7-8-9-0-12(iv)
Counts number of persons that going inside and outside.
PATH 5: 10-11-0-12(v)
After three consecutive failure, the locker gets a signal to move into the safe mode and the system sends an alarm for unauthorized user.

9. PROJECT METRICS

Project metrics are used to control and coordinate software engineering process and to improve quality of the software to be produced. Project specific metrics provide indication of productivity and insight into the technical activities of the project workflow and code.

9.1 FUNCTION POINT METRICES

Function point matrices (FP) can be used as a means for measuring the functionality delivered by a system as normalization value.
FP can be used to:
1. Estimate the cost or effort required to design, code and test the software

2. Predict the number of errors that will be encountered during testing

3. Forecast the number of components or the number of projected source lines in the implemented system.
Function points are derived using an empirical relationship based on countable measure of software's information domain and assessments of software complexity.

COMPUTING FUNCTION POINTS

FP = total count × [0.65 + 0.01 × Σ (Fi)]

Where **total count** is the **sum of all FP** entries obtained in table below:

Table 3: Function point Table

Information Domain Value	Count		Weighting Factor	Values
External Inputs (EIs)	2	X	3	6
External Outputs (EOs)	3	X	4	12
External Inquiries (EQs)	2	X	3	6
Internal Logical Files	1	X	7	7
External Interface Files	4	X	5	20
Count Total				**51**

External Inputs:-user and programmer

External Outputs:-controller area network, home security system and advance uses.

External inquiries:-Alarm and Signals

Internal Logical file:-.hex file

External interface files:-Floor water sensor, door sensor, heat sensor and Camera.

The Fi (i=1 to 14) are value adjustment factors based on responses to the following questions:

Each of these questions is answered using a scale that ranges from 0 to 5.

1. Does the system require reliable backup and recovery? 5
2. Are specialized data communications required to transfer information to or from the application?

   3
3. Are there distributed processing functions?

   2
4. Is performance critical?

   4
5. Will the system run in an existing, heavily utilized operational environment? 4
6. Does the system require online data entry?

   5
7. Does the on-line data entry require the input transaction to be built over multiple screens or operations?

   0
8. Are the ILFs updated on-line?

   3
9. Are the inputs, outputs, files, or enquiries complex?

   1
10. Is the internal processing complex?

    4
11. Is the code designed to be reusable?

    4
12. Are conversion and installation included in the design? 0
13. Is the system designed for multiple installations in different organizations? 4
14. Is the application designed to facilitate change and for ease of use by the user? 5

Therefore, **Σ (Fi) =45**

FP=51 × [0.65 + (0.01 × 45)] = 56.1

9.2 EFFORT AND ESTIMATION

A typical estimation model is derived using regression analysis on collected from past software projects.

Where E is the **effort in person-months**, FP is the **Function Point count**

E = -91.4 + 0.355*FP (Albert and Gaffney model)
= -91.4 + 0.355 * 51.1
=-73.2595

E = -37 + 0.96*FP (Kemmerer Model)
= -37+0.96*51.1
= 12.056

E = -12.88 + 0.405*FP (Small Project Regression Model)
= -12.88 + 0.405 * 51.1
= 7.8155

For Alferdo – Home Security System Function points estimated = 51.1

Therefore, the effort expended over the entire life cycle for software development and maintenance: E = (-37 + (0.96×51.1))

= 12.056 person-hours

Effort $_{estimated}$ = 12 person-hours (approx)

10. SOFTWARE TESTING

As our software is dealing with programming the different security devices that are installed in houses for security. So we have used the white box testing as it deals with programming mostly.

10.1 WHITE BOX TESTING

"White Box Testing is a testing of a software solution internal condition and infrastructure."

It involves checking of a series of predefined inputs against expected or desired outputs. So that when a specific input does not result in the expected output, you encountered a **BUG**

Basic path testing is a white box testing technique that enables to derive logical complexity and defines basic test of execution paths. The test cases are so prepared the each execution path will occur at least once

White box testing techniques

Code coverage analysis: It identifies the areas of the program that are not executed by the set of test cases.

Once gaps are identified, create test cases to verify untested parts of code, thereby increasing the quality of software product.

Statement coverage-It ensures every possible statement to be tested at least once during testing.

Branch coverage – It checks the every possible path in the code <if-else and other conditional loops>

This will remove 80%-90% of this software BUG

Integration Testing

"In Integration Testing different modules are combined and tested as a group". Basically it is to ensure that different modules of the system are able to interact with each other correctly or not. Motion Sensor and CCTV correctly together to detect the presence of intruder in the house as motion sensor will detect the presence of someone and CCTV takes its picture and sends it to the owner of the house. One system monitors the all the modules i.e. taking the data from the module and save it to the database (saving CCTV footage) or retrieve the appropriate data from database (finger print matching for Biometric lock). So we integrated them and tested whether these modules together working perfectly or not.

This will remove 5% of the remaining BUG caused due to miss interaction of the different modules.

Beta Testing: It is the last stage of the Testing. "In Beta Testing the product the deployed for the beta sites outside the company for the real world exposure"

It is necessary for our system. We have deployed our system to some of our trusted beta sites to ensure the system as a whole is working perfectly in real environment in which it has to work or is there any abnormal activity in real environment. And the result is POSITIVE.

Acceptance Testing : It is tested to check whether the requirements of the user or the contract are met.

It include Formal testing with respect to user needs, requirements, and business processes to determine whether or not a system satisfies the acceptance criteria and to enable the user, customers or other authorized entity to determine whether or not to accept the system. Basically it is determine whether the system will be acceptable in market or not based on its features and the current user requirement.

11. CONCLUSION

1. This project will help users in so many things like it is so beneficial in some security system.
2. The project has been thoroughly analysed for its feasibility and its performance.
3. Prototype Model has been selected for the project as the process model. Entire software development life cycle has been applied.

4. Project characteristics have been assessed quantitatively using project metrics (FUNCTION POINTS).
5. The software can be updated and further modifications can be done if required in the future

12. FUTURE SCOPE

Home Automation is going to be the future and it will be called "Smart Home" where everything will be done in just one click. Here are some features that make it different from other existing system

1. Presently, biometric systems store data on either hand geometry or attributes of the iris and retina. Systems likes these, while largely unfamiliar to the general public, are already in use in limited applications and may be the common means of access control, ATM and credit card verification in the world of tomorrow.
2. Using artificial intelligence, systems will automatically learn a family's behaviour patterns and adjust itself accordingly, without the need for programming.

Most importantly this system helps us to save energy and can provide quality life to elderly and differently disabled persons.

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A Review on Optical Computing

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Abstract

Optical Computing is an interesting area where various brilliant features of light are exploited. Major categories of optical computing are, analog optical computing and digital optical computing. In this review article some basis of digital optical computing techniques have been focused such as adders, subtractors and matrix manipulations. This study is reviewed on the basis of these operations performed in non-linear materials.

1. INTRODUCTION

Optical computing is based on idea of using all the properties of speed and parallelism of light in order to process the information at high rates which is in the form of an optical signal. In this article, the focus is on reviewing the various digital optical computing techniques like adder, subtractor and matrix multiplications using the switching characteristic of a non-linear material (NLM) such as photorefractive material [1]. To exploit the switching characteristics of a non-linear material [2-3], four-wave mixing is used. A. K. Das et al. [2] has proposed a technique for adder and subtractor based on non- linear optical switching. They have used spatial encoding technique where the inputs are encoded by the presence and absence of light in a spatially coded mask. In fig. 1 the coded input A is placed on one side and B on the other side of the optical non linear material showing the technique for half addition.

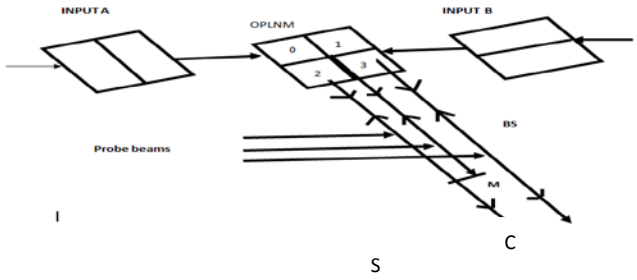

Fig. 1 the All-optical Half addition scheme. M {mirror}, BS {beam splitter}, S and C are 'sum' output and 'carry' output. [2]

Various sub-cells are marked in the material for getting the output and accordingly the input beams are made to fall on the particular section of the material. The sub-cells are shown in fig. 1 as 0, 1, 2 and 3. The beam reflected from the sub-cell marked 3 of the NLM is called 'carry' output and that coming from the addition of the sub-cells marked 1 and 2 is called 'sum' output half adder. By this technique, the complete truth

table is verified. The main switching mechanism and the coding technique of variables in optical full adder is same as the all-optical half addition scheme [2]. Taking Fig. 1 as reference but now in this case the sub cells are increased to eight. The construction of an all-optical subtracter is almost the same as the all-optical adder. In the process, of optical matrix multiplication [3], the two matrices are represented by two planar structure of same size and each plane consists of square shaped pixels. All the elements of these matrices are binary bits. To implement this process, a non linear material is taken at the centre and on the one side the input plane [A] and on the other side, the input plane [B] are placed. Now, laser beams are allowed to be incident on the Optical Non linear. materials (OPLNM)

through these input planes. The output channels coming from each pixels on the OPLNM are coupled together to get the resultant matrices.

2. DISCUSSION AND CONCLUSION

Major advantage of optics lies in its interconnection technology on which performance of computing depends [4]. Optical computing is immune to electromagnetic interference and free from electrical short circuits. The major attraction of optical computing system lies in the fact that it offers speed of computation more than 100 times faster in comparison to that offered by fastest electronic system.

Recently S. K. Chandra [5] have worked on a scheme of single module for phase encoded simultaneous operation of half-addition and half subtraction for the same input bits using four wave mixing in semiconductor optical amplifier (SOA). It will give fast response to accomplish the demand of super fast all optical processing. Authors [6] have also realized full adder/subtractor scheme based on semiconductor optical amplifier (SOA) and Mach-Zehnder interferometer representing it to be one of the promising solutions due to its compact size, thermal stability and low power consumption

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Simplified Thermal Equivalent Circuit of Surface Mounted Permanent Magnet BLDC Motor

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Abstract

Permanent Magnet (PM) motors are popular choice for Industrial applications due to their high efficiency, power density and torque-to-weight ratio. The prediction of the temperature profile inside an operating electric motor is one of the most important challenges while designing. This paper focuses on thermal analysis of Surface Mounted Permanent Magnet (SMPM) BLDC Electric motor. In this paper, a lumped parameter thermal network is developed to predict the motor heat flow and temperatures. The network is composed of interconnected nodes and thermal resistances representing the heat process within motor for steady state analysis. Steady state results are obtained using this approach. The thermal management of the motor is important since the electrical insulation has a temperature limit and affects its efficiency. The designers must know the thermal performance of the equipment to choose a suitable cooling strategy. The rise in the temperature of electric motors under load can cause a problem in many applications. Prior estimation of the thermal behaviour becomes a serious matter due to the dependence of the safe operating conditions and overloading capabilities on the temperature rise. The temperature characteristics depend on the winding resistances, consequently the losses and permanent magnet flux. Therefore, the performance analysis of the machine is thermally dependent. This thermal network is accurately sufficient to predict the thermal behaviour of the critical parts in the electric motor as well as provides information necessary for component material selection, lubricants, cooling methods, insulation, etc.

Keywords-- Surface Mounted Permanent Magnet, Temperature Profile, Thermal Network

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The Flex Project

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Abstract

According to the **World Federation of the Deaf (WFD)**, approximately 66% of deaf people live in developing countries, where authorities are rarely familiar with their needs and where very few deaf children have access to employment and education. Only 10% of the world's deaf population receives any education at all, and only 1% receives this education in sign language- even though majority of them do use the sign language every day.

Reflecting this **educational disadvantage, unemployment rates are extremely high in Deaf-mute community**. Many nations even deny basic civil rights to their Deaf and hard of hearing citizens. Without proper education and the tools to gain acceptance in society, Deaf people will continue to encounter stereotypes. The given paper is based on how to ease the communication gap between the Deaf-mute and the normal people. The focus is on designing an electronic device which can translate the hand gestures into suitable commands for the communication between the two. A Flex sensor glove has been synchronized with the flex sensor along the length of each finger. The Deaf-mute can use these pair of gloves in order to perform hand gestures which can further be converted into speech so that the normal people can understand their point of expression. Hand gesture depicts a particular sign language which in turn symbolizes the alphabets and the words. The Flex sensor and the accelerometer play a very important role in the following procedure. Flex sensors are passive resistive devices that can be used to detect bending or flexing whereas the accelerometer are useful for sensing the vibrations in the systems or for orientation applications.

***Index Terms*— Accelerometer, Flex Sensor, Programmable Interface Controller, Transformer, Voltage regulator**

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