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Smart Health Monitoring and Controlling using Raspberry Pi

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ABSTRACT

In the recent development of Technology Internet of Things(IOT) makes all Devices connected to each other and it can be monitored via internet via internet Devices can be controlled. In latest technologies, IOT gives a platform where the user can access anything from anywhere. Some of the applications of the Internet of Things are Smart Home, Connected Car, Smart Grids and Health Monitoring System. Health monitoring is the process by which the Patent Data (Temp of body, Heartbeat, E.C.G, Respiration etc.) is continuously updated on the internet website/App via the sensors connected to Patent. By IOT the patent data is easily accessed by doctors and doctors can treat well. By Health monitoring System the major advantage is that it reduces human error. In this paper discuss, monitoring& controlling Heart Beat, Temperature of Body and Blood Pressure using Arduino, Raspberry Pi and Medication Box display on Internet Page.

Keywords: *Raspberry Pi3 Board, Heartbeat Sensor, Temperature Sensor, Blood Pressure Sensor, Arduino, Internet of Things.*

1. INTRODUCTION

The Internet of Things (IOT) is the inter-Connect of physical devices, Industries, buildings, and other items embedded with electronics, some software, some sensors, actuators, and internet connectivity which enable these Devices to collect and exchange data. The IOT allows Devices to be sense/ control remotely across network infrastructure, creating Direct Interaction with sensors via network Infrastructure and results in improved accuracy of system and Reliability of system with reducing human Interaction.

One of the Platforms which connect devices with internet/App is Raspberry Pi. It is basically the Linux Operated device which can connect sensors, the actuator in its IO ports and send or receive the command & Data with Internet/App. The combination of Raspberry Pi and IOT made innovation technology in Health care monitoring system. Raspberry Pi act as Nurse of Clinic which takes the Data of (Temperature, Heartbeat, Blood Pressure) Sensors and sends these details periodically on the internet page.

To make system portable a bracelet is made which consist of Temperature, Heart rate Sensor connected with Arduino Uno which takes the sensor data and send it to raspberry pi via Bluetooth module. This bracelet is fixed on hand of Patient. The Raspberry Pi receives these data and sends to Android App via an Internet connection. At every 2 Hours the Blood pressure reading is taken which is directly connected to the Raspberry Pi. According to data is temp/Blood pressure/Heart rate goes above or below the range the medicine is dispatched from Automatic Medicine Box and this will be updated on Page. The data is available on the Page with the help of this Technology the Doctor can easily monitor Patents anytime and anywhere.

2. LITERATURE SURVEY

Author Geng Yang [2] proposed and implemented iHome Health-IoT. he platform involves an open-platform-based intelligent medicine box (iMedBox) with enhanced connectivity and interchangeability for the integration of devices and services; intelligent pharmaceutical packaging (iMedPack) with communication capability enabled by passive radio-frequency identification (RFID) and actuation capability enabled by functional materials; and a flexible and wearable bio-medical sensor device (Bio-Patch) enabled by the state-of-the-art inkjet printing technology and system-on-chip. The proposed platform seamlessly fuses IoT devices (e.g., wearable sensors and intelligent medicine packages) with in-home healthcare services.
Author B. Sneha [3] proposed methodology consists of sensors, alarm, ATMEGA controller, Bluetooth module and android based mobile phone. This module monitors heart rate, ECG, Temp and sends the sensed data to android mobile via Bluetooth which is connected with ATMEGA controller.

Author Punit Gupta [4] proposed methodology consists of ECG, Heart rate, Blood pressure sensors which are connected to Intel Galileo board. It receives the data from the sensor and with the help of Internet Patient data is send to the Web Server and display on the website. The patient family, as well as Doctor and Hospital staff, can monitor Patient status via the website.

Author R.Kumar [7] proposed methodology consist, Temp, Respiration, Heart rate, Accelerometer Sensors connected to Raspberry Pi which receives the patient data and send to the web data base. So the doctor can monitor the status of patient anytime from anywhere.

3. PROBLEM STATEMENT

- In traditional System, Patient must report to the Doctor every three days to check up so Doctor can treat well. But real-time doctor not able to check the patient health status.
- Health monitoring system is Adopted to provide Patient health care data on Internet/Android Mobile, with the help of this data doctor can easily monitor the patient health parameter. It helps Patient in emergency time. But the drawback was the patient health cannot be control in Real-time.

4. PROPOSED MODEL& HARDWARE

The limitation of traditionally health monitoring system over comes in the proposed model. Intelligent Health monitoring and controlling that collects automatically patient's Heart rate, Temperature, Blood pressure and display the information on a Web page. This would help the doctor to monitor his/her patient from anywhere and also to the patient and his/her family to send status directly to the doctor without going to the hospital. Depend on the status doctor can dispatch medicine if any parameter of the patient goes beyond the normal range.

Proposed model consist of the following Hardware:

- **Raspberry Pi3**: Raspberry Pi is popular platform it offers complete Linux server in the tiny platform at a low cost.

Technical Specification:

- Broadcom BCM2837 64bit ARMv7 Quad Core Processor powered Single Board Computer running at 1.2GHz.
- 1GB RAM
- BCM43143 Wi-Fi on board
- Bluetooth Low Energy (BLE) on board
- 40pin extended GPIO 4 x USB 2 ports 4 pole
- Stereo output and Composite video port
- Full-size HDMI CSI camera port for connecting the Raspberry Pi camera
- DSI display port for connecting the Raspberry Pi touch screen display Micro SD port for loading your operating system and storing data
- Upgraded switched Micro USB power source (now supports up to 2.4 Amps)
- Raspberry Pi can be Program By following Languages:
  - ✓ Python
  - ✓ HTML5
  - ✓ JavaScript
  - ✓ C & C++

- **Arduino Uno:** it is the development board which uses C language to program. It is open Source Computer hardware.

Technical Specification:

- Microcontroller ATmega328
- Input Voltage -7-12V
- Digital I/O Pins 14 (6 provide PWM output)
- Analog Input Pins 6
- SRAM 2 KB (ATmega328)
- EEPROM 1 KB (ATmega328)
- Clock Speed 16 MHz
- Arduino Uno can be Program By following Languages:
  - ✓ Python
  - ✓ Snap4Arduino
  - ✓ C Language

- **HC-05 Bluetooth Module:** HC-05 module is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. The HC-05 Bluetooth Module can be used in a Master or Slave configuration.

Technical Specification:

- Operating frequency2.4GHz ISM band.
- GFSK Modulation.
- Emission power is ≤4dBm.
- 3.3 to 5V I/O
- UART Interface with programmable baud rate.
- Speed for Asynchronous: 2.1Mbps / 160 kbps & for Synchronous: 1Mbps.

- **LM-35 Temperature sensor:** The LM35 series are precision integrated-circuit temperature devices with an output voltage linearly-proportional to the Centigrade temperature. It operates in 4-20v Dc supply. It provides 10mV/C.

- **SEN-11574Heart rate sensor:** It consists of led Tx and Rx to sense the flow of blood at every 2mS it blinks the Led light and increments the count value. It operates on 3 to 5V Dc supply with 40mA current.

- **Sunrom-1437 Blood Pressure sensor:** It provides a serial reading of Systolic, Diastolic, and Pulse. It uses 9600 Baud rate. It has three terminal +Vcc, gnd, Serial Output.

- **L293d Motor driver:** L293D is a dual H-bridge motor driver integrated circuit (IC). Motor drivers act as current amplifiers since they take a low-current control signal and provide a higher-current signal. This higher current signal is used to drive the motors.

Technical Specification:

- Supply-Voltage Range: 4.5 V to 36 V
- Separate Input-Logic Supply
- Output Current 600mA Per Channel

5. BLOCK DIAGRAM & DESCRIPTION

In this project, there are two parts:

- Smart Bracelet.
- Controlling unit.

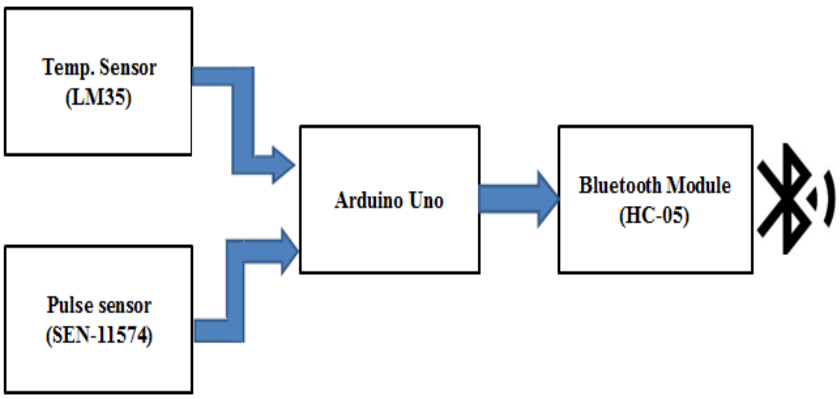
Smart Bracelet:

It consists of Temperature sensor (LM35), whose output is in analog form and it provides output voltage 10mV/Celsius. First with the help of internal ADC of Arduino Output is converted into Digital form which shows Temp in Celsius. The output is in the form of Celsius to convert into Fahrenheit, the calculation is used:

$$\mathbf{Far = (Temp*9÷5) + 32}$$

Pulse Sensor (SEN-11574), whose output is in analog form. The sensor itself consists of an infrared emitter & detector mounted and pressed closely against the skin. When the heart pumps, blood pressure rises sharply, & so does the amount of infrared light from the emitter that gets reflected back to the detector. The detector passes more current when it receives more light, which in turn causes a voltage drop to enter the amplifier circuitry. To smooth the output filter are used which provides noise-free signal.

Arduino take the input from both sensors at Analog Input and convert into digital form with the help of inbuilt ADC. The output is sent via Bluetooth module (HC-05), which is connected to Raspberry pi at 9600 Baud rate.



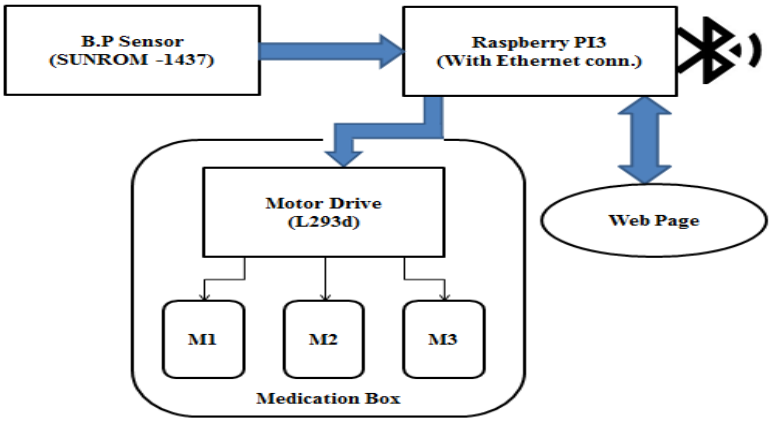


Fig 1: Block Diagram of Model

Controlling Unit:

Blood Pressure sensor (Sunrom-1437) is directly connected to raspberry pi via serial Line. At every 2hrs the Blood pressure data is taken by Raspberry Pi.

In controlling, Unit Brain that is Raspberry Pi controls all over the operation. Raspberry Pi receives Bracelet data via inbuilt Bluetooth as well as Blood Pressure data and send it to the GUI (Graphic User Interface) Page. The GPIO pins are also connected to the Medication Box.

If any parameter of Patient goes above & below the set values the Status is updated along with result like (B.P is Low, Body Temp Is High etc.) according to real-time data the doctor can trigger the button which will open the box of respective medicine. So with the help of this Patient can have medicine easily.

6. SOFTWARE IMPLEMENTATION

- **Flow Chart of Smart Bracelet:**

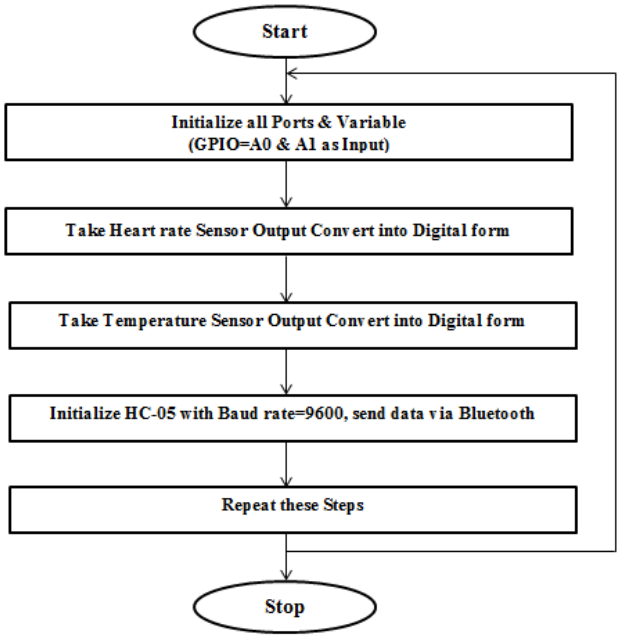


Fig 2: Flow Chart of Smart Bracelet

- **Flow Chart of Controlling unit:**

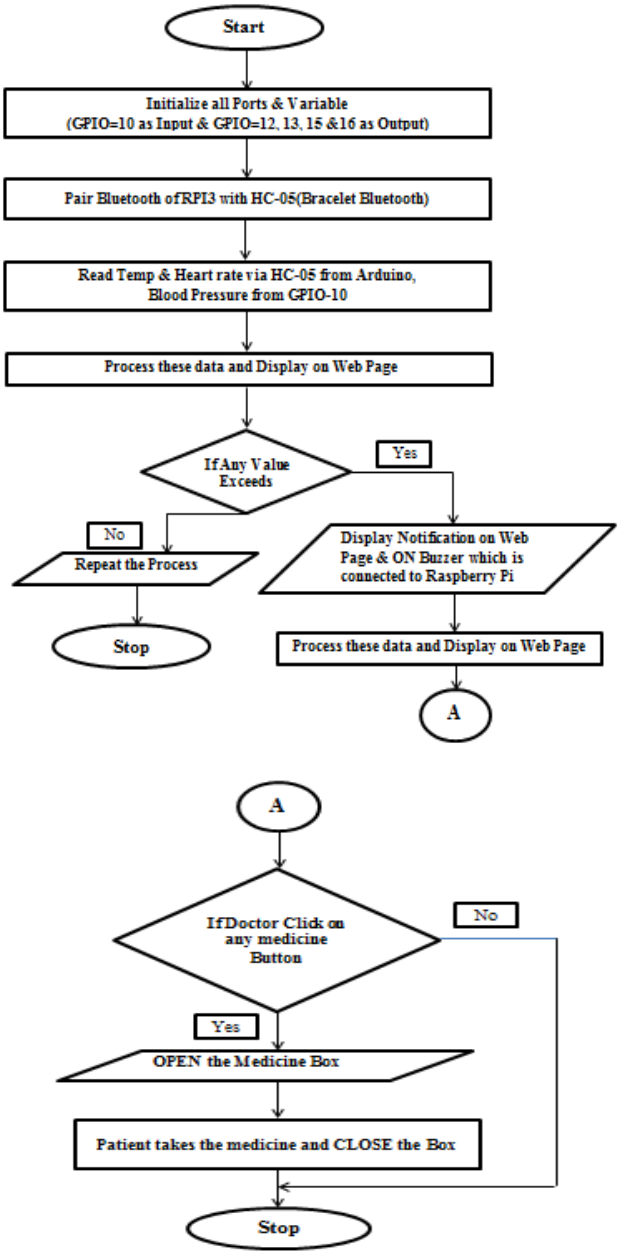


Fig 3: Flow Chart of Controlling Unit

7. EXPERIMENTAL RESULT

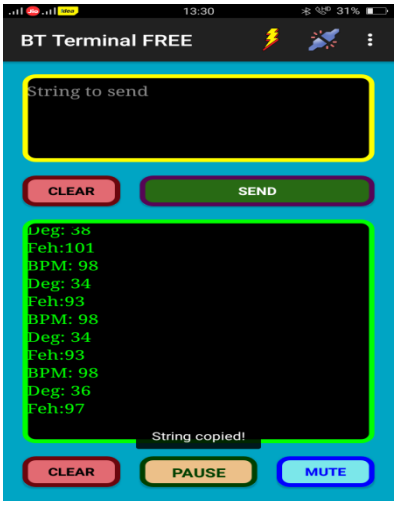


Fig 4: Output of Smart Bracelet on BT Serial Terminal

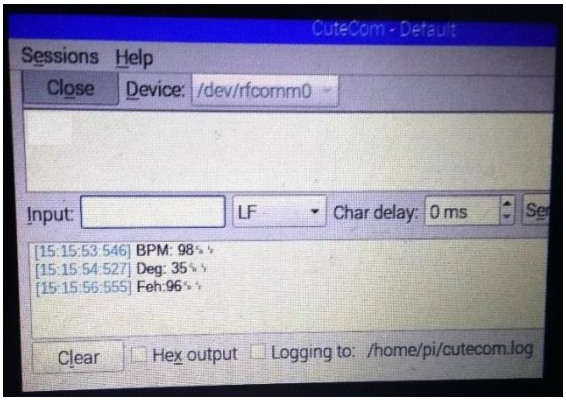


Fig 5: Output of Smart Bracelet on Cutecom serial Terminal of Raspberry Pi3

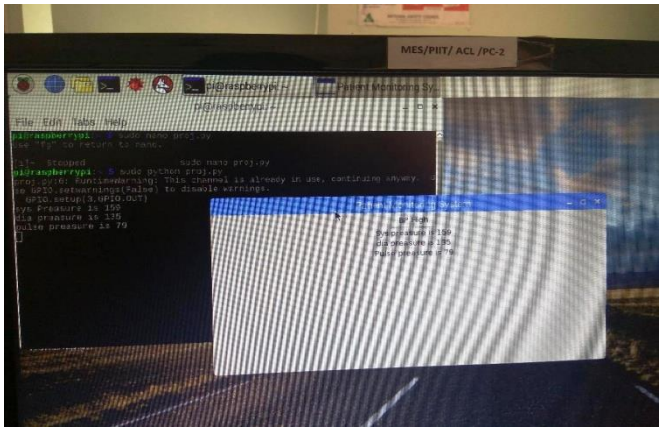


Fig 6: Output GUI of Raspberry Pi3

8. CONCLUSION

An efficient Health monitoring and controlling are developed to monitor the up to date status of the patient irrespective of the presence of the doctor. The system collects information like temperature, blood pressure and pulse rate of the patient and updates on GUI. If any parameter of patient health goes beyond the limit notification is generated and the doctor is able to provide medication by clicking on the respective button of the tablet. Medication box provides tablet when ever Doctor click button on Internet Page. The system is evaluated experimentally and collected the sample data to verify the status of patients successfully.

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