Open Source Software

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Outline

- National mission on education through ICT
- Projects undertaken at IIT Bombay
- Importance of open source software for our country
- Invitation for proposals

National Mission on Education through ICT

- Launched by the Ministry of Human Resources Development (MHRD), Government of India
- Objective: to raise the levels of education in India
- Outlay: Rs. 4,600 crore ($ 1 billion) over three years
- 40% for content generation
- 60% for bandwidth
  - To give 1 GBPS bandwidth to more than 20,000 colleges and 200 universities
  - Out of these, 3,000 are engineering colleges: 5% government run, rest private
- Largest and most ambitious plan
- Likely to continue in the next plan period

Content generation: Line items

1. **NPTEL phase II / III**
2. **PG Classes**
3. **UG Classes**
4. **Video content digitization, conversion, chunking and dubbing CEC / IGNOU / NCERT / SIET / OTHERS**
5. **Provision of e-books and e-journals free to the learners**
6. **Standardisation of quality assurance of contents & certification / automation of certification**
7. **Developing suitable pedagogical methods for various classes, intellectual calibers and research in e-learning**
8. **Development of language converter and translation tool kit**
9. **Development and realization of Virtual Reality Laboratories and supporting facilities for e-learning**
10. **Development of Certification & Testing Modules for Virtual Technological Universities & creation of VTU, multi media research and international programmes**

Content generation: Line items - continued

11. **Experimentation and Development of ultra low cost access devices for wider coverage of learners & their field trials**
12. **Talk to a teacher to provide a substitute for coaching for the economically poor students**
13. **Development of software controlled hardware programming for robotics & other crucial areas**
14. **Adaptation & deployment of open source simulation packages equivalent to MATLAB, ORCAD etc.**
15. **Development of unified ERP system for Educational Institutions**
16. **Publicity & training of motivators & trainers to ensure full utilization of the systems by institutions & students. Teacher Empowerment 'B'**
17. **Conversion of available content in various regional languages**
18. **Development of Vocational Educational modules and use of haptic devices for education & training**

Minimum requirement for funding

Necessary conditions for a project to be funded by this mission:

- **It should be related to education - for research, other funding sources are available**
- **It should be inter-institutional**
- **Any material developed through this mission has to be delivered as open source**
- **It should belong to one of the 18 line items mentioned earlier**
- **No funding will be provided for infrastructure development**
- **Funding for clear deliverables: number of courses, number of faculty members trained, number of students trained, etc.**

IIT Bombay's open source software efforts

Why Open Source Software?

- **Expensive**
- **Possibly cheap, even free (?) for students**
- **Students use commercial software in colleges**
- **Commercial software is not available at small and medium companies - cost**
- **Use of unauthorised software by commercial establishments result in disasters - companies may even have to close down - jail sentence, etc.**
- **Most of SME's in India do not use ANY software: commercial software is expensive; they are not aware of open source software**
- **Puts small companies at a great disadvantage**
- **There is no alternative to open source software**

Documentation for open source software

- **What is required is good documentation**
- **Spoken tutorials is one solution**

Spoken tutorials

- **Spoken tutorial refers to explaining a computer based activity, along with a live demonstration of it in parallel, with a running commentary**
- **Running commentary can be in any language**
- **To create this one needs a PC, a head phone with audio input, costing about Rs. 100 only**
- **The recording can be played back on a PC as a movie - only a Rs. 10 head phone is required**
- **Will now explain how this can be a mass movement**

How to create a spoken tutorial

- **This explains in English how to create a spoken tutorial**
- **This explains how to dub it in other languages**
- **Ran a competition to dub the first one into other languages** ▸ See the banner
- **Mainly people from IIT Bombay participated in it: students, children of support staff, house wives**

Submissions: Making spoken tutorials in other languages

Bandana Singha	Assamese
Tanusri Paul	Bengali
Prakash Singh Badal	Bhojpuri
Ashish Mall	
Prabhakar Pande	
Mukesh Lakhotia	Hindi
Jaya Saraswati	
Nancy Varkey	
Amit Shah	Gujarati
Omprakash Bhendigeri	Kannada
Shailaja Sardessai	Konkani

How to make spoken tutorials in other languages

Sheeja Chacko	Malayalam
Aniket U. Joglekar Chaitrali Joglekar Makarand Kane Sanmati Hosure	Marathi
Jaya Saraswati	Mythili
Tapaswini Pani	Oriya
Neelam Rathore	Rajasthani
Neelam Keswani	Sindhi
Anbumathi Palanisamy	Tamil
Kranthi Kumar Venkatesh	Telugu

Benefits of spoken tutorials

- **Small file size: about 1 MB per minute.**
  - **In one CD (Rs. 10), can pack ten hours of spoken tutorial**
  - **small bandwidth for streaming - e.g. through mobile phones**
- **Inexpensive**
  - **Rs. 100 head phone with audio input is sufficient.**
  - **Screen capture software is either free or low cost on windows, linux, Mac OS X.**

Can reduce digital divide

- **Running commentary can be dubbed into other languages**
- **Original content in other languages or translation**
- **All children (poor, rural, etc.) can also create spoken tutorials**
- **They can use it to learn: listen, pause, try the software in parallel, rewind, etc.**

Benefits of bridging digital divide

- **The 80-90% of public who are now left out will also start contributing**

Using English video with local languages?

- **Attempts to convert the code also into local languages are not successful**
- **Deprive people of employment opportunities**
- **In fact, this is a sensitive topic**
- **English is a compulsory language for all Indian children**
- **What they need is help but not to lose employment**

Our thrust areas for spoken tutorials - 1

Scilab:

- **Alternative to the extremely popular and expensive Matlab**
- **Uses state of the art numerical libraries, just as Matlab does**
- **French space research (CNES) uses Scilab exclusively**
  - **First Scilab user conference in Paris on 1 July 2009**
- **Develop spoken tutorials for the functions in Scilab**
- **By peer groups: by children for children, etc.**
- **Plan to develop social networking website**

Our thrust areas for spoken tutorials - 2

LaTeX

- LaTeX can be used to produce outstanding documents
- If you are going to create many documents in the rest of your life, it is time you started using LaTeX
- If you are going to include a lot of mathematics, there is no substitute for LaTeX at all
- LaTeX documents created in one operating system, say Windows, can be reused, without ANY changes, in other systems, such as Linux and Mac - and conversely
- LaTeX is free and open source
- Above all, it has excellent user communities to help you with doubts - for example, visit http://tug.org/mailman/listinfo/tugindia

maths.mov

LaTeX spoken tutorials on the DVD

- **The following spoken tutorials on LaTeX are available:**
  1. **What is compilation?**
  2. **Installing and running LaTeX on windows**
  3. **Letter writing**
  4. **Report writing**
  5. **Mathematical typesetting**
  6. **Equations**
  7. **Tables and figures**
  8. **How to create bibliography?**
  9. **Inside story of bibliography**
  10. **Slide presentation using beamer**
  11. **Updating MiKTeX on windows**

Assigned the task of dubbing all of these into Hindi and Marathi - Malayalam is in pipe line

Blender

- Free 3-D animation software
- Major animation effort at IIT Bombay
- More than 20 full time staff members working on it
- To develop animations to go with courses
- Need programmers who can write Python script for blender
- Led by Prof. Sridhar Iyer of computer science, IIT Bombay
- Web address: www.oscar.iitb.ac.in

Python

- **Free**
- **High level scripting language**
- **Easy to do computations**
- **Also easy for machine level - e.g. device drivers**
- **Led by Prof. Prabhu Ramachandran of IIT Bombay**
- **www.fossee.in**

Social Networking Site for Spoken Tutorials

- **Identification of requirement: example - want a spoken tutorial on ode of Scilab**
- **Acceptance of the requirement**
- **Call for examples, review for correctness and accept**
- **Announce the accepted examples**
- **Call for script, review for pedagogy and accept**
- **Announce the accepted script**
- **Call for making spoken tutorials, review for clarity and accept**
- **Announce the accepted tutorials**
- **Rank them, build stories around them, etc.**
- **Use the same procedure for dubbing**
- **Pay a honorarium for all of the above activities through a point system**

Accessing from the web page of open source software

- **A visitor looks at the help for `ode` function of Scilab**
- **This gives a link to spoken-tutorial.org, to the function `ode`**
- **Displays the tutorials in two different orders:**
  - **Select the subject: chemical engineering, biology, electrical engineering, etc.**
  - **Then, select the difficulty level: school, beginner, intermediate, research**
- **Alternatively, first select the difficulty level and then the subject area**
- **Finally, select the language**

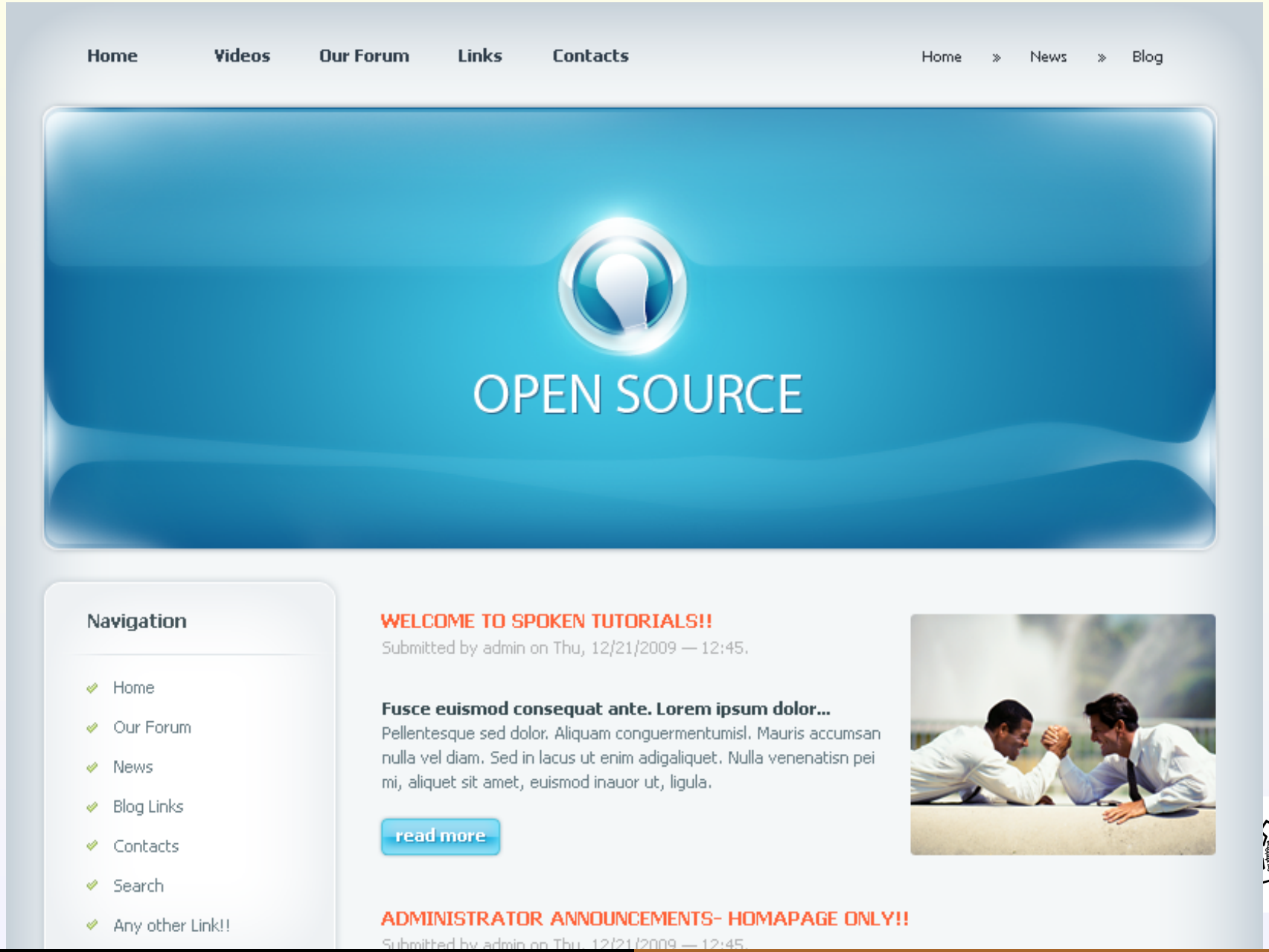
Accessing spoken-tutorial.org directly

- **A visitor comes to the website directly**
- **Selects a software, say, Scilab**
- **Is suggested a sequence of spoken tutorials to see**
- **Will depend on the level of the user: school, beginner, etc.**

Other features

- **Popularity and ranking of spoken tutorials**
- **Inform authors of people watching their work**
- **Blogs on new spoken tutorials created, etc.**

First design



Second design

Open source hardware

Picture of the single board heater system

What does this system do?

Controlling the temperature of a plant

- **by heating with current**
- **by cooling with a fan**

More details here

What does this system have?

- **Plant**
- **Micro controller**
- **Sensors, actuators**

Useful in the following courses

- **Process control**
- **Computer control**
- **Instrumentation**
- **Micro controllers/embedded systems**
- **Real time systems**

Pricing

- **Available for Rs. 2,400**
- **Design is available as open source with bill of materials**
- **Can be built for less than Rs. 1,000**

Part of Virtual Lab

- **Potential users can try remotely**
- **If convinced of its use, can acquire sufficient numbers for hands on training**

What experiments have we conducted on this system?

- **Step and ramp response identification**
- **Frequency testing, leading to Bode plots**
- **P, PI, PID tuning**
- **2-DOF pole placement controller**
- **Internal model controller**
- **Self tuning and simple adaptive controller**
- **Auto tune testing**
- **Minimum and generalised minimum variance controller**
- **PRBS and closed loop identification**

Future course of action

- **Complete the instruction manual:** $>$ 200**pages**
- **Run projects through students at IIT Bombay**
- **Distribute to colleges - story of teachers meet - distribution of 20 of them until now**
- **Encourage development of similar devices for other courses**

Conclusion

- **Open source efforts are not only idealistic, but make economic and commercial sense as well**
- **It has a potential to empower ALL Indian children to collaborate and make us a developed nation**
- **IIT Bombay is working on several open source projects**
- **National Mission on Education through ICT is based on the open source principle**

Thanks

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Details of single board heater system

- A setup designed and developed at IIT Bombay
- Consists of a heater assembly, fan, temperature sensor, microcontroller (ATmega16) and associated circuitry
- Heater assembly
  - Consists of an iron plate placed at a distance of about 3.5 mm from the nichrome coil
  - Gets heated on passage of current
- Computer fan
  - Positioned below the plate
  - Meant for cooling the assembly
- The temperature is sensed by the temperature sensor, AD590
  - Reading in Kelvin scale

To return, click here

ATmega16

- Is a 8-bit Microcontroller with advanced RISC Architecture
- Provides Up to 16MIPS throughput at 16MHZ
- Has 16K bytes (8K X 16) of In-system programmable Flash, 512 bytes of EEPROM and 1K byte of internal SRAM
- Two 8-bit Timer/Counter and one 16-bit Timer/Counter
- Four PWM channels
- 8-channel, 10-bit ADC
- Programmable serial USART
- Operating voltage: 4.5-5.5V
- Speed: 0-16 MHz

What is special about this system?

- **The time constant is less than 1 minute**
- **Can see meaningful (and noisy) measurements with naked eye**
- **Can do a realistic experiment in 10 minutes**
- **Suitable for carrying out ALL experiments of a few control courses**
- **Only need 220V power supply and a PC**
- **Easy to carry**
- **Costs only Rs. 2,400**
- **Design is open source!**

Announcement of dubbing competition

To return, click here