College Net Wi-Fi Enabled Data Acquisition Network Using Openmoko

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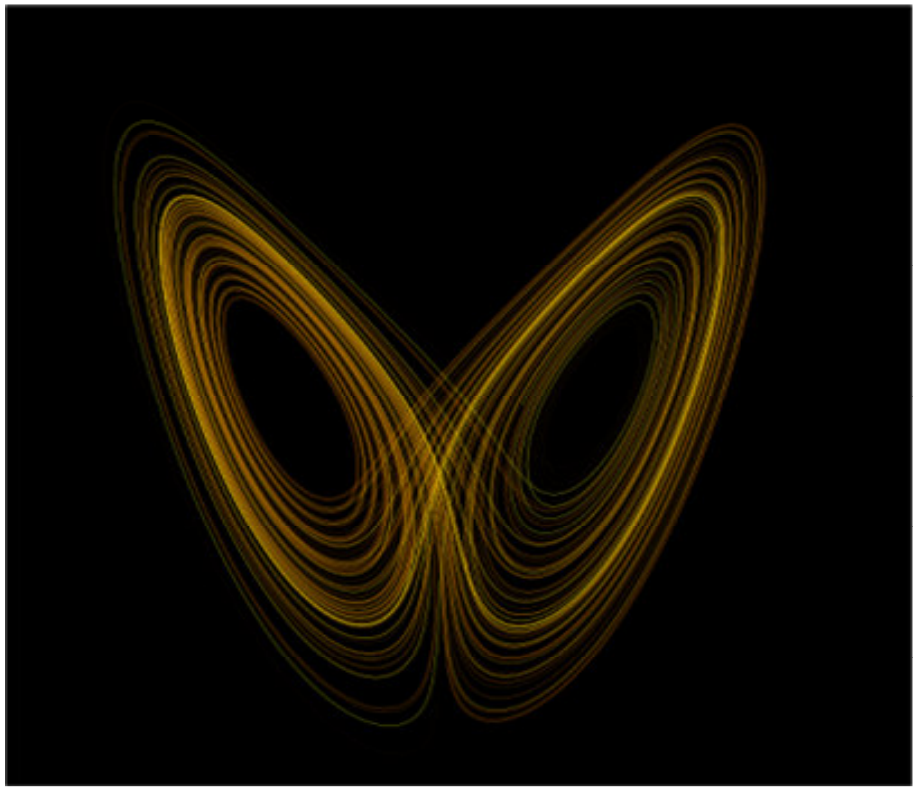


Overview

- Data Acquisition System (DAS)
- Data Acquiring Device
- Openmoko Framework
- Implementation
- Communication Engine and Protocols
- Graphical User Interface Development
- Central Database Storage Server
- Applications of DAS
- Future Scope
- References

Introduction

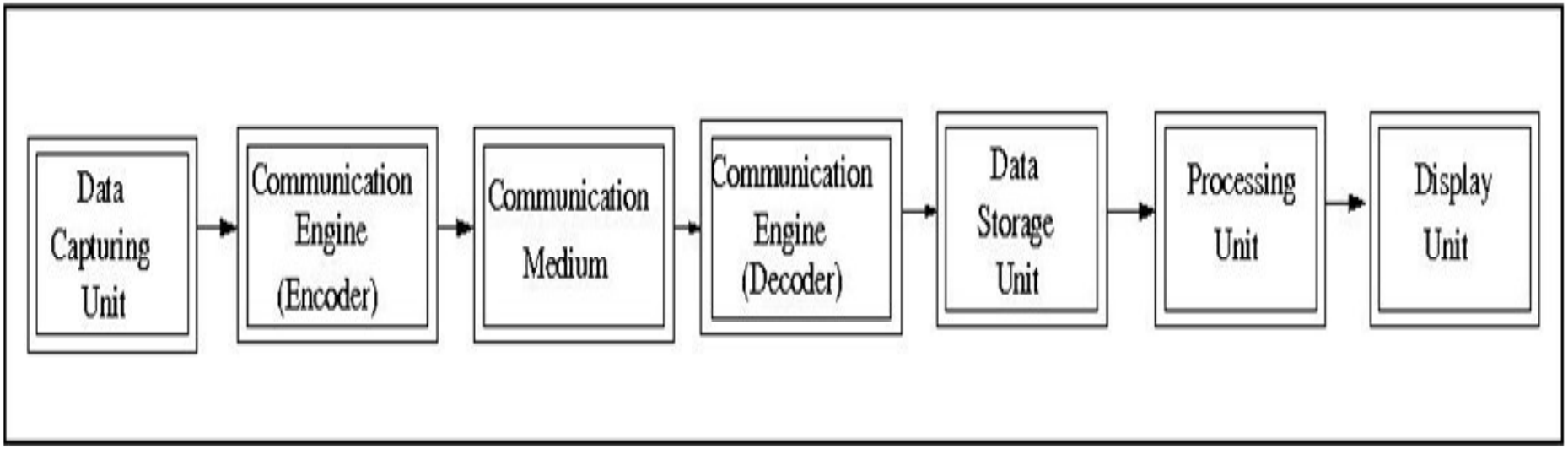
- Design of a secured, automated and user friendly remote data acquisition system.
- This project aims at developing a Data acquisition system which can be deployed in NSIT.
- Currently the testing and target device for data acquisition is a portable hand held embedded device which is touch sensitive.
- Data can be related to anything like student's record, attendance or output of some sensors.
- Data handling and processing is done in a robust manner and output display is made using custom made softwares and graphical user interface

Data Acquisition System (DAS)

- A device to measure and log some data or parameters.
- Sampling of real world signals which can be manipulated by a computer.
- Signals can be digital (called logical signals) or analog signals.
- Data is acquired by using sensors which works automatically or with some human involvement.
- DAS is normally electronic based and made up of hardware and software.
- Hardware part is sensors, cables and electronic components like memory etc.
- Software part is data acquisition logic and the analysis software.

Different Modules of DAS

- Main parts are data acquiring unit, communication engine and data processing unit



- Data Capturing Unit is Openmoko in this project.
- Communication engine is a program written in C++ and PHP which communicates through TCP/IP protocol.

Different Modules of DAS (cont.)

- Communication medium is wireless through Wi-Fi protocol.
- Data storage unit is a remote server with enough memory to store data digitally in form of database.
- Processing Unit is a computer with sufficient processing power.
- Display unit contains the output either on a computer monitor or in the form of printed results.

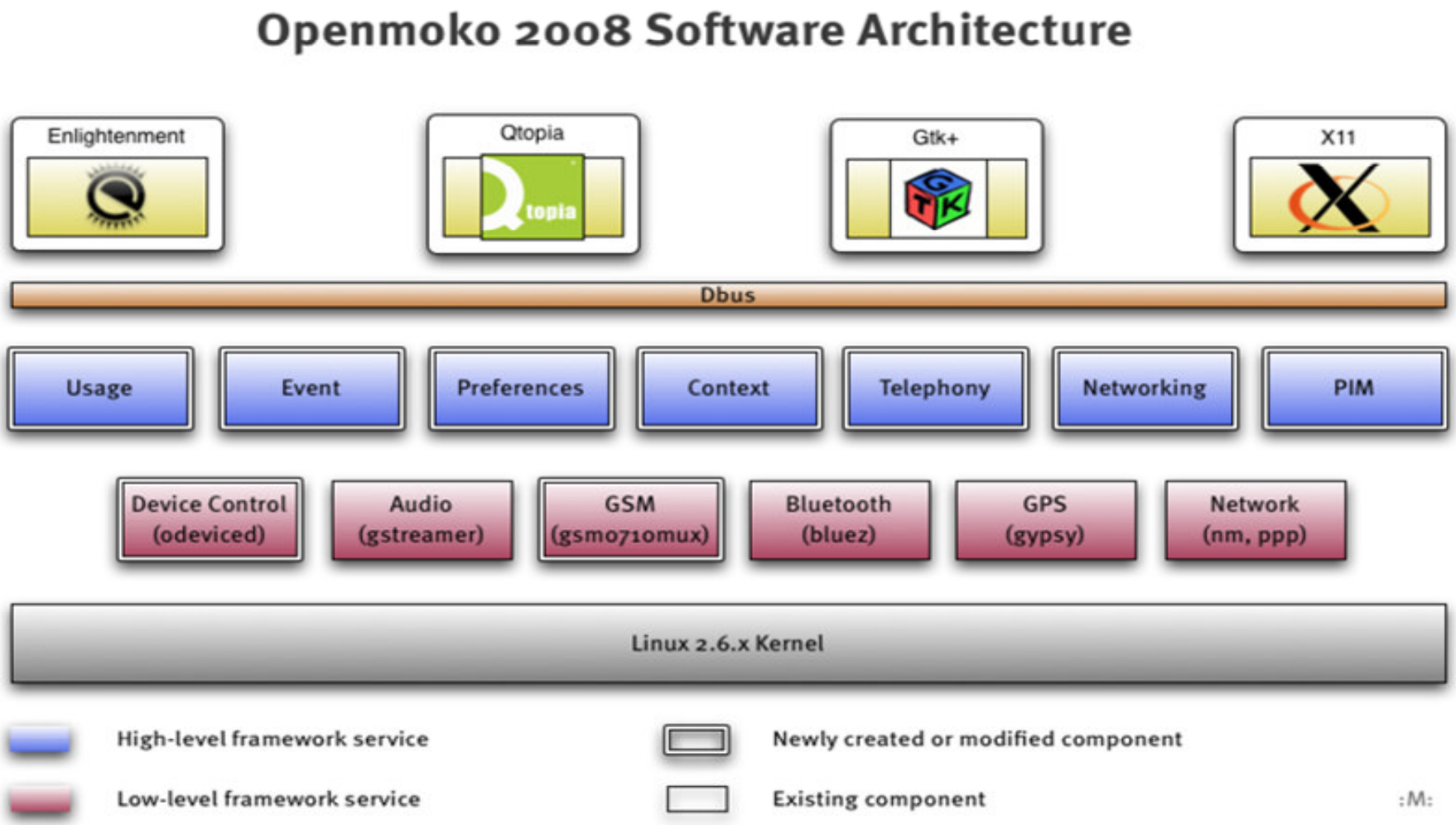
Data Acquisition Device

- Device used in this project is called Openmoko.
- Portable, hand held and touch sensitive.
- Runs Linux as operating system on it.
- Completely open source device.
- Can work as a mobile phone also.

Openmoko Framework (Hardware)

- The hardware specifications are:
- **Hardware Electrical**
- 400/500 MHz Samsung 2442B Processor/SOC (400 minimum, ARM920T core, ARMv4T)
- 128 MB SDRAM total, 64 MB CPU internal, 64 MB external
- **Display (LCD screen)**
- resolution: 480 x 640 pixels
- size: 43mm x 58mm (1.7” x 2.27”)
- **Wi-fi transceiver.**
- **Bluetooth Module**
- **GPS/AGPS module support**
- **GSM/GPRS modules and driver**

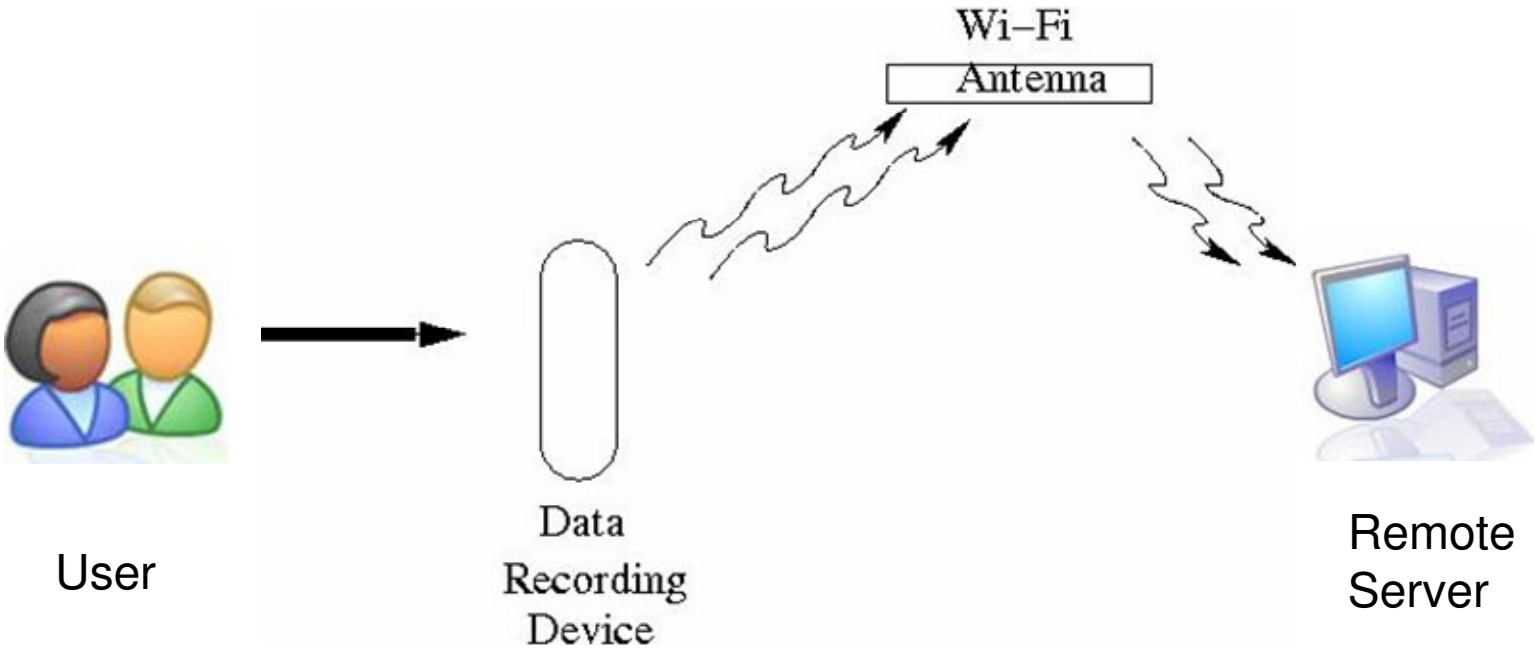
Openmoko Framework (Software)



Implementation

- Developing application for communication between the data capturing unit and storage unit.
- Developing graphical user interface to facilitate the user acquire and record the data in a comfortable and easy way.
- Developing protocols and database structure to be used in the system.
- Porting all applications on the embedded device along with full customization support.
- Set up of a central data server to communicate with data capturing unit.
- Developing an intra college website with many configurable options and graphical user interface using LAMP technology.
- Deployment of whole system in NSIT

Project Overview



Communication Engine and Protocols

- Responsible for transfer of data from data capturing device (openmoko here) and data processing unit (remote server).
- Communication medium is wireless through Wi-Fi protocol.
- Network uses the IPv4 TCP/IP protocol. Data is sent in form of packets through a socket connection between remote server and Openmoko.
- Error detection and Error removal methods are used in the software implementation.
- Communication part is implemented using C++ and PHP programming languages at the network layer.
- Handles data in a robust way. Unsent data is stored locally and sent next time.

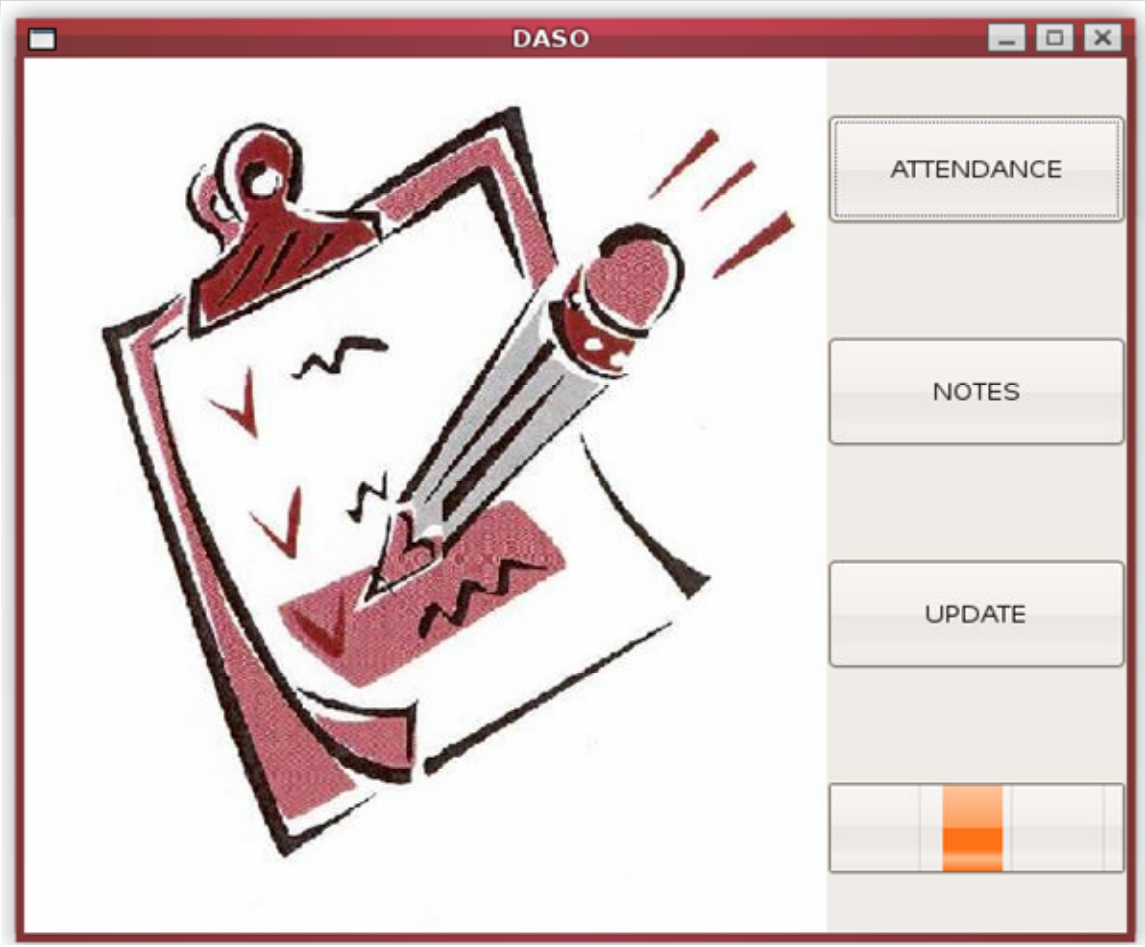
Steps in Communication Setup

- Creation of socket for a particular IP address and port number on both sides.
- Allocation of resource to this socket.
- Sending of data across this socket from sender to receiver.
- Confirmation of receipt of data from the receiver.
- Genuinity of the data is checked via software APIs.

Graphical User Interface Development

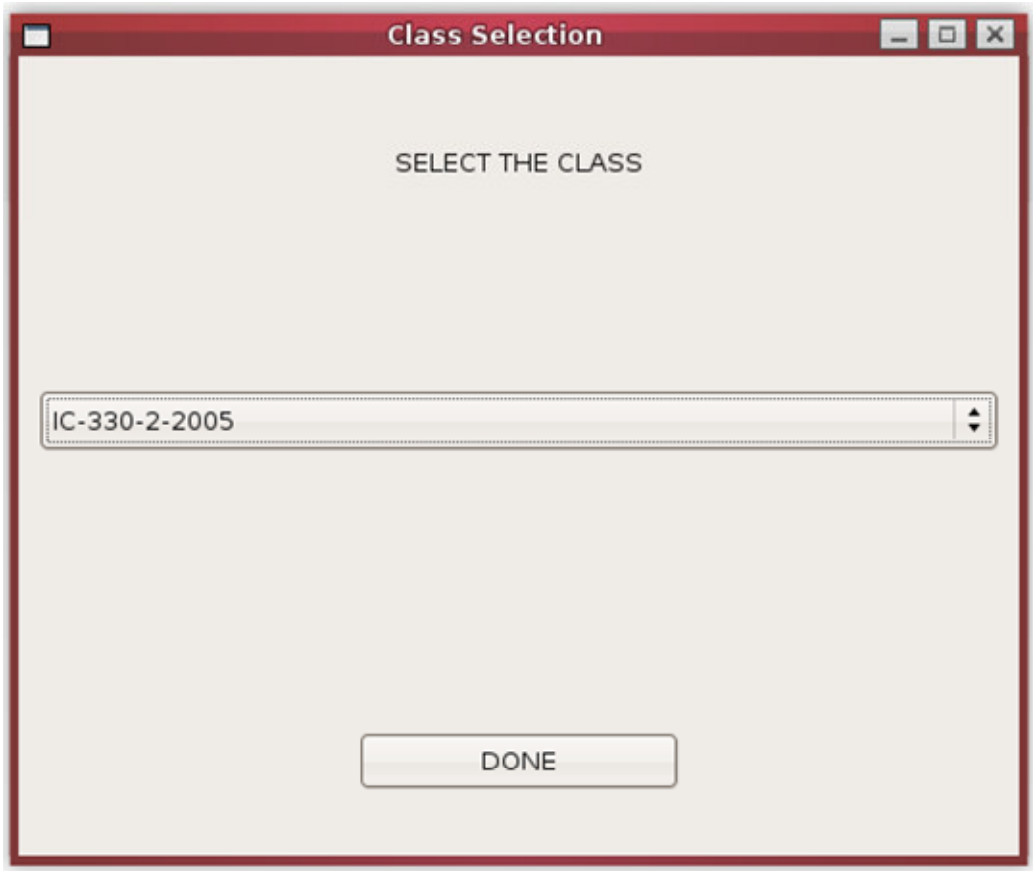
- Data Capturing Device has LCD screen for user interface.
- A user friendly graphical user interface is developed for openmoko.
- Language used in developing GUI is C/C++ using gtk+ library.
- Data can be recorded on the device by touching only using a stylus.

Graphical User Interface



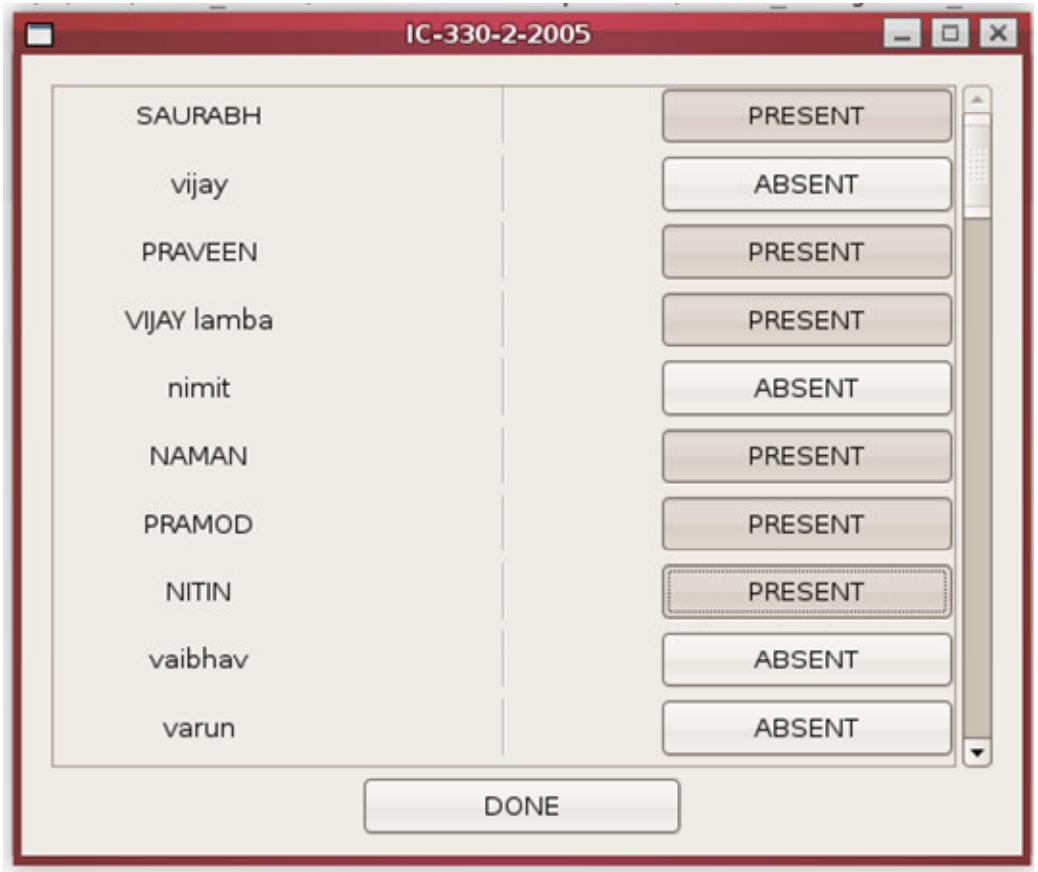
Window for selection of action

Graphical User Interface



Selection of class

Graphical User Interface



Marking the attendance

Central Database Storage Server

- Remote storage Device with enough memory to store the data.
- Communicates via Communication Engine with the data capturing unit.
- Server operates all the time and always remain in a listening mode to receive any data from the remote data acquiring device.
- Server also serves as a web server for which supports an intra college website.
- Server uses operating system Linux having a static IP.
- LAMP (Linux-Apache-MySQL-PHP) technology is used for running website.

Deployment of DAS in NSIT

- Currently, the project aims to support automatic attendance and notes writing feature.
- An intra college website will operate where all the statistics can be seen.
- Each teacher will have a data capturing device (Openmoko) and an account is provided so that they can access the data website.
- Proper Wi-Fi access is needed across the campus to facilitate data communication.
- Compete provision for feeding the data to server through PC in case Wi-Fi medium fails.
- All data will be stored centrally and can be seen in form of plots, bar graph etc.

Deployment of DAS in NSIT (cont.)

- There will not be any need for manually maintaining the statistics of attendance for any month.
- The data can be printed out.
- Attendance data can be merged with the administration's data which contains the marks and other information about the student.
- Data stored is totally secure and no manipulation is allowed by any means.

Advantages

- Extensible and support plug-ins.
- Independent Modules, can be used in other projects
- No dependencies.
- Can be integrated with other applications.
- Can be used with any data acquisition device.
- Openmoko can be interfaced with any sensors.
- Data stored will have proper back up in case of any data loss or failure.

Application of DAS

- Telemetry
- Surveillance
- Experimentation and Calibration
- Disaster Management System, Monitoring and Tracking
- Weather monitoring at Remote Locations

Future Scope

- It can be integrated with speech recognition module which will allow to record the data merely by speaking the words. e.g. attendance can be marked simple by speaking the roll number.
- It can be integrated with Face recognition application. Attendance can be taken by capturing a picture of the class and faces of the present students are recognized.
- Can be interfaced with analog sensors and transducers and data can be stored and plotted on the display unit.

References

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- http://attendance-on-openmoko.googlecode.com/svn/trunk/
- http://wiki.openmoko.org/wiki/Neo_FreeRunner_GTA02_Hardware

Thank you