IOSR Journal of Electronics and Communication Engineering (IOSR-JECE)
e-ISSN: 2278-2834,p-ISSN: 2278-8735
PP 12-18
www.iosrjournals.org

Sophisticated Education Communication System Using PI 2 Model

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Abstract:
Background/Objectives: *The objective of the paper to do different mode of operation using raspberry pi in education system, In Starting mode Raspberry Pi 2 is used to build a communication between Exam hall Invigilator and Exam cell members. Keyboard buttons are used to give preferred comments such as insufficient paper, Staff alternating purpose, student requirements based on examination, Emergency alert to Exam cell. In Exam cell information from the invigilator is view through the PC (Personnel computer) as well as replied comment from exam cell members are view by the invigilator through LCD. Different buttons provides different comment of function. Based on information sharing through Raspberry Pi exam hall supervisor need fulfilled .Suppose In Exam cell members they fail to reply a message can be send to their concerned mobile numbers through GSM module .Proper exam was conducted without student malpractice which provides standard examination result of students. Overall communication between exam hall and exam cell is done through the wireless networks & other mode are used to communication between Principal and HOD & Principal and Exam cell.*

Keywords: *Raspberry pi, GSM module, Wi-Fi, Single Board Computer*

I. Introduction

Timingisthemostimportant factorinanyrealtime applications wheresome applications shouldreact in verysmallamountoftimeinthosesituationapplications needsaplatformwherethetimingconstrainwasmeet. Inreal-timesystems,In this system which uses Raspberry Pi 2. The Raspberry Pi is a series of creditcard-sized single-board computers to promote the teaching of Basic ComputerScience in schools and in developing countries .The original model became far more popular than anticipated, selling outside of its target market for uses such as robotics. Accessories including keyboards, mice and cases are not included with the Raspberry Pi. Some accessories however have been included in several official and unofficial bundles. Using Wi-Fi for Communication purpose. A general rule of thumb in home networking says that Wi-Fi routers operating on the traditional 2.4 GHz band reach up to *150 feet* (*46 m*) indoors and *300 feet* (*92 m*) outdoors. Older 802.11a
routers that ran on 5 GHz bands reached approximately one-third of these distances. In order to get high level with low power Wi-Fi is used. Raspberry is used to process the input and output with highly effective manner compared to other processor. Main advantage in Raspberry is memory slot is available so have an option to include memory by means of SD Card.
.Thegeneralarchitectureof Raspberry pi isshown inFigure1.

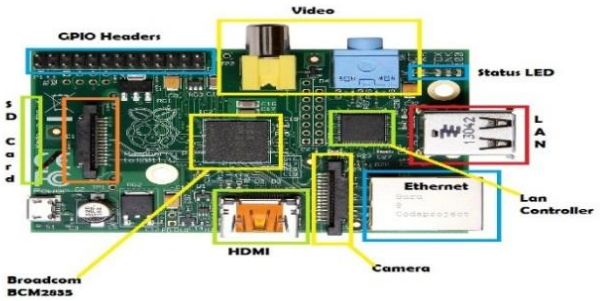

Figure1. Architecture ofRaspberry pi

Enhanced Quad Core Processor and 1GB RAM now provides you with the opportunity to:Build your own workstation – create and manage your documents and spreadsheets with ease using LiberOffice.Faster and more

enjoyable gaming – experience less lag and more seamless gaming in all your favorites. Can't wait to demolish buildings in Mine craft, trigger your TNT now and be amazed by the results.
No more buffer face – boots up Raspbian in less than half the time as the Model B+.
More power for your favorite projects – create Space Programs, Time Lapse Videos, GPS tracking, HD audio and lots more with a full ecosystem of supporting accessories.

Table 1.comparison Arduino vs Raspberry pi

	Arduino Uno	Raspberry Pi Model B
Price	$30	$35
Size	7.6 x 1.9 x 6.4 cm	8.6cm x 5.4cm x 1.7cm
Memory	0.002MB	512MB
Clock Speed	16 MHz	700 MHz
On Board Network	None	10/100 wired Ethernet RJ45
Multitasking	No	Yes
Input voltage	7 to 12 V	5 V
Flash	32KB	SD Card (2 to 16G)
USB	One, input only	Two, peripherals OK
Operating System	None	Linux distributions
Integrated Development Environment	Arduino	Scratch, IDLE, anything with Linux support

Since the Pi is a basically a mini-computer, I decided to take it for a spin and see what I could throw at it, and I have been pleasantly surprised. In fact, it's been so successful that I've decided to try setting it up as a mini server with various services. In doing so, I've come up with a list of advantages that I feel are very compelling.
Power consumption - The Pi draws about five to seven watts of electricity. This is about one tenth of what a comparable full-size box can use. Since servers are running constantly night and day, the electrical savings can really add up. I have calculated that the basic Pi kit (Pi board, case, and power supply) will pay for itself with about one year's worth of electricity savings if it's left to run 24x7x365. I ended up with the CanaKit Basic Kit (ASIN # B00DG9D6IK) which is very affordable and good quality.
No moving parts - The Pi uses an SD card for storage, which is fast and has no moving parts. There are also no fans and other things to worry about. A Class 10 SD card is usually the best performing compared to lower class cards, but this will mainly only affect boot time where there is the most I/O. There is a compatibility chart for SD cards here, results may vary but overall I've had very good luck with Transcend cards which provide a good value **Small form factor** - The Pi (with a case) can be held in your hand. A comparable full-size box cannot. This means the Pi can be integrated inside of devices, too.**No noise** - The Pi is completely silent.
Status lights - There are several status lights on the Pi's motherboard. With a clear case you can see NIC activity, disk I/O, power status, etc.
Expansion capabilities - There are numerous devices available for the Pi, all at very affordable prices. Everything from an I/O board (GPIO) to a camera. The Pi has two USB ports, however by hooking up a powered USB hub, more devices can be added.
Built-in HDMI capable graphics - The display port on the Pi is HDMI and can handle resolutions up to 1920×1200, which is nice for making the Pi in to a video player box for example. There are some converters that can convert to VGA for backwards compatibility. A list of HDMI to VGA converters can be found here. I ended up using the Sanoxy HDMI to VGA cable (ASIN # B0088K7QUQ) which has worked well so far.
Affordable - compared to other similar alternatives, the Pi (revision B) offers the best specs for the price, at least that I've found. It isone of the few devices in its class that offers 512 MB of RAM. The Pi has come down in price since it first arrived, and is finally affordable as a hobby, business use, or whatever need there is.**Huge community support** - The Pi has phenomenal community support. Support can be obtained quite easily for the hardware and/or GNU/Linux software that runs on the Pi mainly in user forums, depending on the GNU/Linux distribution used. A good list of distributions can be found here.**Overclocking capability** - The Pi can be overclocked if there are performance problems with the application used, but it is at the user's risk to do this.**Multiple uses** - Having the storage on an SD card makes it easy to swap with other SD cards running other GNU/Linux distributions to quickly and easily change the functionality of the Pi. If you want to set up the Pi to run as a server to test it out, then later try something else, just swap the SD card and you're done. Using the "dd" command on a GNU/Linux computer, a backup of the SD card can be created and later restored if needed.

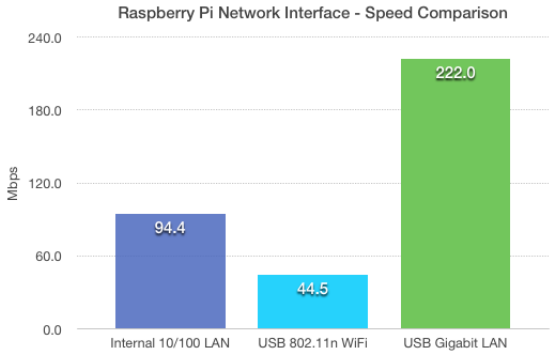

Figure 2 Speed of Raspberry pi

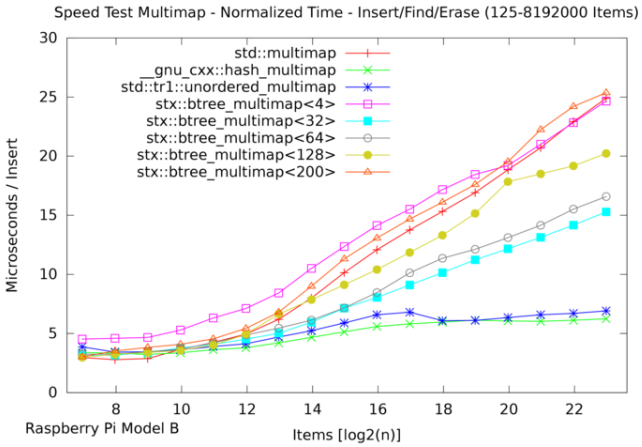

Figure 3 Speed test multi map

The paper is organized as follows; Section 2 discusses the system design flow of research and parameters calculation steps. Section 3 presents the experimental setup and flow chart for the real time application. The results and its discussion are presented in Section 4. Section 5 concludes the paper.

II. System Design

Thissectionpresentsthedesign stages takes the requirements identified in the approved required documents as its initial input. For each requirement, a set of one or more design will be produced. Design focuses mainly on high level design, low level design, interface design and data design. This chapter deals with the design documents created for the proposed system consists of a functional architecture, activity diagram. The system architecture deals with the physical structure of the proposed system.Real time application consists four main components

1. Raspberry pi
2. GSM Module
3. LCD drivers
4. Wi-Fi Routers.

The proposed system with Sender side and with Receiver side showed in Figure 3 and 4 respectively.

In exam hall setup the keyboard is connected to Raspberry pi for giving input using keys as preferred functions such as insufficient papers, graphs or chart needs, emergency alert. The given input should be processed under Raspberry pi using Raspbian compiler. Processed information is communicated to Exam cell using wireless network through UART. Power should be given to Raspberry pi module to begin process. Light crystal display (LCD) is connected in manner to view the received information from exam cell.

In the exam cell set consists of a normal PC with Wi-Fi system. Particular installation has been made to view the exam hall needed information. If he fails to see information, message can be sent to concern person mobile numberto make an alert about the exam Hall person need.

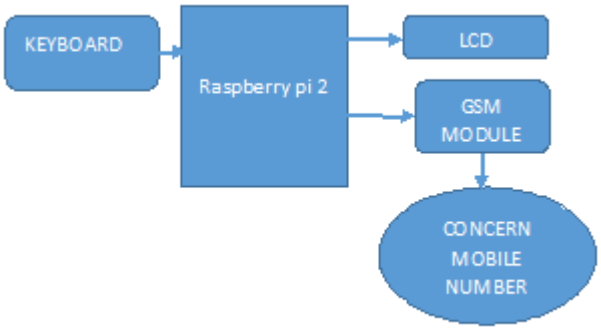

Figure 4 Exam hall /Principal room

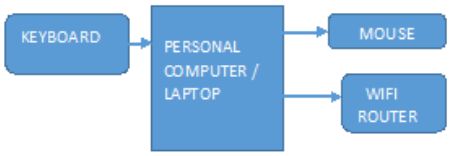

Figure 5 Exam cell/HOD room

Both the figure 3& 4 be general structure of the system. The main block Raspberry pi is a single credit card sized CPU makes an efficient communication with over all network associated with it .Initially the predefined functions are made in Raspberry pi .communication can be done by wifi routers.A wireless network uses radio waves, just like cell phones, televisions and radios do. In fact, communication across a wireless network is a lot like two-way radio communication. Here's what happens:

1. A computer's wireless adapter translates data into a radio signal and transmits it using an antenna.
2. A wireless router receives the signal and decodes it. The router sends the information to the Internet using a physical, wired Ethernet connection.

The process also works in reverse, with the router receiving information from the Internet, translating it into a radio signal and sending it to the computer's wireless adapter.

The radios used for WiFi communication are very similar to the radios used for walkie-talkies, cell phones and other devices. They can transmit and receive radio waves, and they can convert 1s and 0s into radio waves and convert the radio waves back into 1s and 0s. But Wi-Fi radios have a few notable differences from other radios

They transmit at frequencies of 2.4 GHz or 5 GHz. This frequency is considerably higher than the frequencies used for cell phones, walkie-talkies and televisions. The higher frequency allows the signal to carry more data. They use 802.11 networking standards, which come in several flavours:**802.11a** transmits at 5 GHz and can move up to 54 megabits of data per second. It also uses **orthogonal frequency-division multiplexing** (OFDM), a more efficient coding technique that splits that radio signal into several sub-signals before they reach a receiver. This greatly reduces interference.**802.11b** is the slowest and least expensive standard. For a while, its cost made it popular, but now it's becoming less common as faster standards become less expensive. 802.11b transmits in the 2.4 GHz frequency band of the radio spectrum. It can handle up to 11 megabits of data per second, and it uses **complementary code keying** (CCK) modulation to improve speeds. Adding a LCD to any project immediately kicks it up a notch .connect an inexpensive HDD44780 compatible LCD to the Raspberry Pi using 6 GPIO pins. While there are other ways to connect using I2C or the UART, this is the most direct method that gets right down to the bare metal. This technique: allows for inexpensive LCDs to be used does not require any i2c drivers won't steal the only serial port on the Pi.

Whenever you come across a LCD that looks like it has 16 connectors it is most likely using a HD44780 controller. These devices provide the same pin outs making them relatively easy to work with. The LCD uses a parallel interface meaning that we will need many pins from our raspberry pi to control it.

Lcd displays the message which has been send to exam cell. Once they view they give a response. If they fail to watch .alert system of buzzer can ring after that an emergency message has been sent to concern mobile numbers.

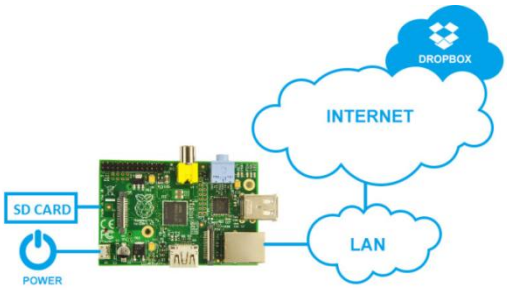

Figure 6 Model wireless communication

2.1 Hardware setup

The Hardware setup consist of raspberry pi play an important communication role.Lcd display is mounted on it.using a suitable power supply to activate the pi , normal keyboard is used to give predefined function such as insufficient paper , absent list , emergency alert and so on.It works depends on modes to communicate the exam person through GSM module.Using a LCD to view the message in exam hall side.In the receiver side laptop or personal computer with wifi connection must be need to communicate .Initial step to alert the person with ringing buzzer in the computer then a message can be send through concern person mobile number. The figure 6 shows a hardware setup

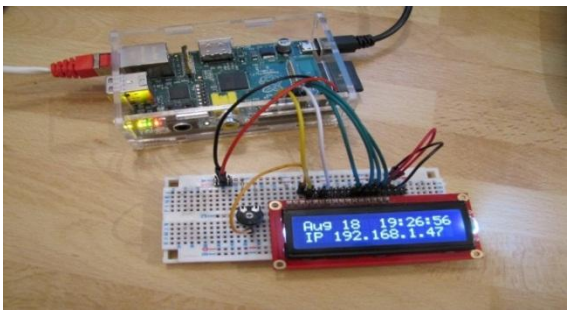

Figure 7 Hardware setup

2.2 Software setup

In the project Raspberry pi uses aRaspbian compiler is used to compile the program. Python language is used for coding purpose. Compare to other coding languages .communication speed also increases. Using a suitable LAN increases the speed of the device as already discuss in the figure 2.The architectural design was given below

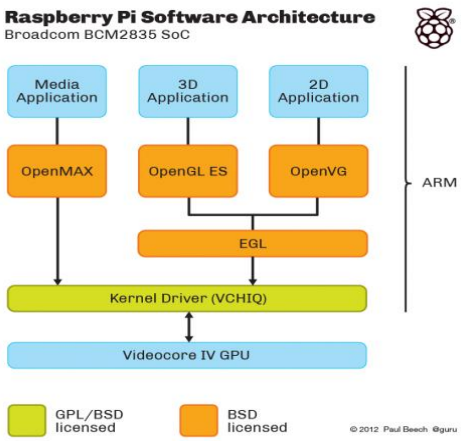

Figure 8 Software architectural design

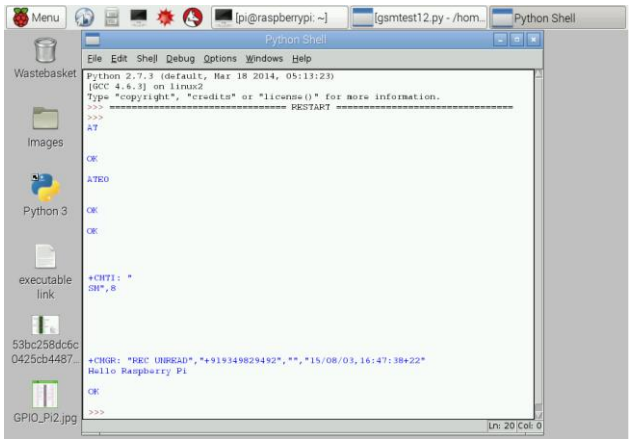

Figure 8.1 GSM installation in python

III. Results

Finally the whole process is completed with use of raspberry pi , predefined keys are uses particular function to process it , based on key function the raspberry pi send the commands to exam cell using Wi-Fi communication , exam cell members view the message and response back to exam hall to fulfill their needs they view the message through LCD display

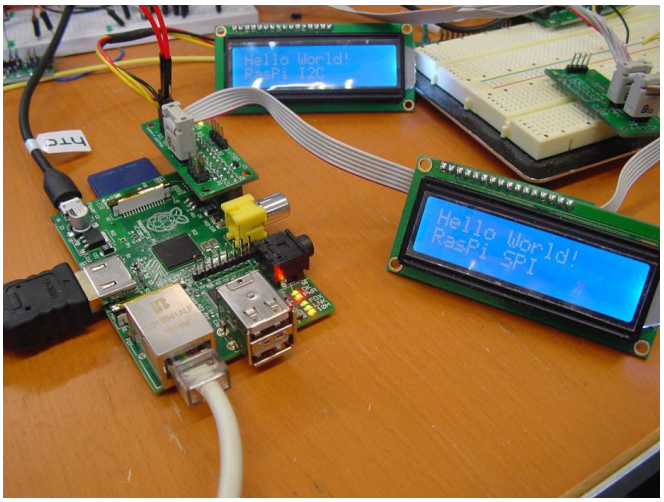

Figure 9 Exam Hall /Principal room side result

Raspberry Pi's GPIO as a Data Bus

The first thing to get your head around, is how is data moved any general purpose computer. In the most general sense in electronics, a bus or data bus is used to move data words of any type from one place to another. Computing is based on data words made up of collections of data bits. These "words" can contain as few as four data bits and often much larger.

The task of a bus designer is to devise circuitry that passes these data words from one circuit to another. These words can be communicated serially (i.e. serial communications) or in parallel.

Serial Bus: The least expensive method in terms of wire cost is to send the bits one at a time over a single pair of wires. This is called serial data transmission. Data words start as sets of bits that exist in parallel. In order to ship these words on a serial basis they must be converted to a serial stream of bits at the transmit end and then reconverted to a parallel word at the receive end. The common name for the circuitry that does this conversion is a SerDes circuit which stands for serializer/deserializer. Integrated circuits are more expensive when they have more pins.

Parallel Bus: At some point, it is more cost effective to add a wire for each bit in the word and send it in parallel on a data bus. Parallel buses have a limited data rate and distance at which they can be reliably run (more so than a serial bus).

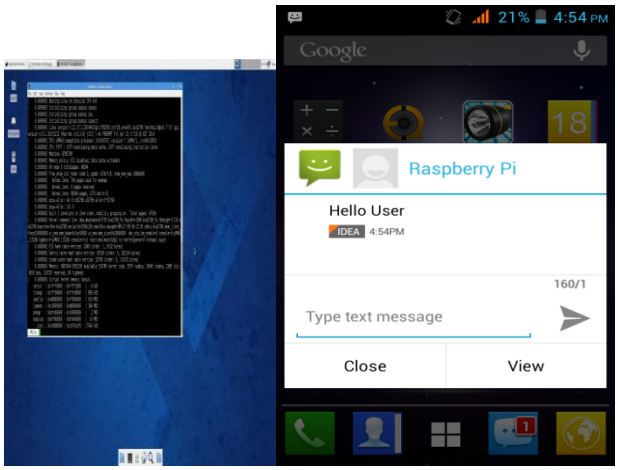

Figure 10 Exam cell / HOD room side result

The same process can be done through different processor but the CPU usage is reduced by usinga raspberry pi.and data communication is easier with reliable.

IV. Conclusion

All technologies are good their usage depends more on specific application according to cost consideration. Arduino is suited more for simple pure hardware projects wherever Raspberry Pi is better for software applications like in embedded system and hold good with complex networks. Beagle bone black and PCduino are similar to Raspberry pi and even more powerful and can be used as replacement for Raspberry Pi but cost plays an important role here as they are much expensive. It means we had to decide carefully by looking at our requirement and cost. Thus raspberry pi suits best for the project of remote monitoring system. This system is capable of recording/capturing video/image, raw data, and transmitting to a personal computer for analysis and monitoring purpose. It has advantage of offering reliability and privacy on both sides as it does authentication and encryption on the receiver side; hence it allows only the person concerned to view the details. Finally communication can be done through the raspberry pi operate with different modes in same kit enhances time saving option.

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