

Raspberry Pi as a Portable Server

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II. RASPBERRY PI

Abstract—The Raspberry Pi is a low cost single-board computer which has recently become very popular. In this paper we showcase our attempt to use Raspberry pi as portable server and perform few applications based on it. The algorithm are coded in python environment which is the default programming environment provided by Raspberry pi. The Raspberry Pi is controlled by a modified version of Debian Linux optimized for the ARM architecture. The display contains a graphical user interface which provides various fields for data entry via an on-screen keyboard.

Index Terms— email, raspberry pi, python, home automation, web server

Introduction

Home automation refers to the application of computer and information technology for control of home appliances and domestic features. Its application varies from simple remote control of lighting to complex computer/micro-controller based networks involving varying degrees of intelligence and automation. Home automation results in increased convenience, energy efficiency, and safety benefits leading to improved quality of life. The popularity of network enabled home automation has been increasing greatly in recent years due to simplicity and much higher affordability. Moreover, with the rapid expansion of the Internet, there is the potential for the remote control and monitoring of such network enabled appliances. However, the new and exciting opportunities to increase the connectivity of devices within the home for the purpose of home automation through internet are yet to be explored. Here there is also an explanation about the Virtual network computing server and the process to execute it and thus work on Raspberry-pi virtually. This paper presents a basic application of Raspberry Pi in home automation control through internet (E-mail) where subject of the received e-mail is read by the developed algorithm fed into raspberry Pi and system responds to the corresponding instructions. The presented system is interactive, efficient and flexible according to the consumer needs. It immediately replies the status of work done by raspberry Pi to the consumer. This is done by receiving the response on the terminal window itself.



Fig. 1. Raspberry pi board[2]

Raspberry Pi (shown in Fig. 1) is a credit-card-sized single board computer developed in the UK by Raspberry Pi foundation with the intention of stimulating the teaching of basic computer science in schools. It has two models; Model A has 256Mb RAM, one USB port and no network connection. Model B has 512Mb RAM, 2 USB ports and an Ethernet port. It has a Broadcom BCM2835 system on a chip which includes an ARM1176JZF -S 700 MHz processor, Video Core IV GPU, and an SD card. The GPU is capable of Blu-ray quality playback, using H.264 at 40MBits/s. It has a fast 3D core accessed using the supplied Open GL ES2.0 and Open VG libraries. The chip specifically provides HDMI and there is no VGA support. The foundation provides Debian and Arch Linux ARM distributions and also Python as the main programming language, with the support for BBC BASIC, C and Perl, detailed description of Raspberry Pi board has been given in Fig. 2 (Raspberry Pi user guide). Python was chosen as the main programming language, as it is generally accepted to be both easy to learn and a fully fledged, programming language suitable for real world applications. With the addition of NumPy, SciPy, Matplotlib, I Python, and PyLab, Python can be used for computational mathematics as well as for the analysis of experimental data or control systems. Also, the recent development of the Raspberry Pi minicomputer has unlocked great potential for computing to be applied in a vast number of areas. Due to the unique advantages of the Raspberry Pi system, this technology holds great promise for providing solutions within the developing

world. This includes but is not limited to education tools, especially the use of GPIO (General Purpose Input/ Output) which allows automated data acquisition and producing simple digital control systems in a school laboratory setting. The most distinctive feature of the Raspberry Pi when used for educational purposes is the GPIO module, which allows interfacing with general purpose electronics.

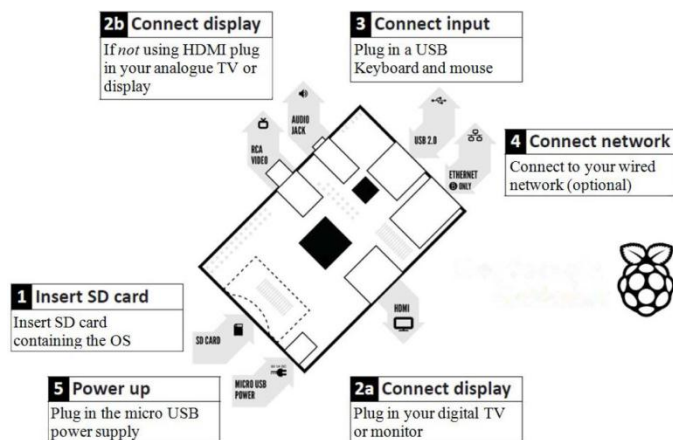


Fig. 2. Description of Raspberry pi board[6]

III. VIRTUAL NETWORK COMPUTING(VNC SERVER)

VNC was originally developed at the Olivetti & Oracle Research Lab in Cambridge, United Kingdom. The original VNC source code and many modern derivatives are open source under the GNU General Public License. In computing, Virtual Network Computing (VNC) is a graphical desktop sharing system that uses the Remote Frame Buffer protocol (RFB) to remotely control another computer. It transmits the keyboard and mouse events from one computer to another, relaying the graphical screen updates back in the other direction, over a network. VNC is platform-independent – There are clients and servers for many GUI-based operating systems and for Java. Multiple clients may connect to a VNC server at the same time. Popular uses for this technology include remote technical support and accessing files on one's work computer from one's home computer, or vice versa. The VNC server is the program on the machine that shares its screen. The server passively allows the client to take control of it. The VNC client (or viewer) is the program that watches, controls, and interacts with the server. The client controls the server.

Tight VNC is used in Raspberry Pi. Firstly the VNC server is setup and installed in Raspberry Pi.

VNC (Setup Procedure)

1. Setup a static IP address
2. Install VNC on the Raspberry pi
3. Setup VNC to run at boot

4. Connect VNC with a client

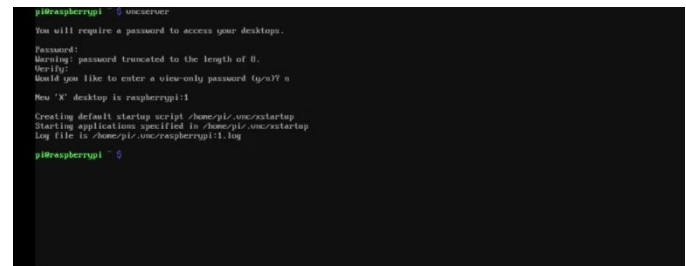


Fig. 3. VNC server on Raspberry pi

- Go to the terminal window LX Terminal and type command : `sudo apt-get install tight VNC server`.
- It will ask if you want (y/n)? type y and wait for the installation to complete.
- After the installation is complete type VNC server it will ask you to create a password.
- Now download a VNC on your system and type the IP address of your pi and connect it.
- Once the connection is complete it will display the raspberry pi screen from which you can access the pi.

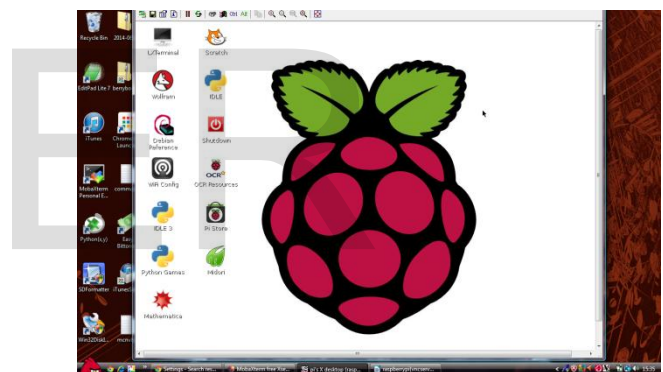


Fig. 4. Raspberry pi screen shared on home system

IV. SYSTEM CONFIGURATION

Fig. 5 describes the configuration of the proposed system. Raspberry Pi has been chosen as the processing unit for the system because of its user friendly features and economical benefits. Further, python coded algorithm has been fed into the raspberry Pi and is connected to the internet through Modulator DE-modulator (MODEM) interface to access and send e-mails to the consumer. Terminal window is used to display the status and response depending on the mail received. A display is to be connected to view the instantaneous status and processing of raspberry Pi.

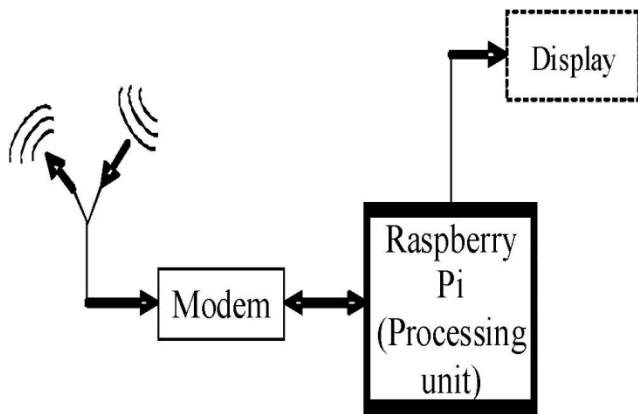


Fig.5. Layout of the proposed configuration

V. CONTROL ALGORITHM

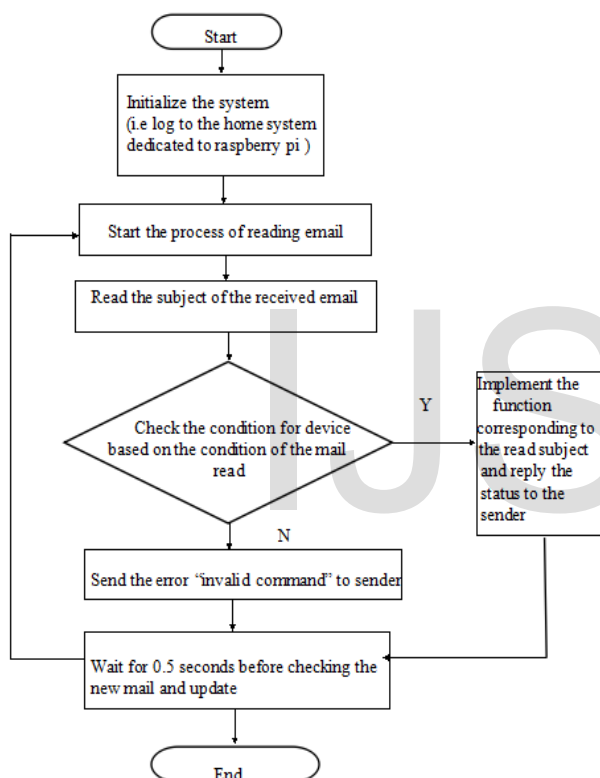


Fig.6. Flowchart of the control algorithm used

The code for implementing the control strategy for home automation was written in python environment on Raspberry Pi. Firstly, the code was set to initialize and log in into home g-mail account (g mail- i map) using the e-mail library of python IDE. After successful initialization, Raspberry Pi starts reading the subjects of e-mails from the account specified in the code. The subject of these e-mails is then compared with the initializing commands. This process is repeated continuously at an interval of 0.5 seconds. Fig. 5 represents the algorithm of the used code

in the form of flowchart. Here, the subject read from the e-mail is stored, and if the subject is 'ON', raspberry Pi replies 'Turning On' to the sender and the structure is looped for checking new mail after every 0.5

VI. PERFORMANCE

Results were generated by a series of E-mails sent to the G-mail account of raspberry pi and the corresponding in box and sent mails of raspberry G-mail account. For example, an E-mail with the subject 'ON' was sent to Raspberry Pi account from the consumer account. The algorithm, read the subject 'ON' and displays the message on the terminal window, and instantly replied to sender by an email - 'Turning ON switch I' under the subject- 'Home automation activated'. The code also includes exception handling in case of invalid e-mail from the consumer. Similarly, the same switch can be turned OFF by sending an e-mail with subject 'OFF' to the raspberry Pi account. So, the results show that home automation has been successfully implemented with efficiency and reliability.

VII. CONCLUSION AND FUTURE WORK

In this highly developing era, where directly or indirectly, everything is dependent on computation and information technology, Raspberry Pi proves to be a smart, economic and efficient platform for implementing the home automation. This paper provides a basic application of home automation using Raspberry Pi which can be easily implemented and used efficiently. The code provided is generic and flexible in a user friendly manner and can be extended for any future applications like power control, surveillance, etc, easily. Moreover, this technique is better than other home automation methods in several ways. For example, in home automation through DTMF, the call tariff is a huge disadvantage, which is not the case in proposed method. Also, in Web server based home automation, the design of web server and the space required is eliminated by this method, because it simply uses the already existing web server provided by G-mail.

VIII. REFERENCES

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