

Design and Implementation of Interactive Home Automation System through E-mail using Raspberry Pi

Smita Babaladi ¹, Prof.S.S.Shirgan ²

P.G. Student, Department of Electronics and Telecommunication Engineering, NBN Engineering College, solapur ,
India¹

HOD, Department of Electronics and Telecommunication Engineering, NBN Engineering College, solapur ,
India²

ABSTRACT: In recent years, the home environment has seen a rapid introduction of network enabled digital technology. This technology offers new and exciting opportunities to increase the connectivity of devices within the home for the purpose of home automation. Home automation refers to control of home appliances using information technology. There are lots of devices in the market that allow you to monitor your home from a central interface. Thus the already existing methods for the automation of home are Bluetooth, Zigbee, GSM based technology. But with the help of rapid expansion of the Internet, there is the potential to control and automate the home appliance using it. It is achieved by interfacing the internet with embedded systems. This paper deals with the idea of Designing and implementing the Raspberry pi based interactive home automation system through E-mail Through this project we able to secure our home and save money.

KEYWORDS: Raspberry Pi, E-mail, WIFI module, Home Automation, Display, Relay, Dimmer.

I. INTRODUCTION

A. Overview:

Home automation system means no. of appliances can be controlled from anywhere in world. Many existing systems are established on home automation system. It comes with two types of systems; depending on hardware system and wireless system In hardware system it includes the Ethernet, fibre optics, telephone line and coaxial wires. But for implementation of wired communication systems cost goes very high. Wireless communication systems include radio frequencies Bluetooth, WIFI. Now days there are many new systems for home automation which includes hardware and wireless system as it is or the combination of both systems. In wireless systems can be of great help for automation systems it is very easy to implement and maintains is also very easy as compared to with wired system technologies such as WIFI cloud network in the recent past wireless systems are used every day and everywhere. Home automation system is getting very easy because of new technology and straight forwardness through smart phones and internet and wireless communication.

II. SYSTEM ANALYSIS

A . Problem Definition

Home Automation system faces four main challenges; those are high cost of ownership, inflexibility, poor managemeability and difficulty in achieving security. The main objective of this research is to design and implementation of home automation system which is capable of controlling and automation most of the house appliance through email. The proposed system has a great flexibility by using WIFI technology

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 6, June 2016

B . Proposed system feature:

The proposed system is distributed home automation system, which consist of WIFI module. Use this WIFI module with Raspberry PI. So that Raspberry pi can easily receive mail from user mail id. This home automation system can be accessed from any local PC with LAN cable or remotely from any PC or mobile handheld device connected to internet .WIFI technology is selected to be network infrastructure that connects server to getting mails on Raspberry pi mail id. WIFI is chosen to improve security of system and to increase system mobility and scalability.

III. PROPOSED SYSTEM AND IMPLEMENTATION

The system is interactive to provide ease in day to day life, also saves electricity, human efforts The proposed system includes Raspberry Pi, HDMI display, LAN or WIFI module , relay board, Keyboard and mouse, dimmer circuit and driver. The system block diagram is shown below. The proposed system mainly works through Internet. Here we are created Email account for Raspberry pi Through this Raspberry pi Email account the appliances which are connected to raspberry pi board will be controlled. When we are sending mail through user mail id to Raspberry pi's mail Id's,it will control home appliances like Light or Fan as specified in Email. In block diagram we are used dimmer circuit for controlling brightness of light. WIFI module use to receiving user mails on Raspberry pi mail ids.

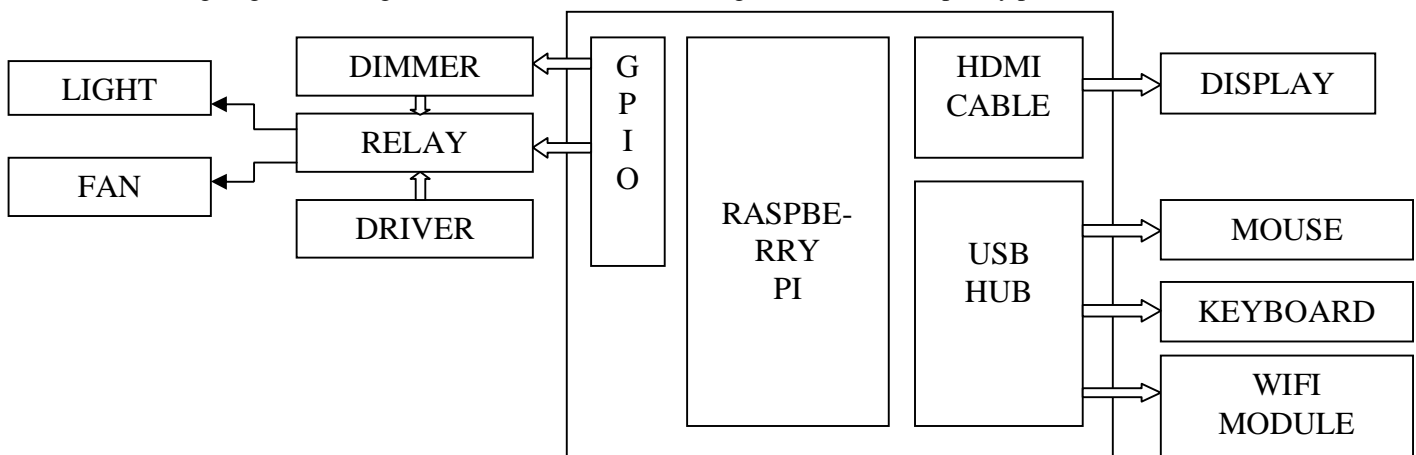


Fig1: Block Diagram of Proposed system

The proposed system consists of Raspberry Pi, LAN Cable, HDMI Display, Light, Motor, Keyboard and mouse Relay Board.

1. Raspberry Pi: The Raspberry Pi is a credit card sized, single board computer developed in the UK by the Raspberry Pi Foundation. The Raspberry Pi has a Broadcom BCM2835 System on a Chip (SoC), which includes an ARM1176JZF-S 700 MHz processor. It has an internal storage of 512 MB, external storage supported up to 32 GB, 1 Ethernet port, 4-2.0 USB ports, 1 micro SD card slot, DSI display connector, 1 HDMI out port, 1 CSI Camera connector, 5V USB power, RCA The Raspberry Pi2 B model CPU is of ARM 11 family operates at 700MHz. The GPU having Broadcom Video core-IV, open GLES 2.0, 1080p30, H.264/MPEG-4, AVC high profile decoder and capable of 1Gpixel/s, 1.5 G Texel/s (or) 40 GFLOPs of general-purpose (GPIO) compute. It operates 1mA at 5V power supply. With the help of GPIO pins we can control the devices from any place. The below Fig2 is shows the model of Raspberry pi and Fig3 shows detail description of GPIO pins.



Fig2: Raspberry Pi 2

Raspberry Pi 3 GPIO Header

Pin#	NAME	NAME	Pin#
01	3.3v DC Power	DC Power 5v	02
03	GPIO02 (SDA1 , I ² C)	DC Power 5v	04
05	GPIO03 (SCL1 , I ² C)	Ground	06
07	GPIO04 (GPIO_GCLK)	(TXD0) GPIO14	08
09	Ground	(RXD0) GPIO15	10
11	GPIO17 (GPIO_GEN0)	(GPIO_GEN1) GPIO18	12
13	GPIO27 (GPIO_GEN2)	Ground	14
15	GPIO22 (GPIO_GEN3)	(GPIO_GEN4) GPIO23	16
17	3.3v DC Power	(GPIO_GEN5) GPIO24	18
19	GPIO10 (SPL_MOSI)	Ground	20
21	GPIO09 (SPL_MISO)	(GPIO_GEN6) GPIO25	22
23	GPIO11 (SPL_CLK)	(SPL_CE0_N) GPIO08	24
25	Ground	(SPL_CE1_N) GPIO07	26
27	ID_SD (I ² C ID EEPROM)	(I ² C ID EEPROM) ID_SC	28
29	GPIO05	Ground	30
31	GPIO06	GPIO12	32
33	GPIO13	Ground	34
35	GPIO19	GPIO16	36
37	GPIO26	GPIO20	38
39	Ground	GPIO21	40

Rev. 2
29/07/2016
www.element14.com/RaspberryPi

Fig3: GPIO Pin out

Total there are 40 GPIO pins are available on Raspberry pi including power and ground pin. IN proposed system 7 GPIO pins are used. The Python is a default programming language for the Raspberry Pi which supports C, C++, Java, Perl and Ruby.

2. **LAN Cable (Local Area Network) or WIFI Module:** To access the internet in Raspberry Pi we need LAN connection, with the help of which we can access the incoming and outgoing E- mail services. Otherwise we can connect WIFI module to our Raspberry pi by connecting to USB Hub .We are using WIFI adapter so that it helps to increase system mobility and scalability. The proposed system uses WIFI module.

3. **HDMI Display:** To see the current status of the home appliances and also to check the updates of Raspberry Pi.

4. **Keyboard and mouse:** Key board and mouse are used to operate the Raspberry Pi, so we can easily do the programming and make changes easily.

5. **Relay Board:** Relay is an electrically controllable switch which is used in industrial controls, automobiles and home appliances, because of their relative simplicity, long life, and proven high reliability. In the proposed system we are using 8-channel relay for switching and controlling the devices, having 8 independently controlled relays. The Control signals use +5V logic levels and is of TTL compatible

6. **Light and Motor:** Light and Motor connected to Raspberry pi using with some interfaces .to operate it through Raspberry pi by Email

7. **Dimmer Circuit:** Dimmer circuit is used for to control the brightness of light .

3.1 INTERFACING

- First of all need to install the Rasbian Operating system in the micro SD card, after that need to insert the SD card in Raspberry Pi kit and give the 5V power supply to the same.
- Connect the HDMI port to the LED TV and thus the display will be observed on LED screen.
- Now connect the keyboard and mouse to the Raspberry Pi USB ports, so will be able to write the code with the help of keyboard and mouse.
- Connect the LAN cable to Ethernet port and so we can access the Raspberry Pi and make the system interactive by sending and receiving E-mails.
- Need to write the code for the proposed system in Python language and store the results in the form of E-mail.
- Light and motor is used to do hardware setup for the device is in ON state or OFF state.

3.2 Implementation Setup:

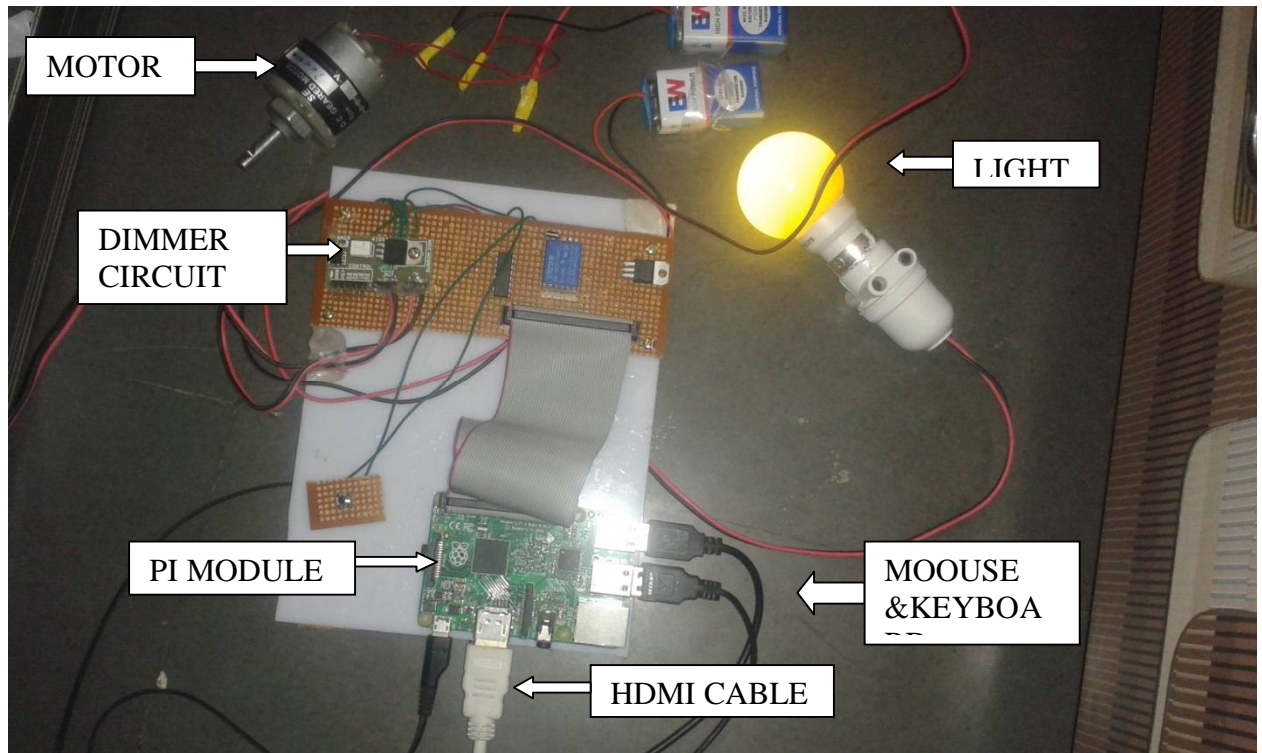


Fig.5: Experimental setup of HAS

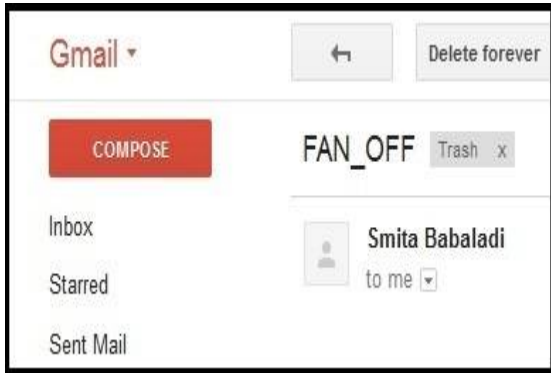
III. SECURITY OF THE SYSTEM:

Unlike the previously implemented such system the security of the system has been given a great deal of importance. A two level security authentication is used .First of all, Raspberry pi module is protected by Its own User ID and Password given by developer which means that only authorized user will be able to access able raspberry pi module. Secondly the system at the receiving end, verifies that the Information (coming through Email) it has received is from the authorized user or from authorized email ID .The user is identified from the Email ID.

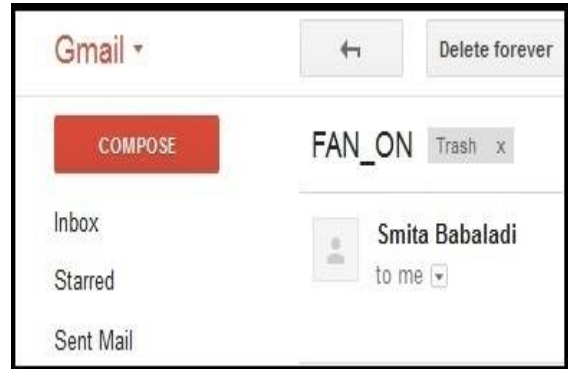
V. RESULTS

The Figures shows the Experimental Results of proposed system.

Case I: Fig (a) shows Inbox of Raspberry pi to turn OFF the FAN. And Fig (b) shows to turn ON the FAN



Fig(a)



Fig(b)

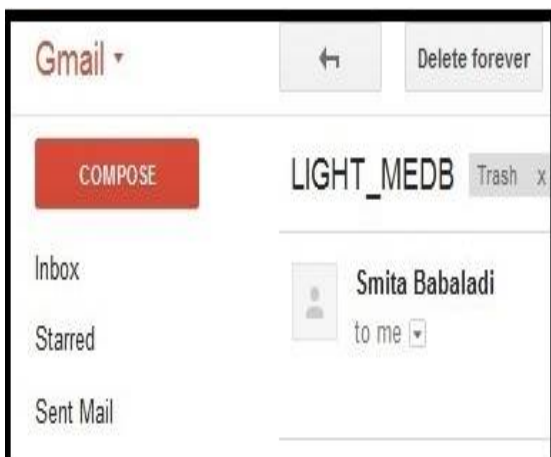
Case II: As the Light is gets switched ON/OFF or making Brightness of light as medium high and low, the following E-mail will be sent to Raspberry Pi. For Brightness medium we can send mail as LIGHT_MEDB, as like that for brightness low we can send LIGHT_NORB and for normal on LIGHT_ON Fig (a)(b)(c)(d) shows inbox of Raspberry pi to turn ON, OFF, Low and Medium Brightness.



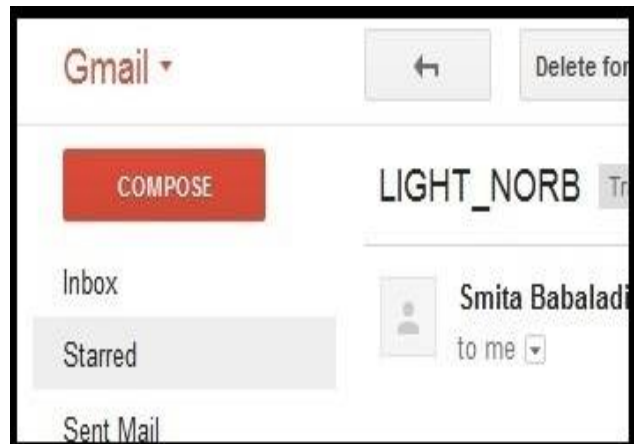
Fig(a)



Fig(b)



Fig(c)



Fig(d)

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 6, June 2016

V. CONCLUSION

We have implemented a home automation system so as we can operate our home appliances from any place in this world. It means we can ON/OFF home appliance through email. This paper aims a basic application of home automation using Raspberry Pi which can be easily implemented and used efficiently. The python code provided will be generic and flexible which is used on Raspberry pi board .It is a user friendly manner.

REFERENCES

- [1] Sriskanthan N. , Tan F. and Karande A. , "Bluetooth based home automation system", Microprocessors and Microsystems, Vol. 26, no. 6, pp. 281-289, 2002.
- [2] www.raspberrypi.org/archives/tag/raspberrypi-user-guide
- [3] Baudel T. and Beaudouin-Lafon M., "Charade: remote control of objects using free-hand gestures", Communications of the ACM, vol. 36,no. 7,pp. 28-35, 1993.
- [4] Bromley K., Perry M., and Webb G. "Trends in Smart Home System Connectivity and Services", www.nextwave.org.uk,2003.
- [5] Kushiro N. , Suzuki S., Nakata M., Takahara H. and Inoue M., "Integrated home gateway controller for home energy management system", IEEE International Conference on Consumer Electronics, pp. 386-387,2003.
- [6] Ok S. and Park H. , "Implementation of initial provisioning function for home gateway based on open service gateway initiative platform", The 8th International Conference on
- [7] Advanced Communication Technology, pp. 1517-1520,2006.
- [8] Saito T., Tomoda I., Takabatake Y., Ami J. and Teramoto K., "Home Gateway Architecture And Its Implementation", IEEE International Conference on Consumer Electronics, pp. 194-195,2000.
- [9] Ardam H. and Coskun I., "A remote controller for home and office appliances by telephone", IEEE Transactions on Consumer Electronics, vol. 44, no. 4,pp. 1291-1297, 1998
- [10] AI-Ali A. R. and AI-Rousan M., "Java-based home automation system", IEEE Transactions on Consumer Electronics, vol. 50, no. 2, pp. 498-504, 2004.
- [11] Ali M., V laskamp J.H.A, Eddiny N.N. , Falconer B. and Oramc., "Technical Development and Socioeconomic Implications of the Raspberry Pi as a Learning Tool in
- [12] Developing Countries", 5th Computer Science and Electronic Engineering Conference (CEEC), pp. 103- 108,2013.
- [13] Dennis, A. K. 2013. "Raspberry Pi Home Automation with Arduino", Packt Publishing

BIOGRAPHY



Ms.Smita Babaladi is pursuing M.E.in the stream of Electronics and Telecommunication Engineering from NBN sinhgad college of Engineering, solapur ,Maharashtra ,India.She has completed her B.E. in stream of Electronics and Telecommunication from A.G.Patil Institute of Technology solapur, in 2013.Her are of interest are Embedded system and Computer Networking.



Prof.Siddharth Shirgan is working as Assistanc Professor in the Department of Electronics and Telecommunication at NBN Sinhgad college of Engineering Solapur,Maharashtra,India. He has teaching experience of 15 years. He has published more than 12 paper in national and international Journals. He has research on Cognitive Radio.