

Raspberry Pi Based Interactive Home Automation System through Internet of Things

Nithyashree B
MTech Student

Department Of Computer Science And Engineering
Dr. Ambedkar Institute of technology
Bengaluru, India
nithi3231@gmail.com

Dr. Siddaraju
Professor and Head

Department Of Computer Science And Engineering
Dr. Ambedkar Institute of technology
Bengaluru, India

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 on 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, Zig bee, 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 implementing the Raspberry pi based interactive home automation system through internet of things and to control the home appliance like fan light and door and status of your home appliance devices. Through this project we able to secure our home, reduce the wastage of electricity, and improve our home security etc.

Keywords— Home automation, Internet of Things, Raspberry pi, Server

I. INTRODUCTION

Internet of Things is a concept where each device is assigned to an IP address and through that IP address anyone makes that device identifiable on internet. The Internet is an evolving entity. It started as the “Internet of Computers.” Research studies have forecast an explosive growth in the number of “things” or devices that will be connected to the Internet. The resulting network is called the “Internet of Things”. IoT is having the potential to change the lifestyle of peoples. In day today’s life people prefer more of automatic systems rather than any manual systems. The major elements of IoT based home automation system is Raspberry pi and the Relay along with their driving circuitry. Home automation can be defined as a mechanism removing as much human interaction as technically possible and desirable in various domestic processes and replacing them with programmed electronic systems. Ultimately it is a system that aims to heighten quality of life with the automation of household appliances that may be controlled over the Internet or Telephone.

It is a very simple concept where devices in our home or wherever they are, have the capability to communicate with each other via the internet. The idea of home automation systems connected to the net, which can be used to control appliances in your home like lights, door locks, air conditioning, etc. through a web interface or smartphone application. This project will show how we can get started on making a raspberry pi home automation system that is web based using normal HTTP protocols. We will be able to control any appliance in home from anywhere around the world when we are connected with this Raspberry Pi home automation



Figure 1: Smart home

II. LITERATURE SURVEY

This paper provides a simple introduction to the IoT, its application and potential benefits to the society. IoT has received much attention from scientists, industry and government all over the world for its potential in changing modern day living. IoT is envisioned as billions of sensors connected to the internet through wireless and other communication technologies. The sensors would generate large amount of data which needs to be analysed, interpreted and utilized. Home Automation System uses the technology of Internet of Things for monitoring and controlling of the electrical and electronic appliances at home from any remote location by simply using a Smartphone. Implementation of a low cost, flexible home automation system is presented. It enhances the use of wireless communication which provides the user

with remote control of various electronic and electrical appliances

III. HOME AUTOMATION HISTORY AND DESCRIPTION

In 19th century, concept of home automation came into the picture. The Electronic Computing Home operator was developed in the April 1968 and has been enhanced from a set of spare electronics. Further X10 standard was developed to allow transmitters and receivers to broadcasting messages such as “turn ON” and “turn OFF” via radio frequency. X10 system has number of disadvantages. With the invention of the Raspberry pi which is small credit card size computer having large number of peripherals along with communication ports like Ethernet, USB ports, HDMI port, now a day’s home automation is become very easy and interesting. Home automation includes all that a building automation provides like door and window controls, climate controls, control of multimedia home theatres, pet feeding, plant watering and so on. Home automation is nothing but ‘Smart home’ or ‘Intelligent home’. Such smart homes or intelligent homes are controlled with the help of various technologies. GSM, WIFI, Bluetooth, Zig bee and so on are used for the purpose of home automation. Home automation systems connected to the net, which can be used to control appliances in our home like lights, door locks, air conditioning, etc. through a web interface or Smartphone application. A lot of technologies are being developed around this concept such as independent light weight IoT networks, protocols for passing data, etc.

IV. SYSTEM DESIGN

A. Raspberry Pi

The Raspberry Pi is a series of credit card – sized singleboard computers developed in the United Kingdom by the Raspberry Pi Foundation with the intention of promoting the teaching of basic computer science. They develop free resources to help people learn about computing and how to make things with computers. Raspberry Pi’s inception began in 2006. Two models were announced in 19 February 2012: Model A and Model B. Model B+ was announced July 2014. Pi 3 Model B is announced on 29th February 2016. Raspberry pi is low cost minicomputer. It is possible to connect Monitor of PC as well as television to the Raspberry pi. Mouse and Keyboard can be connected to the Raspberry pi. All models having a Broadcom system on a chip, it includes an ARM compatible central processing unit (CPU) and an on-chip graphics processing unit. CPU speed ranges from 700 MHz to 1.2 GHz for the Pi 3. on board memory range from 256 MB to 1 GB RAM. Secure Digital (SD) cards are used to store the operating system and program

memory. Most of the Raspberry pi board are having USB ports, HDMI port, DSI port, Audio jack, 40 GPIO pins, In-built Bluetooth, WIFI and so on. Raspberry pi is having its own operating system. Raspbian, Ubuntu mate, snappy Ubuntu, Pidora, linutop, Arch linux ARM and so on are the various operating systems used for the Raspberry pi. Raspberry pi supports different programming languages like C++, Python, SQL, and HTSQL. C++ uses for programming Arduino. HTSQL (Hyper Text Structured Query language) to provide a web interface to database that is easy to query via the web browser. It also supports java, java script, php and so on.

The Raspberry Pi has four distinct power modes :

- The run mode – the central processing unit (CPU) and all functionality of the ARM core are available and powered up.
- The standby mode – the main core clocks are shut down (the parts of the CPU that process instructions are no longer running) although the power circuits on the core are still active. In this mode, known as “Wait for Interrupt”(WFI) mode, the core can be quickly woken up by a process generating a special call to the CPU called an interrupt. This interrupt will stop any current processing and do what the calling process has asked for.
- The shutdown mode – there is no power.
- The dormant mode – the core is powered down and caches are left powered on.



Figure 2: Raspberry pi board

B. Relay and Relay Driver Circuit

Relay is nothing but it is the electromagnetic switch. Relay allows one circuit to switch another circuit while they are separated. Relay is used when we want to use a low voltage circuit to turn ON and OFF the device which required high voltage for its operation. For example, 5V supply connected to the relay is sufficient to drive the bulb operated on 230V AC mains. Relays are available in various configurations of operating voltages like 6V, 9V, 12V, 24V and so on. Relay is divided into two parts, one is input and other is output. Input side is nothing but a coil which generate

magnetic field when small input voltage is given to it. Relay having three contactors: Normally closed (NC), Normally opened (No) and common (CoM). By using the proper combinations of the contactors electrical appliances may turn ON or OFF.

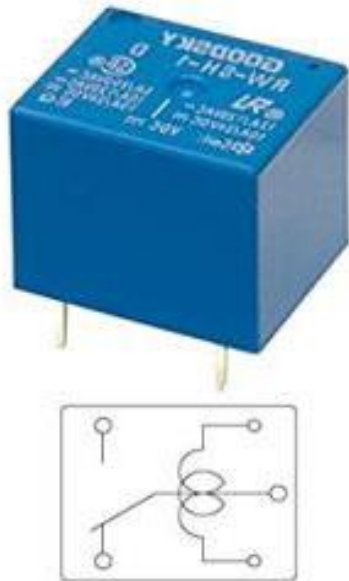


Figure 3: Relay module

C. Mobile Devices

Mobile devices are not big but small computing devices. They are small enough so that we can operate and hold in hand. They are also having their own operating systems. Mobile device can be move from one location to other. Example of mobile devices are: Smart phones, laptops, Tablets and so on.



Figure 4: Mobile Devices

D. Door Lock Solenoid

This DC 12V Cabinet Door lock Electric lock Assembly Solenoid can be used for locking sell-machine, storage shelf, file cabinet and etc. The hidden way of unlocking can be used for an emergency. The lock works as the circuits disconnects, and it will unlock as the instant power-on. It is steady, durable and energy-saving and had a long lifespan. In the anti-theft and shockproof design, the lock is better than other kinds of locks. After connecting the wires and when the current is

available, the electric lock can control the door’s opening and closing.

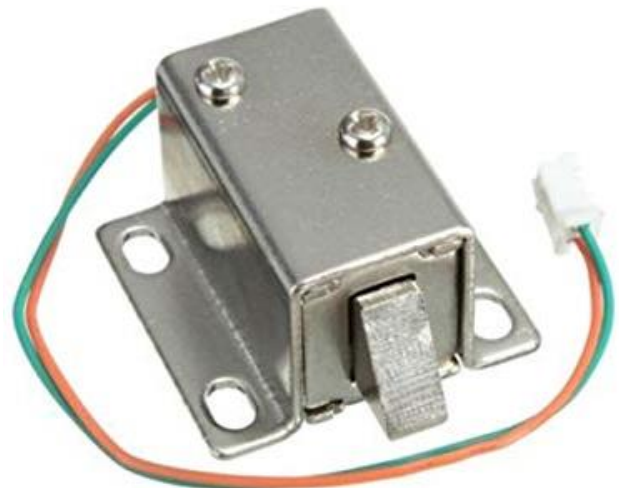


Figure 5: Door Lock Solenoid

V. METHODOLOGY

1. Hardware implementation

To make the system hardware we gone through below block diagram. The whole block diagram is divided into two sections, first is Server side and other one is client or user side.

Server side is totally installed on the Raspberry pi. Server is created on the Raspberry pi with the help of LAMP (linux, Apache, MySQL, PHP). Two PHP files are created and stored on the Server that we have created on the Raspberry pi.

Raspberry pi is having 40 GPIO pins. These pins are used to control the home appliances. Relay are connected to the GPIO pins of the Raspberry pi through the Relay Driver Circuitry. output of the GPIO pins is 3.3V. In order to drive Relay minimum 6V voltage is required so this can be obtained with the help of Relay driver circuitry. All home appliances are connected to the Relay.

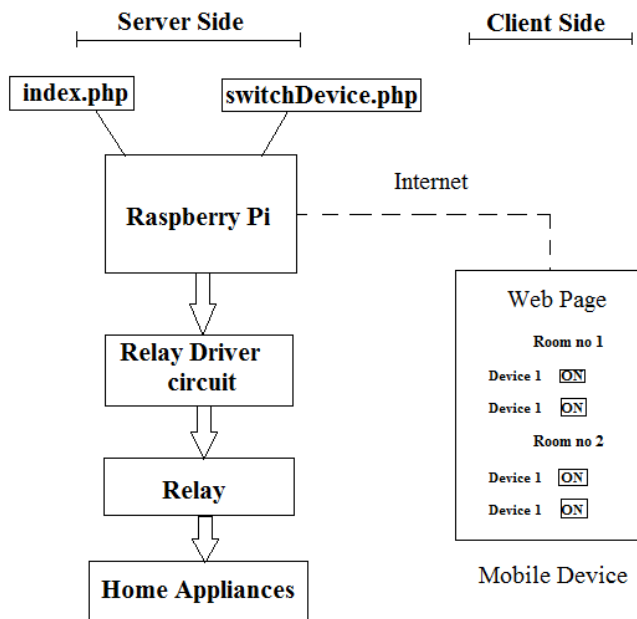


Figure 6: Flow chart of system

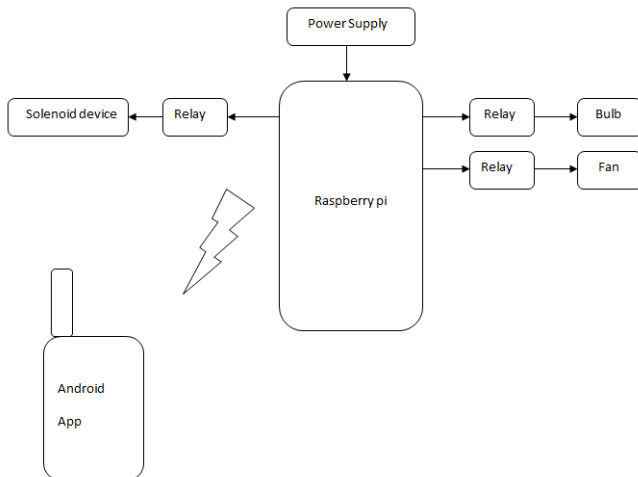


Figure 7: Block diagram of system

Client side is nothing but a User side. Users need to use Mobile device to access the Raspberry pi through the internet. Once the user connects mobile device in network and after putting the IP address of the Raspberry pi in the browser of Mobile device will be able to see the web page which contains UI to control home appliances in each room. UI simply shows the number of rooms and home appliances present in each room. It also contains buttons to toggle the status of home appliances of each room. Number of home appliances can be controlled simultaneously.

2. Software implementation

Programming is done with embedded C language. Two files are created, one is index and another one is switch Device. These two files are stored on the local LAMP server of the Raspberry pi. Dreamweaver software is used to develop the web page and to create the UI present on that web page.

VI. SIMULATION AND RESULT

A. TURN ON HOME APPLIANCES



Figure 8: Web page layout to turn ON home appliances



Figure 9: output for figure 8

B. TURN OFF HOME APPLIANCES



Figure 10: Web page layout to turn OFF home appliances



Figure 11: output for above figure 10

VII. CONCLUSION

The work for IoT based home automation is completed successfully using internet source and Raspberry pi. It is reliable and scalable home automation system with low cost and easy to implement. It makes human life easy

and comfortable. It is possible to operate home appliances from any part of the globe.

Raspberry Pi in home appliance can save energy & reduce time complexity which provides facility to user to manage their home appliance from anywhere through mobile. In future we can add some more facilities to enhance the capability of this application.

VIII. REFERENCES

- [1] D. Norris, *The Internet of Things: Do-It-Yourself at Home Projects for Arduino, Raspberry Pi and BeagleBone Black*. Tab Electronics, 2015.
- [2] D. Giusto, A. Iera, G. Morabito, and L. Atzori, *The Internet of Things*. New York, NY: Springer New York, 2010.
- [3] Raspberry pi as a sensor Web node for home automation Vladimir Vujovic, Mirjana Maksimovic
<http://dx.doi.org/10.1016/j.compeleceng.2015.01.01>
- [4] A. Z. Akar and U. Buhur, "An internet based wireless home automation system for multifunctional devices," *IEEE Trans. Consum. Electron.*, vol. 51, no. 4, pp. 116 –1174, Nov. 2005.
- [5] Jump up Bush, Steve (25 May 2011). "Dongle computer lets kids discover programming on a TV". *Electronics Weekly*. Retrieved 11 July, 2011
- [6] Horan B. *Practical Raspberry Pi*. USA: Apress; 2013.