Smart Home Automation System

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Abstract:

This paper proposes the design of Inter of Things (IoT) based home automation system using Raspberry pi. Currently in day today's life we can hardly find a house without a home automation system. This project is intended to construct a home automation system that uses any mobile device to control the home appliances. This home automation system is based on IoT. Home automation is very exciting field when it uses new technologies like Internet of Things (IoT). Raspberry pi is credit card size computer. Raspberry pi supports large number of peripherals. Raspberry pi is having different communication media like Ethernet port, HDMI port, USB port, Display Serial Interface, Camera Serial Interface, Bluetooth, Bluetooth low energy. It allows controlling number of home appliances simultaneously. Here local server is created on Raspberry pi. User required to use different mobile devices like smart phones, Laptops, Tablets to operate the home appliances with the help of UI created on web page.

Keywords: Home automation, Internet of Things, Raspberry pi, Server, Mobile devices.

1. INTRODUCTION

Internet of Things is a concept where each device is assign 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) [1]. 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 are 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 [3].

Figure 1: *Smart home*

2. LITEARTURE SURVEY

This paper provides a simple introduction to the IoT, its application and potential benefits to the society [1]. 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 analyzed, interpreted and utilized [2]. 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 [4].

3. HOME AUTOMATION & HISTORY

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 and 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.

4. SYSTEM DESIGN

A. Raspberry Pi

The Raspberry Pi is a series of credit card–sized single board 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 in July 2014. Pi 3 Model B is announced on 29th February 2016 [5]. 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 RAMS. Secure Digital (SD) cards are used to store the operating system and program memory. Most of the Raspberry pi boards are having USB ports, HDMI post, 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 [6]:

- The run mode – the central processing unit (CPU) and all functionality of the ARM11 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.

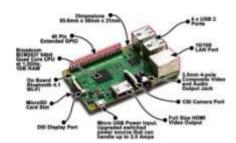- The dormant mode – the core is powered down and all caches are left powered on.

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 close (NC), Normally Open (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 noting 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. Examples of mobile devices are: Smart phones, Laptops, Tablets and so on.

Figure 4: *Mobile Devices*

5. 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.
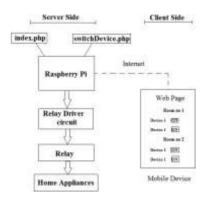
Figure 5: *Block diagram of system*

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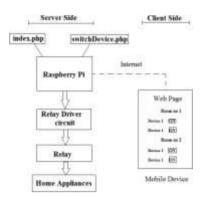

Figure 4: *Mobile Devices*

6. METHODOLOGY

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Figure 5: *Block diagram of system*

Server side is totally installed on the Raspberry pi. Server is created on the Raspberry pi with the help of LAMP (Linux, Apache, MySQL and 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 is 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.

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.
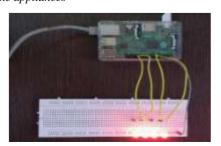
3. Software implementation

Programming is done with PHP language. Two PHP files are created. One is index.php and another one is switchDevice.php. 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.

6. *SIMULATION AND RESULT*

- **TURN ON HOME APPLIANCES**

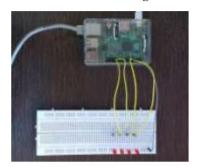**Figure 6:** *Web page layout to turn ON home appliances*

Figure 7: *Output for above fig.6*

- **TURN OFF HOME APPLIANCES**

Figure 8: *Web page layout to turn OFF home appliances*

Figure 9: *Output for above fig.8*

7. 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.

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