IOT Based Electronic Monitoring System Using Raspberry pi

Vinitha.M[1], Mahendran.R[2], Janani.B[3]

Student, Computer Science and Engineering, Adithya Institute of Technology, Coimbatore[1,2]

Assistant Professor, Computer Science and Engineering, Adithya Institute of Technology, Coimbatore[3]

Abstract: This paper proposes the design of Inter of Things (IoT) based home automation system using Raspberry pi. Currently in day today's life can hardly find a house without a home automation system. This project is intended to construct a home automation system that uses any device to control the electronic 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 to control number of home appliances simultaneously. The local server is created on Raspberry pi.Home Automation System is a web based application that allows the user to monitor and control their home using their any device. This system requires a micro SD card with an OS for the Raspberry Pi. In this project OS Raspbian which is mostly preferred for projects, before copying the OS on the micro SD card copy a file named NOOBS which helps to download the latest OS's for the Raspberry PI as well as works as an interface like BIOS in windows. After booting the OS we installed Python 2.7, 3.0, Scratch etc. for programming. User required to use different devices like smart phones, iphones, Tablets to operate the home appliances with the help of UI created on web page. Home automation is becoming more and more popular day by day due to its numerous advantages. This can be achieved by local networking or by remote control. The Raspberry Pi is a low cost single-board computer which has recently become very popular. Via internet (webpage) user can access or operate any connected device from anywhere and system also checks for any device left switched on by user to switch it off. With the use of various sensors (Infrared sensors, temperature sensors) and actuators entire connection is established between Ethernet shield and the device. System would also be able to monitor presence of any person inside the room and using this data, user can manage the operability of any connected devices. Modules can be integrated as and when required for easing the task and effort of human.

Keywords: HDMI, IoT, Raspberry PI.

INTRODUCTION

Today the technological worlds centralize principle is to automate each conceivable thing for simplicity in life, providing security, saving electricity and time. Regarding this home automation is one of the prior things to automatically on and off the home appliances. Home automation can be characterized as a method for doing something without human inclusion. It may incorporate brought together to control of lighting, machines, heating, ventilation, air-conditioning, and security door locking and different systems, to provide improved convenience, comfort, energy efficiency and security. The idea of automating each appliance in the home is done from many years ago, it started with connecting two electric wires to the battery and close the circuit by connecting load as a light. Later it can be developed by different organizations, which creates its own automation systems with different devices like sensors, controllers, actuators, buses, and interfaces. In present days most of the automation systems utilize the combination of hardwired and wireless systems for controlling the appliances. It should have both equipment and programming set up for proficient systems. The popularity of home automation has been expanding incredibly because of much higher reasonableness and straightforwardness through Smart phones and wireless networks. Internet of Things is interlinked through these networks; because of the popularity of the home automation is improved by the quality of service provided by the devices. Different home automation systems are developed by different authors for automatically on and off the appliances with different applications. In this project, we discuss Design and Development of Activation and Controlling of Home Automation System via the web. It predominantly concentrates on the control of home appliances remotely when the person is far from the home. This project is primarily concerned with the programmed control of light or whatever other home machines, Control of Door and Home Security through web application using the Internet as communication protocol interfaces and Raspberry Pi as processing unit. This project intends to control the system with the web by either turning device on or off so that the entrance control that system can be controlled from anyplace on the planet.

LITEARTURE 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.

Advantages of Home automation systems:
In recent years, wireless systems like Wi-Fi have become more and more common in home networking. Also in home and building automation systems, the use of wireless technologies gives several advantages that could not be achieved using a wired network only.
Reduced installation costs: First and foremost, installation costs are significantly reduced since no cabling is necessary. Wired solutions require cabling, where material as well as the professional laying of cables (e.g. into walls) is expensive.
System scalability and easy extension: Deploying a wireless network is especially advantageous when, due to new or changed requirements, extension of the network is necessary. In contrast to wired installations, in which cabling extension is tedious. This makes wireless installations a seminal investment.
Aesthetical benefits: Apart from covering a larger area, this attribute helps to full aesthetical requirements as well. Examples include representative buildings with all-glass architecture and historical buildings where design or conservatory reasons do not allow laying of cables.

Existing System:

The literature related to the research topic has been reviewed for last twenty years in order to find out work carried out by various researchers. There are many systems for remote monitoring and control designed as commercial products or experimental research platforms. It is noticed that most of the research carried out belongs to the following categories Internet based Monitoring using Servers, GPRS modems, etc. with different approaches. GSM-SMS protocols using GSM module individually or in combination with Internet Technologies. Wireless Monitoring using Bluetooth, Wi-Fi, Zigbee and RF. connection of the devices is set through wires which reduces the speed in data transfer and also if there is any cut in the wires, it's not so easy to identify for a longer connection. transfer of data is very slow in process and it takes time for performing any action.connectivity methods like Bluetooth, radio frequency and zig-bee has a bit short range for the connection to be enabled. only a single board is used in connecting all the devices which makes it slower in terms of processing the data and also only one process could run at a time.

Proposed System:

In this paper, propose a system, which is very different than the existing system. Now to implement it with the help of Wi-Fi . The main advantage of this system is that it can be implemented with a wider range. It allows communicating with a brief and small set up without wired connection. This system can be extended for a proper Surveillance of home (Humidity control, security and remote sensing) system.
The proposed system is based on the interconnection between Wi-Fi modules in which the client wifi modules will be connected to the station wifi module which will be giving commands through the smart phone which is connected to the same as an external device, will have priority in giving instructions and extracting work over them, works in master-slave principle.
There won't be any relay connections between the devices which helps in reducing the time required in data transfer and loosing of data.
There would be a continuous monitoring of data that is being transferred and also generating a log out of it.
The whole system is wireless, so there won't be any loss in data at maximum and also there won't be any problem due to wiring.

SYSTEM ARCHITECTURE

Overview :
Home Automation is needed to be without new wiring and to be very easy installation. Field of home appliance network is still young, many initiatives and standardization efforts have already been made. This new kind of system brought the android application and raspberry-pi into home automation implementation. The proposed system

architecture generally incorporates a raspberry pi computer for the purposes of network management and provision of remote access. It can be configured according to our home system.
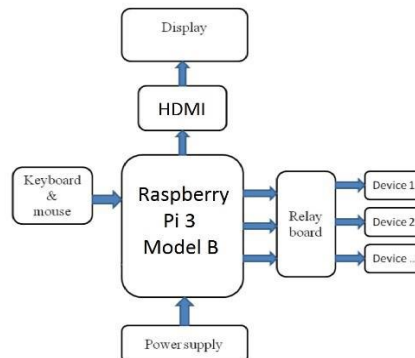
The user will communicate to raspberry-pi through the Internet via Wi-Fi network. This system is flexible and scalable, allowing additional home appliances designed by multiple vendors, to be securely and safely added to the home network with the minimum amount of efforts. The Wi-Fi network must be having adequate strength also. we can use a Wi-Fi-modem for steeping a Wi-Fi. The serial data coming from Wi-Fi is connected to the raspberry-pi circuit. The main part of the home automation system consists of raspberry-pi board. The user can have an Android interface for using the system. It can be seen as a mini computer capable of doing many functions. The raspberry-pi board is configured for each home appliances. So according to the user intervention they can control over relay circuitry by the user interface which turns the pin command corresponding to relay switches on and device start function. The system is scalable and allows multi-vendor appliances to be added with no major changes to it. This project mainly consists of three modules as follows.

1) Raspberry Pi
2) Relay Circuit
3) Wi-Fi Router Configuration
4) Keyboard & Mouse
5) Interfacing

1) 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. 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 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 :

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.

IJARCCE

International Journal of Advanced Research in Computer and Communication Engineering
ISO 3297:2007 Certified
Vol. 7, Issue 3, March 2018

2) 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
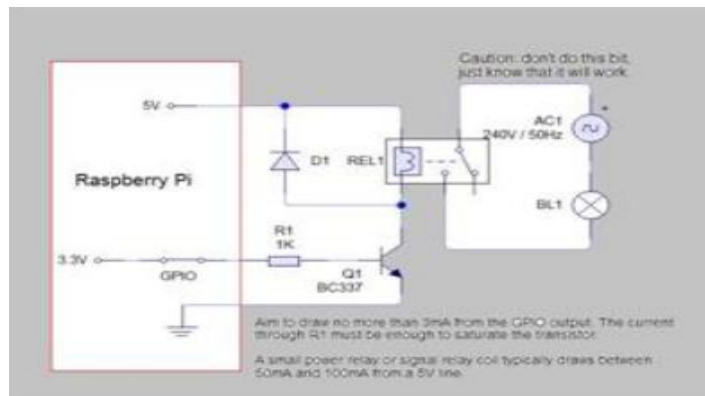
Relay connected with raspberry-pi

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.

3) Wi-Fi Router Configuration:

The Wi-Fi unit provides the medium for communication. It can be also configured to make security services. The Wi-Fi should be configured with a certain address and user commands will be directing through Wi-Fi unit. The latest Model of Raspberry Pi has inbuilt Wi-Fi connectivity.

4) Keyboard & Mouse

Keyboard and Mouse are used to operate the Raspberry Pi, just like our normal computer (PC). Keyboard & mouse are used to program and operate the raspberry Pi.

5) Interfacing:

Interfacing comprises of various steps, these steps are asFirst, write the Raspbian OS into an SD card by using ―Win32Disk Imager‖, and put it on Raspberry Pi board, and then give power to the Raspberry Pi. Connect HDMI to view the display of the Raspberry Pi operation.

Connect keyboard and mouse to the Raspberry Pi USB ports for operating the raspberry pi and to change the keyboard settings by typing ―Sudo nano /etc/default/keyboard‖ on LX-terminal from the UK' to US', then reboot it by sudo reboot‖.

Configure the Raspberry Pi by using a command raspi-config‖ according to the need of the project requirements, then reboot it. Write the code for the corresponding application in python IDLES.

Interfacing Devices:

They are small enough so that we can operate and hold in hand. They are also having their own operating systems. Example devices are: Smart phones, Laptops, Tablets and so on.

METHODOLOGY

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.
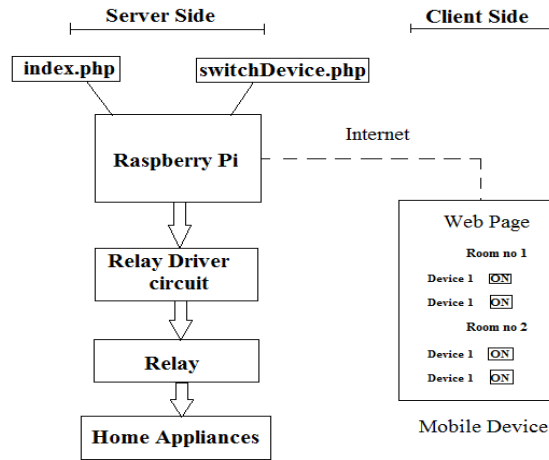

Server side is totally installed on the Raspberry pi. Server is created on the Raspberry pi with the help of LAMP (Linux, Apache, MySQL, PHP). Two PHP files are created and stored on the Server that we have created on the Raspberry pi. Raspberry pi is having 40 GPIO pins. These pins are used to control 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. 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 desktop 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.

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. Moodle framework is used to develop the web page and to create the UI present on that web page.

SIMULATION AND RESULT

TURN ON HOME APPLIANCES

DOI 10.17148/IJARCCE.2018.7333
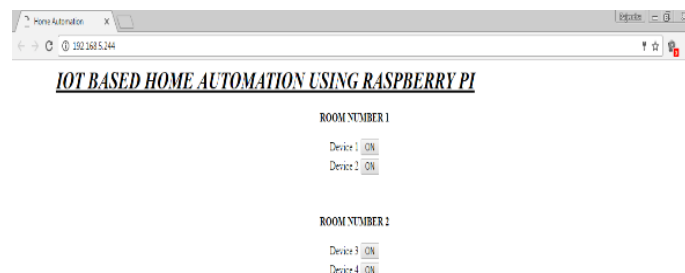
TURN OFF HOME APPLIANCES
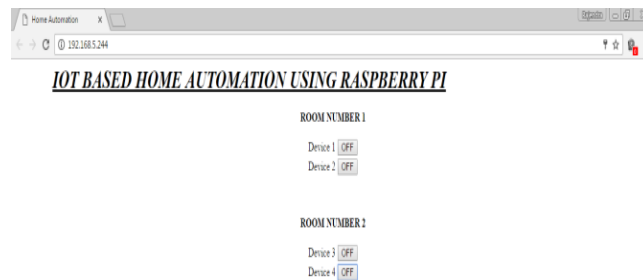
SYSTEM OPERATION

The User Interface of the application (Web or Android) allows the user to communicate with the Raspberry Pi over the internet. The end user gives the command of turning ON or OFF the specific appliance by pressing the ON/OFF button in the application. The application interacts via the internet and transmits the code to the Raspberry Pi. Raspberry reads the command and sends the signal to the respected SSR via GPIO. The respected relay operates and turns the appliance ON or OFF.

CONCLUSION

The goal of the paper was to design a home automated system using Raspberry pie. So, as to help people to easily Operate the home appliances. This project is based on the Raspberry pi, and the language used for communication of kit is python and webpage is php and html code. These platforms are Free Open Source Software. So the overall implementation cost is low and can be easily configured. now implementing smart home ideas interfacing it with the kit and making Home to perform automated Operations. Which help people to easily monitor home appliances without any learning. 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. In future implementation for wide areas (companies and flats) and easy user interface by developing a mobile application for cross platforms,improved security.

REFERENCES

[1] Ameetchauhan, Sangeetaagarwal "SMS based remote control System in International Journal of computer Science and Management, 2011.
[2] Kaur.I "Microcontroller based home automation system with Security" in International Journal of advancements in computer science and applications, pp 60-65, 2010
[3] Mahesh.N, Jivani, GSM based remote for home and office automation, September 2014.