

Raspberry Pi Based Home Automation

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Abstract— This IoT Application focuses on building a smart wireless home Automation system which controls and manages hardware devices accessed by the owner using IoT technology which includes Raspberry Pi and Android application as User Interface (UI). It allows to control number of home appliances simultaneously. User can use different mobile devices like Smartphone's and tablets to operate the home appliances. Relay modules are used for current controlling and stability. This application also consists of IR sensor to detect intruder and provide appropriate alert.

Key words: Home Automation, Internet of Things, Raspberry pi

I. INTRODUCTION

The home automation system is mainly implemented by sensors, controlling devices and actuators. The sensors detect light, motion, temperature and other sensing elements, and then send that data to the main controlling device. These sensors can be thermocouples or thermostats, photo detectors, level sensors, pressure sensors, current transformers, IR sensors, etc., which need an additional signal conditioning equipment to communicate with the main controller. Controllers may be personal computers/laptops, touch pads, smart phones, etc., attached to the controlling devices like programmable-logic controllers or microcontrollers that receive the information from the sensors, and based on the program, control the actuators like relays. The system can be modified based on the load operations. The programmable controller allows to connect various sensors and actuators through various input and output modules whether they are analog or digital. Actuators are the final controlling devices like limit switches, relays, motors and other controlling mechanisms which finally control the home equipments. Communication plays an important role in this home automation system for the remote access of these operations.[1] There are various communication protocols available for home automation systems like RF, IR, DTMF, Wi-Fi, Bluetooth, GSM, Zigbee, Ethernet, IOT and PC Serial Communication.

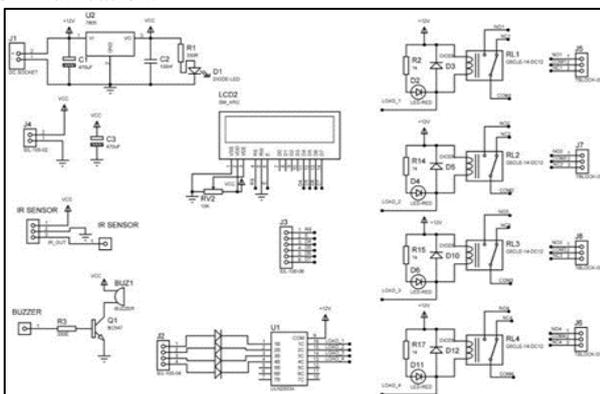


Fig. 1: Circuit Design of Home Automation using Raspberry Pi.

II. OBJECTIVE

The main objective of this project is to develop a home automation system with Android application controlled remote. As technology is advancing so houses are also getting smarter. Modern houses are gradually shifting from conventional switches to centralized control system, involving wireless controlled switches. Presently, conventional wall switches located in different parts of the house makes it difficult for the user to go near them to operate. Even more it becomes more difficult for the elderly or physically handicapped people to do so. Remote controlled home automation system provides a simpler solution with Android application technology.

Remote operation is achieved by any smartphone/Tablet etc., with Android OS, upon a GUI (Graphical User Interface) based touch screen operation. In order to achieve this, Android application act as transmitter, which sends ON/OFF commands to the receiver where loads are connected. [3]By operating the specified remote switch on the transmitter, the loads can be turned ON/OFF remotely through wireless technology. The microcontroller used here is of 8051 family. The loads are interfaced to the microcontroller using Opto-isolators and TRIAC's.

III. PROBLEM STATEMENT

The focus of our application is on helping users to operate home appliances with their own Smartphone's and to help elderly or handicapped people live a more independent life as long as possible. The objective of our system is to take care of several domestic systems that may normally be difficult for those who are handicap or elderly to take care of. The proposed idea will allow a user with any android enabled device to run a piece of downloadable software on any mobile device such as a Smartphone's. This application will allow the user to control a device that is connected to any home appliance that is Pi enabled. The focus of this application will be to direct a security system with webcam surveillance, door sensor notification and a light control system. Sensors will be connected to the home appliances with Pi so that they can be monitored and controlled. Suppose an employee who has gone to work and during this period a thief sneaks up into the housebreaking through a window. The proposed system would enable the client to monitor his home when a door or a window sensor triggers the alarm. The Client could also check the status of the outside light and turn on and off the light without the need to get out of bed. These devices would also benefit users with limited mobility that may have a difficult time getting to or even reaching their light switch. These objectives require a large amount of technology. The user interface must be as simple and powerful as possible and operate in a self-organized way.

IV. METHODOLOGY USED

For a project to be finished certain conditions had to be met such as hardware components being built and comprehensive software to control appliances being developed. [5]Original plan consisted of making a web application which would be able to control lights and any extra appliances as well as set up various tasks to automate those said appliances. Software would have to be built in Ruby and Ruby on Rails with the aim to create an easy to use API, so that anyone would be able to add new devices and functions to the platform without substantial technical knowledge. Software would have to reside as a server on Raspberry Pi, where user would be able to connect to it from anywhere as long as it is at home and online. Overall this project was about creating a cheap and easy to use system that anyone could afford and then customise to their needs.

V. REVIEW OF LITERATURE

With change in technology and the enhancement of technology and smart services, people's expectations have changed a lot during the course of time to perfectly turn the traditional house into smart home, and also think that what a home should do or how the services should be provided and accessed at home to become a smart home and so has the idea of home automation systems. As per our survey currently there exists no system at cheaper rates. Various systems are hard to install, difficult to use and maintain. Current systems are generally proprietary and closed, not very customizable by the end user.

Implementation of home automation using the latest technology gives us more convenience, security and safety. Smartphone affordability increases every year and Smartphone's have begun to play important roles in our daily lives due to their size and portability. Google's Android operating system (OS) is one of the leading and most preferred smart phones. Controlling home appliances by using an Android phone gives users the ability to control their home appliances anywhere and at any time while at home and saves time spent in searching for the remote control unit of home automation systems since the user's phone is usually kept close at hand. This project presents the design and implementation of a low cost prototype of a Bluetooth-based home automation system using an Android phone. The design uses an Arduino Mega 2560-R3 board and the home appliances are physically connected to input/output ports of this board via relays. Cytron BlueBee is used to establish wireless communication between them. Bluetooth Home, an Android application, is developed to provide a user friendly graphical user interface (GUI) for the remote control of home appliances. Automation performs an increasingly vital role in daily experience and global economy. Engineers strive to combine automated devices with mathematical and organizational tools to create complex systems for a rapidly expanding range of applications and human activities. The concept of home automation has been around since the late 1970s. But with the enhancement of technology and smart services, people's expectations have changed a lot during the course of time to perfectly turn the traditional house into smart home, and also think that what a home should do or how the services should be provided and accessed at home to

became a smart home and so has the idea of home automation systems. A home automation system means to grant the end users to manage and handle the electric appliances. If we look at different home automation systems over time, they have always tried to provide efficient, convenient, and safe ways for home inhabitants to access their homes. Regardless of the change in user's hope, growing technology, or change of time, the appearance of a home automation system has remained the same.

In Bluetooth based home automation system the home appliances are connected to the Raspberry pi board at input output ports using relay. The program of Arduino BT board is based on high level interactive C language of microcontrollers; the connection is made via Bluetooth. The Bluetooth connection is established between Arduino BT board and phone for wireless communication. In this system the python script is used and it can install on any of the Symbian OS environment, it is portable. One circuit is designed and implemented for receiving the feedback from the phone, which indicate the status of the device.

[5]The challenges faces during the making of such systems are innumerable. Home automation systems suffers from four main challenges; these are poor manageability, inflexibility, difficulty in achieving security and high cost of ownership, The main objectives of this research is to design and implement a home automation system using IoT that is capable of controlling and automating most of the house appliances through an easy manageable web interface. The proposed system has a great flexibility by using

Point	Throughput		Average	
	Distance	Wall	Bluetooth 5.0	Bluetooth 4.2
1*	3.5m	0	1549	770
2	5m	1	1215	672
3	9.2m	2	1110	650
4*	3.7m	1	1452	695
5	11.4m	3	900	629

Table 1: Range of Distance coverage

Wi-Fi technology to interconnect its distributed sensors to home automation server. This will decrease the deployment cost and will increase the ability of upgrading, and system reconfiguration

Survey of different home automation system shows that there are various kinds of technologies used to implement this type of system. All the proposed systems have been presented and compared in this paper which reveals some merits and demerits of the systems. This review explained different home automation system e.g. Web based, Bluetooth-based, mobile-based, SMS based, ZigBee based, Arduino microcontroller based, Android app based, IOT based and cloud-based. Due to its performance, simplicity, low cost and reliability home automation system is making its position in global market, that day is not so far when every home will be the smart home.

VI. COMPARATIVE ANALYSIS

From above surveyed papers, all the home control automation system uses wireless technology. Smartphone plays a very vital role in all these systems. [3]The android phone which uses the app inventor and Accessory Development Kit which can be attached to the android device for the transfer of data

between the devices and external peripherals. The spoken command is used for controlling the home appliances by Bluetooth Module BTM 222 which uses AT commands serially to communicate with the mobile and another along with ARM9 processor. [8]The gate way which also mainly provides a low cost system by eliminating the various components. The sensors which have been employed in this system can improve the automation by proving a alert signal in case of problems. Simply the microcontroller which control the home equipment through the SMS received from the user, in which the ZigBee with the Wi-Fi technology and GSM network which establish the very best performance of the home appliance control from the remote areas.

[2]There are many methods by which we can implement home automation system .Some of the method are listed below:

VII. FUTURE-SCOPE

With introduction of Internet-of-things, majority of consumers are focusing on equipping their homes with smart technologies, to be tech-savvy or tech-enabled, particularly in the developed countries. The Global market for home

- Home Appliance Control using A Remote Control.
 - Home Appliance Control using DTMF.
 - Home Appliance Control using Free Hand Gesture.
 - Home Appliance Control using Internet and ratio
- automation has been segmented on the basis of application into entertainment in the form of home video and audio, HVAC or heating, ventilation, and air-conditioning, security and safety, lighting, robotics, and healthcare, among other.

From personal perspective the security of the house is most important we can securely switch the security of the system.

VIII. CHALLENGES

[9]Liability-The connected electronic device should perform the action as it has to be and the mobile connected application should be properly configured. Many vendor access different API in order to provide dynamic GUI; hence app compatibility is highly recommended and should be liable enough to fill customer need.

Reliability- The device connected in the automation should be in proper working condition, if not the third party i.e. the vendor company have to bear with the situation. Therefore regular maintenance is recommended for consistent performance.

Security-One of the most concerned parameter is security. One couldn't simply deploy smart home automation system without following security parameters and concern. The consumer should be responsible to opt. for appropriate vendor who has complete security measure.

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