A

Project Report

on

"HOME AUTOMATION USING RASPBERRY PI 3"

Submitted in partial fulfilment of the requirements

of the degree of

Bachelor of Engineering in Electrical Engineering

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DECLARATION

I declare that this written submission represents my ideas in my own words and where others ideas or words have been included, I have adequately cited and referenced the original sources. I also declared that I have adhered to all principles of academic honesty and integrity and have not represented or fabricated or falsified any idea/data/fact/source in my submission. I understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission have not been taken when needed.

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Date-

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ABSTRACT

The main aim of the project is to control home applications remotely by using Android-OS-based smart phone. This is an advanced technology in the home automation. Usually conventional wall switches are located in different corners of a house and, thus necessitate the need of manual operations like pressing to turn the loads on or off. It becomes very difficult for the elderly or physically handicapped people to operate them. Thus, the proposed system is enhanced to control home applications through an Android-based application of smart phones or tablets that offers the provision for entering the selected numbers for operating the corresponding load. This proposed system works with a circuit called Raspberry pi 3 and a rectified power supply. A WiFi connection is used for communication. Once an owner connects an Android application device to this system through a WiFi, then the owner can send the control signals through the WiFi. The owner can also enter the selected option on the Android application through the GUI for corresponding loads, and the data is sent to the raspberry pi. The received data is compared with the stored data in the raspberry pi and, if it matches, then the raspberry pi performs the corresponding operation for controlling loads.

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Introduction

1.1 Overview

Home Automation is a term used to describe the working together of all household amenities and appliances. For example, a centrally-controlled LCD panel can have the capability to control everything from heating, air conditioning, security systems, audio systems, video systems, lighting, kitchen appliances, and home theatre installations. Internet or IP protocol-based communication in home automation systems is always a popular choice among researchers. The Internet is easily scalable, flexible when it comes to access and use, and very popular as a communication method in today's world, so the hardware and the network required for access is readily available,offers high bandwidth and very low communication cost, and devices can connect to and disconnect from the network easily.

These are some of the features that make the Internet such an attractive choice for researchers. Utilizing the Internet as a means to access and control the home seems to be the next logical step forward for home automation systems.From an end user's point of view, using Internet to access their home is easy, convenient, cheap, flexible, and offers no complication of an added technology to learn. User interface devices like laptops, smartphones, PCs, and tablets are easily available in the market, and these devices are already a part of people's daily lives. So, incorporating home automation into these already-popular user devices seems to be the natural progression.

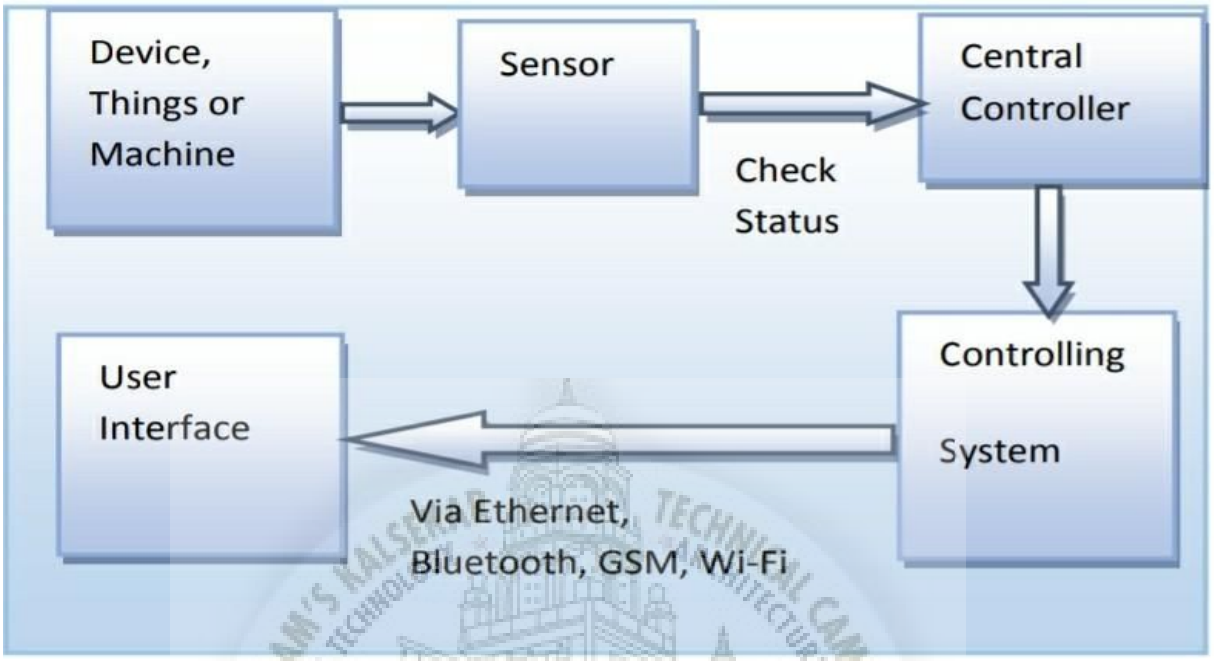


Fig. 1.a Basic Block Diagram of Home Automation

1.2 Importance

The household activities are automated by the development of special appliances such as water heaters to reduce the time taken to boil water for bathing and automatic washing machines to reduce manual labor of washing clothes. In developed countries, homes are wired for electrical power, doorbell, TV outlets, and telephones. The different application includes when a person enters the room, the light turns on. In advanced technology, the room can sense the presence of the person and who the person is. Taking into account the day of the week, time of the day and other such factors it can also set apt lighting, temperature levels, television channels or music levels.

In the case of a smoke detector when fire or smoke is detected, the lights in the entire house begin to blink to alert the resident to the probable fire. In case of a home theatre, the home

automation system can avoid distraction and lock the audio and video components and can also make an announcement. The home automation system can also dial up the house owner on their mobile phone to alert them or call any alarm monitoring company. Home automated systems can be cost effective because there are a wide range of price levels and it does not just have to be aspect of a high community lifestyle. Home automation is being implemented into more and more homes of older adults and people with disabilities in order to maintain their independence and safety. These smart homes allow older adults and people with disabilities to stay in their homes where they feel comfortable, instead of moving to a costly health care facility. The transition to a health care facility can cause a lot of anxiety and home automation can either prevent or delay this anxiety.[2] For the disabled smart homes give them opportunity for independence, which will help them gain confidence and determination. Smart homes can provide both older adults and people with disabilities with many different types of emergency assistance systems, security features, fall prevention, automated timers, and alerts. These systems allow for the individual to feel secure in their homes knowing that help is only minutes away. Smart home systems will make it possible for family members to monitor their loved ones from anywhere with an internet connection.

Some of the biggest benefits that home automation provides are:

- Savings: Smart thermostats and smart light bulbs save energy, cutting utility costs over time. Some home automation technologies monitor water usage, too, helping to prevent exorbitant water bills. Certain devices even offer rebates.
- Safety: Many home automation technologies fall under the umbrella of home security. Consumers purchase these devices because they want to make their homes safer and more secure. Automated lighting thwarts would-be burglars, and motion sensors help people enter doors and walk hallways late at night. (Security cameras offer benefits through either remote monitoring of package deliveries or real-time video of home inhabitants or unwanted visitors.)
- Convenience: Because home automation technology performs rote tasks automatically, end users experience great convenience. Lots of smart gadgets are compatible with one another, and you can set different triggers between devices to

automate regular home processes. For instance, you could set your smart locks to turn on your smart lighting when you unlock the front door.

- Control: Consumers also choose smart home devices to better control functions within the home. With home automation technology, you can know what's happening inside your home at all times.
- Comfort: Some people use smart technology to record shows or to play music throughout the home. Connected devices can also help create a comfortable atmosphere they provide intelligent and adaptive lighting, sound, and temperature, which can all help create an inviting environment.
- Peace of Mind: Finally, many consumers invest in home automation technology for peace of mind. A new mom or dad can check on their little one thanks to smart cameras and other technologies. Or, if you can't remember whether you closed the garage after you left, you can verify remotely with an app.

1.3 Features

Computers, wireless transmitters, cell phones, and touch screens controls different features of home automation such as:

1. Security – With home automation, the lights of the car are turned on in order to help you to walk in the dark. In case the alarm goes off, the authorities can be alerted and a message can be sent to your cell phone by the system.
2. Thermostat – This is programmed to run the central heating and cooling system as per our own required settings. For example, air conditioner is set to an energy saving setting when the house is vacant and sets back to the normal setting when the resident is about to return home.
3. Drapes – With the help of the home automation system, the drapes of the room can be opened and closed during the night time.
4. Lighting – This can be set as per our own required settings for dim and bright light.
5. Audio/Video – The home automation system can turn on the stereo and play music or can also turn on the television to any channel.
6. Lawn sprinklers – The sprinkler system can be activated as per the schedule settings.

7. Vacuuming – Robotic vacuum cleaners automatically glides over the carpet to help you keep the house neat and tidy.

In the present time, the technologically advanced world is getting more and more advance as new technology is penetrating deeper into our personal lives even in our homes as well. Home automation system is becoming very popular around the world. Home automation is used to control and monitor electronic security systems, lighting, climate, appliances, audio or video equipment, etc. Home automation is the residential extension of a building automation, and it is an automation of the home, housework or household activity. The benefits of automation are that it is secure and saves money, time, maintenance costs, and makes life easier.

Home automation systems are categorized into the following three types depending upon the type of wired or wireless controllers:

- Power Line Based Home Automation
- Wired or Bus Cable Home Automation
- Wireless Home Automation
- Generally in today's modern world human beings are addicted to using modern equipment. The intention of this project is to make an android OS based smartphone or tablet workable for controlling each and every appliance of industries or household. There are several Android applications available in the market to turn our Android-based smart phone or tablet into a remote control for our home.

Chapter 2

Literature Survey

Early home automation began with labor-saving machines. Self-contained electric or gas powered home appliances became viable in the 1900s with the introduction of electric power distribution[6] and led to the introduction of washing machines (1904), water heaters (1889), refrigerators, sewing machines, dishwashers, and clothes dryers.

In 1975, the first general purpose home automation network technology, X10, was developed. It is a communication protocol for electronic devices. It primarily uses electric power transmission wiring for signalling and control, where the signals involve brief radio frequency bursts of digital data, and remains the most widely available. By 1978, X10 products included a 16 channel command console, a lamp module, and an appliance module. Soon after came the wall switch module and the first X10 timer.

The current major initiatives in Japan, the US and Europe to develop more comprehensive systems originated in the 1980s.The earliest home control systems were proposed by Hitachi and Matsushita in 1978. From the early 1980s, many Japanese firms published their own home automation blueprints, developed demonstration houses and launched proprietary systems. These Included major electrical appliance manufacturers such as Matsushita, Toshiba, Mitsubishi,Sanyo, Sony, and Sharp. Some interphone companies first added security functions to their systems. Secom, a security services firm, expanded upon its original security system to develop a central control station for remote control of home security.

In US, 1982, AT&T established the concept of "Intelligent Building". The Informant Building an office building and conference center in Dallas which promoted a good sense of community among tenants and customers, was erected to demonstrate how advanced IT from different suppliers could be used in the intelligent building.

The Smart House Project was established in 1984 as project of the National Research Center of the National Association of Home Builders (NAHB), USA, with thecooperation of a number of major industrial partners. NAHB formed the SMART HOUSE Limited Partnership (L.P.). It sought the participation of several manufactures for every major type of hardware that would be needed for Smart House systems. By 1987 more than forty leading manufacturers had joined the project. Some of them signed formal contracts called "Research and Licensing Agreements", to develop products.

Different systems developed for Home Automation are as follows:

I. Bluetooth based home automation system using cell phones.
II. Zigbee based home automation system using cell phones.
III. GSM based home automation system using cell phones.
IV. Wi-Fi based home automation system using cell phones.
V. Home automation using RF module.
VI. Home automation using Android ADK.
VII. Cloud Based home automation system.
VIII. Raspberry pi home automation with wireless sensors using smart phone.
IX. Wireless Home Automation system using IoT.

Chapter 3

Setup Accessories

3.1 Hardware Parts

- The fastest and smartest Raspberry Pi board (Raspberry Pi3)
- An SD card 16GB
- A Relay channel module (4-channel)
- Some Electronic devices
- jumper wires
- Power supply
- An HDMI monitor (optional)
- keyboard and mouse (optional)

3.2 Software Parts

- Raspberry Pi Operating System (Raspbian)
- Language like Python/PHP/HTML/CSS
- Software tools like MyPi, VNC

3.3 Hardware Specification

- The raspberry pi board comprises a program memory (RAM), processor and graphics chip, CPU, GPU, Ethernet port, GPIO pins, Xbee socket, UART, power source connector. And various interfaces for other external devices.

- It also requires mass storage, for that we use an SD flash memory card. So that raspberry pi board will boot from this SD card similarly as a PC boots up into windows from its hard disk.

- Essential hardware specifications of raspberry pi board mainly include SD card containing Linux OS, US keyboard, monitor, power supply and video cable.

- Optional hardware specifications include USB mouse, powered USB hub, case, internet connection, the Model A or B: USB WiFi adaptor is used and internet connection to Model B is LAN cable.

Memory

The raspberry pi model B board is designed with 1GB of SDRAM. Raspberry pi is a small size PC compare with other PCs. The normal PCs RAM memory is available in gigabytes. But in raspberry also RAM memory is available upto 1GB.

CPU (Central Processing Unit)

The Central processing unit is the brain of the raspberry pi board and that is responsible for carrying out the instructions of the computer through logical and mathematical operations. The raspberry pi uses 1.2GHz Broadcom BCM2837 64bit ARMv7 Quad Core Processor, which has joined the ranks of the Samsung galaxy phone.

GPU (Graphics Processing Unit)

The GPU is a specialized chip in the raspberry pi board and that is designed to speed up the operation of image calculations. This board designed with a Broadcom video core IV and it supports OpenGL

Ethernet Port

The Ethernet port of the raspberry pi is the main gateway for communicating with additional devices. The raspberry pi Ethernet port is used to plug your home router to access the internet.

GPIO Pins

The general purpose input & output pins are used in the raspberry pi to associate with the other electronic boards. These pins can accept input & output commands based on programming raspberry pi. The raspberry pi affords digital GPIO pins. These pins are used to connect other electronic components. For example, you can connect it to the temperature sensor to transmit digital data.

Other Ports

It comes with 4 USB ports. This USB ports are used to connect various external devices like Keyboard, Mouse, Flash Drives, etc. It also consist of one Full size HDMI port to connect other displays. Also there is a CSI camera port for connection of camera. There is also a DSI display port for touch screen display connection. A microSD port is also provided for loading the Operating System.

Other Connectivities

Raspberry Pi also comes with some other connectivities like Bluetooth and WiFi. The WiFi chipset used here is BCM43143 which is on board chip. The Bluetooth used here is Low Energy on board Bluetooth.

3.4 Major components of project

Raspberry pi

The Raspberry Pi is a series of small single-board computers developed in the United Kingdom by the Raspberry Pi Foundation to promote the teaching of basic computer science in schools and in developing countries.

Processor speed ranges from 700 MHz to 1.4 GHz for the Pi 3 Model B+; on-board memory ranges from 256 MB to 1 GB RAM. Secure Digital (SD) cards are used to store the operating system and program memory in either SDHC or MicroSDHC sizes.

The boards have one to four USB ports. For video output, HDMI and composite video are supported, with a standard 3.5 mm phono jack for audio output. Lower-level output is provided by a number of GPIO pins which support common protocols like I²C. The B-models have an 8P8C Ethernet port and the Pi 3 and Pi Zero W have on-board Wi-Fi 802.11n and Bluetooth.

There are a number of developers and applications that are leveraging the Raspberry Pi for home automation. These programmers are making an effort to modify the Raspberry Pi into a

cost-affordable solution in energy monitoring and power consumption. Because of the relatively low cost of the Raspberry Pi, this has become a popular and economical solution to the more expensive commercial alternatives. Raspberry Pi is no longer limited to home and science projects, but can be widely used as an Industrial IoT solution and achieve goals of industry.

Wifi router

Nowadays most of the things are getting wireless like smartphones, laptops, tv, etc. So everyone is using wifi router in their home for internet. The wifi router provides fastest internet service depending on the speed of your internet. It comes in different frequencies like 2.4GHz, 5GHz etc. Depending on this frequency, the wifi coverage is based. Normal range of the wifi routers is 150 mtr or 300 mtr. This distance in enough to use internet in every corner of the home. That's why the wifi routers are chosen for home automation.

Electric devices

The electric devices are used to lighten the house. Tube Lights, bulbs, are used for lighting purpose. In today's time, advanced lighting in invented. That is brighter light with low electricity consumption. The LED tubes or LED bulbs are used nowadays. They are electricity saving and cost saving also. In general we use fans, tubes, air conditioner, fridge in our home.

Relay board

- A relay is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch.
- Relays are used where it is necessary to control a circuit by a separate low-power signal, or where several circuits must be controlled by one signal.

- SPDT (Single-Pole Double-Throw) relays have a single set of Form C, break before make or transfer contacts. That is, a common terminal connects to either of two others, never connecting to both at the same time.
- Relays are used wherever it is necessary to control a high power or high voltage circuit with a low power circuit, especially when galvanic isolation is desirable.
- High-voltage or high-current devices can be controlled with small, low voltage wiring and pilots switches.
- Operators can be isolated from the high voltage circuit. Low power devices such as microprocessors can drive relays to control electrical loads beyond their direct drive capability.
- In an automobile, a starter relay allows the high current of the cranking motor to be controlled with small wiring and contacts in the ignition key.

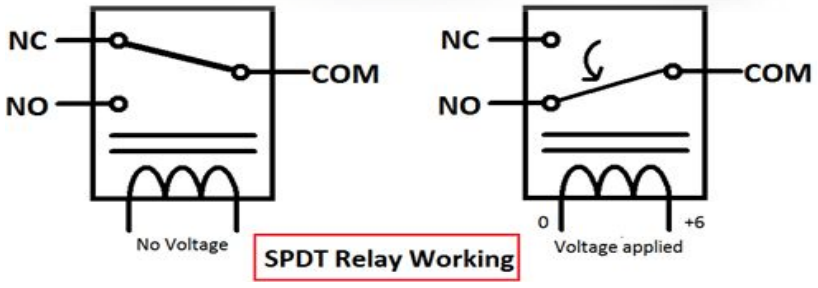


Fig. 3.4.a

Smartphone

Smartphone is the need of human being. Every single thing can be done on the smartphone. The user interface of the smartphones is so simple that even old aged people can easily use it. This smartphones are the future of the automation. Even payments are done on smartphones using NFC or other payment methods like samsung pay or apple pay.The average smartphone is not really a phone at all. It is a hand-held computer capable of making phone calls. But as a computer, it is capable of doing just about anything you can do with a laptop or desktop. As long as you have enough space, memory and the right apps, the capabilities of the average smartphone are nearly limitless. This is why it is a perfect tool to pair with smart home technologies.

Chapter 4

Raspberry Pi 3

Fig. 4.a Raspberry Pi Circuit

4.1 Description

- The Raspberry Pi 3 Model B is the third generation Raspberry Pi. This powerful credit-card sized single board computer can be used for many applications and supersedes the original Raspberry Pi Model B+ and Raspberry Pi 2 Model B.
- Whilst maintaining the popular board format the Raspberry Pi 3 Model B brings you a more powerful processor, 10x faster than the first generation Raspberry Pi.
- Additionally it adds wireless LAN & Bluetooth connectivity making it the ideal solution for powerful connected designs.

4.2 Pin Diagram

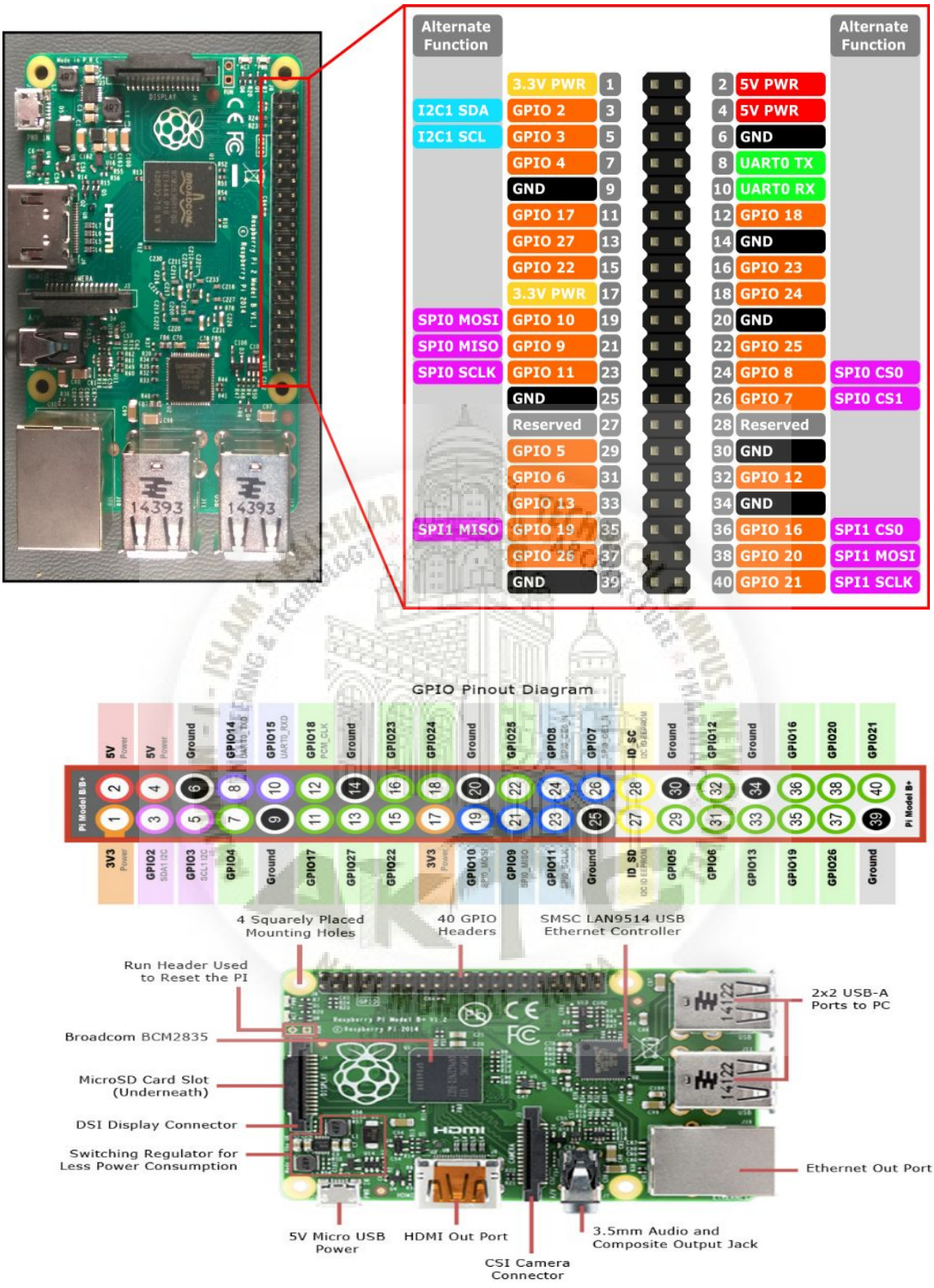


Fig. 4.2.a Pin diagram

4.3 Pin Description

■ **Power Pins -** The **power pins** pull power directly from the Raspberry Pi. There are 4 power pin available. Two of them are of 3.3 volts and other two are of 5 volts power.

■ **GPIO** – These are your standard pins that simply be used to turn devices on and off. For example, a LED. There are total 24 GPIO pins available to use.

■ **I2C** (Inter-Integrated Circuit) - These pins allow you to connect and talk to hardware modules that support this protocol (I2C Protocol). This will typically take up 2 pins.

■ **SPI** (Serial Peripheral Interface Bus) - These pins can be used to connect and talk to SPI devices. Pretty much the same as I2C but makes use of a different protocol.

■ **UART** (Universal Asynchronous Receiver/Transmitter) - These are the serial pins used to communicate with other devices.

■ **DNC** – This stands for do not connect, this is pretty self-explanatory.

■ **GND -** These are the pins you use to ground your devices. It doesn't matter which pin you use as they are all connected to the same line. There are 8 pins available to ground.

4.4 Relay Driver

A relay is an electrically operated switch. Many relays use an electromagnet to operate a switching mechanism mechanically, but other operating principles are also used. Relays are used where it is necessary to control a circuit by a low-power signal (with complete electrical isolation between control and controlled circuits), or where several circuits must be controlled by one signal.

Fig. 4.4.a Relays

A relay is an electrically operated switch. Current flowing through the coil of the relay creates a magnetic field which attracts a lever and changes the switch contacts. The coil current can be on or off so relays have two switch positions and most have double throw (changeover) switch contacts as shown in the diagram.

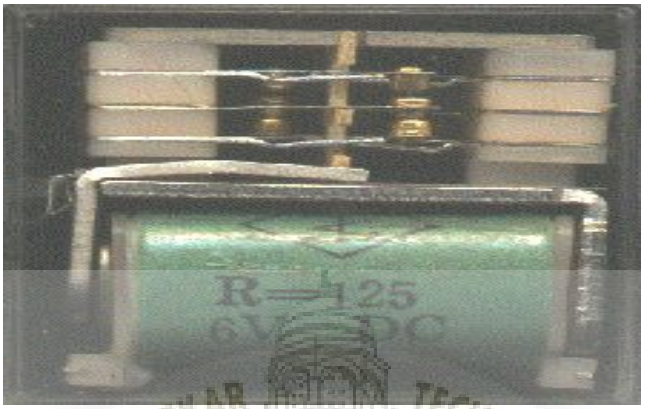


Fig:4.4.b Relay showing coil and switch contacts

Relays allow one circuit to switch a second circuit which can be completely separate from the first. For example a low voltage battery circuit can use a relay to switch a 230V AC mains circuit. There is no electrical connection inside the relay between the two circuits; the link is magnetic and mechanical. The coil of a relay passes a relatively large current, typically 30mA for a 12V relay, but it can be as much as 100mA for relays designed to operate from lower voltages. Most ICs (chips) cannot provide this current and a transistor is usually used to amplify the small IC current to the larger value required for the relay coil. The maximum output current for the popular 555 timer IC is 200mA so these devices can supply relay coils directly without amplification.

Relays are usually SPDT or DPDT but they can have many more sets of switch contacts, for example relays with 4 sets of changeover contacts are readily available. For further information about switch contacts and the terms used to describe them please see the page on switches. Most relays are designed for PCB mounting but you can solder wires directly to the pins providing you take care to avoid melting the plastic case of the relay.

The supplier's catalogue should show you the relay's connections. The coil will be obvious and it may be connected either way round. Relay coils produce brief high voltage 'spikes'

when they are switched off and this can destroy transistors and ICs in the circuit. To prevent damage you must connect a protection diode across the relay coil.

The figure shows a relay with its coil and switch contacts. You can see a lever on the left being attracted by magnetism when the coil is switched on. This lever moves the switch contacts.

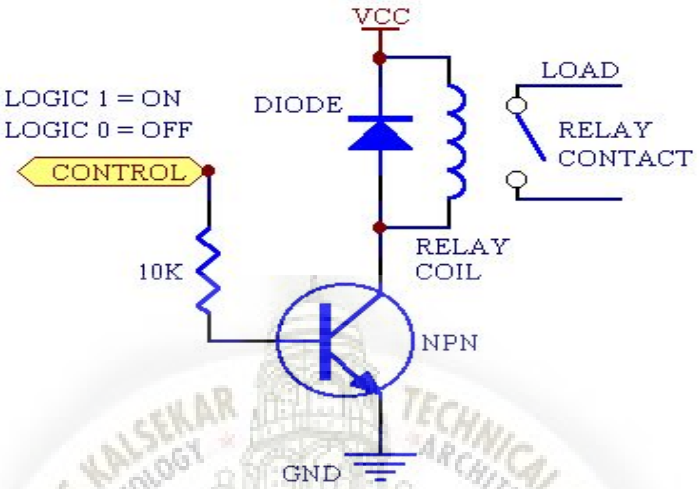


Fig:4.4.c Relay Circuit

There is one set of contacts (SPDT) in the foreground and another behind them, making the relay DPDT.

The relay switch connections are usually labelled COM, NC and NO:

COM = Common, always connect to this; it is the moving part of the switch.

NC = Normally Closed, COM is connected to this when the relay coil is off.

NO = Normally Open, COM is connected to this when the relay coil is on.

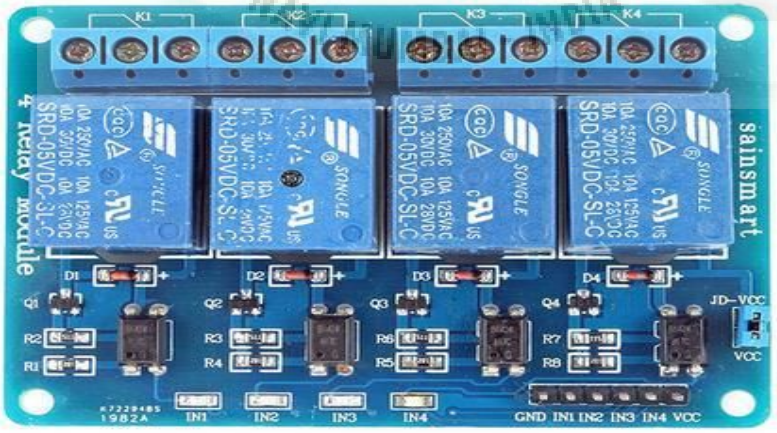


Fig. 4.4.d 4 Channel Relay Board

3.4.1 Applications of Relays

Relays are used to and for:

1. Control a high-voltage circuit with a low-voltage signal, as in some types of modems or audio amplifiers.
2. Control a high-current circuit with a low-current signal, as in the starter solenoid of an automobile.
3. Detect and isolate faults on transmission and distribution lines by opening and closing circuit breakers.
4. Time delay functions. Relays can be modified to delay opening or delay closing a set of contacts. A very short (a fraction of a second) delay would use a copper disk between the armature and moving blade assembly. Current flowing in the disk maintains magnetic field for a short time, lengthening release time. For a slightly longer (up to a minute) delay, a dashpot is used. A dashpot is a piston filled with fluid that is allowed to escape slowly. The time period can be varied by increasing or decreasing the flow rate. For longer time periods, a mechanical clockwork timer is installed.

Chapter 5

Installation Procedure

5.1 Connections

- We have to connect the Raspberry Pi and other devices with the relay module. We took 4-channel relay board for this project.
- Depending on the equipment you want to operate with the Pi, take the number of jumper wires.
- Connect the Raspberry Pi 3 with the relay using positive and negative cables.
- Cut the flex cable of the lamp. The Red is for the live connection, and Yellow is for neutral.
- Wring the ends of the wires, make proper insulation and connect the Yelow ends of the wire with each other.
- Now, connect the Red wire with the relay and tight it with the help of screws.

5.2 Os Installation

- Install the Operating System on the Raspberry Pi and also install Python language. We have two options to choose from; either the keyboard & mouse or the ssh tools like PuTTY & NMAP to connect with your Pi device.
- Download the Raspbian jessie from raspberry fourm and flash it on memory card using etcher software.

5.3 Software Installation

5.3.1 Python

- To work on this project on raspberry pi we need to install the python packages on raspberry pi
- A Python program will receive the On/Off messages and switch the Raspberry Pi GPIO on/off, which switches the relay on/off.
- To install python type following commands in terminal window

  sudo apt-get install python3

- To check Python is working or not write the program lines as shown below:

```
import RPi.GPIO as GPIO
GPIO.setmode(GPIO.BCM)
GPIO.setup(4, GPIO.OUT)
GPIO.output(4, 0)
```

- It will send the signal from pin no 4 on raspberry pi to the relay board. If it toggles the relay and turn on or off the device, the python packages are installed successfully.

5.4 Server installation

- You will install a web server on your Raspberry Pi that will run a Javascript application to send On/Off messages to a message broker (MQTT).
- Apache server -
- Apache is a popular web server application you can install on the Raspberry Pi to allow it to serve web pages.
- sudo apt-get install apache2 -y

5.4.1 Webiopi server

- WebIOPi is a web application which allows you to control your Raspberry Pi's GPIO. Just install it on your Pi, and use any browser from your network.

- It also allows to control your Pi's GPIO over Internet, so it's a good starting point for home remote control.
- Install WebIOPi for the Raspberry Pi 3
- Boot the Raspberry Pi 3 and make sure that it has a running internet connection.Then, enter in the terminal

  sudo wget http://sourceforge.net/projects/webiopi/files/WebIOPi-0.7.1.tar.gz

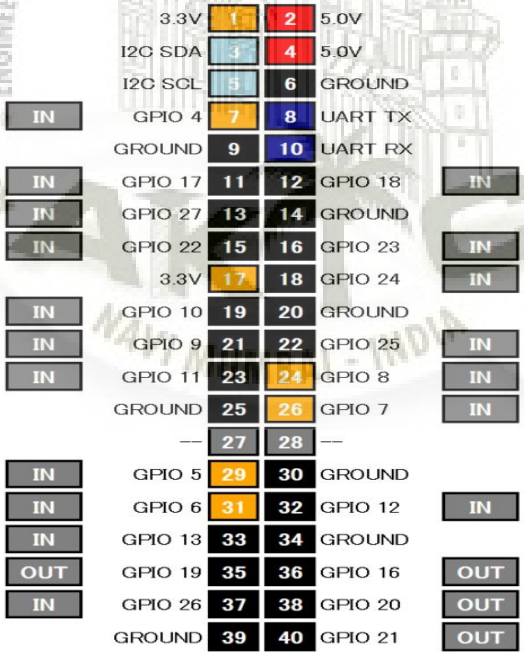
  sudo tar xvzf WebIOPi-0.7.1.tar.gz

  cd WebIOPi-0.7.1

sudo wget https://raw.githubusercontent.com/doublebind/raspi/master/webiopi-pi2bplus.patch

sudo patch -p1 -i webiopi-pi2bplus.patch

sudo ./setup.sh



5.4.2 MyPi server

- It is the same server like Webiopi. But the MyPi server comes with a smartphone application which allows you to controle home appliances over your smartphone.

➔ To install it,

Open Termial or connect to your Raspberry Pi by ssh.

Change the current directory to /home/pi by typing:

cd /home/pi

➔ Download MyPi TCP Server by typing:

wget www.ioslinks.com/mypi/server.zip

➔ Unzip the package by typing:

unzip server.zip

➔ Start MyPi Server by typing:

python3 mypi_server.pyc

➔ Launch MyPi iOS App and click the gear icon.

Replace IP with your Raspberry Pi IP Address.

➔ Click Save and from the main screen click Connect.

Tap any button to chage GPIO status.

- Every Time when the Raspberry pi starts, we manually need to start the MyPi server. So to avoid this problem we will need to start the MyPi server on boot of Raspberry Pi

➔ Stop MyPi Server by pressing CTRL C twice.

➔ Edit rc.local file by typing:

sudo nano /etc/rc.local

➔ Scroll down and type the following command BEFORE the exit 0 line:

python3 /home/pi/mypi_server.pyc &

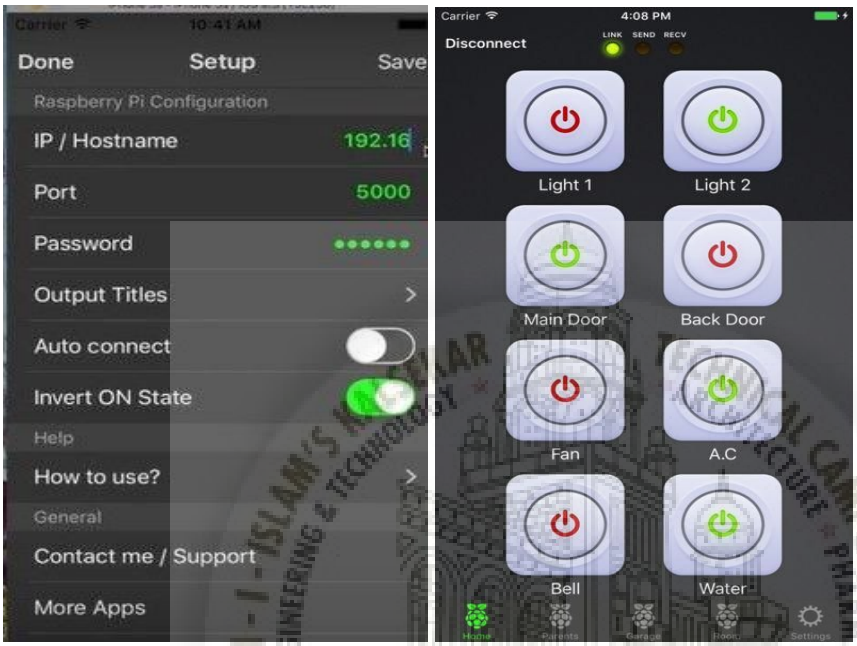
➔ Save changes by pressing CTRL O and ENTER.

➔ Quit by pressing CTRL X.

➔ Reboot your Raspberry Pi by typing:

sudo reboot

- Now Whenever the Raspberry Pi will reboot, the MyPi server start.



5.4.2.1 MyPi Default Configuration

TCP Port : 5000

Connection Password : 123456

Initial output level : 1

Output pins : 7,11,13,15,16,18,19,21

Input pins : 29,31,32,33,36,37,23,24

Output modes : T = Toggle , M = Momentary.

Delay : 1.0 (in seconds, applies only when output mode is momentary).

Chapter 6

Working

The connection of the Raspberry pi is shown below:.

- The Raspberry pi is loaded with an os called Raspbian in micro sd card. The server and languages are installed as mentioned before.
- The language used for programming is python language.

- Python language is simple and easy to understand.
- As it shows the Positive and negative connection is done with the relay using jumper wires with Raspberry pi. Also Gpio pins are connected to the 4-channel using jumper wires.
- The Raspberry pi is powered with a 5 volt charger which is easily available.

The Raspberry pi is booted and connected to wifi router to control the home equipments. The ip addresses used over the wifi are always dynamic which changes randomly. To make it static, on the router setup page the raspberry pi is set on permanent ip address so that whenever it restarts the ip address should remain the same. The servers are setup such that whenever raspberry pi restarts, the servers runs automatically at the boot.

The smartphones are always connected to the home router when we are at home. So the raspberry pi and smartphone are connected to the same wifi network.

The software named MyPi is installed on the smartphones. This application is user friendly. MyPi interacts with the raspberry pi through the router. There are several buttons on the MyPi software. When these buttons are toggled, it sends the signal to the raspberry pi through the router. This buttons are linked to the specific python scripts on the raspberry py. On button click, the signal is send to the Raspberry pi which runs the specific script of specific gpio. Then the gpio produces a switching signal which turns on or off the relay. The relay works as a switch. The electrical equipments used in home are connected to the relay. Whenever the relay gets signal from raspberry pi, it toggles and turns on or off the specific electrical equipment.

Rebuilding consumer expectations, home automation has been projected to target wide array applications for the new digital consumer. Some of the areas where consumers can expect to see home automation led IoT-enabled connectivity are:

- Lighting control
- HVAC
- Lawn/Gardening management
- Smart Home Appliances
- Improved Home safety and security

- Home air quality and water quality monitoring
- Natural Language-based voice assistants
- Better Infotainment delivery
- AI-driven digital experiences
- Smart Switches
- Smart Locks
- Smart Energy Meters

With so many devices connected through the same network, issues can and will happen. Some of the most common problems faced in home automation are:

- **System Integration:** Most people tend to run into trouble with their equipment half of the time. Mixing and matching older products with newer ones are sure to cause a headache. Reason being is that the newer versions of the equipment have updated inputs and outputs such as HDMI or Optical Digital. For Example: If you have a newer model receiver with optical digital capabilities, but your television is an older model; that television may not have an input to connect with the (OD) cable. Another common issue is trying to connect different brands to each other. Having a Vizio Television, Sony Blu-Ray, and a Samsung Receiver will not be compatible. Always try to run the same brand across the board to avoid problems.
- **Wiring:** With so many connected devices looped together, it's very easy for things to come unplugged. Wired connections are infamous of this and no matter how well connected those red, white, and yellow cables seem to be, they always find a way to slip out. Wiring issues can also come from too much current during a power surge so it's best to invest in a surge protector. Too much current should also flip the home's circuit breakers off or blow a fuse. If problems persist after confirming you have not blown a fuse, be sure to contact a certified electrician for help.
- **Overheating:** All devices have vents and those vents must be clean or the unit will overheat and blow a fuse. Dust is a major culprit and if you're using an entertainment center with tight shelves, the equipment can't breathe. Never cram many devices together or stack books and papers against these electronics. Increasing the ventilation

around the device will not only help avoid blown components, but it will also extend the life of the device by decreasing stress.

- **Physical Damage:** Accidentally dropping or mishandling things is a sure way to damage it. Never leave any liquids near your electronics and if certain devices aren't working, do not get angry and be patient. It sounds trivial, but most physical damage is caused by the actual owner and most warranties won't cover the equipment if physical damage is present.

Chapter 7

Conclusion

We as a group had begun working for more than a year ago and now we come to the completion of our project. It has been a very fulfilling experience for all of us. We have got a thorough learning experience and we shall cherish it for long. Despite being challenging and different from other assignments, it is a path where we have learnt a lot about hardware, software, troubleshooting and other aspects of engineering. It was a chance given to us that we go deep into applying what we had learnt in earlier years of our studies and we grabbed it with both hands.

For simplicity we divided the project work into smaller parts and alternately took leads in performing those parts following the principle of the best man for the job. Since we were new to this, at initial stages most of our decisions were not apt for the required situations. At such times our professors and other knowledgeable friends came to our help. From finding the project idea to publishing this report, learning has been a continuous process. There have been times where we have taken inappropriate decisions but have then learnt how to overcome them and not to commit those errors in future tasks.

The project has helped us study the practical use of microcontroller. We have learnt that what are the various stages one needs to follow when pursuing a project and how efforts as a team can be put towards finding solution to problems arising in the process.

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