

IOT BASED HOME AUTOMATION USING RASPBERRY PI

Project report submitted in partial fulfillment of the requirement for the
degree of Bachelor of Technology

in

Computer Science and Engineering/Information Technology

By

Siddharth Malik(151300)

Deepam Chaurishi (151259)

Under the supervision

of

Dr. Ekta Gandotra

to



Department of Computer Science and Engineering

**Jaypee University of Information Technology Waknaghat, Solan-
173215, Himachal Pradesh**

Candidate's Declaration

I hereby declare that the work presented in this report entitled “**IOT BASED HOME AUTOMATION USING RASPBERRY PI**” in partial fulfillment of the requirements for the award of the degree of **Bachelor of Technology in Computer Science and Engineering** submitted in the department of Computer Science & Engineering and Information Technology, Jaypee University of Information Technology, Waknaghat is an authentic record of my own work carried out over a period from August 2018 to May 2019 under the supervision of **Dr. Ekta Gandotra** (Assistant Professor Sr. Grade, Department of CSE and IT).

The context in the report is not submitted for the award of any other degree or diploma.

Siddharth Malik (151300)

Deepam Chaurishi (151259)

This is to certify that the above statement made by the candidates is true to the best of my knowledge.

Dr. Ekta Gandotra

Assistant Professor Sr. Grade

Department of CSE and IT

Dated: 10 May, 2019

Acknowledgement

It is our privilege to express our sincerest regards to our project supervisor **Dr. Ekta Gandotra** for their valuable inputs, able guidance, encouragement, whole-hearted cooperation and direction throughout the duration of our project.

We deeply express our sincere thanks to our Head of Department **Prof. Dr. Satya Prakash Ghre** for encouraging and allowing us to present the project on the topic “IOT BASED HOME AUTOMATION USING RASPBERRY PI” at our department premises for the award of our B. Tech degree.

I would also like to express my sincere thanks to all my friends and others who have helped me directly or indirectly during the project work.

Date: 10-5-2019

Siddharth Malik(151300)

Deepam Chaurishi(151259)

TABLE OF CONTENTS

CONTENTS	PAGE NUMBER
LIST OF FIGURES-----	vi - vii
LIST OF ACRONYMS AND ABBREVIATIONS-----	viii
ABSTRACT-----	ix
CHAPTER-1 INTRODUCTION-----	1 - 5
1.1 INTRODUCTION-----	1
1.2 BACKGROUND-----	2
1.3 HOME AUTOMATION-----	3
1.4 PROBLEM STATEMENT-----	5
1.5 OBJECTIVE-----	5
CHAPTER-2 METHODOLOGY-----	6 - 10
2.1 CIRCUIT DIAGRAM-----	6
2.2 UPDATES-----	7
2.3 TEMPERATURE AND HUMIDITY SENSORS-----	7
2.3.1 BLOCK DIAGRAM-----	7
2.4 HARDWARE IMPLEMENTATION-----	8
2.5 WIRELESS BASED HOME AUTOMATION-----	10
CHAPTER-3 LITERATURE SURVEY-----	12 - 17
3.1 RASPBERRY PI BASED HOME AUTOMATION SYSTEM USING INTERNET OF THINGS-----	12
3.2 RASPBERRY PI BASED HOME AUTOMATION WITH WIRELESS SENSORS USING SMART PHONE-----	13
3.2.1 TRANSMITTING DATA TO RASPBERRY PI-----	13
3.2.2 RECEIVING DATA FROM RASPBERRY PI-----	14

3.3 HOME AUTOMATION CONTROL SYSTEM USING SMS-----	15
3.4 HOME AUTOMATION USING ANDROID APPLICATION-----	16
3.5 HOME AUTOMATION USING WIFI-----	17
CHAPTER-4 TOOLS AND TECHNIQUES-----	18 - 28
4.1 PIR SENSOR-----	18
4.2 DHT11 SENSOR-----	20
4.3 DS18B20 SENSOR-----	23
4.4 RASPBERRY PI-----	24
4.5 12V FAN-----	27
4.6 INSTALLING RASPBERRY PI IN PC-----	28
CHAPTER-5 RESULTS AND CONCLUSION OF HOME AUTOMATION-----	34 - 37
5.1 RESULTS-----	34
5.2 ADVANTAGES OF HOME AUTOMATION-----	35
5.2.1 ENERGY SAVINGS-----	35
5.2.2 CONVENIENCE-----	36
5.2.3 SECURITY-----	36
5.3 DISADVANTAGES-----	36
5.3.1 RELIABILITY-----	36
5.3.2 COMPLEX TECHNOLOGY-----	36
5.3.3 EXPENSIVE-----	37
5.4 FUTURE SCOPE OF PROJECT-----	37
5.4.1 GROWTH IN AUTOMATION MARKET IN INDIA-----	37
5.4.2 COMMODIFICATION OF AUTOMATION MARKET-----	37
CONCLUSION-----	39
REFERENCES-----	40

LIST OF FIGURES

FIGURE NUMBER	TITLE	PAGE NUMBER
Fig 1.1	Automated House	1
Fig 1.2	Various appliances connected to a device	4
Fig 2.1	Circuit Diagram of model	6
Fig 2.2	Flow diagram of different sensors with raspberry pi	7
Fig 2.3	Server Client connection establishment	8
Fig 2.4	Raspberry pi connected to a battery	10
Fig 3.1	Automated home flow diagram	12
Fig 3.2	Transmitting data to raspberry pi	13
Fig 3.3	Receiving data from Raspberry pi	14
Fig 4.1	PIR sensor	18
Fig 4.2	PIR circuit diagram	18
Fig 4.3	Detection method of PIR sensor	19
Fig 4.4	DHT11 sensor	20
Fig 4.5	Resistance vs Temperature graph	21
Fig 4.6	DHT11 circuit diagram	22
Fig 4.7	DS18B20 sensor	23
Fig 4.8	Raspberry Pi	24
Fig 4.9	Raspberry pi pin descriptions	26
Fig 4.10	12V Mini Fan	27
Fig 4.11	Installation stage	28
Fig 4.12	Raspberry pi being setup in the PC	28
Fig 4.13	Raspi-config	29
Fig 4.14	Virtual breadboard connections	29
Fig 4.15	Interface of mobile application	30

Fig 4.16	Interface of PC application	31
Fig 4.17	Multiple options provided by the app	31
Fig 4.18	Description of the different sensors	32
Fig 4.19	Working project model	33
Fig 5.1	DHT11 readings	34
Fig 5.2	Screenshot of temperature reading in app	35

LIST OF ACRONYMS AND ABBREVIATIONS

ABBREVIATIONS	FULL FORM
AIS	Automatic Irrigation System
T&H	Temperature and Humidity
I/O	Input,Output
Hz	Hertz
V	Volts
IDE	Integrated Development Environment
KHz	Kilo-Hertz
IDC	Insulation Displacement Connector

ABSTRACT

Home automation plays an important role in establishing a smart home and is an ever exciting field that have grown largely over the last few years. New innovations has made the homes progressively appropriate, efficient and much increasingly secured. The low cost devices used for joining the various electronic equipments and different sensors over an internet connection are supported and connected with the help of the Raspberry pi. Creating a smart home which can be effectively controlled and observed by the Raspberry pi by the means of Internet of Things is the principle target of present work.

This gives home owners a very dependable, simple and a quick approach to automate the environment.

In this project we have made a similar and more convenient working model where the light, fans and PIR sensors can be controlled via smart phone also the change in temperature and humidity can be monitored on our smart phones and can be controlled by taking the required measures without taking much overhead.

CHAPTER 1: INTRODUCTION

1.1 INTRODUCTION

Home automation is an important milestone that has played an important role in achieving an intelligent network and is always an exciting field that has exploded in recent years. Technological advances have made homes cheaper, more efficient and safer. The introduction of the Raspberry Pi in the world of residential automation has provided many adaptations to transform a common home into a smart home. Raspberry Pi provides us with an economical platform to connect electrical / electronic devices and different sensors at home with the help of the Internet. The main objective of the current work is to design a smart home that can be controlled and monitored using Raspberry Pi via the Internet of Things (IoT). This will help owners provide a simple, fast and reliable way to automate their type of environment. It is essentially the automation of domestic, domestic or domestic activities. It can also include centralized control of lights and devices, HVAC control (heating, ventilation and air conditioning), security locks, etc. Its sole purpose offers greater comfort, efficiency, energy efficiency and safety.



Figure 1.1: Automated House

Internet Of Things (IoT) is the association of physical things embedded inside the programming projects, sensors, contraptions, and framework arrange which helps in enabling these articles in social occasion and exchanging the data. In home mechanization splendid contraptions and sensors distinguishes the physical experiences and changes over into stream of information data. The critical parts of home mechanization reliant on IoT are sensor systems and raspberry pi. Sensor systems are used for distinguishing and watching while raspberry pi is used for get-together the data, checking the data and manages the contraptions like light, fan, light, any sort of entryway development and opening-closing of windows. Accept the light is less and I will feel awkward by then by the encompassing lights then it will normally open up the blinds . As such, the home automisation can be portrayed as a part which ousts as much human obstruction as much as in truth possible and appealing in various family strategies and superseding them with the redid electronic systems. As it is a system that focuses in upgrading the individual fulfillment with the mechanization of family unit exercises which can be overseen over the Internet.

1.2 Background

The primary smart homes were just thoughts and not genuine structures. For the decades, sci-fi has been investigating home automation. A few essayists has envisioned a future where homes are intelligent, and apparently use to run themselves.

Despite the fact that the possibility of home automation has been around us for quite a while, yet genuine keen homes have been in the presence in a brief time.

1901 – 1920– The invention of home appliances – Home machines were used to be a fabulous achievement in the mid twentieth century. These achievements began with the event to initially engine filled vacuum cleaner in 1902. A progressively logical Electricity - controlled vaccum was prepared in 1909. All through the two decades refrigerators would be created, and moreover pieces of clothing dryers, toasters, irons, garments washers and an altogether more.

1966 - 1968 – ECHO IV and the Kitchen Computer –Although it was not commercially sold, the ECHO IV was the first smart device. This clever device can be used for computing shopping lists, controlling the house temperature and turning home appliances on and off when required.

1997- 2000s Smart Homes- Smart homes or has begun to rise since the early 2000s. Smart homes very quickly became a very affordable option, and therefore it became a very viable technology for the consumers. Some domestic technologies like home networking and several other devices started appearing on the stores.

Present Smart Homes- These days smart homes have turned more towards security and living in an environment friendly manner. They are much more sustainable and they ensures that our homes won't expend any unnecessary energy. Also they help's in alerting us to intruders.

Current fashions in home automation include remote mobile control, automated lights, scheduling appliances, automated thermostate, mobile/email or text notifications, and video surveillance.

1.3 Home Automation

The facilitation for the consumer to automate houses remotely is the main target of this machine. There may be a need to automate homes in order that customers can take advantage of the technological advancement in any such manner that someone is able to send a signal to the home control centre while he/she forgets to show off devices together with air conditioner as opposed to returning domestic. Further to this home safety has additionally been a chief trouble. Therefore here we develop a gadget that lets in person to govern home appliances from anywhere he wishes and on every occasion he wishes. Faraway shrewd home systems may additionally include centralized manipulate of lights, HVAC (heating, ventilation and air conditioners), home equipment and any other safety structures, to provide advanced convenience, energy performance, comfort and security. The recognition of faraway intelligent home machine has been on increase substantially throughout the latest years due to plenty of better availability and simplicity through internet connectivity.

A home automation framework commonly associates connected gadgets to a focal center point or "portal". The UI for control of the framework utilizes either tablets, personal computers, a cell phone application, or a Web interface, that may likewise be available on a website over the Internet.

While there are many competing sellers, there are very few worldwide accepted industry standards and the smart home space is heavily fragmented. Makers regularly avoid free usage by retention documentation and by suit.



Fig 1.2: Various appliances connected to a device

The idea of the "Internet of Things" is nearly connected with the commercialization of Domestic and Industrial automation. As the quantity of controllable gadgets in the homes are rising, interconnection and correspondence between the gadgets is getting to be troublesome. Remote wise home framework can likewise give a remote interface to Domestic, Industrial machines or the frameworks itself, through phone line, remote transmission or the internet, to give control and observing by means of a Smartphone or a program. A case of remote observing is:

The Remote clever home framework could be activated if a smoke indicator distinguishes a fire or smoke condition, making all lights in the house flicker to caution any inhabitants of the house to the conceivable crisis.

1.4 Problem Statement

The goal of my project is to help users manage the devices with their smartphones and help the elderly or disabled to live a more independent life as long as possible. Our idea will allow a user with any Android device to run downloadable software on any mobile device, such as a smartphone. This application will allow users to control a device attached to any Pi-enabled device. The purpose of our application will be to manage a security system with web camera surveillance, door sensor notification and a light control system. The sensors will be connected to devices with Pi so that they can be monitored and controlled completely.

Accept an agent has gotten down to business and in the midst of this period a cheat sneaks up into the house overcoming a window. The proposed structure would enable the client to screen his home when a door or a window sensor triggers the alarm. Customer can screen his home with webcam and could expeditiously enlighten adjacent master or a policeman. The Client can similarly check the status of the outside lights and murder on and the lights without the need to get up. These devices would in like manner benefit the customers with confined adaptability that may have a troublesome time getting to or despite accomplishing their light switch. The UI will be as fundamental and astounding as could be permitted and will work in a self-organized way.

1.5 OBJECTIVE

The objective is to design and create a home automation system with the help of IoT (Internet of Things).

To help the home owners to provide a simple, reliable and fast way to automate their home environment.

The objective of our framework is on a very basic level to manage the residential systems that may ordinarily be troublesome for the people who are old or impeded to bargain with. This proposed thought will allow a customer with any Android engaged device to run a touch of installable programming on any mobile phone.

CHAPTER 2: METHODOLOGY

First of all, we need to design the vessel to place the circuit in that to avoid water or some other damage.

Plant pot can either be:

- Created with the help of clay.
- Can be cut out off the required measurements from any already existing pot.

2.1 Circuit Diagram

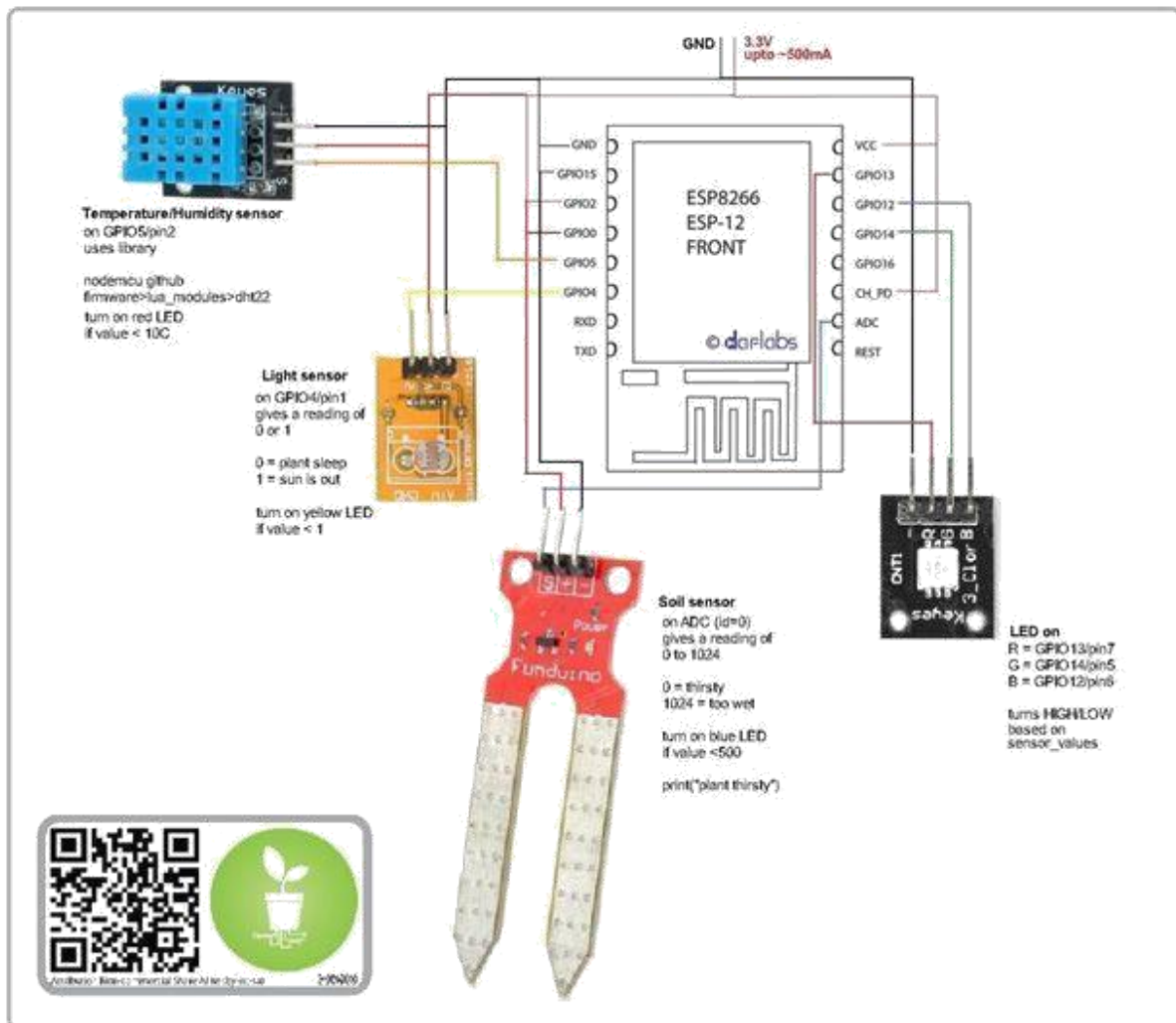


Fig 2.1: Circuit Diagram of model

2.2 Updates

This system will give signals for every process which is currently in progress like

1. In the event that gadget indicates blue flag it implies plant is thirsty.
2. Red signals implies plant is too cool or hot all these depends upon the nature of condition around them.
3. On the chance when Yellow appears , it implies no light (Sleeping mode).
4. If green appears then it means everything is going good and all the conditions are
5. appropriate.

2.3 Temperature and humidity sensors

In the pot DHT11 and DHT22 temperature and humidity sensors are used which are new models for estimation. In this temperature is shown in Celsius and it indicates humidity.

The DHT11 demonstrates 20% to 80% perusing and having ± 0.5 of accuracy, it might increase or decrease slightly.

2.3.1 Block Diagram:

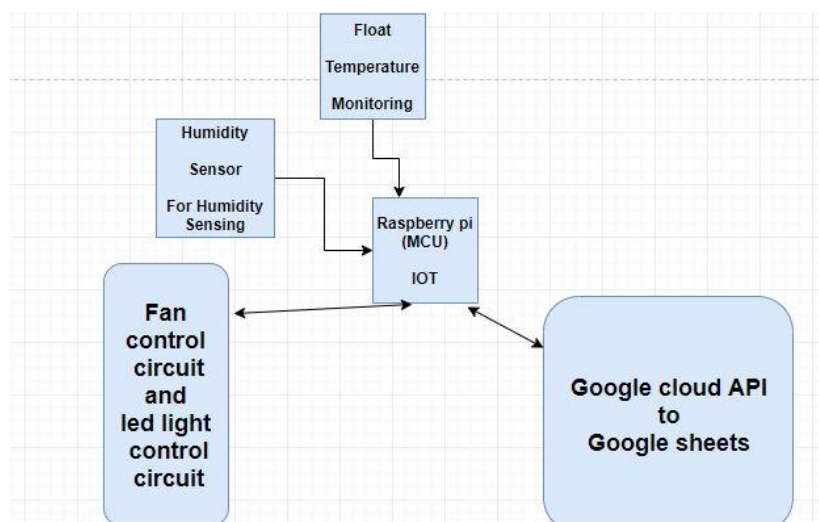


Fig 2.2: Flow diagram of different sensors connected with raspberry pi

2.4 Hardware Implementation

To show the hardware implementation we have the following flow diagram.

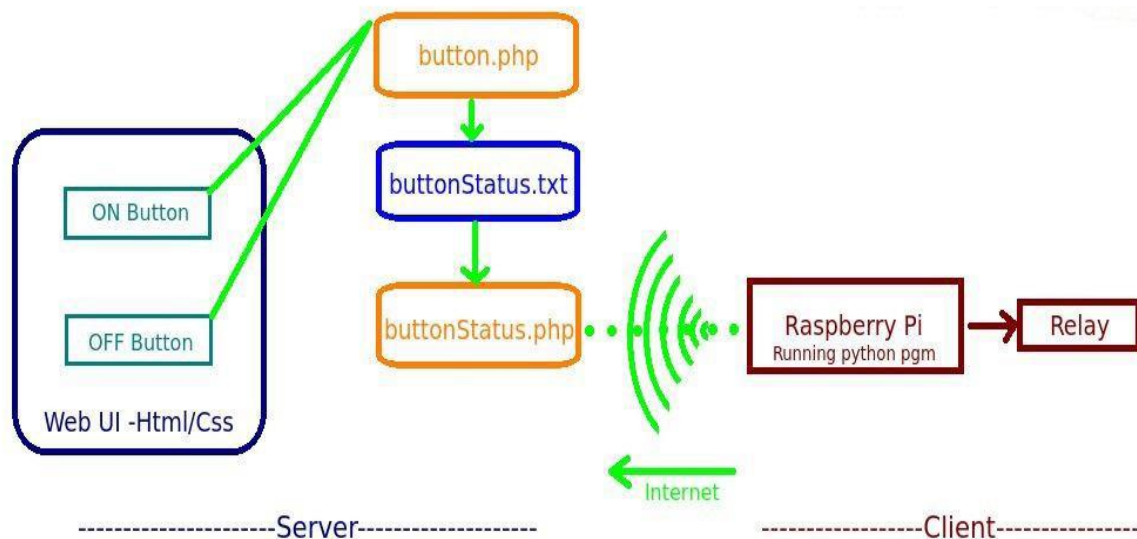


Fig 2.3: Server Client connection establishment

The entire square graph can be isolated into two segments, one is server side and the other one is client side or client side.

Server side is completely presented on the Raspberry pi. Server is created on the raspberry pi with the help of the Linux, PHP MySQL, Apache or we can call it as LAMP. Two PHP records are delivered and set away on the Server side that we have framed on the Raspberry pi. Raspberry pi have 40 GPIO pins, and all of these pins helps in controlling the home appliances.

Exchanges are also connected with the GPIO pins of the Raspberry pi with the help of the hand-off driver hardware. Yield the GPIO pins gives is 3.3V. To drive hand-off least 6V voltage is required. This can be acquired through the transfer driver circuitry and all the home apparatuses are associated with the hand-off.

Client side is just a User side. Clients need to use Mobile device to get to the Raspberry pi through the web. At the point when the client makes the association of versatile device in system and by consequently putting the IP address of the Raspberry pi in the program of Mobile gadget it will have the ability to see the page which contains UI to control home machines in each room. UI fundamentally shows the individual number of rooms and home

apparatuses present in each room. It furthermore contains changes to flip the status of home apparatuses of each room .A number of home machines can be controlled in the meantime. The entire square graph can be isolated into two segments, one is server side and the other one is client side or client side.

Server side is totally introduced on the Raspberry pi. Server is produced on the raspberry pi with the assistance of the Linux, Apache, MySql PHP or we can call it as LAMP. Two PHP records are produced and put away on the Server side that we have created on the Raspberry pi. Raspberry pi have 40 GPIO pins, and every one of these pins helps in controlling the home apparatuses.

Transfers are additionally associated with the GPIO pins of the Raspberry pi with the assistance of the hand-off driver circuitry. Yield the GPIO pins gives is 3.3V. To drive hand-off least 6V voltage is required. This can be acquired through the transfer driver circuitry and all the home apparatuses are associated with the hand-off.

Client side is just a User side. Clients need to use Mobile device to get to the Raspberry pi through web. At the point when the client makes the association of versatile device in system and by consequently putting the IP address of the Raspberry pi in the program of Mobile gadget it will have the ability to see the page which contains UI to control home machines in each room. UI fundamentally shows the individual number of rooms and home apparatuses present in each room. It furthermore contains changes to flip the status of home apparatuses of each room.

2.5 Wireless Based Home Automation

Remote home automation should be possible by utilizing ZigBee .ZigBee is a remote innovation for home automation which can give us high security) and IoT. The computerization can be utilized in homes, workplaces, schools, or in universities too. We can control warming, lighting, molding, ventilation, locks for security reason and so on. It expands the adaptability, solace, security and comfort. Remote based control framework consolidates the different advancements like Wi-Fi and bluetooth. Utilizing remote innovation machines can be associated utilizing different systems administration advances. Discourse based directions can likewise be utilized in remote control framework. It consolidates the arduino/raspberry pi, Wi-Fi, and sensors. Linux working framework is utilized, which gives wise control module comprising learning catching and example acknowledgment framework. Pc is associated with raspberry pi and correspondence is finished utilizing the Wi-Fi.

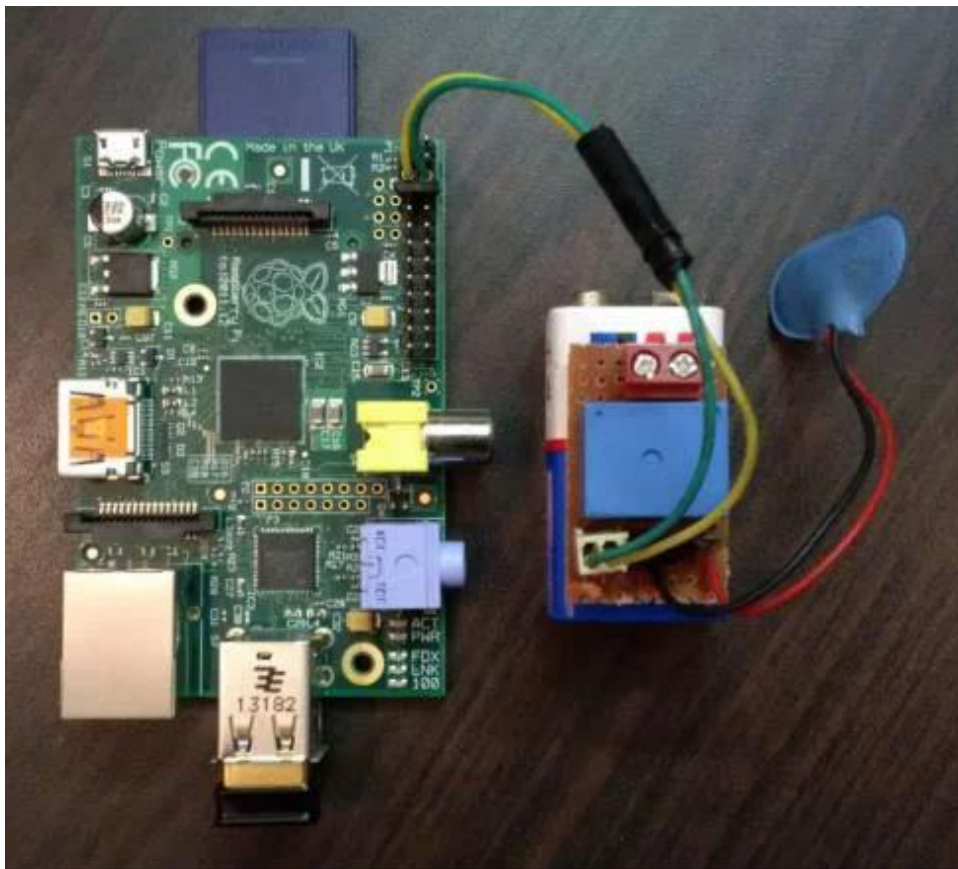


Fig 2.4: Raspberry pi connected to a battery

The list of devices and sensors used in this project are as follows:

1. Raspberry pi
2. Power source
3. DST11 sensor(temperature/humidity sensor)
4. RGB led module
5. Light sensor
6. PIR sensor
7. DS18B20 sensor
8. Magnets
9. Jumper wires

CHAPTER 3: LITERATURE SURVEY

3.1 Raspberry Pi Based Home Automation System using internet of things:

This current task's primary center is for the security and to screen the gadgets utilizing raspberry pi sensors, MSP430 microcontroller. Raspberry pi assumes a noteworthy job in dealing with the execution of code and handling it. The Raspberry pi here is associated with web by means of a Modulator and Demodulator (MODEM) to deal with or get to the different messages sent to the client. The gadget (home machines) to control has been coordinated with the circuit utilizing a hand-off channel because of high voltage appraisals of home apparatuses. To see the updates of machines this task makes utilization of a display screen which is associated with the Raspberry pi.

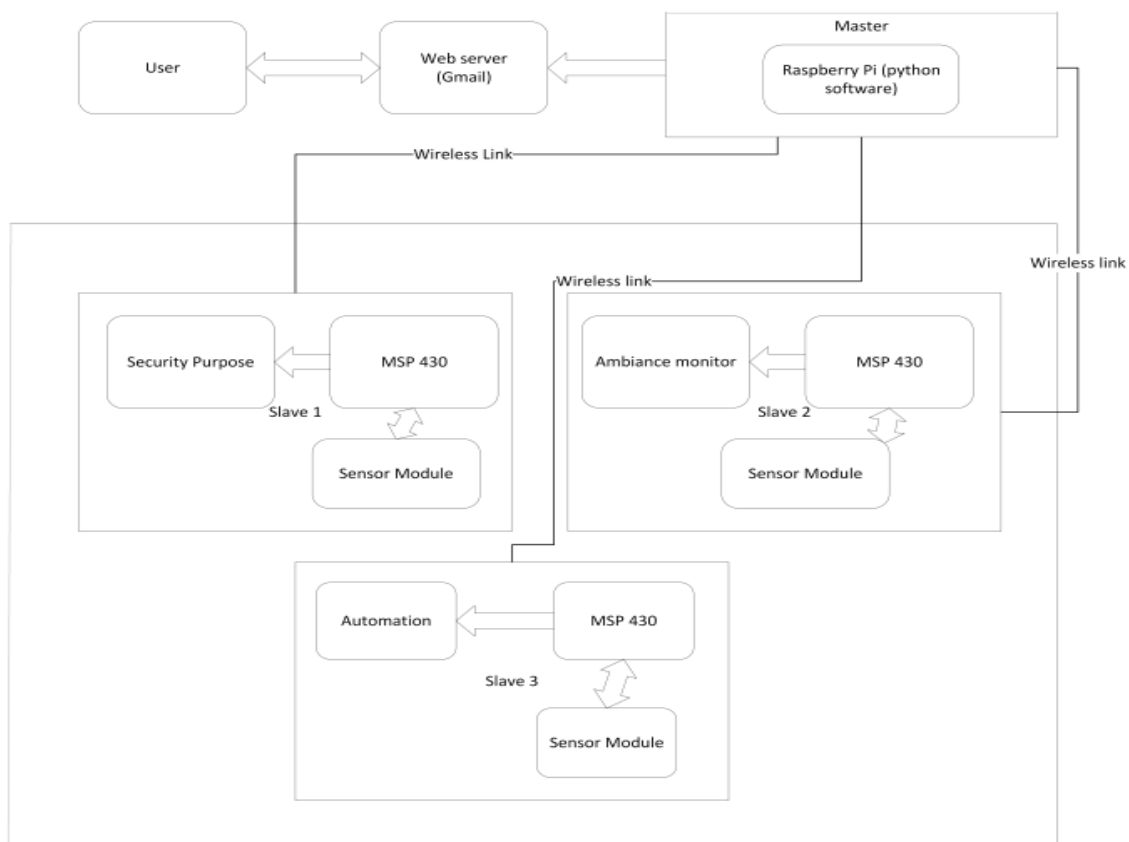


Fig 3.1: Automated home flow diagram

3.2 Raspberry pi based home automation with wireless sensors using smart phone:

The home automation system is developed using Raspberry Pi, by reading algorithms and subject of emails. The Raspberry Pi is guaranteed to be an efficient implementation platform and proven to be an intelligent and economical home automation system. Home automation using Raspberry pi is better than any other residential automation method implemented in other ways. For example, using home automation DTMF (Dual Tone Multi-Frequency), the detection rate proved to be a big drawback, that is, the problem that cannot be mentioned in the proposed method. Even though Web servers are designed for home automation and the required storage space through a web server, they are ignored in this way because it only uses web server services that have been set up via email. The LED is used to identify the switching action. The system is an efficient and flexible interactive system. Send a command to the Raspberry Pi, run on the server side of our laptop or the web server receives the user side input command and the script sent correctly to the client (Raspberry Pi). Here, these inputs are used as commands to turn the lights on/off. When we give the command to turn on the light script server side, the data and information activation relays are forwarded to the Raspberry Pi and GPIO pins. The system can send the current update to the server to detect if the light is on/off.

3.2.1 Transmitting data to raspberry pi

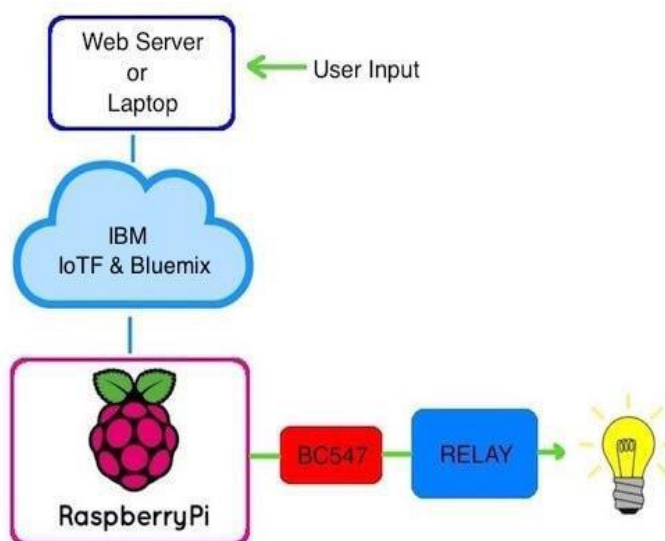


Fig 3.2: Transmitting data to raspberry pi

3.2.2 Receiving Data from the Raspberry Pi

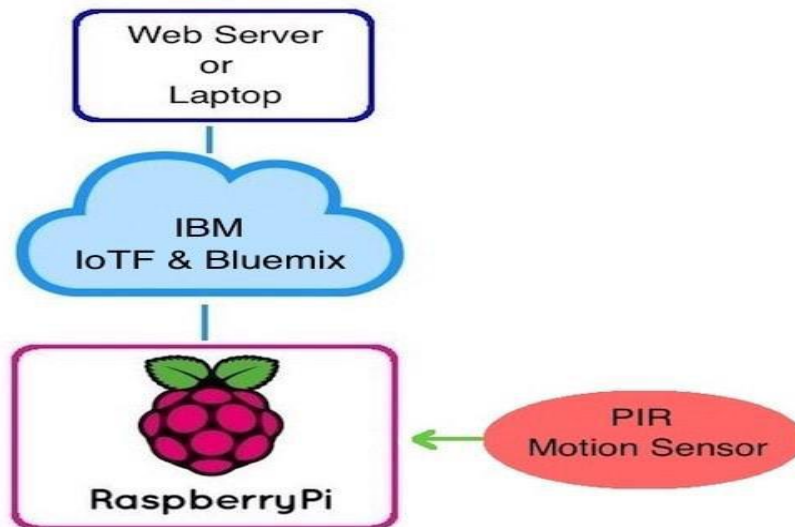


Fig 3.3: Receiving data from Raspberry pi

3.3 Home Automation control system using SMS

In the realm of computerization we need our day by day life to be controlled remotely. The point of the task is controlling of home machines remotely when the client is far from the place. This is SMS based framework and client employments remote innovation (GSM). The framework utilizes GSM innovation in this manner giving all around access to the framework for mechanized machine control. 8051 Micro Controller is the crucial part of this task. The fundamental target of this venture is to research controlling of home apparatuses remotely and cost successfully. The inspiration was to encourage the clients to robotize their homes having remotely widespread access. The home machines control framework with a compelling expense was believed to be constructed that ought to be versatile giving remote access controlling plan to the apparatuses.

Screen and control house or office mechanical assemblies and supplies effectively through the mobile phone set by sending Commands as SMS messages and getting the contraptions status. The rule thought driving this endeavor is getting the sent SMS and further dealing with it as required to play out a couple of undertakings. The possibility of the SMS sent picks the sort of movement. The undertaking depends on a very direct standard. In any case, the SMS sent is secured and accumulated from the getting versatile station and after that the required control banner is delivered and sent to the moderate gear that we have arranged by the course got from the sent message. A microcontroller based using SMS structure has been proposed for our endeavor. GSM (Global System for Mobile Communication): It is a cell correspondence standard. SMS (Short Message Service): it is an organization open on electronic mobile phones that permits the sending of short substance messages (content information administration).

3.4 Home Automation using Android Application

The home computerization frameworks are picking up prominence step by step because of their usability and wide activities capacities. Some require home computerization framework to fulfill their necessities and comfort while for physically tested individuals it can give extraordinary help. There have been a few looks into and advancements on the home automation frameworks. In the present occasions, we can discover the vast majority of the general population sticking to their versatile telephones and keen gadgets for the duration of the day. Subsequently with the assistance of his sidekick – a portable telephone, some day by day family assignments can be achieved by exemplifying the utilization of the versatile

telephone. To build up an Automatic Control framework that helps in controlling the gadgets associated with it, with the assistance of Wi-Fi interconnection. To facilitate the method for getting to the gadgets in controlling it, and keeping up the best possible log of the information which the gadget detects. To build up a framework which would be extremely helpful for impeded people in doing works all alone without looking for any assistance.

a) The proposed framework depends on the interconnection between Wi-Fi modules in which the customer wifi modules will be connected to the station wifi module which will give directions through the advanced cell which is associated with the same as an outside gadget, will have need in giving directions and removing work over them, works in master slave guideline.

b) There won't be any hand-off associations between the gadgets which helps in diminishing the time required in information exchange what's more, losing of information.

c) There would be a persistent checking of information that is being exchanged and furthermore producing a log out of it.

d) Mobile application is being created for a easy to use collaboration between the client what's more, the gadgets.

e) The entire framework is remote, so there won't be any misfortune in information at most extreme and likewise there won't be any issue due to wiring.

3.5 Home Automation Using WIFI

MOTIVATION

Now and again there might be impaired individuals in house and they are not ready to move much of the time for controlling machines in house, so utilizing home computerization framework these individuals can without much of a stretch control every one of the machines. For impaired individuals it is fundamental to create home robotization framework which required less and simple client communication.

In this framework android application used to send flag to arduino board and Wi-Fi module associated with arduino gives this flag to arduino for controlling machines utilizing transfer board.

The PIR sensor contains two openings in it, each space is made of an extraordinary material that is delicate to IR. At the point when the sensor is inactive, both the openings will distinguish a similar measure of infrared, the encompassing radiations transmitted from the rooms or dividers or outside. At the point when a warm body like a human or any creature cruises by, it first catches one portion of the PIR sensor, which causes a positive differential change between the two parts. At the point when the warm body leaves the detecting region, the turn around occurs, whereby the sensor creates a negative differential change. These change beats are what is distinguished.

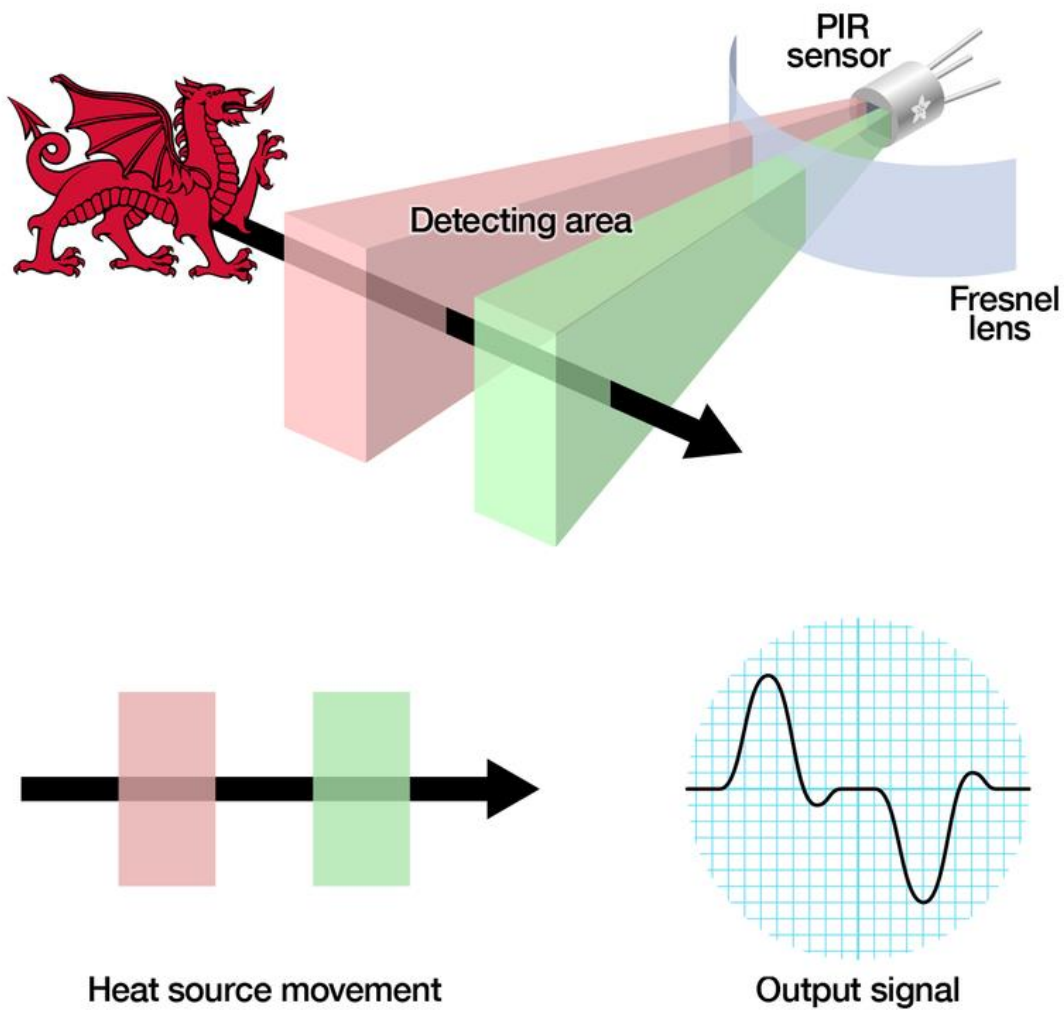


Fig 4.3: Detection method of PIR sensor

4.2 DHT11 Sensor

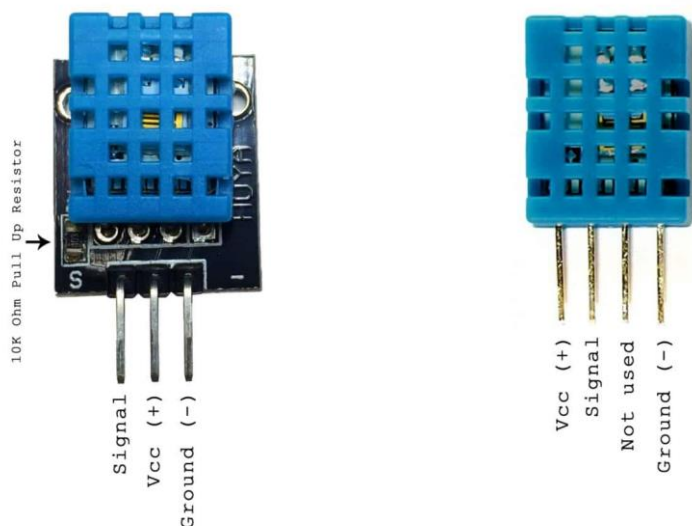


Fig 4.4: DHT11 sensor

The DHT11 is an extremely important and advanced temperature and humidity sensor. It uses a capacitive humidity sensor and a thermistor to measure the moisture content in the air and temperature of the room. It is very simple to use, but requires careful planning to collect data.

The DHT11 can detect temperatures in the range of 0 to 50 degrees Celsius with an accuracy of ± 2 degrees, while humidity ranges between 20 and 80% with an accuracy of 5%.

It consists of a moisture sensing device, a thermistor or an NTC temperature sensor with an IC installed on the back of the sensor. The moisture sensing device is used to measure moisture which also carries two electrodes and a moisture retention substrate between them. Then, as the moisture changes, the conductivity of the substrates also changes along with the change in resistance between the two electrodes. The IC reads the change in resistance, which allows the microcontroller to read it. On the contrary, to measure the temperature, these sensors use an NTC temperature sensor or a thermistor.

A thermistor acts as a variable resistance that varies the resistance with the temperature change. These sensors are manufactured by the sintering of semiconductor materials, such as ceramics or polymers, to observe a larger temperature difference with only small changes in temperature. The term "NTC" means "negative temperature coefficient", which means that the resistance decreases with increasing temperature.

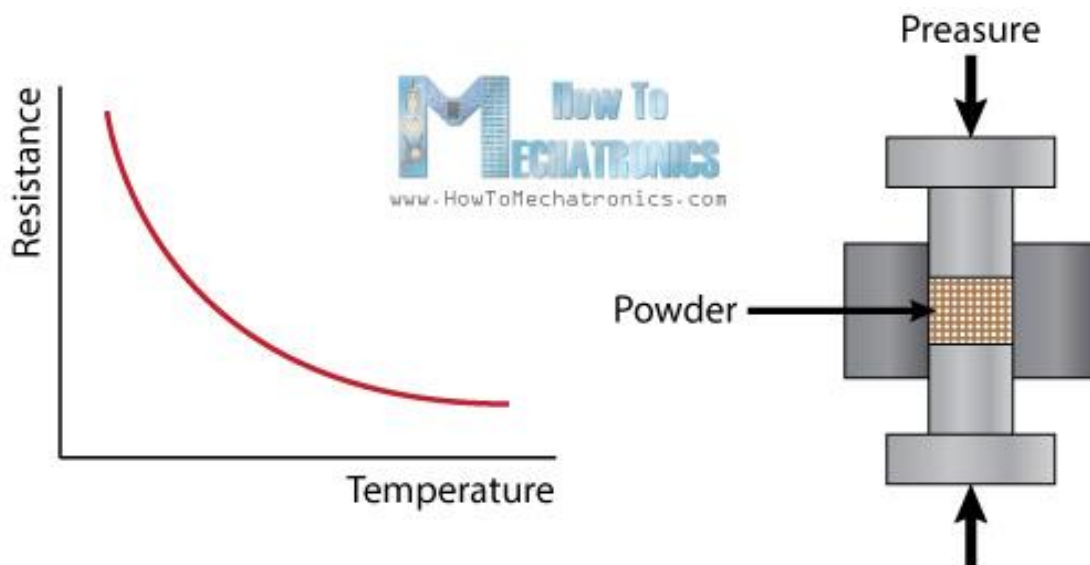


Fig 4.5: Resistance vs Temperature graph

The DHT11 sensor is having its own “single wire protocol” which is used for transmitting the data. This protocol requires the timing with utmost precision and the timing diagrams for extracting the data from the sensors.

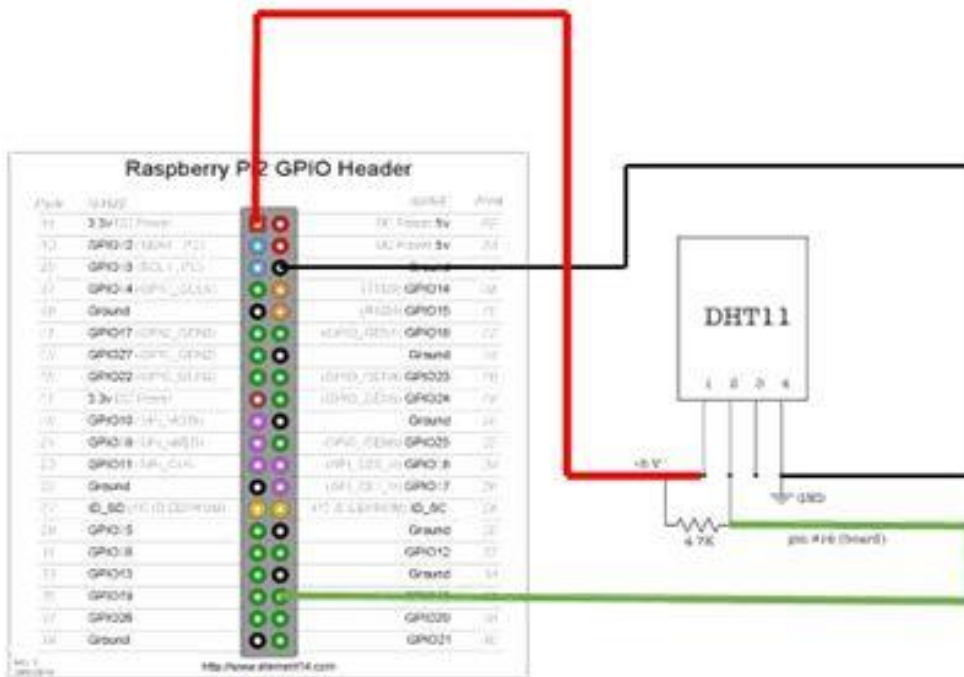


Fig 4.6: DHT11 circuit diagram

The DHT11 sensor consists of four pins, GND, VCC, data pins and an unconnected pin which is technically not connected anywhere. A 5K to 10K ohm pull-up resistor is required to keep the data line high and allow communication between the Arduino board and the sensors. These sensors come in a variety of models with a safety board and built-in pull-up resistors, consisting of only three pins.

4.3 DS18B20 Sensor



Fig 4.7: DS18B20 sensor

The DS18B20 is a thermometer sensor that recognizes the temperature through a single cable interface and returns in Celsius degrees.

DS18B20 is a digital thermometer that provides Celsius temperature estimates from 9 to 12 bits and a non-volatile programmable up-and-down activation method. The DS18B20 communicates by a 1-wire transmission and by definition requires only one line of information to be used with the central microprocessor. Furthermore, the DS18B20 can separate the power supply directly from the information line, eliminating the need for an external power supply.

Each DS18B20 has a unique 64-bit sequential code that allows multiple DS18B20s to operate on transfers with 1 similar wire. Therefore, it is conceivable to use a single microprocessor to control the numerous DS18B20s circulating in a wide range of fields. Several applications have advantages, including HVAC environmental controls, temperature observation frames within the facility, hardware or gear types, and program control and monitoring facilities.

Raspberry Pi unidirectional unlike the first Pi, verifiable applications will see an increase of 2.5 times for individual applications and more than 20 times when video playback is activated with the NEON motor chip.

Raspberry Pi 3 also supports wireless networks, with Wi-Fi and Bluetooth implicit. Unlike its predecessor, the new board is equipped to play 1080p MP4 video with 60 frames per second (with a bit rate of approximately 5400 Kbps), which improves media certificates of video technology.

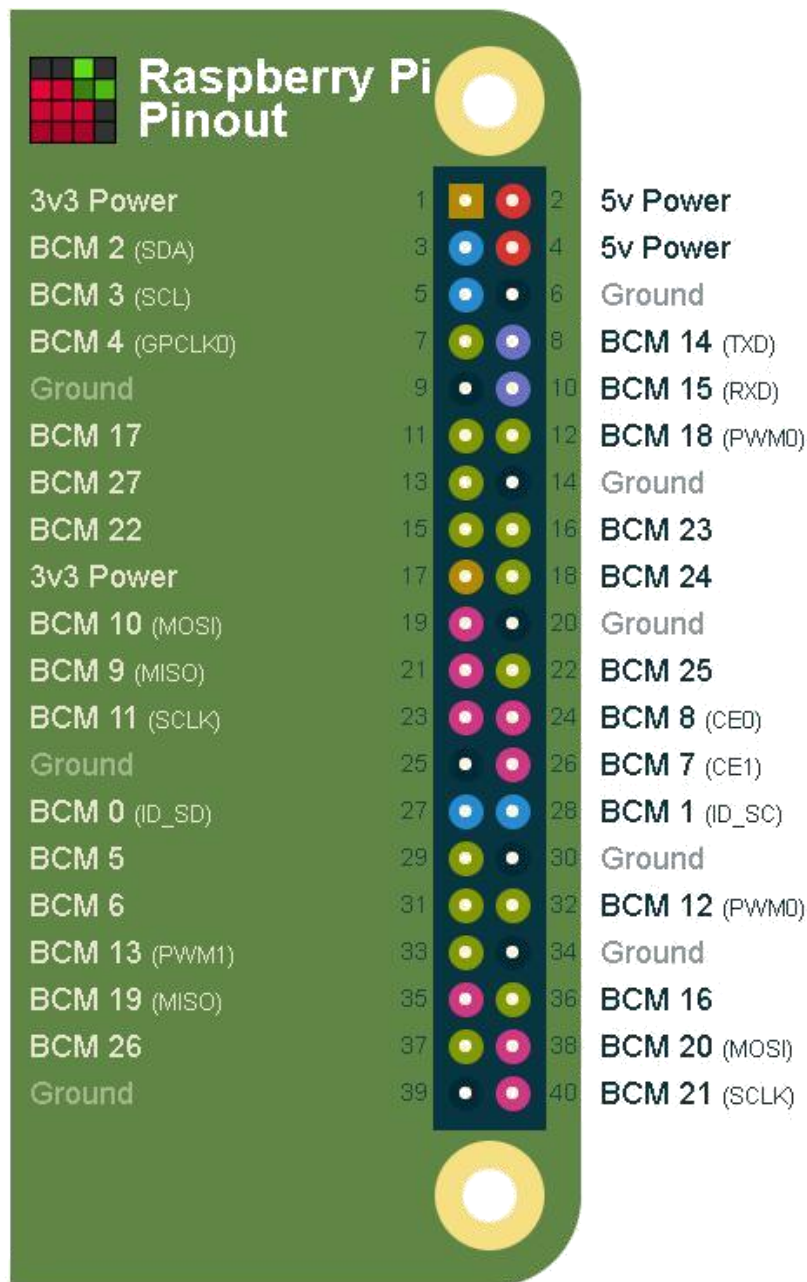


Fig 4.9: Raspberry pi pin descriptions

4.5 12V Fan

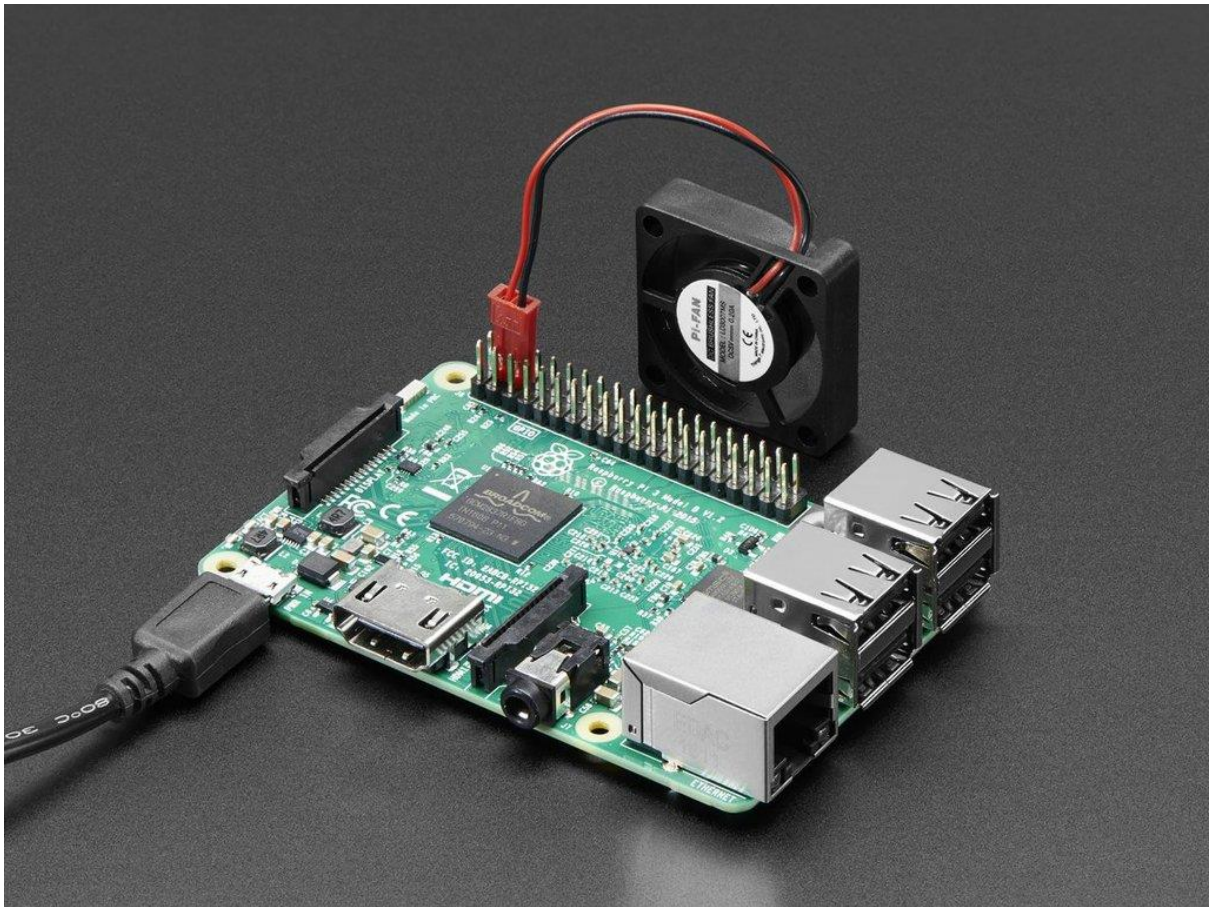


Fig 4.10: 12V Mini Fan

The 12V fan is meant for the demo purpose which shows how we can connect the household fans with a mobile app and how the fan can be controlled by a user from anywhere.

The fan is directly connected with a relay which is used to control the power supply i.e providing only the enough power required to run the fan.

4.6 Installing Raspberry pi in PC:

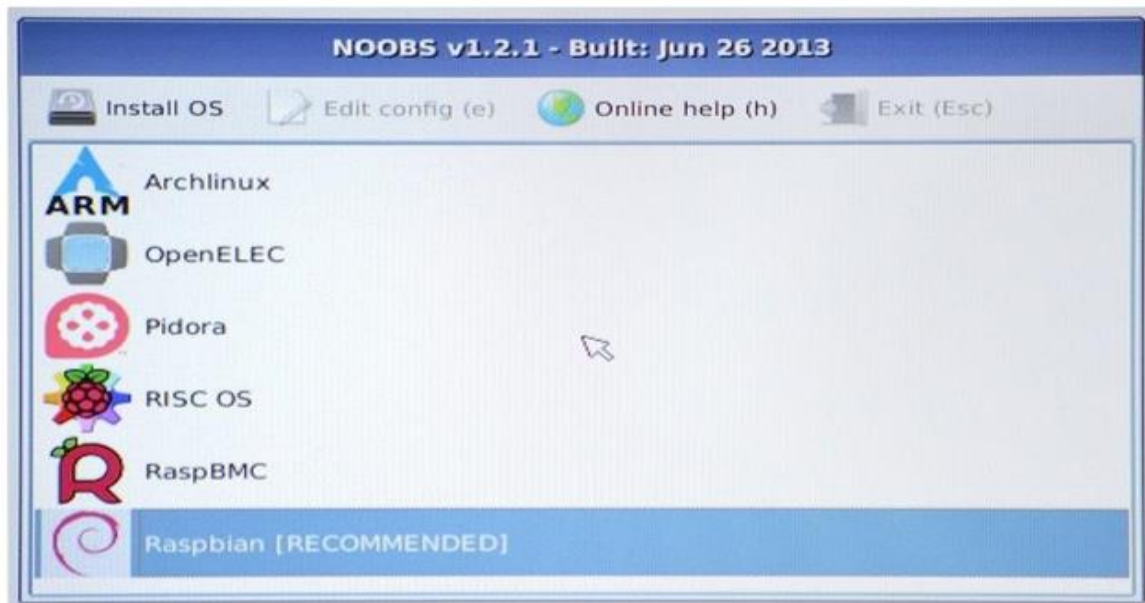


Fig 4.11: Installation stage



Fig 4.12: Raspberry pi being setup in the PC

This is the welcome screen which is displayed while getting installed.

Once it gets installed another screen is displayed like

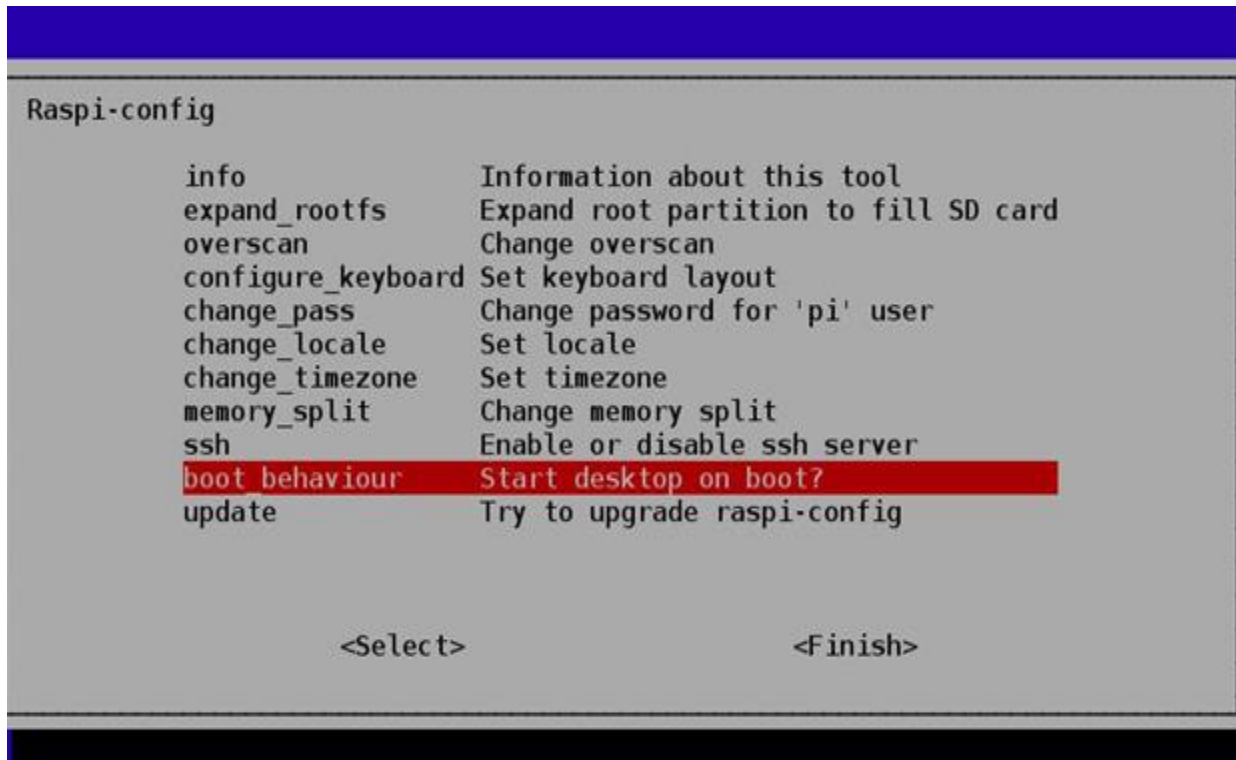


Fig 4.13: Raspi-config

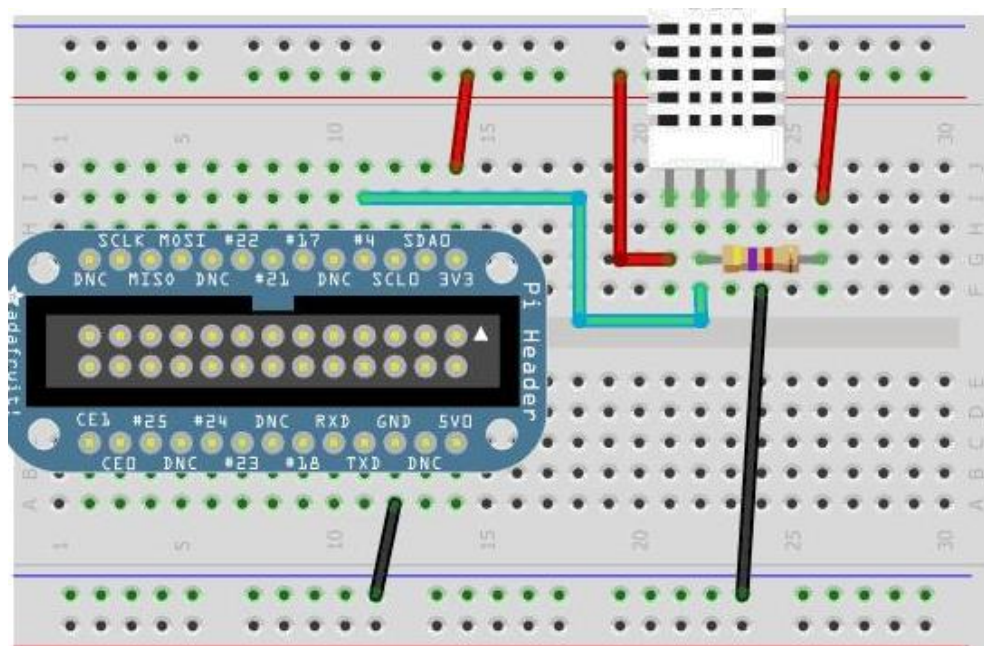


Fig 4.14: Virtual breadboard connections

All the devices and sensors can be visualized and can be implemented on this virtual breadboard which can help in learning in a more effective manner both in terms of money and time consumption.

But when we implement things on physical sensors we require *python* for the coding purpose at the back end of the project.

Also we require another software in our system named '*cayenne*'

Cayenne application can also be downloaded from the Google play store and changes can be made in it according to the desired requirements.

Once the application is successfully installed in our mobile phone then it can be directly connected with the raspberry pi by establishing the mobile hotspot and once connected, all the devices connected with raspberry pi can be controlled directly with the users using simple interface buttons for eg:

- Controlling the lights
- Controlling fan
- Monitoring change in temperature and humidity
- Monitoring any intruders movement.

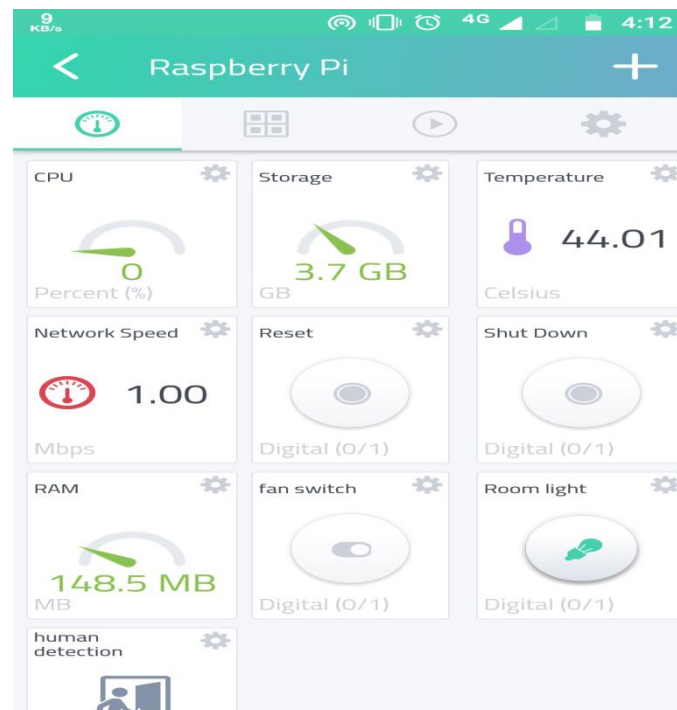


Fig 4.15 Interface of mobile application

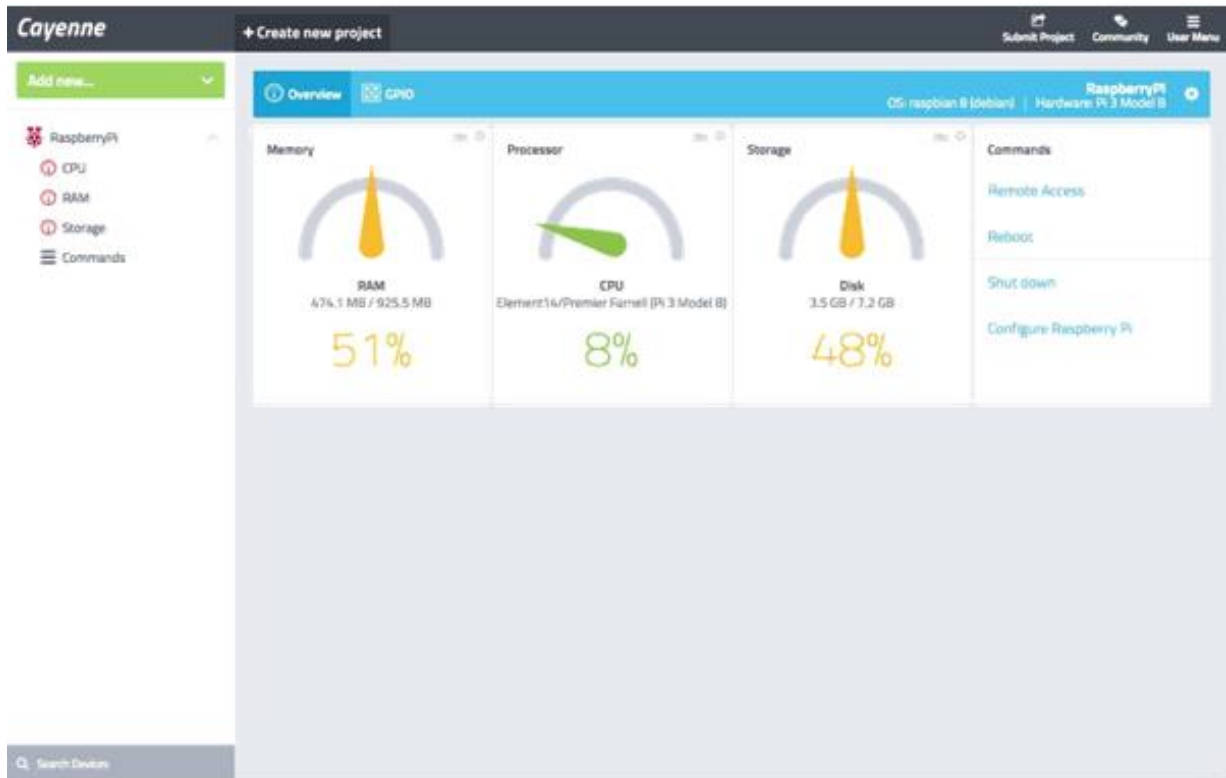


Fig 4.16: Interface of PC application

With the help of this we can easily connect with our sensors connected with Raspberry pi and can know the status of each from anywhere across the globe.



Fig 4.17: Multiple options provided by the app

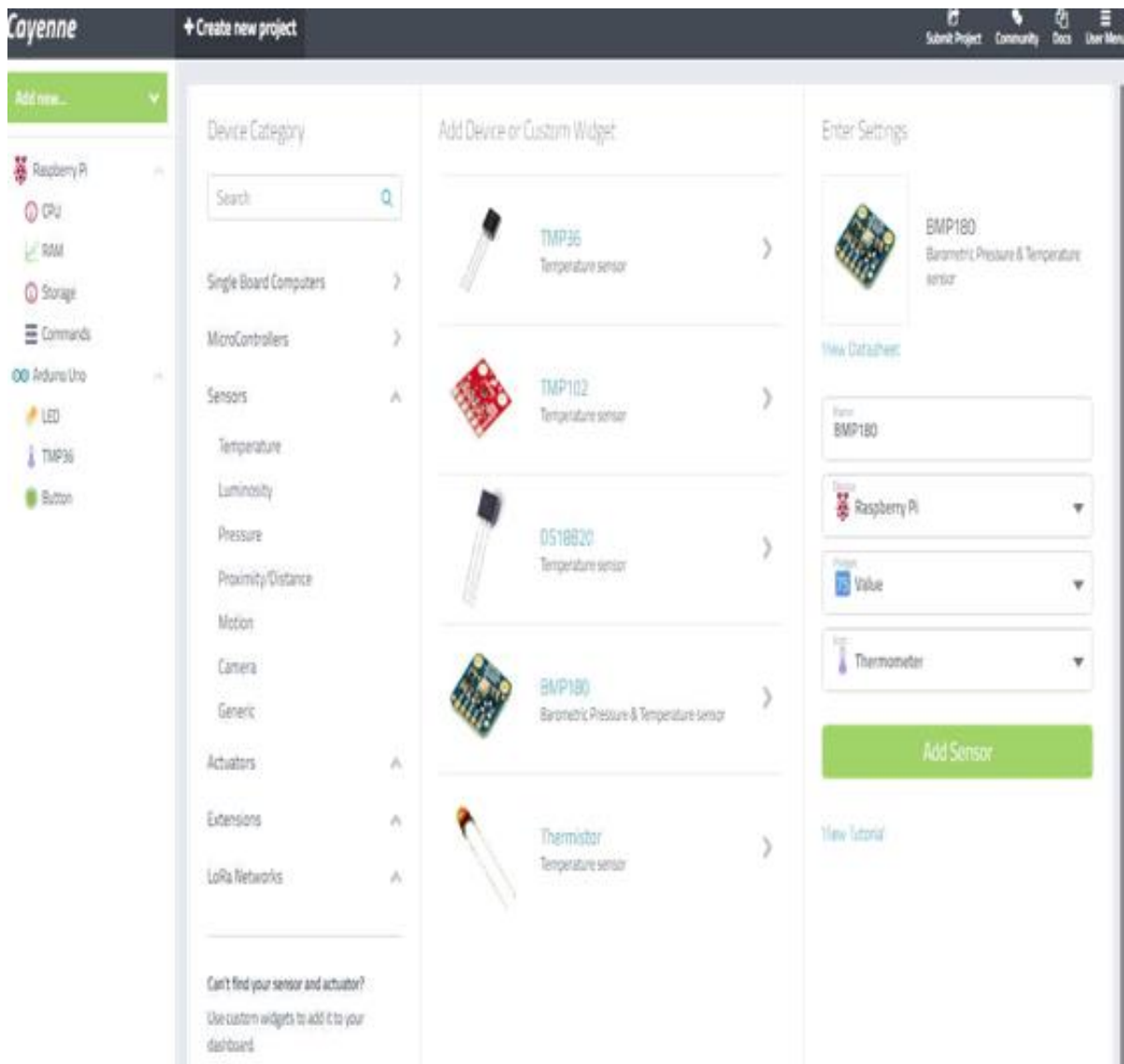


Fig 4.18 (Description of the different sensors)

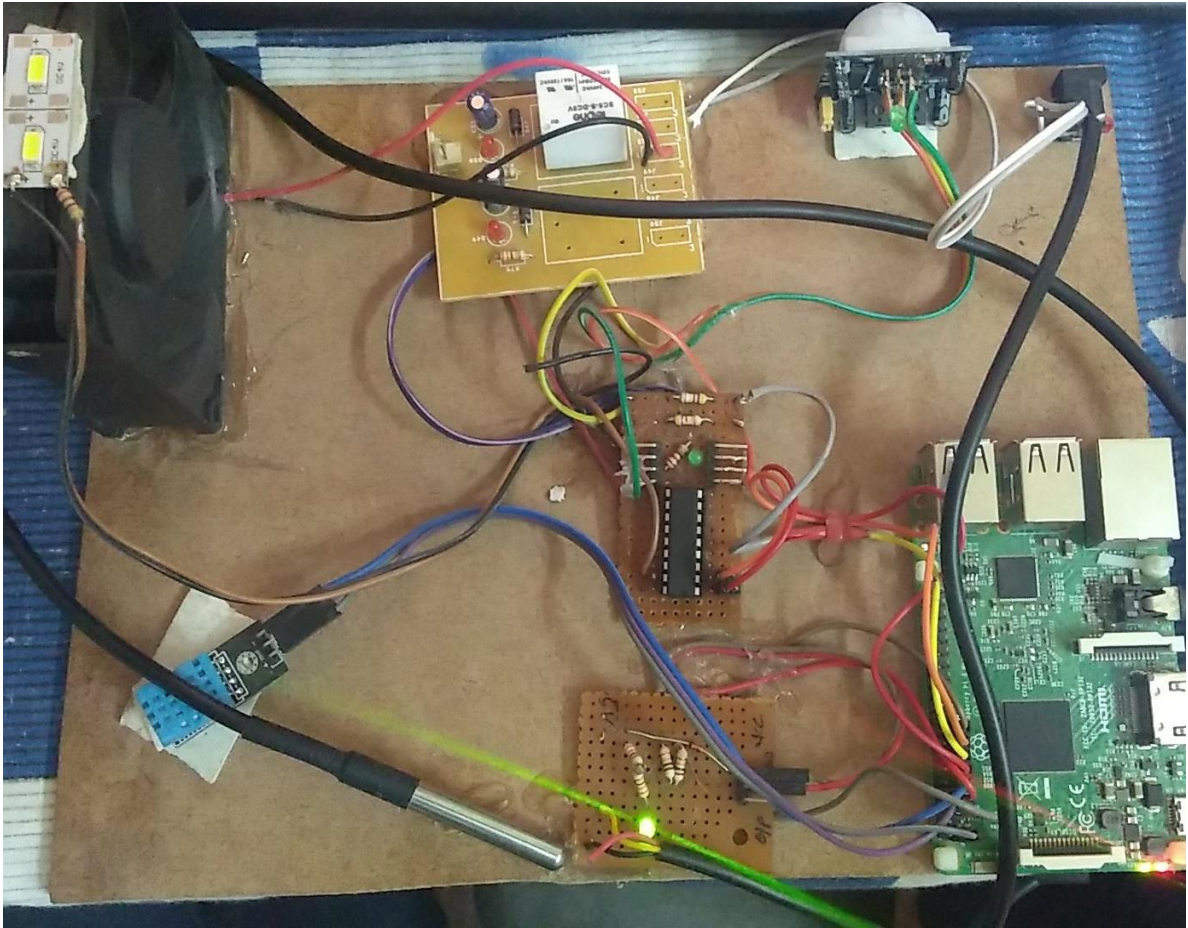


Fig 4.19: Working project model

The above shown picture is the representation of the complete project when all the sensors are connected altogether with the raspberry pi.

Here an extra power supply will be given for the fan because the power supply given to raspberry pi will not be enough for the fan to run and further the relay is connected to avoid any damage to the system in case of any irregular or high power supply from the external source.

CHAPTER 5: RESULTS AND CONCLUSION OF HOME AUTOMATION

5.1 Results

Finally after installing the required software and Raspberry Pi as well as assembling the final home automation model, we initiate the performance analysis of the model.

First DHT11 sensor measures the Temperature and Humidity of the room and displays it on the screen.

```
33*****
11*****
DHT Sensor not connected
11*****
Temperature= 27.0
Humidity= 25.0
Time= 08/05/19 16:09:10
22*****
          Written to Row No. Sahil-iot-Home-Automation
33*****
11*****
Temperature= 27.0
Humidity= 25.0
Time= 08/05/19 16:09:18
22*****
          Written to Row No. Sahil-iot-Home-Automation
```

Fig 5.1: DHT11 readings

The graphical representation of the temperature at different time slots is recorded and the results are graphically represented in the app as shown in the figure.

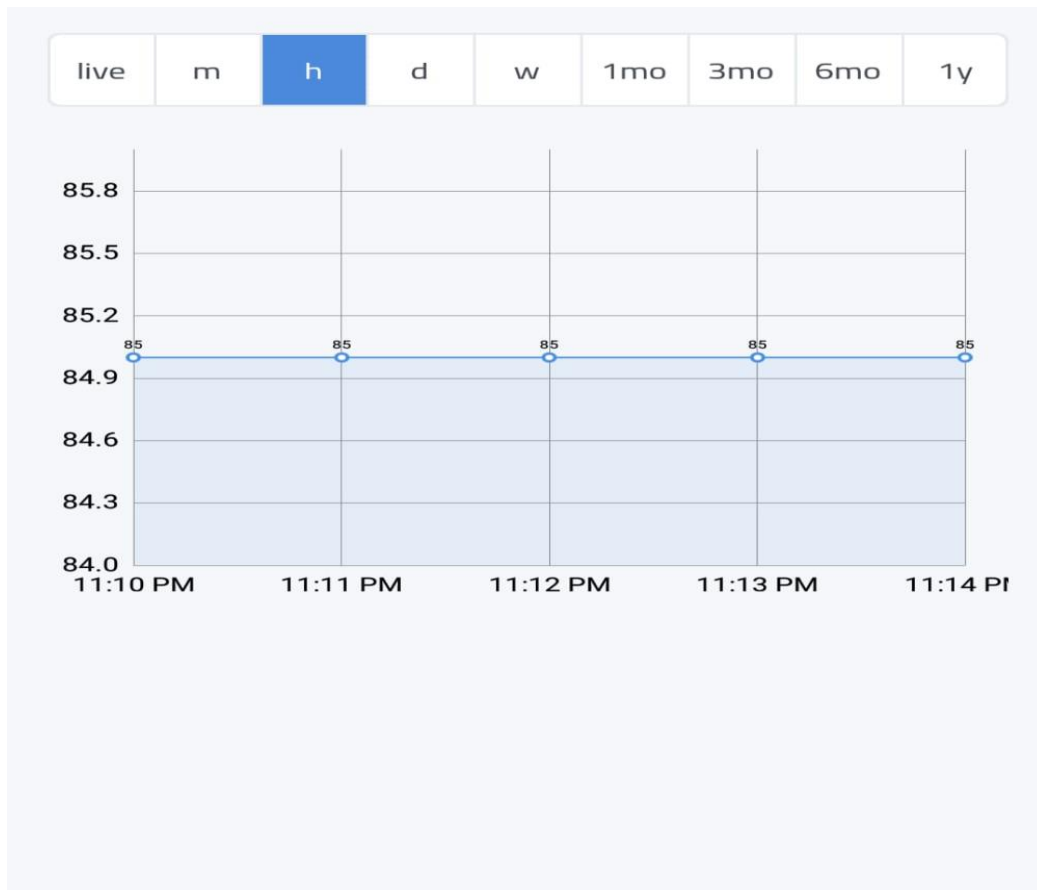


Fig 5.2 : Screenshot of temperature reading in app

Also we are able to switch ONN and OFF the Fan and the LED through our app installed in our smart phone. The PIR sensor also indicates the motion and informs the user through the app.

5.2 Advantages of Home Automation :

5.2.1 Energy Savings

Home automation systems have surely substantiated themselves in the energy efficiency field. Electronic indoor regulators empowers us to pre-program temperatures reliant on the period of day and the day of the week. Additionally, some even fit in with our works on, learning and acclimating to our temperature tendencies without our any reliably contributing pre-picked plan. Traditional or lead based computerization can similarly be associated with in

every practical sense and every gadget that can be remotely controlled – from espresso makers to sprinkler frameworks.

Energy sparing finally depend upon the kind of device we select and its automation limits. However, all around, item creators measure the systems can empower customers to save some place in the scope of 10 to 15 percent off on the bills.

5.2.2 Convenience

In the present speedy paced society, the less you have to worry over, the better. Isn't that so? Solace is another basic moving motivation behind home automation devices, which in every practical sense discard little issues, for instance, shutting the lights off beforehand you hit the bed or modifying the indoor controller when you get up around the start of the day.

5.2.3 Security

Remote monitoring can comfort our brains while we're away from the house. With remote dashboards, lights can be switched on and off, and robotized blinds can be raised and brought down. These abilities – joined with robotized security frameworks – can enable us to relieve from the dangers of interruptions: we shall be alarmed instantly if something unique occurs.

5.3 Disadvantages:

5.3.1 Reliability

Smart homes will greatly depend on the network connection. If your supply of the Internet is cut, it will leave many technical items that are not working. In addition, wireless signals can be interrupted by various electronic devices in the home, which will make some smart products gradual work or not at all.

5.3.2 Complex Technology

Mechanizing everything in life although sounds amazingly engaging, but it is not so for elderly people or for physically handicapped or for someone who is not much technically

advanced, for them it may consume a lot of time in reading manuals and sometimes it gets very complex for them to understand the procedure.

5.3.3 Expensive

Regardless of the way that the expense of home automation systems has ended up being generously more sensible starting late, the amount to purchase and present a device can at present incorporate. Client Reports offers a broad assortment of information and encounters – including costs, on the best home automation structures accessible.

5.4 Future Scope of Project:-

Future of the Home Automation is very bright. Everyone dreams of a comfortable and a luxurious lifestyle. Because of the luxurious lifestyle and a busy and hactic schedule more and more people are attracted towards this technological advancement of home automation.

5.4.1 Growth in Automation Market in India

The next phase of home automation will be based on some technological advances in the field of automation, such as improvements in wireless automation solutions and price cuts, as people will use home automation extensively. Some of the trends we will see at this stage of the industry are :

Some huge organizations like Siemens and Schneider, Philips will carry mass market automation items with an impressive UI yet at lower costs than the present cost so an ever increasing number of individuals can manage the cost of it.

Arrangement contributions will gradually move towards a superior easy to use plan so clients can undoubtedly utilize the Automation items without counseling any specialized master.

5.4.2 Commodification of Automation market (2021 onward)

As a technological industry, if the Home Automation turns into a progressively common thing, at that point there will be various players in the market, numerous item contributions and the

focused evaluating. Estimations are that market of just Home Automation will be 3.2 billion dollars by 2020. It implies that Indian market will have a multi-billion dollar opportunity in the coming future.

We will see that there will be more no. of rivals in the market which further will prompt the challenge in costs and lower edges, and the major part of the houses will utilize the Home automation innovation, So it will move toward becoming as basic as having a TV or a cooler at home.

CONCLUSION

In this undertaking, we assume that by using this home automation framework, we can make exceptionally easy the lives of old and delicate people, since now it is not required to get out of bed and turn off the light, the fan or anything else. We Control everything over the internet. Likewise, we can improve the security provision of our home using IOT for, for example, using PIR sensors, we can identify any movement of intruders inside the house. If we are away from home, we can activate the PIR sensor at home, if there is any movement inside the house, it will send a notification to the raspberry pi via internet. For further advancement, we can add a servomotor to the input and, if there is anyone inside the house, at that point the servomotor turns and the doorway gets bolted. In the same way, we can reduce our energy loads, since we can control the electrical devices through the network and turn them off when it is not necessary. In this line, we can use residential automation in many ways.

REFERENCES

- [1] Charles Severance, " *Raspberry Pi Based Home Automation System*
- [2] Jinsoo Han, Jaekwan Yun, Jonghyun Jang, Kwang-Roh Park, " *Raspberry pie home automation with wireless sensors using smart phone*", *IEEE Transactions on Consumer Electronics*, vol. 56, no. 3, pp. 1843-1847, Aug. 2010.
- [3] Vamsikrishna Patchava, Sonti Dinesh Kumar, Shaik Riyaz Hussain, K. Rama Naidu, " *Home Automation control system using SMS*" *Proceeding of IEEE International Conference on Electrical Computer and Communication Technologies (ICECCT 2015)*, pp. 1-4, March 2015.
- [4] Eben Upton, Gareth Halfacree, "*Home Automation Using WIFI*", 2012.
- [5] <https://www.zdnet.com/article/what-is-the-raspberry-pi-3-everything-you-need-to-know-about-the-tiny-low-cost-computer/>
- [6] <https://learn.adafruit.com/dht/overview>.
- [7] <https://learn.adafruit.com/pir-passive-infrared-proximity-motion-sensor/overview>
- [8] <https://www.raspberrypi.org/products/raspberry-pi-3-model-b/>
- [9] http://wiki.seeedstudio.com/Raspberry_Pi_3_Model_B/