Ahmednagar Jilha Maratha VidyaPrasarakSamaj's

New Arts, Commerce & Science College, (Autonomous) Ahmednagar

Project Report on

"Home Automation By Using Raspberry Pi"

Submitted by :-

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MSc. II (Electronic Science)

2022-23

Under the Guidance of

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Department of Electronic Science

Certificate

This is certify that **Miss. Walhekar Rutuja Jalindar** has successfully submitted the project report entitled **"Home Automation By Using Raspberry Pi "** towards the fulfillment of the project in Electronics Science, at Department of Electronics science, New arts, commerce & science college, Ahmednagar , Savitribai Phule Pune University, during the year 2022-23.

Guide **H.O.D**

Internal **External**

Acknowledgement:

This acknowledgement is intended to thank all those who guided and supported me in carrying out my project. When expressed in words, feelings of gratitude are partially conveyed.

At first I would like to express my heartiest gratitude & thanks to our H.O.D **D. K. Sonawane sir** & other respected teachers for their kind help and guidance throughout my course.

I want to special thanks to **Prof. Avhale G. V.** for suggesting me my project andproviding me valuable guidance and support through whole of work.

I am grateful to my friends for supporting me to carry outmy project work.

I wish to dedicate this report to my parents, whose constant encouragement, support and blessings made my work far easier. Omission of credits is regretted.

Miss :- Rutuja Jalindar Walhekar

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Chapter 1: Introduction to developed system

1.1 Aim & Objectives:

To design and develop Smart home using Raspberry pi.

To fulfill the above mention criteria the project work has been carried out with following objectives,

- To understand the importance of Home Automation.
- To interfacing various types of sensors.
- To design and develop Raspberry pi based hardware platform.
- To develop algorithm to make Home more Smarter

1.2 Introduction:

Home automation has shaped into one of the largest and fastest-growing markets in technology. Offering a myriad of products to make life simpler and convenient, automation services have now become affordable, thus widening their reach. One of the most significant advantages of home automation is centrally granting single-point control to the low-down on all home functions. It speeds up mundane tasks, allowing the user increased comfort and convenience. Additionally, you can integrate all the basic functions like lights, music, security systems and have complete control over the functioning of your smart-home via a smartphone or tablet. Home automation systems can link motion detectors, surveillance cameras, automated door locks, and other tangible security measures. Whether you are at home or halfway around the world, you can choose to receive security alerts on your personal devices, watch actions in real-time, and monitor the safety devices accordingly.You may program your hub *en route* to regulate heating or cooling so that you get the apt temperature when you step in. Similarly, occupancy sensors turn off lights based on occupancy to keep bills in control. In the same way, shades drastically lower your heating and air conditioning expenditures throughout the year by adjusting the amount of heat that can enter and depart your home.

Daylight sensors can be used to optimise light usage. Based on the motion detected in a room, heating and cooling can be turned on and off, or readjusted as needed. Motorised shades can eliminate any hassle by allowing you to program a series of actions ahead of time – or even remotely. Automation makes your home cost-effective, eco-friendly, and so much

more comfortable

The beauty of home automation lies in the fact that it can be tailor-made to your needs and specific budget. For instance, someone may prefer tablets to phones for easy viewing. One can set up voice commands with smart assistants like Amazon Alexa or use customised smartphone and tablet apps, smart control panels, and remote controls. Everyday decisions like controlling the shades or turning on the television become simpler and quicker.

Few things are more valuable in life than feeling at ease in the comfort of your home. You can control light and temperature from anywhere in your house using a home automation system without having to move around. For example, you can ask your voice assistant to play your favourite song to wash away all the distress from a long day at work. You can trust your smart home to relieve you of your anxieties of having to double-check turning off appliances and locking your doors. It is reassuring to have the aid of home automation, to do away with the monotony of everyday chores.

In this age of technology-driven design, consumers are becoming more eager to adopt home automation as it offers various benefits. These include cost-effectiveness and energy efficiency, home monitoring from remote locations, better comfort and convenience, and a premium appeal for their houses. Smart homes are the future since they anticipate one's wants and provide customers with a new lifestyle that is more connected, convenient, and intelligent. With automation fast becoming the 'new normal,' the smart home innovation is destined to risk

One of the main advantages of home automation systems is energy efficiency. Automating air conditioning, lighting, security, or communication translates to significant savings in energy consumption. There is also an improvement in the quality of life of users who now have a home adapted to all their needs. One of the main advantages of home automation systems is energy efficiency. Automating air conditioning, lighting, security, or communication translates to significant savings in energy consumption. There is also an improvement in the quality of life of users who now have a home adapted to all their needs.

1.3 Uses of all Sensors in the project :-

- **Camera module 5MP:**

In my project im using Camera Module 5MP For Display who stand out side of Door ,when Someone came and press the doorbell then inside’s person will be able to see picture of

the outside person on the screen.

- **Switch Button:-**

  Im using Normally open Switch Button For as door bell,when someone outside of door and press switch button the inside of home buzzer will be alert us someone is stand outside of our home

- **LM35 :-**

  Im using LM35 temperature sensor for automatic Fan is ON and OFF.LM35 detect the room temperature of our room and then Fan will be automatically ON . When temperature is getting down the Fan will be OFF automatically and when room temperature is getting up then fan will be ON automatically

- **LDR :-**

  In my project im using LDR Light Dependent Resistance working of ldr is when illuminated mode is increased then light resistance is decreased and when illuminated mode is decreased the light resistance is increased and for this use automatic light turn off and on.

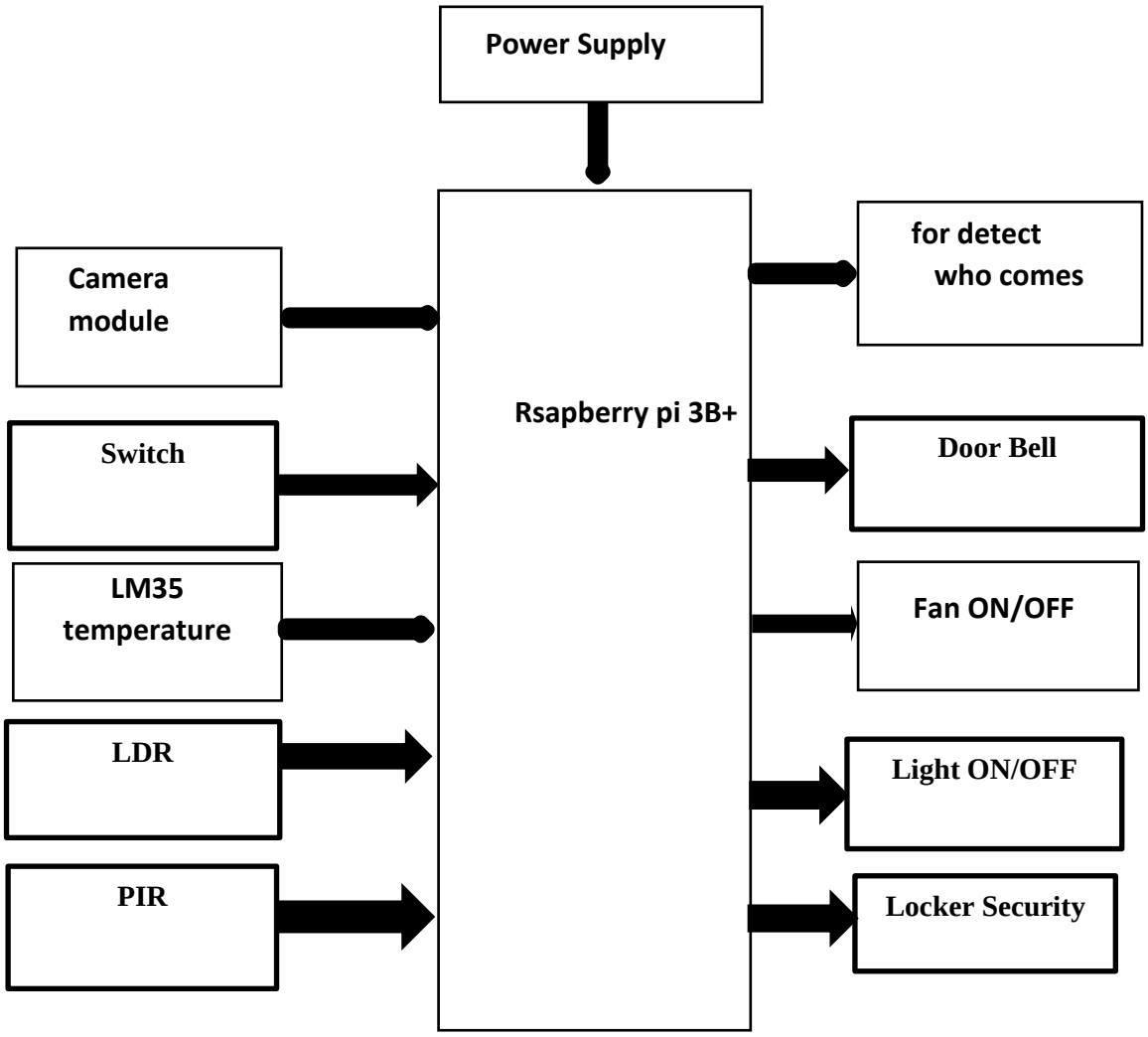
- **PIR Sensor:-**

  Using PIR sensor detect who is came in front of jewellery locker if someone went there the PIR sensor detect to any motion in front of locker and alert to the hometown's people.

1.4 Importance:

- By measuring room temperature and fan automatically ON/OFF
- By detecting brightness and ON/OFF light**.**

1.5 Block Diagram:



1.4 Pin Diagram of Raspberry pi:

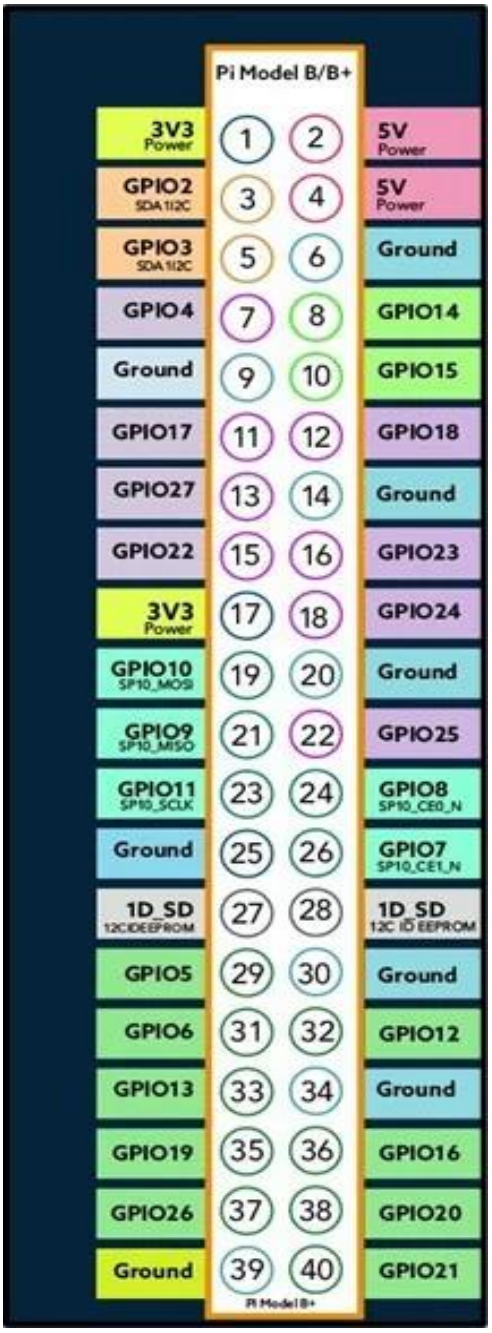


Fig 2.Circuit Diagram of Raspberry pi

Chapter 2: Development of system hardware

2.1 Introduction to Raspberry pi:

Raspberry Pi, developed by Raspberry Pi Foundation in association with Broadcom, is a series of small single-board computers and perhaps the most inspiring computer available today.

From the moment you see the shiny green circuit board of Raspberry Pi, it invites you to tinker with it, play with it, start programming, and create your own software with it. Earlier, the Raspberry Pi was used to teach basic computer science in schools but later, because of its low cost and open design, the model became far more popular than anticipated. It is widely used to make gaming devices, fitness gadgets, weather stations, and much more. But apart from that, it is used by thousands of people of all ages who want to take their first step in computer science.

2.2 Generations and Models

In 2012, the company launched the Raspberry Pi and the current generations of regular Raspberry Pi boards are **Zero, 1, 2, 3, and 4**.

Generation 1 Raspberry Pi had the following four options −

Model A

Model A +

Model B

Model B +

Among these models, the **Raspberry Pi B models** are the original credit-card sized format.

On the other hand, the **Raspberry Pi A models** have a smaller and more compact footprint and hence, these models have the reduced connectivity options.

Raspberry Pi Zero models, which come with or without GPIO (general-purpose input output) headers installed, are the most compact of all the Raspberry Pi boards types.

Software developer Eben Upton and Software Engineers Pete Lomas and David Braden formed the Raspberry Pi foundation in 2006. The main aim of this foundation was to devise a computer to inspire children. Hence, in order to reduce the cost, the early prototypes of the Raspberry Pi were based on the 8-bit Atmel ATmega microcontroller On February 29th, 2012,

the team started taking the orders for Model B and in the same year, they started its production run which consisted of around 10,000 units. These models were manufactured by the founders in China and Taiwan.

On February 4th, 2013, they started taking the orders for lower cost Model A. Similarly, on November 10th, 2014, the team launched for even more low-cost Model A+. The cheapest Raspberry Pi Zero was launched on November 26th, 2015.The name Raspberry Pi was chosen with “Raspberry” as an ode to tradition of naming early computer companies after fruit. Here, "Pi" is for Python Programming Language.

2.1.1 Technical specifications of Raspberry pi

Raspberry Pi Version	Release Date	Form Factor	Dimensions (in mm)
Raspberry Pi 4 Model B	2019-2020	Standard	85.6 x 56.5
Raspberry Pi 3 Model B+	2018	Standard	85.6 x 56.5
Raspberry Pi 3 Model B	2016	Standard	85.6 x 56.5
Raspberry Pi 3 Model A+	2018	Compact	65 x 56.5
Raspberry Pi Zero Wireless with Headers	2017	Mini	65 x 30 x 5
Raspberry Pi Zero Wireless	2016	Mini	65 x 30 x 5
Raspberry Pi Zero	2015	Mini	65 x 30 x 5
Raspberry Pi 2 Model B	2015	Standard	85.6 x 56.5
Raspberry Pi 1 Model B +	2014	Standard	85.6 x 56.5
Raspberry Pi 1 Model B	2012	Standard	85.6 x 56.5
Raspberry Pi 1 Model A+	2014	Compact	65 x 56.5
Raspberry Pi 1 Model A	2013	Standard	85.6 x 56.5

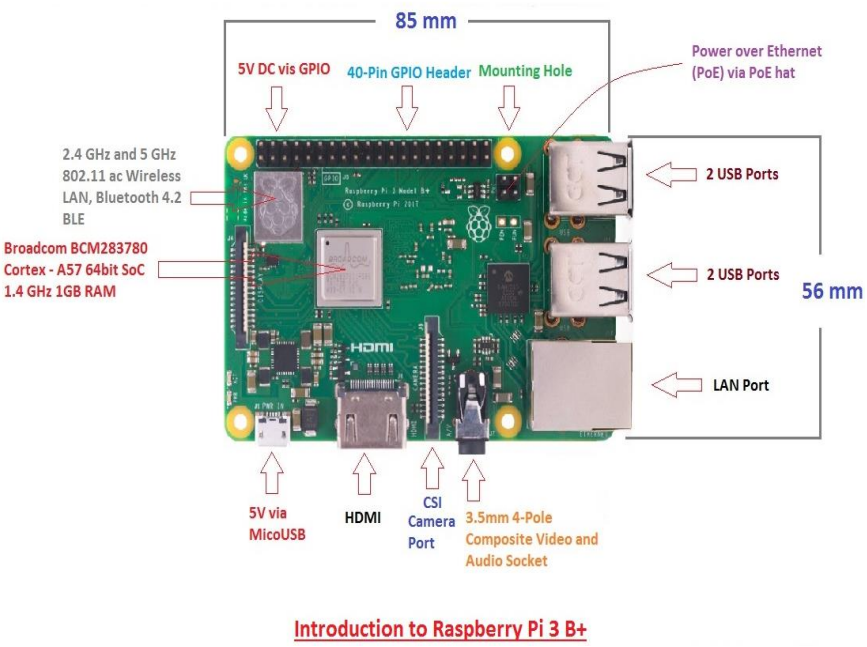


Figure 5: Diagram of Reaspberry pi

2.2 Introduction to 5MP Camera module:

2.2.1 Information

The Raspberry Pi Camera Board is a custom designed add-on module for Raspberry Pi hardware. It attaches to Raspberry Pi hardware through a custom CSI interface. The sensor has 5 megapixel native resolution in still capture mode.

The camera board attaches to the Raspberry Pi via a ribbon cable. One end of the ribbon cable goes to the camera PCB and the other end attached to Raspberry Pi hardware itself. You need to get the ribbon cable connections the right way, or the camera will not work. On the camera PCB, the blue backing on the cable should be facing away from the PCB, and on the Raspberry Pi hardware it should be facing towards the Ethernet connection.

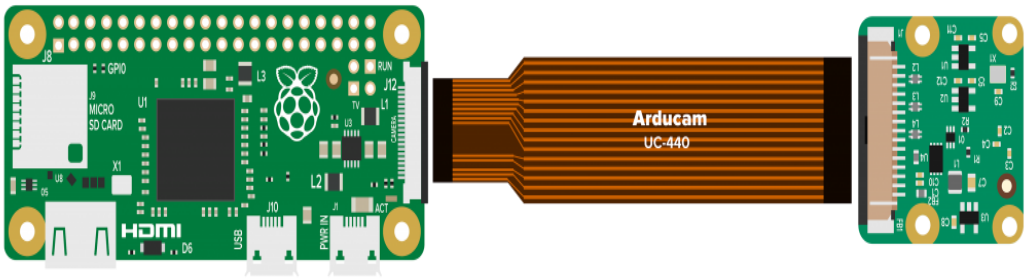
First, plug the ribbon connector of the camera module into the connector on the Raspberry Pi. The white connector closer to the USB and Ethernet ports is the one for the camera. The other port, located on the other side of the single-board computer, is meant for connecting a display.…

2.2.2 General Description:

The Raspberry Pi Camera Board is a custom designed add-on module for Raspberry Pi hardware. It attaches to Raspberry Pi hardware through a custom CSI interface. The sensor has 5 megapixel native resolution in still capture mode. In video mode it supports capture resolutions up to 1080p at 30 frames per second.

Pin #	Name	Description
1	GND	Ground
2	CAM_D0_N	MIPI Data Lane 0 Negative
3	CAM_D0_P	MIPI Data Lane 0 Positive
4	GND	Ground
5	CAM_D1_N	MIPI Data Lane 1 Negative
6	CAM_D1_P	MIPI Data Lane 1 Positive
7	GND	Ground
8	CAM_CK_N	MIPI Clock Lane Negative
9	CAM_CK_P	MIPI Clock Lane Positive
10	GND	Ground
11	CAM_IO0	Power Enable
12	CAM_IO1	LED Indicator
13	CAM_SCL	I2C SCL
14	CAM_SDA	I2C SDA
15	CAM_3V3	3.3V Power Input

Connector on the Raspberry Pi with Camera



2.2.3 Camera 5MP Specifications :

- Fully Compatible with Both the Model A, Model B and Model B+ Raspberry Pi
- 5MP Omnivision 5647 Camera Module
- Still Picture Resolution: 2592 x 1944
- Video: Supports 1080p @ 30fps, 720p @ 60fps and 640x480p 60/90 Recording
- 15-pin MIPI Camera Serial Interface - Plugs Directly into the Raspberry Pi Board
- Size: 20 x 25 x 9mm
- Weight 3g

2.3 Introduction to Noramlly Closed pushbutton Switch:-

2.3.1 Description of Switch:-

Normally open and normally closed switch contacts are the terminology used to describe the open and close positions of the switch in normal conditions. Here, a normal condition is a condition when the switch is not energized manually or electrically. Normally open condition means the contact of the switch is in an open position when it is not energized. In a similar way, the normally close condition means the switch is in the close position when there is no force on its actuator.

A switch is a simple element to turn on or off any device or equipment. Thus, a switch can be defined as an electrical component that connects and disconnects the electrical path. A switch is a binary device (that has two states -0 or 1); they are either completely closed (On) or completely open(off).

2.3.2 Diagram of switch:-

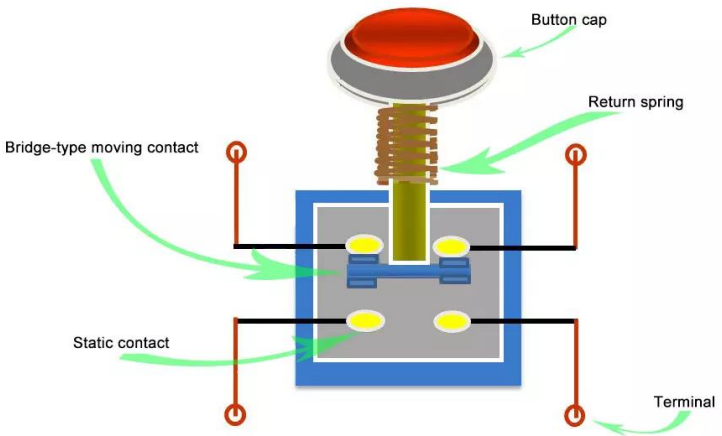


Fig 7. Diagram of switch

2.3.3 Pushbutton switch Specifications

- Up to 4 poles
- N/O or C/O contact configuration
- Gold or silver contacts
- Sealed or unsealed versions
- Right angle versions
- Single or dual actuator
- Round or rectangular actuator buttons
- Flush actuator versions
- Snap action versions

2.3.4 Features of Switch

- Low On Resistance : RON: 4.0 Typical @ VCC = 4.5 V
- Minimal Propagation Delay : tpd < 0.5 ns
- Control Input Compatible with TTL Levels
- ESD Performance: Human Body Model > ±2 kV
- 5-Pin SC−70 or 5-Pin TSOP−5 Packages Available
- These are Pb−Free Devices

2.4 Introduction to LM35 sensor module

2.4.1 Description

As the LM35 device draws only 60 μA from the supply, it has very low self-heating of less than 0.1°C in still air. The LM35 device is rated to operate over a −55°C to 150°C temperature range, while the LM35C device is rated for a −40°C to 110°C range (−10° with improved accuracy). LM35 is a temperature sensor that outputs an analog signal which is proportional to the instantaneous temperature. The output voltage can easily be interpreted **to obtain a**

temperature reading in Celsius. The advantage of lm35 over thermistor is it does not require any external calibration. The coating also protects it from self-heating. Low cost (approximately $0.95) and greater accuracy make it popular among hobbyists, DIY circuit makers, and students. Many low-end products take advantage of low cost, greater accuracy and used LM35 in their products. Its approximately 15+ years to its first release but the sensor is still surviving and is used in any products.

In order to understand the working principle of LM35 temperature sensor we have to understand the linear scale factor. In the features of LM35 it is given to be **+10 mills volt per degree centigrade**. It means that with increase in output of 10 mills volt by the sensor vout pin the temperature value increases by one. For example, if the sensor is outputting 100 mills volt at vout pin the temperature in centigrade will be 10-degree centigrade. The same goes for the negative temperature reading. If the sensor is outputting -100 mills volt the temperature will be -10 degrees Celsius.

LM35 can be used in two circuit configurations. Both yield different results. In the first configuration, you can only measure the positive temperature from 2 degrees Celsius to 150 degrees Celsius. In this first configuration, we simply power lm35 and connect the output directly to analog to digital converters. In the second configuration, we can utilize all the sensor resources and can measure the full range temperature from -55 degree centigrade to 150-degree centigrade. This configuration is a little complex but yields high results. We have to connect an external resistor, in this case, to switch the level of negative voltage upwards. The external resistor value can be calculated from the formula given below the configuration circuit. The second configuration circuit can be made in various ways.To see about the second configuration circuits visit the LM35 **datasheet** by Texas Instruments. Texas Instruments **data sheet** enlists the circuit with clear component values. Although the first configuration did not need a resistor at the output side, I recommend connecting an 80 k to 100 k resistor between vout and gnd pin. When I performed several experiments I noticed that the readings some time

fluctuate and the vout pin floats. So a resistor between vout and gnd tights the vout pin low.

Fig of LM35

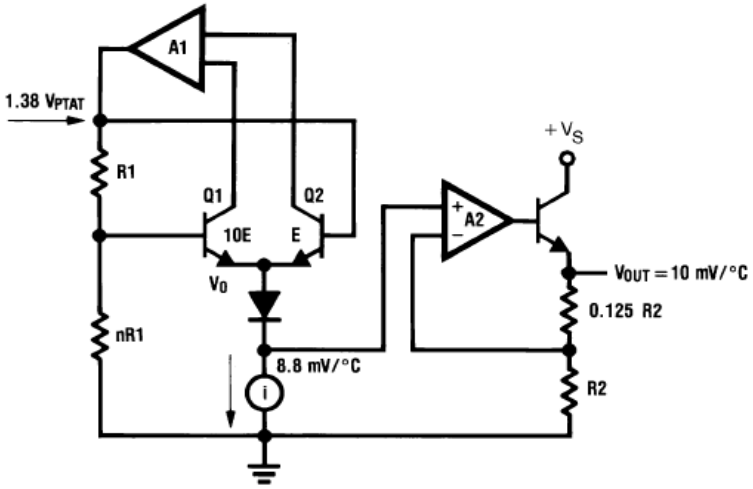


Fig 8.Block Diagram of LM35 module

2.4.2 Features and Specifications

- Output calibrated in ° Celsius
- 0.5° C accuracy at 25° C.
- Wide range of operation between -55° to +150°C
- Wide range of operatin voltage ranging between 4 to 30 volts
- Current consumption of less than 60 μA
- Calibrated Directly in Celsius (Centigrade)
- Linear + 10-mV/°C Scale Factor
- 0.5°C Ensured Accuracy (at 25°C)
- Rated for Full −55°C to 150°C Range
- Suitable for Remote Applications
- Operates from 4 V to 30 V
- Less than 60-μA Current Drain
- Low Self-Heating, 0.08°C in Still Air
- Non-Linearity Only ±¼°C Typical
- Low-Impedance Output, 0.1 Ω for 1-mA Load

2.4.3 Applications

- It's used for measuring the temperature of a particular environment.
- It provides thermal shutdown for a circuit or component used in a specific project.
- It can be used for battery temperature measurement. ...
- It can be used in HVAC applications as a temperature measurement device.

2.5 Introduction to LDR Sensor

2.5.1General Description

LDR is an acronym for **Light Dependent Resistor**. LDRs are tiny light-sensing devices also known as **photoresistors**. An LDR is a resistor whose resistance changes as the amount of light falling on it changes. The resistance of the LDR decreases with an increase in light intensity, and vice-versa. This property allows us to use them for making light sensing circuits.cFor using an LDR, we always have to make a voltage divider circuit. When the value of resistance of LDR increases in comparison to the fixed resistance, the voltage across it also increases. When the light falls on the resistor, then the resistance changes. These resistors are often used in many circuits where it is required to sense the presence of light. These resistors have a variety of functions and resistance. For instance, when the LDR is in darkness, then it can be used to turn ON a light or to turn OFF a light when it is in the light. A typical light dependent resistor has a resistance in the darkness of 1MOhm, and in the brightness a resistance of a couple of Kohm.

This resistor works on the principle of photo conductivity. It is nothing but, when the light falls on its surface, then the material conductivity reduces and also the electrons in the valence band of the device are excited to the conduction band. These photons in the incident light must have energy greater than the band gap of the semiconductor material.This makes the electrons to jump from the valence band to conduction. These devices depend on the light, when light falls on the LDR then the resistance decreases, and increases in the dark.When a LDR is kept in the dark place, its resistance is high and, when the LDR is kept in the light its resistance will decrease. Light dependent resistors have a low cost and simple structure. These resistors are frequently used as light sensors. These resistors are mainly used when there is a need to sense the absence and presence of the light such as burglar alarm circuits, alarm clock, light intensity meters, etc. LDR resistors mainly involves in various electrical and electronic projects. For better understanding of this concept, here we are explaining some real time projects where the LDR resistors are used.

Fig 9. Diagram of Light Dependend Resistance

2.5.2 Features

- Maximum power dissipation is 200mW.
- The maximum voltage at 0 lux is 200V.
- The peak wavelength is 600nm.
- Minimum resistance at 10lux is 1.8kΩ
- Maximum .resistance at 10lux is 4.5kΩ
- Typical resistance at100lux is 0.7kΩ
- Dark resistance after 1 sec is 0.03M

2.5.3 Advantages

- Sensitivity is High
- Simple & Small devices
- Easily used
- Inexpensive
- There is no union potential.
- The light-dark resistance ratio is high.

2.6 Introduction to PIR Sensor:-

2.6.1 Description:

PIR sensors allow you to sense motion, almost always used to detect whether a human has moved in or out of the sensors range. They are small, inexpensive, low-power, easy to use and don't wear out. For that reason they are commonly found in appliances and gadgets used in homes or businesses. They are often referred to as PIR, "Passive Infrared", "Pyroelectric", or "IR motion" sensors. PIRs are basically made of a pyroelectric sensor (which you can see below as the round metal can with a rectangular crystal in the center), which can detect levels of infrared radiation. Everything emits some low level radiation, and the hotter something is, the more radiation is emitted. The sensor in a motion detector is actually split in two halves. The reason for that is that we are looking to detect motion (change) not average IR levels. The two halves are wired up so that they cancel each other out. If one half sees more or less IR radiation than the other, the output will swing high or low. For many basic projects or products that need to detect when a person has left or entered the area, or has approached, PIR sensors are great. They are low power and low cost, pretty rugged, have a wide lens range, and are easy to interface with. Note that PIRs won't tell you how many people are around or how close they are to the sensor, the lens is often fixed to a certain sweep and distance (although it can be hacked somewhere) and they are also sometimes set off by housepets. Experimentation is key!

The passive infrared sensor does not radiate energy to space. It receives the infrared radiation from the human body to make an alarm. Any object with temperature is constantly radiating infrared rays to the outside world. The surface temperature of the human body is between 36° C - 27 ° C and most of its radiant energy concentrated in the wavelength range of 8 um-12 um. Passive infrared alarms classified into infrared detectors (infrared probes) and alarm control sections. The most widely used infrared detector is a pyroelectric detector. It uses as a sensor for converting human infrared radiation into electricity. If the human infrared radiation is directly irradiated on the detector, it will, of course, cause a temperature change to output a signal. But in doing all this, the detection distance will not be more. In order to lengthen the detection distance of the detector, an optical system must be added to collect the infrared radiation. Usually, plastic optical reflection system or plastic **Fresnel lens** used as a focusing system for infrared radiation.

2.6.2 PIR Sensor pinout:

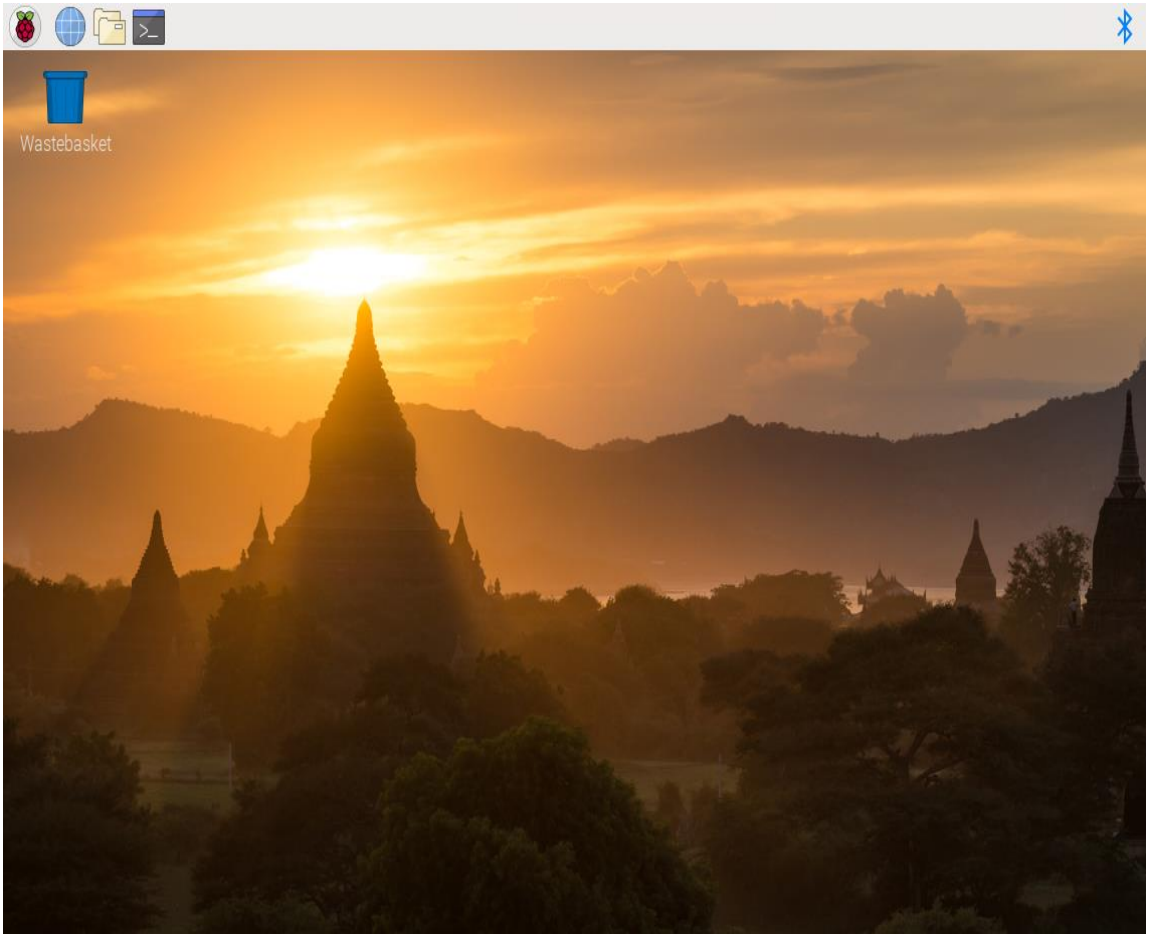
- Vcc – Input voltage is +5V for typical applications. Can range from 4.5V- 12V
- Low/High Output – Digital pulse high (3.3V) when triggered (motion detected) digital low(0V) when idle(no motion detected
- Gnd – Connected to ground of circuit

Chapter 3: Development of System Software

3.1 Introduction to Raspbian OS Software

Your Raspberry Pi doesn't have a power switch. As soon as you connect it to a power outlet, it will turn on.

1. Plug the power supply into a socket and connect it to your Raspberry Pi's power port.
2. After a few seconds the Raspberry Pi OS desktop will appear
3. Click on Next to start the setup.
4. Set your Country, Language, and Timezone, then click on Next again.
5. Enter a new username and password for your Raspberry Pi and click on Next.
6. Set up your screen so that the Desktop completely fills your monitor.
7. Connect to your wireless network by selecting its name, entering the password, and clicking on Next
8. Click on Next, and let the wizard check for updates to Raspberry Pi OS and install them (this might take a little while)
9. Click on Restart to finish the setup.
10. Insert the SD card you've set up with Raspberry Pi OS into the microSD card slot on the underside of your Raspberry Pi.
11. Insert the SD card you've set up with Raspberry Pi OS into the microSD card slot on the underside of your Raspberry Pi.
12. Find the USB connector end of your mouse's cable, and connect the mouse to a USB
13. port on Raspberry Pi (it doesn't matter which port you use).
14. Connect the keyboard in the same way
15. Make sure your screen is plugged into a wall socket and switched on.
16. Look at the HDMI port(s) on your Raspberry Pi — notice that they have a flat side on
17. Thonny Python IDE. Write your program in the top pane
18. click File > Save as... to save it, and click Run > Run current script to execute the
19. Output will appear in the bottom interpreter pane..


Wastebasket

3.1 Flow Chart

3.2.1 Flow chart of Camera Module

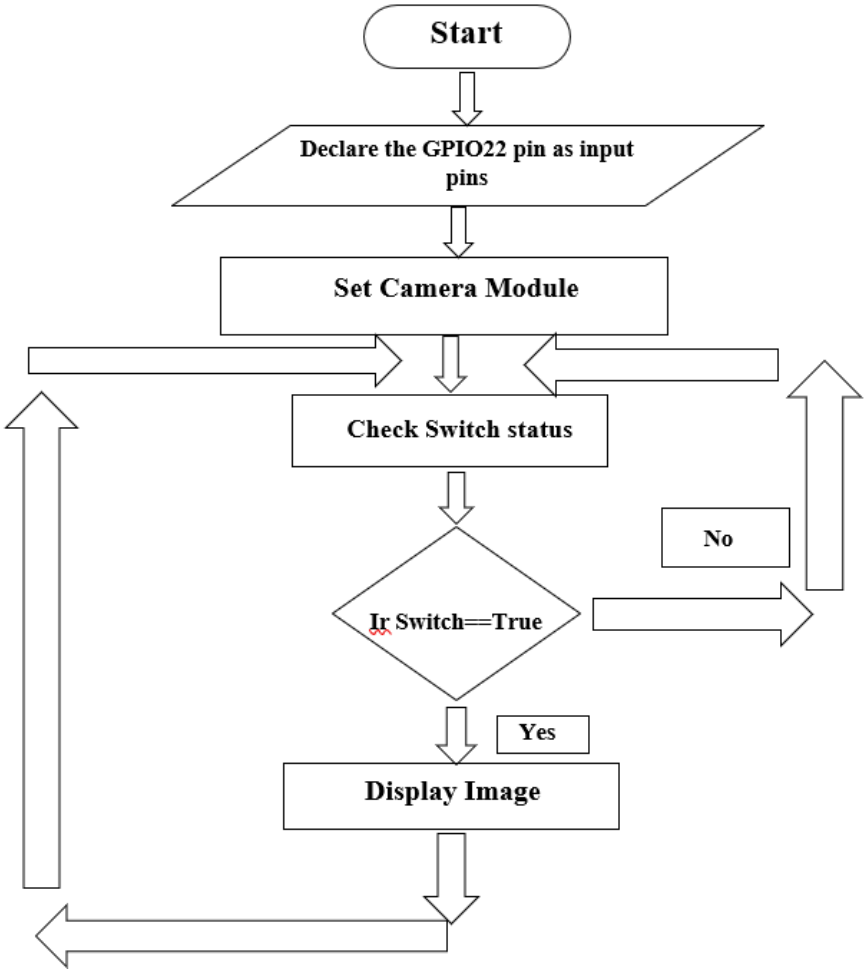
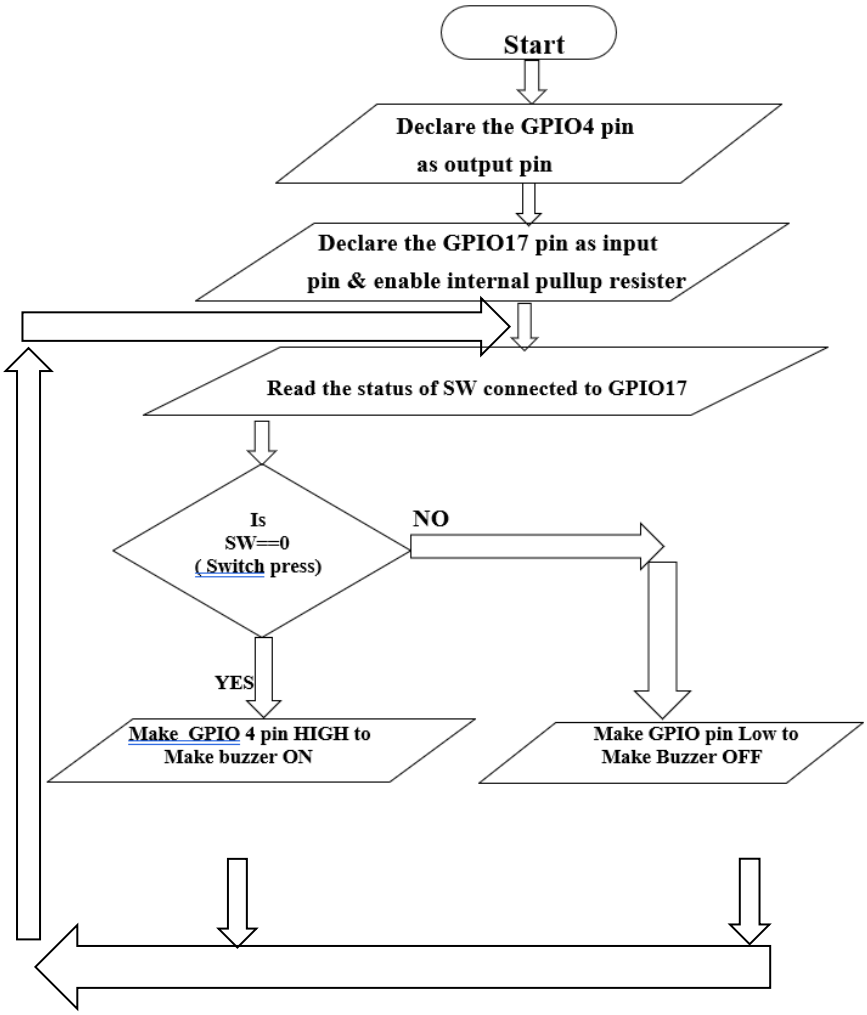


Fig 10.Flow chart of Camera module

3.2.2 Flow chart of Switch



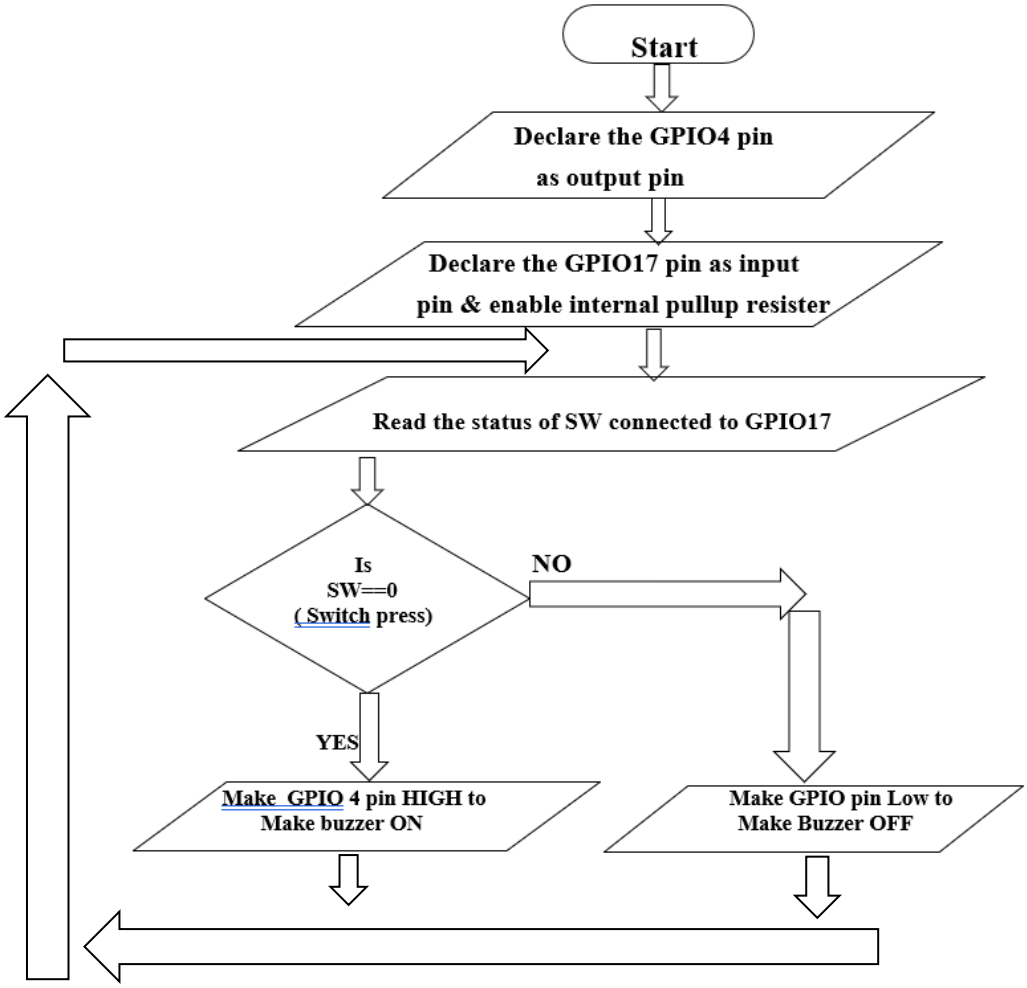


Fig 11.Flow chart of Switch Button

3.2.3 Flowchart of LM 35

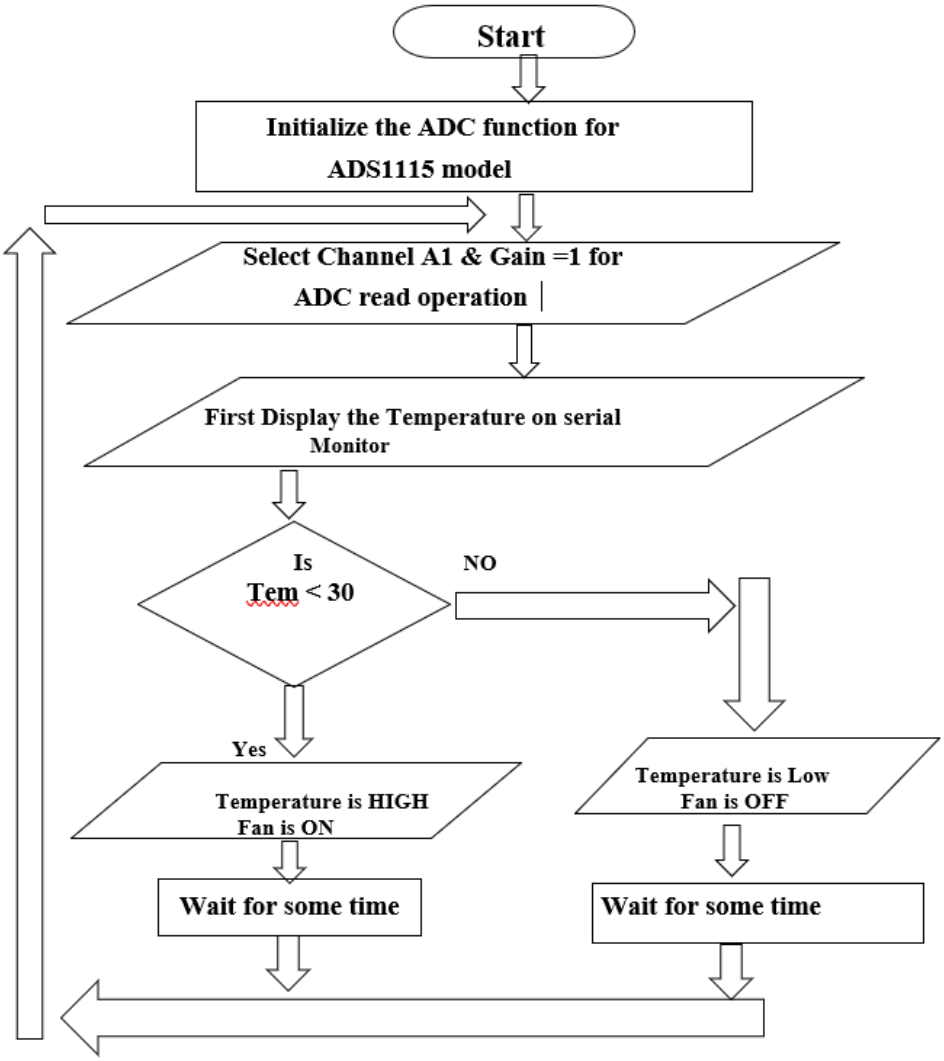


Fig 12.LM 35

3.2.5 Flowchart LDR:-

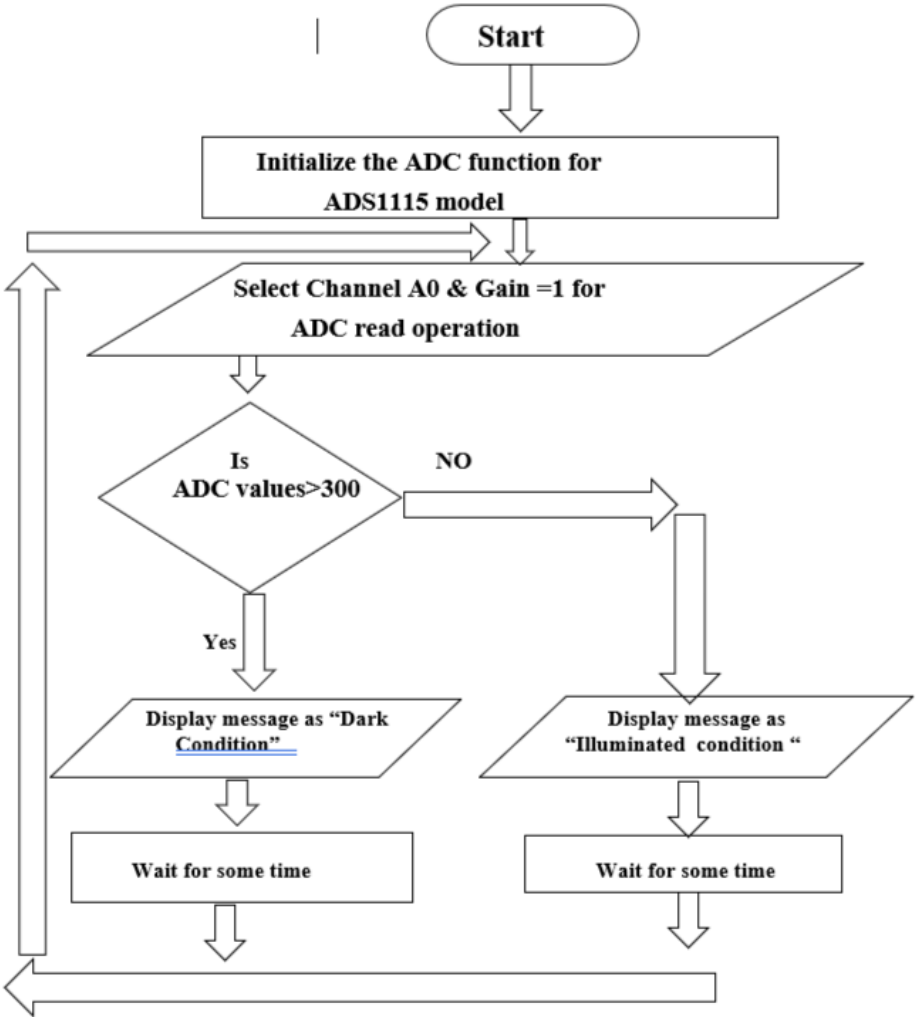


Fig 13.Flow chart of LDR

3.2.6Flowchart of PIR sensor

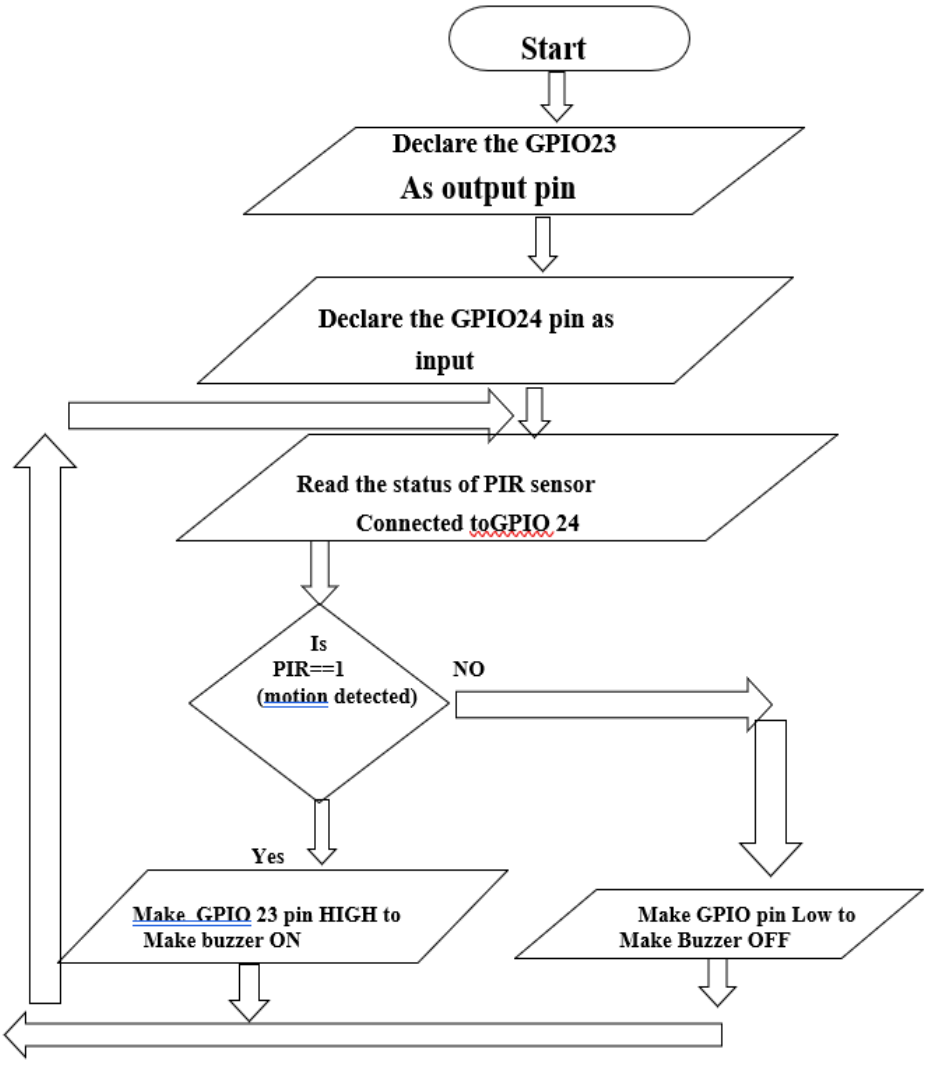


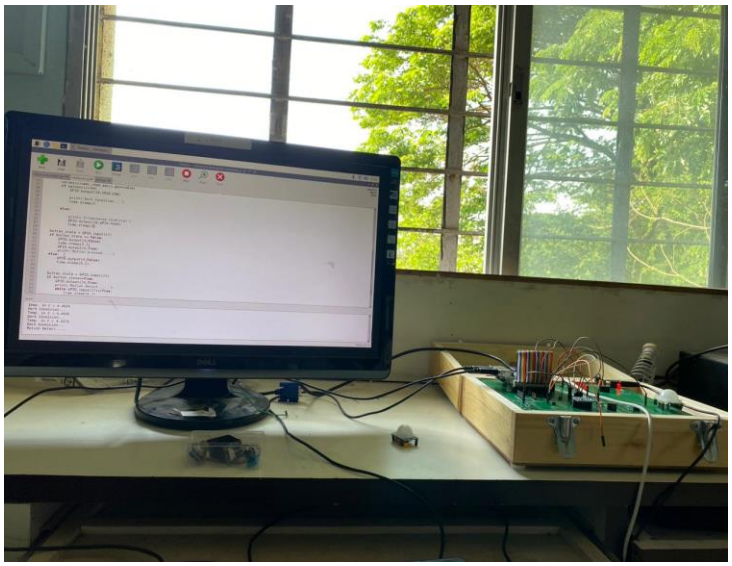
Fig 14.Flow chart of PIR sensor

Chapter 4: Result and Conclusion

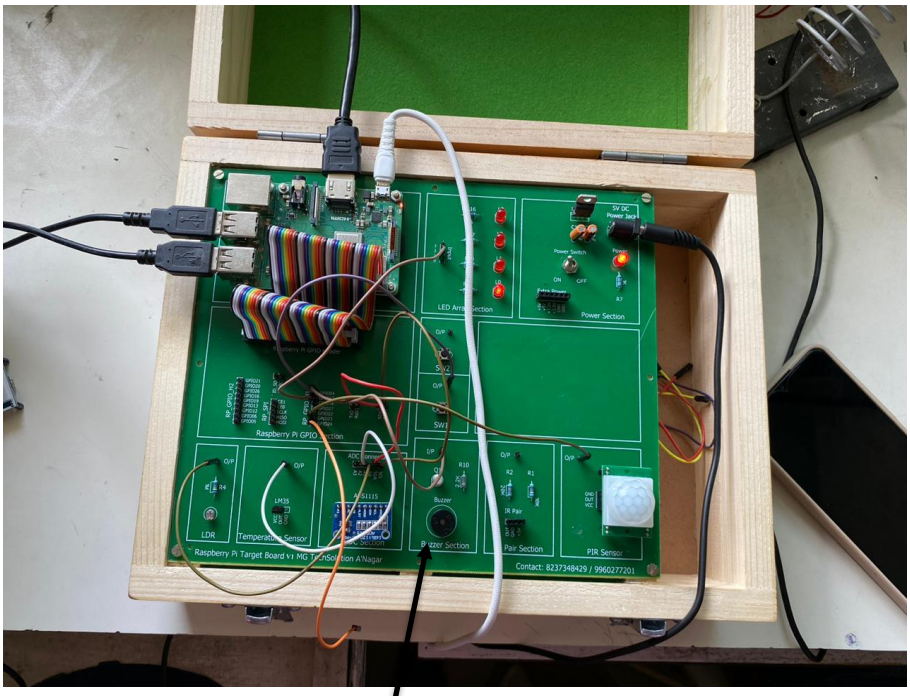
4.1 Experimental Setup of developed system

The experimental setup of developed system is consisting of system of hardware, temperature sensor, PIR sensor for mation detection , LDR for light and dark mode . The sensors are connected to the system. The power to the system is provided by supply 5V DC. From an application point of view, the developed system is place in home.

Display Screen

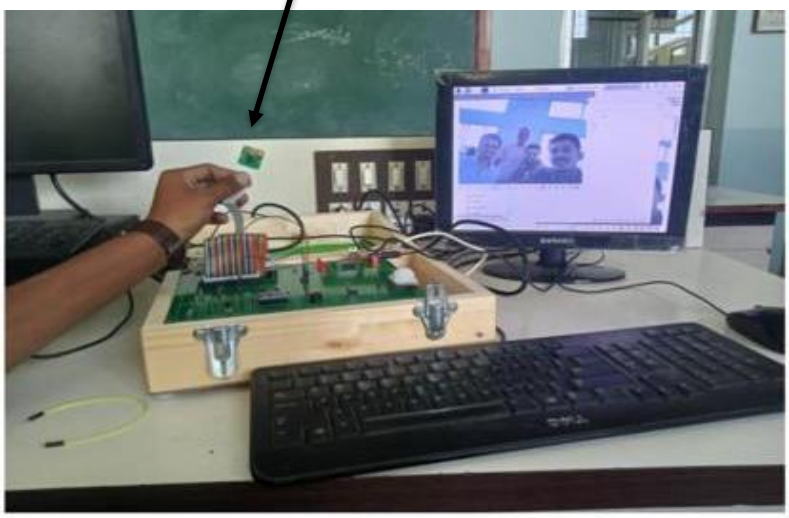


On Screen Display of room Temperature , Mation detection and Illuminated and dark condition



Connections of
Switch , PIR , LDR and LM35

Camera Module Image



4.2 Conclusion

The proposed ‘Smart Home’system succesfully studied using sensors.

The system allows the Light,Fan,temperature and level. The developed system is smaller in size and weight; it works with low power consumption and has fast response. Thus it can be implemented for portable applications.Future work will be focused on improving overall accuracy of the system. So that it couldbe freely implemented in field operations.

4.3:- Future scope:-

- The user need not learn about programming to use this device. It is built using a simple Python programming language which makes it easy to read code functions and possess automatic memory capabilities.
- Raspberry Pi is ideal for small companies and businesses running with a small budget and users do not require to buy special licenses to use it. Small-scale businesses can use it to automate functions like web management or media server and database.
- The product is versatile and you can have it perform different functions.
- Raspberry Pi is a greener technology that makes it easy for small businesses to recycle their waste.
- It is an adaptive technology device that allows users to play videos using high definition resolution of up to 1080p and develop systems like embedded systems and digital jukeboxes

References:-

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