SRI KRISHNA COLLEGE OF ENGINEERING AND TECHNOLOGY

(An Autonomous Institution)
(Approved by AICTE and Affiliated to Anna University, Chennai)
ACCREDITED BY NAAC WITH "A" GRADE

SMART HOME AUTOMATION

A PROJECT REPORT

Submitted by

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In partial fulfillment of the requirements

for the award of the degree

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IN

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BONAFIDE CERTIFICATE

Certified that this project report **" SMART HOME AUTOMATION "** is the bona fide work of " **J.ARTHI(19EUEE019), P.ARUL RAJAN(19EUEE020), S.ARUNKUMAR(19EUEE023)"** who carried out the project work under my supervision.

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HEAD OF THE DEPARTMENT	**SUPERVISOR**

This project report submitted for the Autonomous Project Viva-voce examination held on 30.03.2021

INTERNAL EXAMINER	**EXTERNAL EXAMINER**

DECLARATION

We affirm that the project titled **SMART HOME AUTOMATION** is being submitted in partial fulfillment for the award of **BACHELOR OF ENGINEERING (B.E.)** is the original work carried out by us. It has not formed the part of any other project submitted for award of any degree or diploma, either in this or other university.

Signature of the candidates

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P.Arul Rajan

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I certify that the declaration made above by the candidate is true.

Signature of the Guide

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We would like to thank the management for supporting us during our entire project and encouraging us to be innovative and backing us in everything we did.

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Abstract

In recent years, the development in Information And Communication Technology (ICT) are mainly focused on the Internet of Things (IOT). The Internet of Things is the interconnection of the various computing devices embedded in the daily appliances to the internet, thus enabling them to communicate with each other. This enhances the end users quality of life and to improve efficiency and sustainability in the day to day activities. This research work investigates the potential of `Full Home Control', which is the aim of the Home Automation Systems in near future. The analysis and implementation of smart home automation technology using NodeMCU ESP8266 , Blynk app and sensors to control home appliances such as light, fan, socket is presented in this paper. The proposed research work helps in controlling the home appliances with internet connection via wireless Fidelity Wifi connection using nodeMCU and various sensors like LM35 sensor, PIR sensor, LDR sensor. Therefore there is no need of inspecting them often. Home owners will be able to receive feedback status of any home appliances under control whether switched on or off remotely from their mobile phones. The proposed prototype of NodeMCU based home automation system was implemented with a fan, light and socket.

Keywords - Home automation; IOT(Internet Of Things); NodeMCU ESP8266; Blynk; LM35 sensor; PIR sensor; LDR sensor.

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LIST OF SYMBOLS

μ	Micro (10^{-6})
V	Voltage
A	Ampere
V_o	LM35 output voltage
T	temperature in °c (Celsius)

LIST OF ABBREVIATIONS

Abbreviation	Expansion
IOT	Internet Of Things
LDR	Light Dependent Resistor
PIR	Passive Infrared Sensor
IC	Integrated Circuit
GSM	Global System for Mobile communication
GPRS	General Packet Radio Service
ADC	Analog Input Pins
DIO	Digital I/O Pins

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INTRODUCTION

Now a days smart home is one of the major area of interest among consumers. A smart home is a residence with network connected electrical devices which are controlled remotely. Smart home automation [1][2] includes the control and monitoring of home attributes such as lighting, climate, entertainment systems and appliances using smart phone even at home or miles away from any part of the world. It also provides home security such as access control and surveillance system. The Internet of Things(IOT) [3][4] is the interconnection of the various computing devices embedded in the daily appliances to the internet, thus enabling them to communicate with each other. In shortly, many of the smart devices will be communicating over IOT[5] The analyst firm Gartner predicts that by 2020 there will be more than 20 billion devices connected to the Internet of Things And in that Total will reach 25 billion by 2021.

Think about a world were personal refrigerator will provide you list of all your stuff required for upcoming few days base on your present utilization in it. Through home automation, household devices such as TV, light bulb, fan, etc. are assigned a unique address and are connected through a common home gateway. These can be remotely accessed and controlled from any PC, mobile or laptop. That can drastically decrease energy consumption and get better the living environment as well as enhancing the indoor safety.

Along with the quick developments in technology, the devices in the recent past are becoming smarter. The real-world appliances are being prepared with intellect and computing capability so that they can configure themselves accordingly. Sensors[6] attached to embedded devices along with the low power wireless connectivity can facilitate to remotely monitor and control the devices. This forms an integral component of Internet of Things (IoT) network. IoT also helps in transferring of data from sensors through wireless network, achieving recognition and informational exchange in open computing network. Things that we are using in our daily life are becoming smart with the current technologies but it isn't sufficient until we connect them to act with the dynamic environment and in addition to make their own inter-network, that is, machine-to-machine communication.

we automate the functioning of some essential home appliances like fans, lights and sockets by the readings received by various sensors installed at

different parts of the house. The sensors such as LDR,HC-SR 501[7],LM35 will be connected to the Node MCU ESP8266 which will process the readings received by the sensors and control the relays connected to the appliances.

2. Literature Review

The proposed system has a compilation of three loads controlled using a microcontroller called nodeMCU.

Karanchery et. al [8] in their work called "Smart Power Socket using Internet of Things" have build a power socket controlled through wifi. The drawback of the system is that there is no well established communication between the user and the device.

Kodali et. al[9] in his work named "MQTT based home automation system using ESP8266" uses a messaging protocol named MQTT protocol. The disadvantage of this protocol is that it operates over TCP which requires more processing power and more memory. TCP uses handshake protocol which requires frequent wake up and communication time intervals. This affects battery consumption.

Anandhavalli et. al[10] proposed a work named "Smart Home Automation Control Using Bluetooth And GSM" where the area covered through Bluetooth has low coverage.

ElShafee et al.[11] in their work designed and implemented a wifi based home automation system.

Ganesh et. al[12] proposed a model based on GSM based home automation system.

2.1 System realization

The growth in the field of IOT (Internet Of Things) have made the electrical equipments to reach a far better position. Still researches and analysis are going on to improve the quality of those devices. This maximizes the home security, allows flexibility for new devices and appliances.

The proposed model is composed of a microcontroller node MCU to control home appliances and GSM module to establish the communication between the user and the system. Blynk app to control the loads using mobile. The sensors such as LDR ,LM 35 and PIR sensors are used for automatic on and

off of the appliances. Blynk has lots of functions such as timer setting, feedback system and so on.

3. Proposed system

The block diagram of the proposed model is given in the Fig. 3.1.The architecture consists of NodeMCU and Blynk .In this proposed model, the blynk app is used to establish the communication between the user and the microcontroller. The ON/OFF command from the user is send to NodeMCU ESP8266 through the blynk app. The command is processed by the micro controller and the output is given to the relay thus controlling the ON or OFF state of the home appliances. GSM module is used for the establishing the communication between the user and the system.

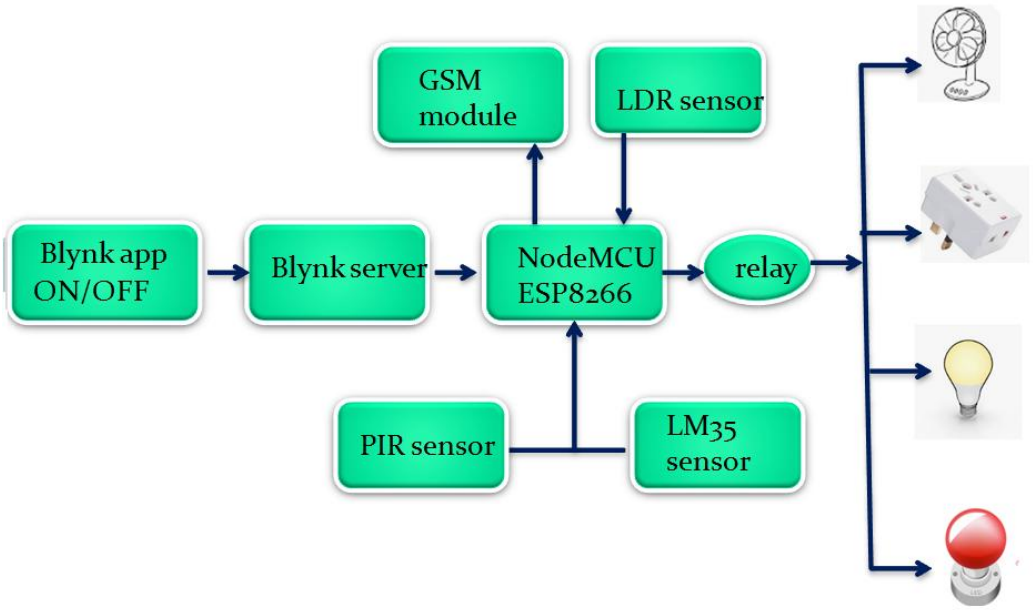


Fig. 3.1. Block Diagram 1

The sensor block diagram is given in Fig. 3.2.The readings of the sensors are given to the nodeMCU ESP8266 where the values are processed and the loads are controlled through the relay automatically. A voltage regulator circuit is used to regulate the supply voltage of 230 V AC into 5 V DC. The 5V dc supply is given to the NodeMCU and 5V relay.

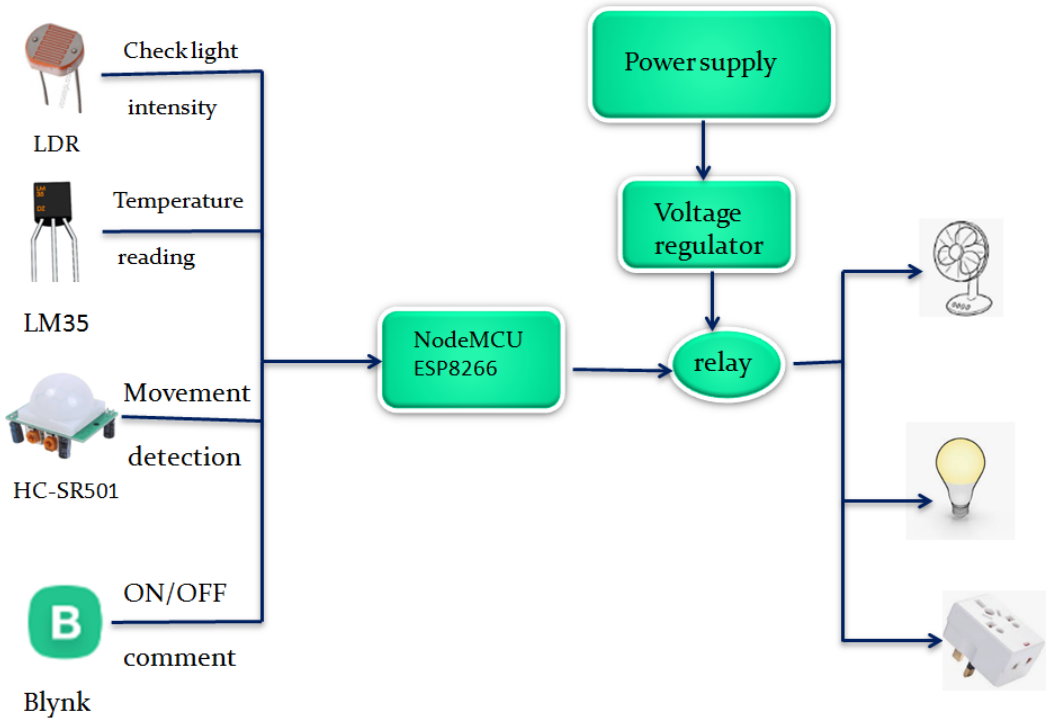


Fig. 3.2. Block diagram 2

The working is depicted by the flow chart given in Fig. 3. 3. The NodeMCU is supplied with 5V dc supply and triggered. The connection between the blynk app and the NodeMCU is established by the wifi connection. The Blynk app checks for the proper authentication code for Hotspot and password. If the hotspot and password are incorrect the connection is not established. After verifying once the connection is established, the user command is given as input to the microcontroller. The microcontroller process the data and control the home appliances such as Bulb, fan, socket through the relay. The relay acts as a switch which helps to provide or resist the supply to loads. The relay used here is a 5V relay. Relay serves as the connecter between the 5 V dc supply and the 230V ac supply. The GSM module used is for communicating the state of the system with the user.

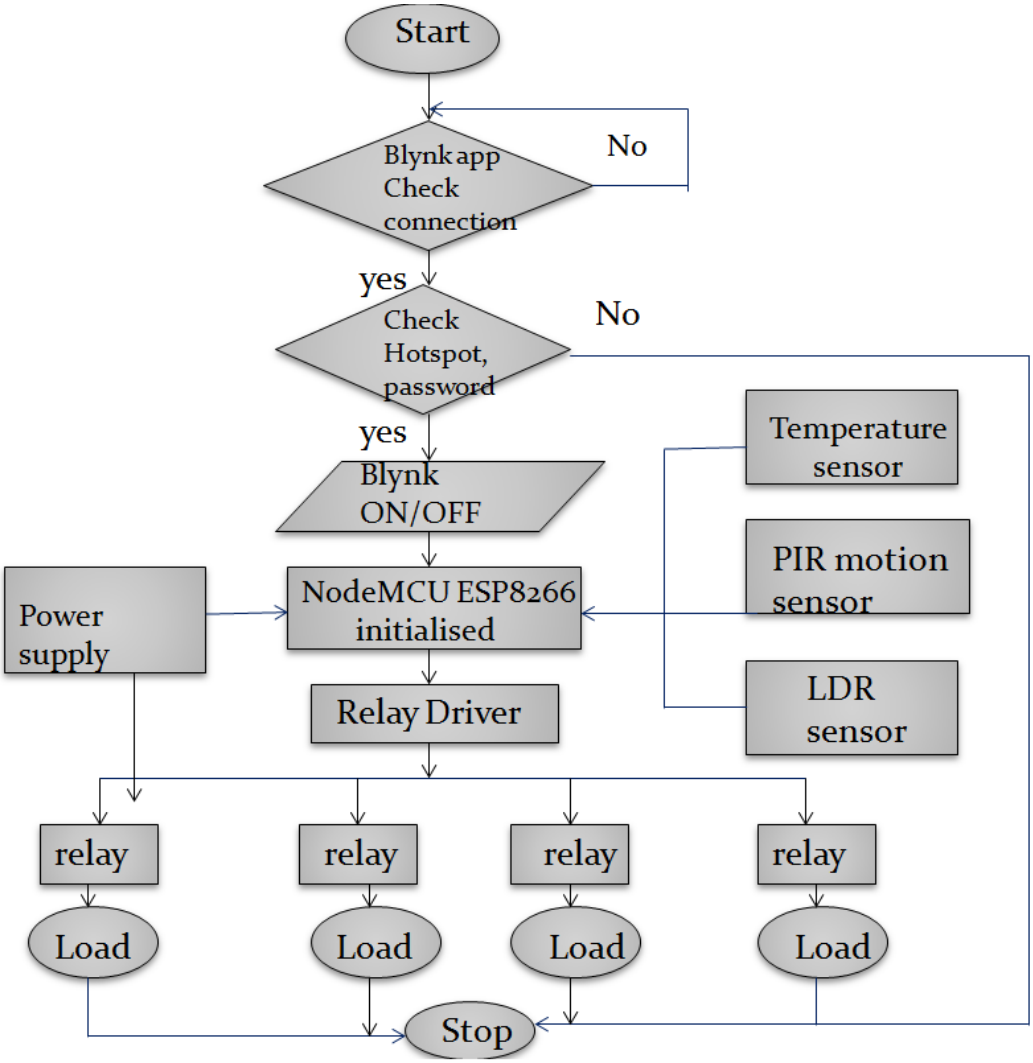


Fig. 3.3. Flowchart 1

The working of the sensor circuit can be explained using the flowchart provided in the Fig. 3.4. LDR sensor reads the light intensity and provide the value as input to the microcontroller. When the light intensity is decreased, the resistance of the sensor decreases resulting in the flow of current through the microcontroller pin. Thus a closed circuit is established for the Bulb connected through the relay. Lm 35 sensor is used to sense the temperature. It's operating range is high. The values from LM 35 sensor is given to the microcontroller which is compared with the bearable temperature value. Once the reading exceeds the limit, the PIR sensor reading is considered. If it is equal to 1(means that human movement is noticed) the circuit of the Fan connected across the relay is closed. Thus these sensors are used to control the loads automatically reducing the human work.

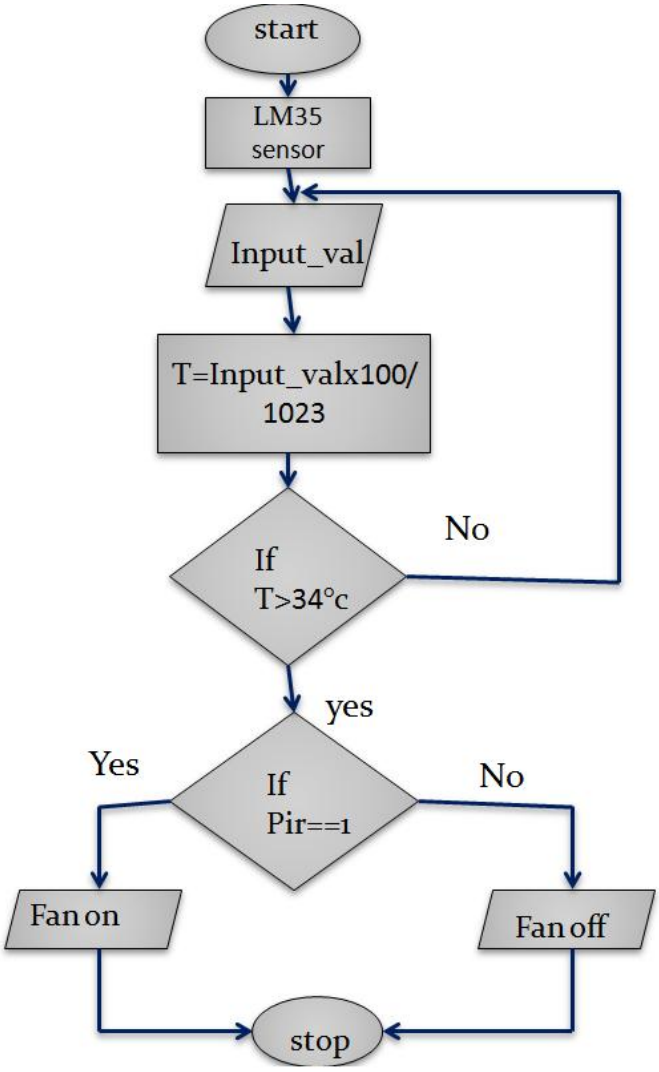


Fig. 3.4. Flowchart 2

4. HARDWARE

The core components of the proposed model are,

- NodeMCU
- 5 V Relay
- Voltage regulator
- LM 35 sensor
- PIR sensor
- LDR sensor

Components	Description	Quantity	link
NodeMCU	ESP8266-12E board	1	https://amzn.to/2LbvQIa
Relay	2 module 5v relay	1	https://www.amazon.in//B06Y1DGK2Z
Voltage converter	230V AC to 5V DC converter	1	https://www.amazon.in//B07Q88DS3T
led	5mm red colour led	1	-
Temperature sensor	LM35	1	https://www.amazon.in//B08TWL9XGL
LDR sensor	8mm ldr	1	https://www.amazon.in//B01BADCLHo
PIR sensor	HC-SR501	1	https://www.amazon.in//B071HSHWX6

4. Components details

4.1 NodeMCU

NodeMCU is connected to internet hotspot of smartphone via wifi connection. NodeMCU is an open source Lua based firmware and development board specially for iot applications.It includes firmware that runs on the ESP8266 wi-fi SoC from Espressif systems.Powered through USB port.Operating voltage is 3.3v. Digital I/O pins(DIO): 16. Analog Input pins(ADC): 1. Flash memory: 4 MB .Small sized module to fit inside iot projects.

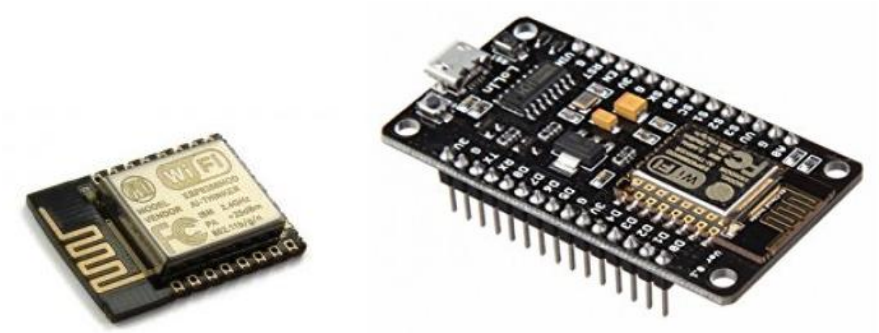
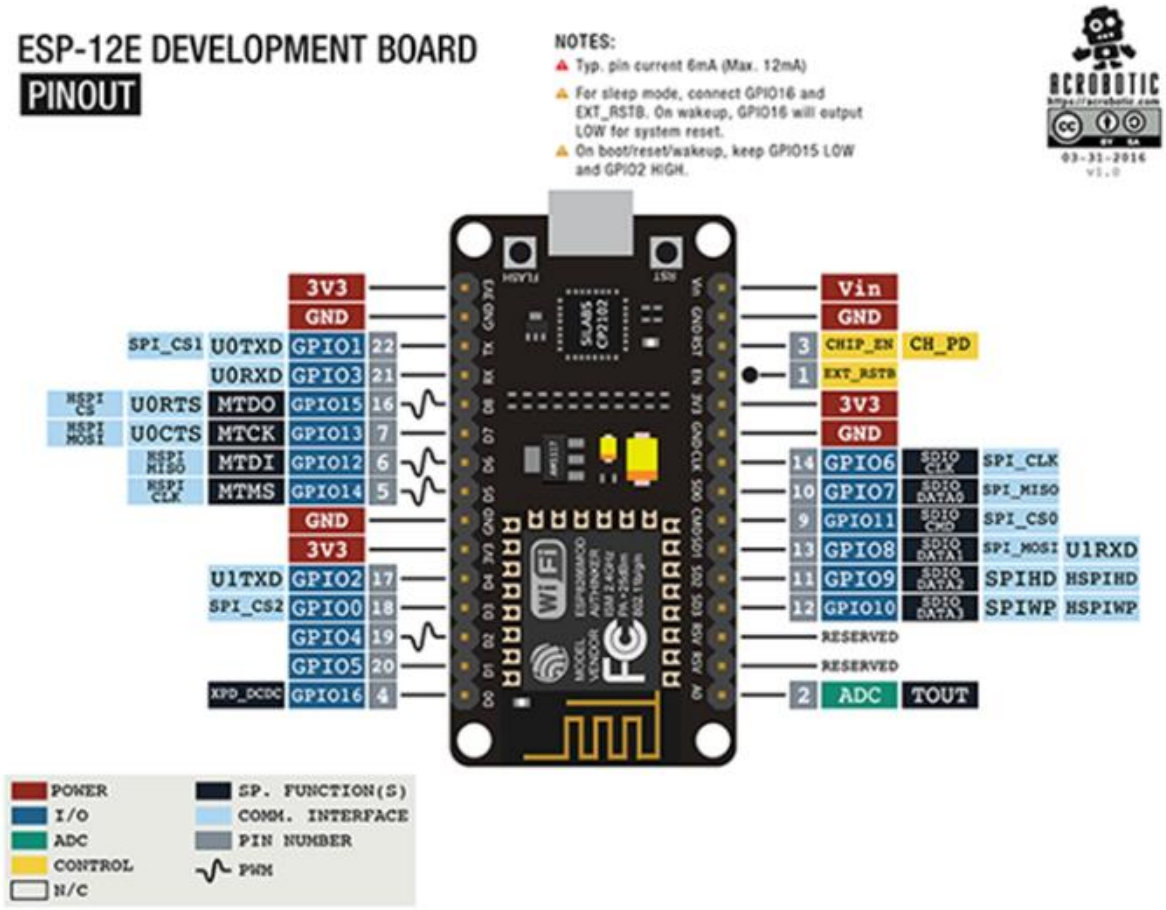


Fig. 4.1. Node MCU and ESP8266

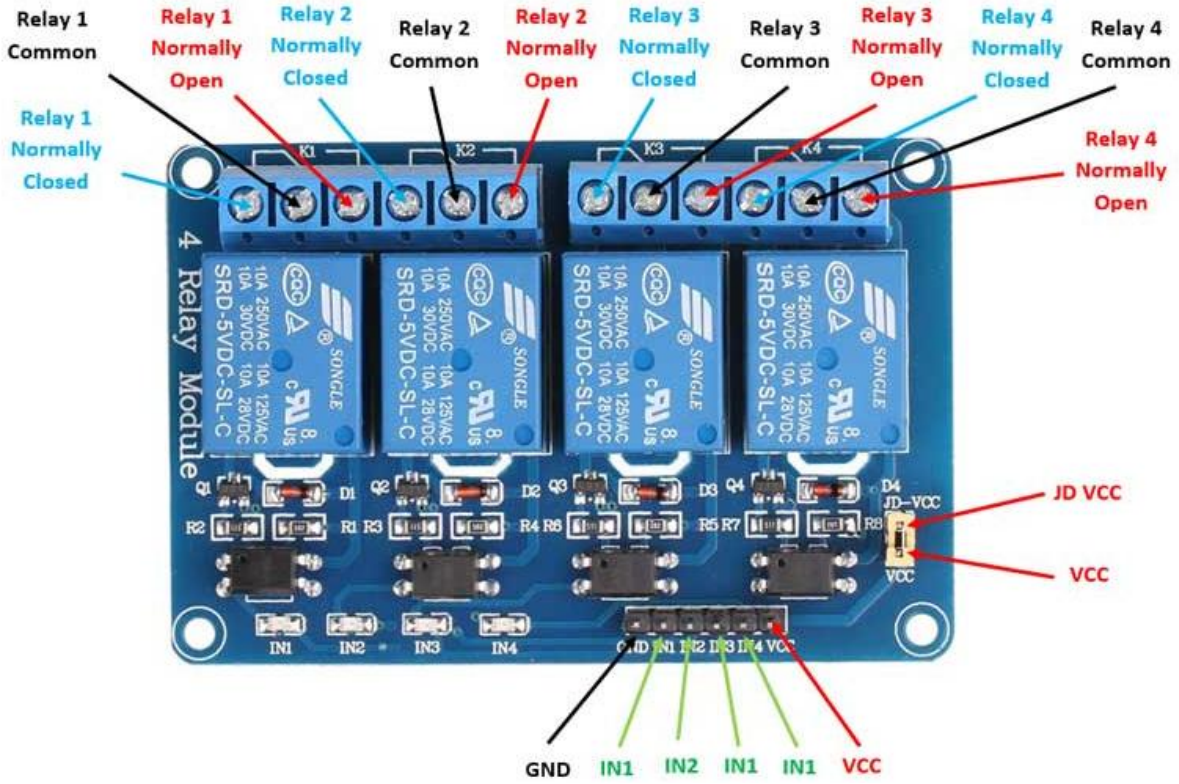


4.1.1 pin configuration of NodeMCU

4.2 Relay KIT

Drives load from digital NodeMCU output pins.It contains four 5v relays and associated switching and isolating components.The contacts on each relay are specified for 250vac and 30vdc and 10A.Current at active state: 70mA(single),300mA(four).Maximum contact voltage:250VAC,30VDC. Supply voltage: 3.75 v to 6v.Trigger current: 5mA.Maximum current: 10A

4.2. 5V Relay Module



4.2.1. Pin configuration of relay module

4.3 Voltage regulator – LM7805

Converts any voltage to fixed +5v. It is a three pin IC. Pin 1 (input pin)- accepts the incoming DC voltage,which the regulator will eventually

regulate down to 5v. Pin 2 (ground)- establishes ground for the regulator. Pin 3 (output pin)- Regulated 5v DC output. In LM7805,last two digits indicate the fixed output voltage provided (+5v). Suitable capacitors can be connected to the input and output pins depending upon the respective voltage levels.

4.3 Voltage regulator- LM7805

4.4 LM 35 sensor

LM35 sensor can measure room temperature. Measure temperature ranging from -55°c to 150°c. Output voltage is directly propotional to temperature (i.e.)there will be a rise of 10mv for every 1°c rise in temperature. Drain current is <60μA. Small and hence suitable for remote applications. Low cost temperature sensor.

Voltage is converted to temperature,

$V_o = 10mv/°c \times T$

Where,

V_o - LM35 output voltage

T – temperature in °c

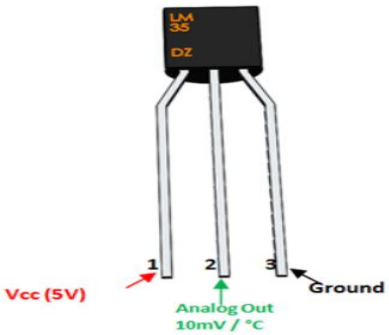


Fig.4.4. LM 35 sensor

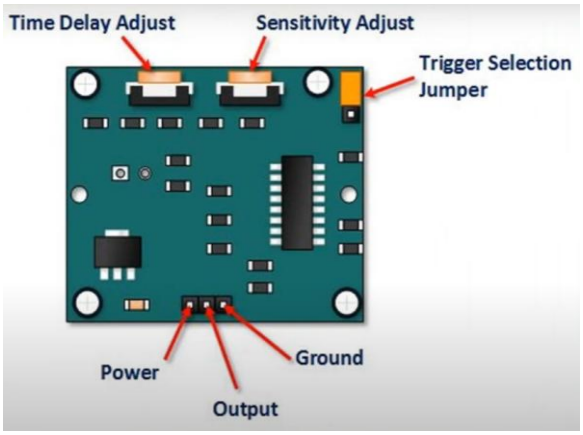
4.5 PIR sensor :- HC-SR501

Motion sensor –can distinguish between human and object movement. Has operating modes-repeatable and non-repeatable. It has two important materials,

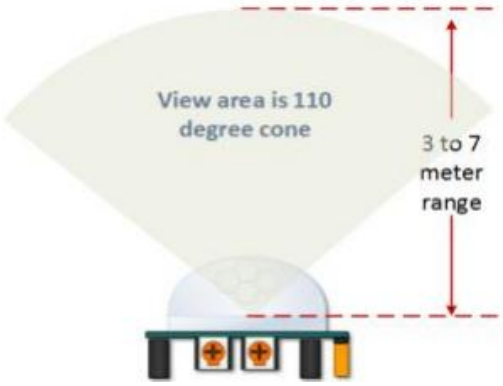
i)pyroelectric crystal- detect the heat signatures from a living organism.

ii)Fresnel lenses-widen the range of sensor and focuses the infrared rays to pyroelectric sensor.

Low power consumption-65mA . Operating temperature: -20°c to 80°c. Input voltage: 5v . Range: 4.5- 12v



4.5.1. PIR sensor - Bottom view



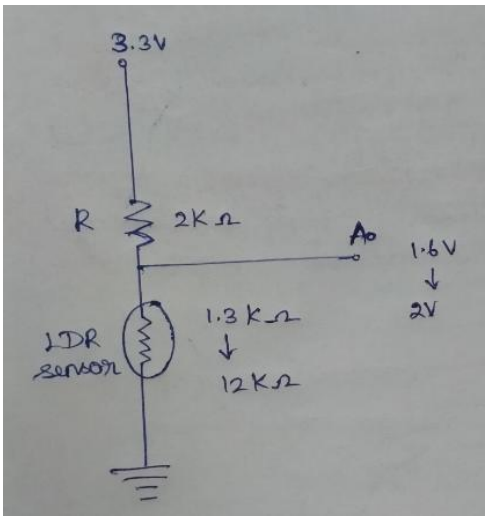
4.5.2. PIR sensor - Lateral view

4.5. PIR sensor

4.6 LDR sensor

Used to indicate the presence or absence of light. It converts the light energy to electrical signal output. It generates an output signal indicating the intensity of light that exists in a very narrow range of frequencies basically called ‘light’. It’s range lies from “infra-red” to “Visible” up to “ultraviolet” light spectrum.

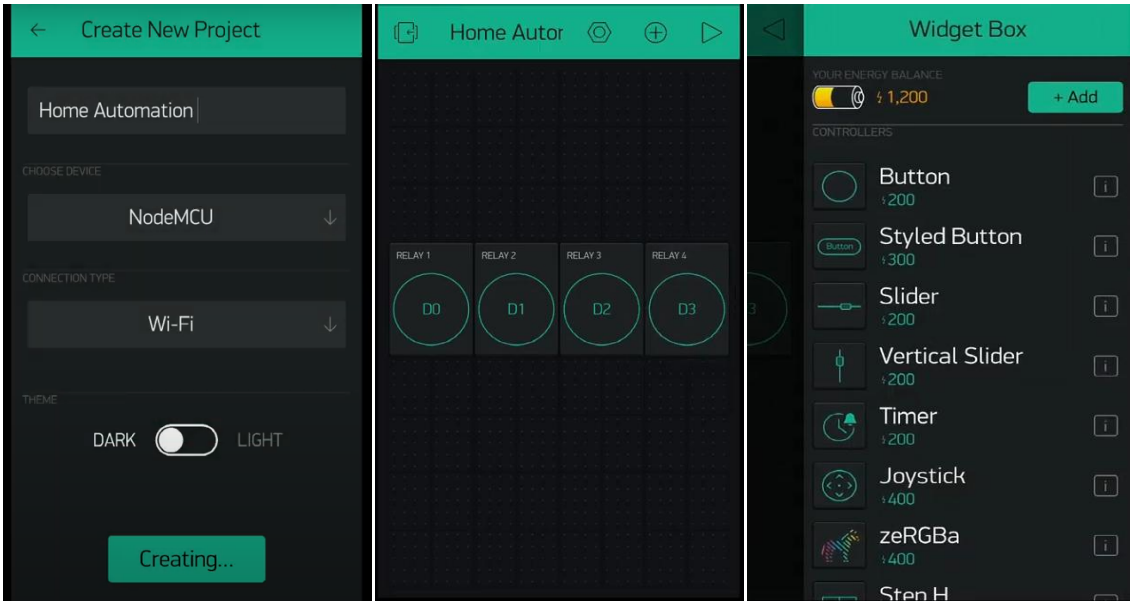
4.6. LDR sensor



4.6.1. LDR - working principle

4.7 Blynk application

Blynk is a platform with IOS and android apps to control Arduino, Raspberry Pi and so on. The control is through internet connection. It is a digital dashboard where graphical interface can be built by simply dragging and dropping widgets. Blynk is especially designed for IOT(Internet of things). It can control sensor data, store and also visualize it.



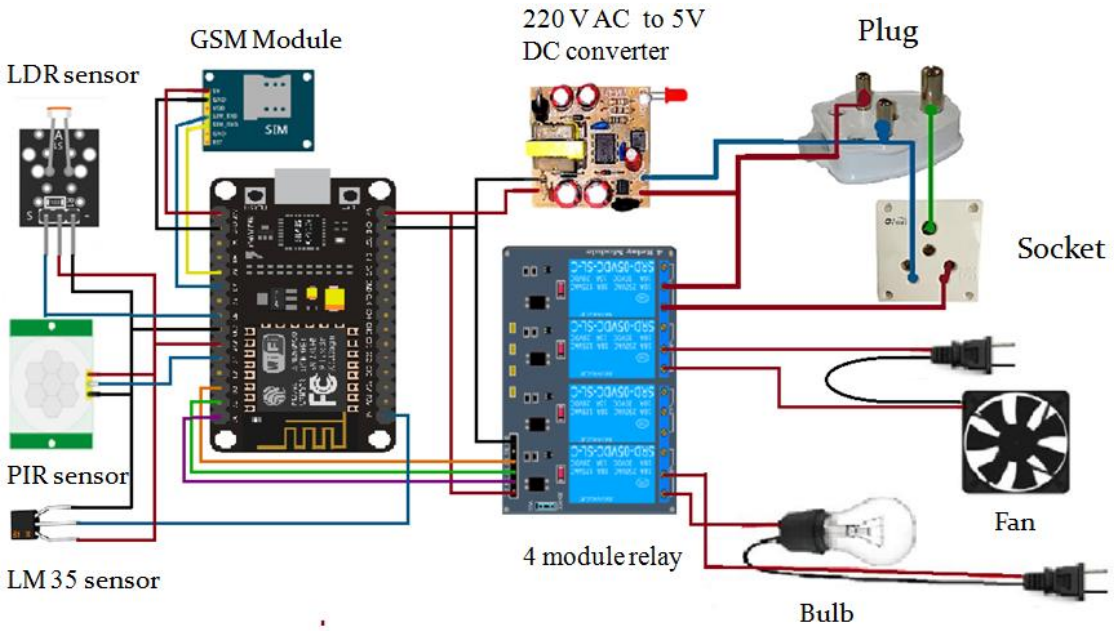
4.7. Blynk

4.8 GSM module – SIM900A

GSM module enables the communication between a microcontroller (or a microprocessor) and the GSM/GPSR network.The SIM900A is a readily available GSM module which can be used for developing IOT(Internet Of Things) and embedded applications. SIM900A is a dual-band GSM/GPRS engine that works on frequencies EGSM 900MHZ and DCS 1800MHz. SIM900A is a 68 terminal device.

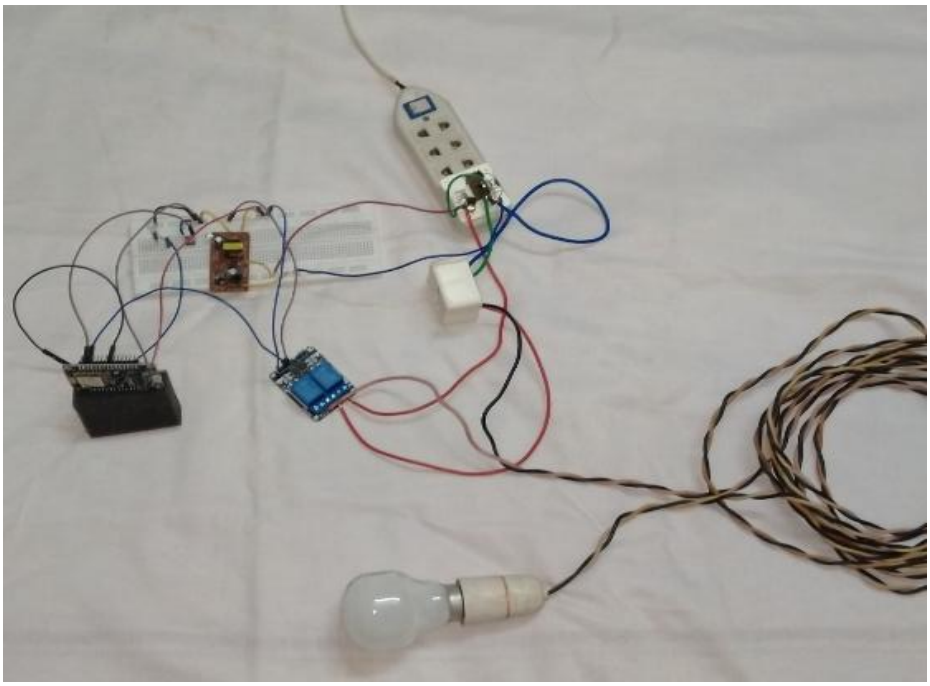
4.8. GSM module – SIM900A

4.9. Circuit diagram



4.9 Circuit diagram

4.10. Hardware setup



4.10. Hardware setup

5. Result and Discussions

Proposed model helps in maximizing home security. Alows flexibility for new devices and appliances. Enables the remote control of home functions. Improves appliance functionality. Thus increases energy efficiency. It helps users to get ride of the fear of over charging or over usage of current. Manual interference is reduced reduced to a large extend preventing wastage of time and energy. Main advantage of this system is that it alerts the user about any problem the minute it takes place and can save thousands of damages.

6. Conclusion and future work

This study presented the design, fabrication, and implementation of a portable, user-friendly, and low-cost automation system for Smart Homes based on IoT. This system is designed in such a way to provide both manual and automatic control of home attributes. It provides the monitoring and control even from remote areas. The results of this study are promising, and the developed system can increase the safety, security, intelligence, and comfort of users. The proposed system can be expanded with additional sensors and actuators. The developed system can also be improved to make it suitable for future commercialization. Our next study will use voice and gesture controlled home automation to make the proposed system more user friendly. We will optimize all circuits using printed circuit boards to save space. In future we shall enhance the project with messaging and voltage monitoring system.

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