DESIGN AND DEVELOPMENT OF SMART HOME AUTOMATION USING IOT

Submitted in partial fulfillment of the requirements for the award of

Bachelor of Engineering Degree in

Electrical and Electronics Engineering

By

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INSTITUTE OF SCIENCE AND TECHNOLGY

(DEEMED TO BE UNIVERSITY)

Accredited with Grade "A" by NAAC

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BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of **MATHESH.A** (Reg. No. 39140030) and **SARAN.P** (Reg. No. 39140049) who carried out the project entitled **"DESIGN AND DEVELOPMENT OF SMART HOME AUTOMATION USING IOT"** under our supervision from November 2022 to April 2023.

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DECLARATION

We **MATHESH. A** (Reg. No. 39140030) and **SARAN. P** (Reg. No. 39140049) hereby declare that the Project Report entitled **"DESIGN AND DEVELOPMENT OF SMART HOME AUTOMATION USING IOT"** done by us under the guidance of Dr. G.T. Sundar Rajan is submitted in partial fulfillment of the requirements for theaward of Bachelor of Engineering degree in Electrical and Electronics Engineering.

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ABSTRACT

Electronic - Home automation structures have gotten commonness of late, paralleling advances in the possibility of the Internet of Things. The current endeavor exhibits the utilization of an unobtrusive home computerization system,inside the structure of assistive advancement. The system utilization relies upon the Arduino microcontroller along with Bluetooth correspondences capacity, and it is proposed for use by the elderly and people with insufficiencies. The structureis anything but difficult to use, with an instinctual interface executed on anAndroid based propelled cell phone. Showings exhibit that the structure empowers control of home devices, lights, warming, cooling systems and security devices by the arranged customers, i.e., the elderly and crippled. In order to help maintain comfortable living conditions within a home, home monitoring and automation are utilized. The standards of human's comfort in homes can be categorized into several types. Among these categories, the most significant ones are the thermal comfort, which is related to temperature and humidity, followed by the visual comfort, related to colors and light, and hygienic comfort, associated with air quality. Additionally, making the house smart is to allow for intelligent automatic executing of several commands after analyzing thecollected data. Automation can be accomplished by using the Internet of Things (IoT). The proposed design uses the Emmons's platform for collecting and visualizing monitored data and remote controlling of home appliances and devices. The selected platform is very flexible and user-friendly. The sensing of different variables inside the house is conducted using the NodeMCU-ESP8266 microcontroller board, which allows Realtime data sensing, processing and uploading/downloading to/from the Emmons's cloud server.

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LIST OF ABBREVIATIONS

DHT	-	Digital Temperature and Humidity sensor
LCD	-	Liquid Crystal Display
LDR	-	Light Dependent Resistor
LED	-	Light Emitting Diode
PIR	-	Passive Infrared
IR	-	Infrared Radiation

CHAPTER 1

INTRODUCTION

1.1 OVERVIEW

Home Automation using cloud network is a system that uses computers or mobile devices to control basic home functions and features automatically through internet from anywhere around the world, an automated home is sometimes called a smart home. This network uses a consolidation of a mobile phone application and PC based program to provide the means of user interface to the consumer. The home automation system differsfrom other system by allowing the user to operate the system from anywhere around the world through internet connection. In this project we have developed a Home Automation system as shown in figure 1.1, that employs the integration of multi-touch mobile devices, cloud networking, wireless communication, and power-line communication to provide the user with remote control of various lights and appliances within their home. This system uses a consolidation of a mobile phone application, handheld wireless remote, and PC basedprogram to provide a means of user interface to the consumer. The home automation system differs from other systems by allowing the user to operate the system without the dependency of a mobile carrier or Internet connection via the in-home wireless remote. This system is designed to be low cost and expandable allowing a variety of devices to be controlled.

Fig 1.1 Smart Home

Advances in computer vision present an opportunity to expand and enhance the practice of collecting waste from the medical hospitality system. Precise waste collection and to protect the ward workers from air -borne disease and extend the market of computer vision applications in the field of precision hospital management. All essential steps required for implementing this electronic zig bin fully described throughout the paper, starting from gathering images in order to create a website to monitor the bin status level by the combination of line follower and smart bin system. This method is a new approach in collection of waste from hospitals with an atomized system without any human interaction by network system and using automation. An embedded system is a microprocessor-based computer hardware system with software that is designed to perform a dedicated function, either as an independent system or as a part of a large system. Complexities range from a single microcontroller to a suite of processors with connected peripherals and networks; from no user interface to complex graphical user interfaces. The complexity of an embedded system varies significantly depending on the task for which it is designed. As much as 98 percent of all microprocessors manufactured are used in embedded systems.

Cloud computing is the delivery of different services through the Internet. These resources include tools and applications like data storage, servers, databases, networking, and software. Rather than keeping files on a proprietary hard drive or local storage device, cloud-based storage makes it possible to save them to a remote database. Cloud computing is a popular option for people and businesses for a number of reasons including cost savings, increased productivity, speed and efficiency, performance, and security. Inter-connection networks are composed of switching elements. Topology is the pattern to connect the individual switches to other elements, like processors, memories and other switches. Direct connection networks − Direct networks have point-to-point connections between neighbouring nodes. These networks are static, which means that the point-to-point connections are fixed. Some examples of direct networks are rings, meshes and cubes. Indirect connection networks − Indirect networks have no fixed neighbours. The communication topology can be changed dynamically based on the application demands. Indirect networks can be subdivided into three parts: bus networks, multistage networks and crossbar switches.

CHAPTER 2
LITERATURE SURVEY

2.1 MAJOR FINDINGS FROM LITERATURE SURVEY

Fig 2.1 Smart application usage in lockdown COVID -19

As shown in figure 2.1, new survey finds 70% of consumers improved home during COVID-19, more than half used smart devices. Smart home solutions are helping consumersadapt to more time at home during pandemic Smart living has always been about reimaginingand optimizing physical space to solve problems and adapt to new realities through the use of technology, and we've seen this adoption accelerate in 2020," said Daniel Desmarais, Global Product Marketing Manager, Xiaomi. "Connected homes, automated systems, and new technology are helping people create ecosystems within their homes to solve new challenges presented by increased time at home, whether it's adapting or creating new uses for old spaces, such as office space or classrooms, or just creating a more streamlined homethat is easier to manage and control."

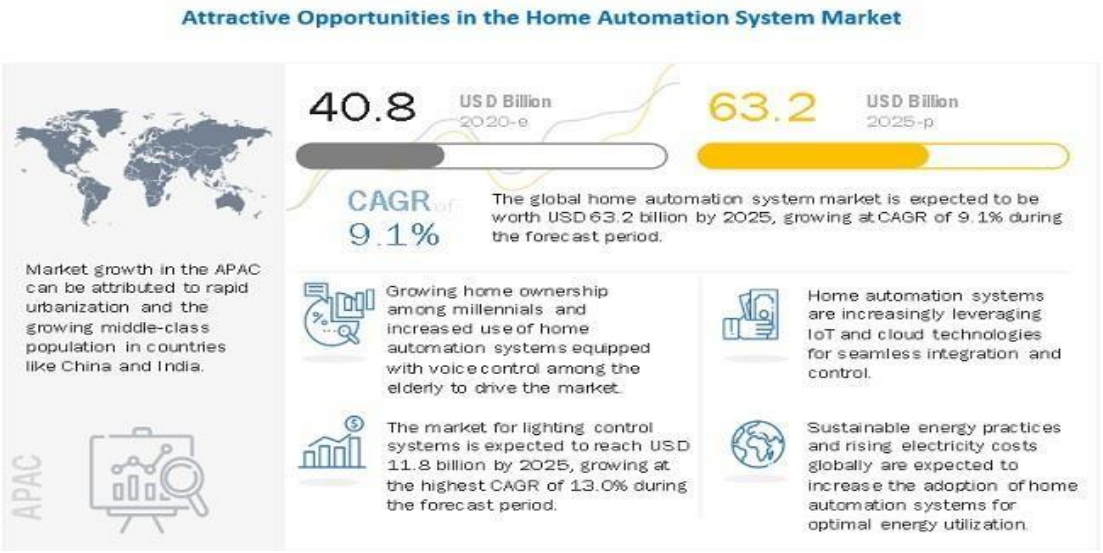

Fig 2.2 Home automation system market

According to Market sand Markets as shown in figure 2.2, the home automation systemmarket is projected to grow from USD 40.8 billion in 2020 to USD 63.2 billion by 2025; it is expected to grow at a Compound Annual Growth Rate (CAGR) of 9.1% from 2020 to 2025. Various types of home automation system are being deployed worldwide, from luxuryhome automation systems to DIY home automation systems. They not only provide convenience to homeowners, but also assist with home security and energy savings. The objective of the report is to define, describe, and forecast the home automation system market based on management, product, software and algorithm, and region. Home automation system Driver: Lower insurance costs for homeowners investing in home securitysystems and increasing services offered by telecommunication companies

Indeervar Reddy *et. al.,* (2017) proposes “Home automation of lights & fans using IOT”. This paper talks about the evolution of technology which has been increased the consumption of electric power locally and globally which lead to a dramatic increase in demand for electric power. Electricity consumption rate in different forms at home and commercially increased. Sometimes, it affects household appliances due to the raised demands based on conditions of load shedding, electricity shortfall, and emergencies. It includes sudden electricity breakdown due to heavy rainfall or storm. This study investigates the adaptation of an optimal solution for the usage of energy to meet a revolutionary change. A technique is proposed that will address the

issues regarding electric power shortfall and emergencies caused by the sudden breakthrough of electricity. The proposed technique automates the appliances in three main ways, a) locally automation, b) web-based, c) app-based automation. Using a microcontroller, appliances are locally controlled. By using a web page or application, the appliances are controlled remotely. This work helps in saving energy by automatic or manual switching of appliances on and off according to need through the web or apps. Experimental results show that the average accuracy of the system for local scenarios is 88.71, for web-based scenarios is 88.55 and for app-based is 88.56 respectively. It also handles emergency situations by calculating the load and perform smart switching, so that devices may remain safe even in abnormal situations like low or high voltages.

Gomathi.B et. al., (2015) proposes “Implementation of Fan ON/OFF Control Using Internet of Things for Home Automation”. It says that IoT is one of the platforms of today's Smart City, and Smart Energy Management Systems. Internet of Things (IOT) is a recently emerging advanced technology by which devices can be monitored and controlled through internet. IoT is gradually gaining its importance in building automated industrial system using wireless devices, sensors and controllers. Home automation or smart home is rather presented as an emerging technology made feasible within the home environment to facilitate enough comfort, convenience, flexibility, security and energy efficient system for the user. IoT can also be used in controlling home appliances resulting in automated homes. The system proposed here is to control the speed of Fan.HTML code is used for creating an UI for the user, and Embedded C is the commanding code for the Microcontroller. Thus the system leads to an efficient home automation using internet. The system can be useful to those who need to access their home appliances while they are away and also can incredibly help to improve the lives of the literate physically disabled and old aged people. By the system proposed we are demonstrating a cost-effective, user-friendly system. The main target for this system is to design and implement a cost-efficient system.

Sudha kousaly et. al., (2014) proposes “IOT Based Smart Security and Smart Home Automation” it says that “Internet of Things” is fast becoming a disruptive technology business opportunity, with standards emerging primarily for wireless communication

between devices and gadgets in day to day human life, in general referred to as Things. This project aims at controlling home appliances and building a smart wireless home security system using Wi-Fi as communication protocol. The Home Automation can be implemented using different types of wireless communication techniques such as ZigBee, Wi-Fi, Bluetooth, GSM, etc. These existing methods have drawbacks as they work in short range. To overcome the drawbacks, we are going to implement this project “IOT based Smart security and Smart Home Automation”. The project focuses on controlling lights and fans referred as Home Automation and providing Smart security by sending a captured image through an E-mail to the owner using internet when an object is detected. By using “Node MCU” Module we are going to implement this project. This will be more helpful for Handicapped and aged people

Kusuma S M2 proposed “Home Automation Using Internet of Things” which says that with advancement of Automation technology, life is getting simpler and easier in all aspects. In today’s world Automatic systems are being preferred over manual system. With the rapid increase in the number of users of internet over the past decade has made Internet a part and parcel of life, and IoT is the latest and emerging internet technology. Internet of things is a growing network of everyday object-from industrial machine to consumer goods that can share information and complete tasks while you are busy with other activities. Wireless Home Automation system (WHAS) using IoT is a system that uses computers or mobile devices to control basic home functions and features automatically through internet from anywhere around the world, an automated home is sometimes called a smart home. It is meant to save the electric power and human energy. The home automation system differs from other system by allowing the user to operate the system from anywhere around the world through internet connection

Vaishnavi S. Gunge and Pratibha S. Yalagi, "Smart Home Automation: A Literature Review", National Seminar on Recent Trends in Data Mining-RTDM, 2016. The paper says that the internet also helps to monitor the data and manually control the devices. Most new models of Raspberry Pi has USB and ethernet ports, making it easy to upload data in the internet.

2.2 PROBLEM IDENTIFICATION

In these present days home computerization is persuading the chance to be vital to improve our life conditions. Comfort and straightforwardness of utilizing home machines isthe thing that home robotization is progressing. Home robotization offers a bleeding edge lifestyle in which an individual finds the opportunity to control his whole house utilizing a pushed wireless, from turning on a TV to locking/opening sections; it in like way offers a competent utilization of centrality. By the by, to get or verify such framework exhibited will cost a great extent of cash and that is the authentic reason of why home computerization has not gotten much premium and thought, adding to that in like way the multifaceted thought of displaying it and engineering it. Therefore, it is essential to bode well and simple to organize, in the event that this is allowed to individuals, they will gain it in their homes, workplaces and schools. In a way, a framework alteration for the home computerization is required with the genuine goal to chop down the cost of applying it to houses. In addition, home computerization offers ease of cerebrum and body to injured or potentially progressively settled individuals in their homes by only a single tick to do what they requireas imparted as of now

2.3 STANDARDS

IEEE 2700-2017 Standard for Sensor Performance Parameter Definitions

IEEE 2700-2017 is a standard for sensor performance parameter definitions, that provides a common framework for sensor performance specification terminology, units, conditions, and limits for various sensors, including accelerometers, magnetometers, gyroscopes, barometers, pressure sensors, hygrometers, humidity sensors, temperature sensors, ambient light sensors, and proximity sensors. The standard presents a standard methodology for defining sensor performance parameters with the intent to ease system integration burden and accelerate time to market (TTM). Within the standard, a minimum set of performance parameters is defined with required units, conditions, and distributions for each sensor. The standard is intended for sensor technologies with digital I/O interfaces.

IEEE Standard for Framework of Blockchain-based Internet of Thing (IoT) Data Management

IEEE 2144.1-2020 is a standard that defines a framework of blockchain-based Internet of Things (IoT) data management. The standard is applicable to business scenarios that employ data management systems with data collected from IoT devices for internal business decision making, data sharing, and/or data trade with external party. The standard identifies the common building blocks and interfaces for blockchain-based IoT data management systems, including data collection, storage, processing, and sharing. Additionally, the standard provides guidelines for the security, privacy, and interoperability of blockchain-based IoT data management systems. Overall, IEEE 2144.1-2020 provides technical resources and guidelines for the development and implementation of secure and efficient blockchain-based IoT data management systems, which can be used in various business scenarios that involve IoT devices and data.

IEEE Standard for an Architectural Framework for the Internet of Things (IoT)

IEEE 2413-2019 is a standard that defines an architectural framework for the Internet of Things (IoT). The standard leverages the IEEE 2413 standard for an architectural framework for IoT, which is globally recognized and applicable to various domains. The standard provides a common language and framework for IoT systems, including the identification of IoT system components, interfaces, and interactions. Additionally, the standard provides guidelines for the design, development, and deployment of IoT systems, including the use of open standards, security, and privacy. Overall, IEEE 2413-2019 provides technical resources and guidelines for the development and implementation of secure, interoperable, and efficient IoT systems, which can be used in various domains and applications.

IEEE 1118.1-1990 IEEE Standard for Microcontroller System Serial Control Bus

IEEE 1118.1-1990 is a standard that defines a serial control bus for inter-device and intra-site interconnection of microcontrollers. The standard provides a multidrop bit-serial communication protocol that allows the interconnection of distributed independently manufactured devices. Additionally, the standard provides specifications for a common architecture, generic bus services, system management, data link, and several physical media. The serial control bus expands upon BITBUS

without making existing devices obsolete. While the standard is inactive and withdrawn, it provides a historical reference for the development and implementation of microcontroller systems.

EEE 1621-2004 IEEE Standard for User Interface Elements in Power Control of Electronic Devices Employed in Office/Consumer Environments

IEEE 1621-2004 is a standard that defines user interface elements in power control of electronic devices employed in office/consumer environments. The standard provides guidelines for the design and implementation of user interfaces for power control of electronic devices, including the use of visual and auditory feedback, user controls, and power management. Additionally, the standard provides specifications for the design of user interfaces that are accessible, usable, and efficient. While the standard is not recent, it provides a historical reference for the development and implementation of user interfaces for power control of electronic devices.

2.4 CONSTRAINTS IN THE PROJECTS

- Cost: Home automation systems can be expensive, and the cost can increase depending on the complexity of the system and the number of devices you want to automate.

- Compatibility: Home automation systems often use different protocols and technologies, which may not be compatible with all devices. This can limit the devices that can be integrated into the system and reduce its functionality.

- Reliability: Home automation systems rely on a stable internet connection and power supply. If there is an interruption in either of these, the system may not work as expected.

- Privacy and security: As home automation systems rely on the internet and various sensors, there is a risk of data breaches and cyber-attacks. Proper security measures need to be taken to ensure that personal information and data are protected.

- Complexity: Home automation systems can be complex to set up and operate, which may require technical knowledge and expertise.

- Compatibility with existing infrastructure: It can be challenging to retrofit an existing home with a home automation system that is compatible with the current wiring and infrastructure.

2.5 TRADEOFF IN THE PROJECT

- Home automation involves the use of technology to control various devices and systems in a home, such as lighting, heating and cooling, security, and entertainment systems. While home automation offers many benefits, there are also trade-offs to consider.

- One trade-off of home automation is the initial cost. The devices and systems needed for home automation can be expensive, especially if you want to automate your entire home. Additionally, there may be installation costs if you require professional installation.

- Another trade-off is the potential for technology failures. If the automation system fails, you may not be able to control your devices or systems, which can be inconvenient and potentially dangerous in some cases. It is also possible for the system to become hacked or otherwise compromised, which can pose a security risk.

- Privacy is another trade-off to consider with home automation. Some people may be uncomfortable with the idea of having their devices and systems connected to the internet, as this can potentially allow for unauthorized access or surveillance.

- Finally, home automation can also lead to increased energy consumption, as some automated devices may continue to operate even when they are not needed. This can lead to higher energy bills and a larger carbon footprint.

2.6 CONVENTIONAL SMART HOME AUTOMATION SYSTEM

Construction of fully electro mated system

The Arduino Mega 2560 and the Arduino Ethernet shield have been used to implement the smart home micro web-server. Arduino is open-source electronics prototyping platformbased on flexible, easy-to-use hardware and software. The Arduino Mega 2560 microcontroller board is based on the ATmega256 having 54 digital input/output pins. TheEthernet is interfaced to the Arduino via the Arduino SPI pins. Low voltage switching relayswere used to integrate the devices with the Arduino for demonstrating the switching functionality in this proposed project a mobile app is created and it includes all the featuresof controlling the home appliances with the help of speech recognition and interconnectivityof devices. The mobile app that is created, contains all the commands like switching on/off the AC, Fan, Washing machine, etc. Thus, this concept basically contains the smart appliances in a home that can be controlled by WIFI and Bluetooth and connected wirelesslywith the mobile phones. The mobile app in the mobile phone will be containing the optionsto give different commands to the appliances and controlling it with our mobile app. The main page of the app will be having the login page that will be used to authenticate the user using the IP Address and the password. After successful login the user will be able to control all the appliances with the mobile app and the voice recognition.

Using Bluetooth relay bot.

The concept Internet of Things (IoT) can be closely tied together with home automation. IoT devices, such as smart thermometers, can be controlled by, for example, a smartphone and thus possibly providing worldwide range through the Internet. These devices together with the rising popularity of the smartphone account for one of the reasons to the increase in home automation. Home automation with IoT devices provides great convenience and means of optimizing energy consumption by, for example, enabling automatic energy saving or presenting power consumption data to a user in real time. However, it could become expensive if conventional devices were to be replaced by their IoT equivalents. Therefore, when converting to a smart house, a major issue is making all non-IoT devices compatible with a home-automation system. Gill et al. identify the intrusiveness of installations as one of the areas that have hindered consumer adoption of home automation

technologies. Consequently, converting non-IoT devices should be done in a manner such that a user would easily be able to install a system, without the need to make hardware changes in the house. IoT devices also have their drawbacks, mainly in the way they communicate with each other. According to Gill et al. the interoperability between home automation technologies, such as the vast use of different communication protocols, is one of the major factors impeding consumer adoption of home-automation system. Therefore, in an ideal home-automation system, the communication protocols used should preferably be those supported by common consumer devices, in order to provide maximumcompatibility. This section further explains the purpose of creating a concept for automating existing home appliances construction of application for controlling home application

GPRS-based Home Automation and images of the house to its owner's mobile through GPRS. The webcam detects movement by comparing frames and also light intensity. Videostreaming of the proposed work is done using the home Internet connection, not the GSM modem. U. Ali proposes another home and office automation system using GPRS in mobilephones. The user interacts with the home via a client/server architecture implemented at home using a PC and a micro-Java application. Home devices are controlled by a controller,which is connected to the computers parallel port. The proposed system allows users to remotely control and inquire the status of the devices that are connected to the device controller. Automation system based on WSNs and GPRS. It allows users, to control equipment in their home, and collect data about weather conditions and status of device at home through their mobile devices. Different from other GPRS based home automation, theproposed system uses a system-based central controller. Researchers S.R. Das developed an iOS-based home automation security system using GPRS. The proposed system uses the client/server model for communication. The authors develop an iOS application that runs on a user's mobile phone and acts as the client and the cloud to which the home devices areconnected acts as the server. The authors use cameras of video and motion sensors for providing security at home. When a motion sensor is triggered, the video cameras in the start to record. A user can view these live motions on mobile device through GPS.

CHAPTER -3

PROJECT DESCRIPTION

3.1 ARCHITECTURE

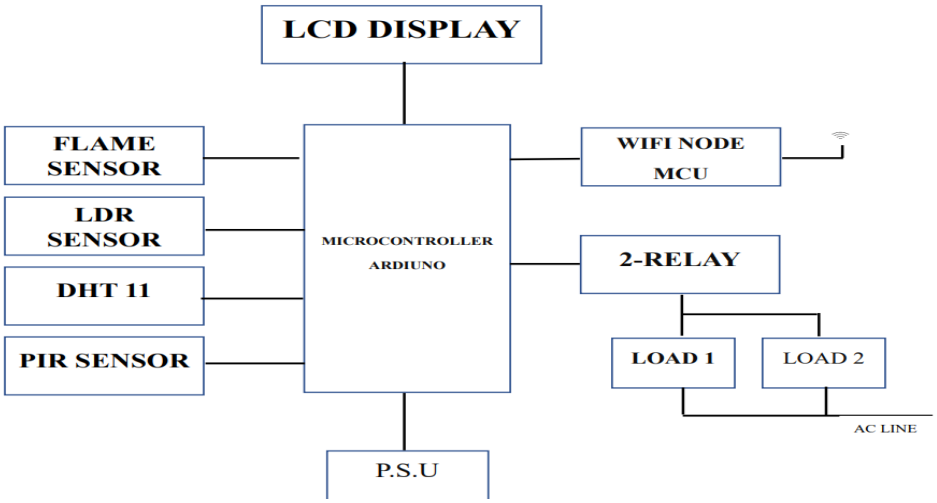

Fig. 3.1 Architecture of our project

In our project, we have used multiple sensors (IEEE 2700-2017) like PIR sensor which is used to detect the human motion, DHT 11 which is used to detect the temperature and humidity in the surrounding environment, LDR sensor which is used detect the light and fire sensor to detect the fire in the environment. All these sensors are connected to the main microcontroller which is Arduino UNO as shown in the fig 3.1. The loads are connected to 2-channel relay. All the sensor output are sent to Arduino and these details are transmitted using the Node-MCU with the help of IoT (IEEE 2144.1-2020) and viewed in the specially designed web page.

3.2 OBJECTIVE

- To assembling a remote home robotization structure constrained by gadget associatedwith the web.
- Integrate the contraption to the controller: The overwhelming need that must be recollected when developing a Smart Home is that it must be savvy. The contraption controller must be humbly organized with the machines in the house with a basic foundation.

- Test the set up and analyze the data: After the system is set-up, with the help of a mobile phone and a controller, tests are driven while data is recorded and inspected.
- To arrangement and execute monetarily adroit home robotization structure yet a capableone.
- To plan an easy to use and a guaranteed structure to control home machines particularly planned to support the more prepared individuals and weakened.

3.3 METHODOLOGY

As we enter the twenty first century, the transaction among individuals and pc is breaking vintage confinements and coming into another domain. Inside the massivelyinnovation driven worldwide of these days' phones have develop as a piece of our ways of life. Cell phones are not simply discussion device. Our endeavor attempts to infer arrangements furnishing better oversee on local machine with assistance of cell phone. The current contraption incorporates substantially machines in our home which can be been controlled through switches. Those gadgets can be turned ON and OFF physically at whatever point needed. This contraption is substantially less verified and subject to electric threats. Likewise,the wastage of vitality tends to a central point of subject. The proposed task is considered systems administration our cell mobile to all machines through a smart trustworthiness circuit. The proposed gadget incorporates astute practical insight Circuit associated with thehome hardware. Notoriety of every single home apparatus may be made do with the guide of buyer from distant with help of individual's cellphone Our endeavor attempts to infer arrangements furnishing better oversee on local machine with assistance of cell phone. The current contraption incorporates substantially machines in our home which can be been controlled through switches. Those gadgets can be turned ON and OFF physically at whatever point needed. This contraption is substantially less verified and subject to electric threats. Likewise, the wastage of vitality tends to a central point of subject. The proposed gadget incorporates astute practical insight Circuit associated with the home hardware. Notoriety of every single home apparatus may be made do with the guide ofbuyer from distant with help of individual's cellphone.

3.4 APPLICATION

- It is mainly used for handicapped and old peoples
- It is used to access our home application even from far distance

3.5 SMART HOME AUTOMATION USING IOT SYSTEM

Designing and developing a smart home automation system using IoT requires careful consideration of several factors. Here's a proposed system for the same:

- Hardware Components: To begin with, you'll need several hardware components like sensors, microcontrollers, and actuators to create a smart home automation system. You can choose from a wide range of sensors depending on your requirement, such as motion sensors, temperature sensors, light sensors, gas sensors, and so on. Microcontrollers like Raspberry Pi, Arduino, and ESP32 are commonly used for smart home automation. Additionally, you'll need actuators like motors, relays, and solenoids to control devices like lights, fans, and locks.

- Network Connectivity: IoT devices work on a network and can be used in various domains (IEEE 2413-2019) and for your smart home automation system to function seamlessly, you'll need to ensure stable network connectivity. You can choose between wired and wireless connectivity options like Wi-Fi, Bluetooth, Zigbee, or Z-Wave depending on the range and capacity of the devices you're using.

- Software Components: The software components of your smart home automation system will comprise the control system and the user interface. The control system will include firmware and software that interact with the hardware components and make decisions based on the data collected by the sensors. The user interface, on the other hand, will provide an easy-to-use platform for controlling and monitoring the smart devices in your home.

- Data Analytics: Collecting data from sensors is not enough; you need to

analyze it to make meaningful decisions. Data analytics tools can help you identify patterns and trends, which can be used to optimize energy consumption, security, and other aspects of your smart home automation system.

- Integration with Other Devices and Services: Your smart home automation system should be compatible with other devices and services to create a fully connected home. You can integrate your smart home with virtual assistants like Amazon Alexa or Google Assistant, or with third-party services like IFTTT, to automate several processes.

- Security: With smart home devices, security is of paramount importance. Your smart home automation system should be secure and resilient against cyber threats, such as hacking and phishing attacks. Ensure that you use secure communication protocols and encryption techniques to protect your system from unauthorized access.

- Testing and Maintenance: Once you have developed your smart home automation system,

- it's essential to test it thoroughly to ensure that it's functioning as expected. You can conduct several tests, including functional testing, performance testing, and security testing. Additionally, you must also perform regular maintenance activities like updating firmware and software to keep your system up-to-date with the latest security patches and features.

In conclusion, developing a smart home automation system using IoT involves several complex components and requires careful planning and execution. However, by following the steps mentioned above, you can create a robust and functional smart home automation system that enhances your living experience

3.6 FUTURE ENHANCEMENT

Home of the future is a space for the digital natives. With the invention of lots of automation technologies featuring IOT and AI, home automation has become a reality. Onecan implement several of their tasks with just a single command of verbal instructions. Thesetechnologies can used to build fully functional home automation system and control smart home devices including smart lights, connected thermostats, and appliances.

There are several new technologies which can become a part of home in the near future:

Increased efficiency, control, and customization: Artificial intelligence is set to make you lazy in the near future. Technology will become much more efficient and one will be able to control everything from volume to security from one central place. The devices will work automatically and you don't need to waste your energy it will act upon user's preferences. AI would revolutionize home by automatic threat detection and proactive alertness.

Integration of Smart home devices: One can command it to control small things of home through voice and Smartphones. All the tech giants are working in the field of IoT to bring advancements in the home automation devices. In near future, homes will be equipped withsuch IoT devices which will make your daily lives work faster smoother and more accurate.Mark Zuckerberg came up with a goofy proof-of-concept video showing off an idealized version of how his Jarvis system actually works. Google Home, which is Google's smart speaker loaded with Google Assistant, was updated at last year's Google I/O with a bunch of new features, including "proactive assistance", also known as push notifications, hands- free calling, Spotify, Sound Cloud, and Deezer integrations, and more. Also, more recently, Google launched two more Google Home speakers, Home Max and Home Mini.

Smart spaces outside homes: Smart parking through sensors will help to recognize whether the parking is available or not. Camera monitoring can be done and with the help of artificial intelligence and computer vision, both parking facilities and security can be provided. It would be a faster and smoother process and act as a reference

for other smart systems to be built accordingly. Streetlights can also be automated through sensors and build for effective use for the people nearby Development of smart appliances: The devices which we use to use like television,refrigerator and even the mirror is getting smarter today with evolution of technology. Thesmart mirror should not only act as a face video but also help to other tasks like listening to music and stuff. Televisions have become part of a centralized entertainment and can also beused for social media. The refrigerator has been upgraded to sense the temperature outsideand operate accordingly. The washing machine will wash the clothes according to the clothesmaterial and switch off after drying. They will keep on advancing as the technology evolves.Personal home delivery: Drones will be used to deliver the packages at the right time.

They will replace the normal salesman job. They might also be used for several other tasks like monitoring the weather outside the home, returning something back to a relative's homenearby and so on. They can also be used for monitoring the traffic in our locality.

CHAPTER 4
SIMULATION CIRCUIT AND RESULT

4.1 SIMULATION ANALYSIS

4.1.1 SYSTEM DEVELOPMENT:

ARDUINO IDE

Arduino IDE is an open-source software development environment that is used to program microcontrollers (IEEE 1118.1-1990), specifically Arduino boards. It is a platform that is easy to use, and is aimed at both beginners and experienced programmers.

Arduino IDE is compatible with several operating systems, including Windows, macOS, and Linux, and supports several programming languages, including C and C++. The software also comes with a set of libraries that can be used to interact with external devices and sensors.

The interface of the Arduino IDE is simple and easy to use, with a text editor, a message area that displays feedback from the compiler, and a sidebar that displays the structure of the program being developed. The software also features a serial monitor that allows the programmer to interact with the microcontroller and view the data it generates.

In summary, the Arduino IDE is a powerful tool for programming microcontrollers that offers a user-friendly interface, easy-to-use libraries, and cross-platform compatibility. It is an excellent choice for beginners who are just starting to learn about microcontrollers, as well as experienced programmers who need to quickly prototype and develop microcontroller-based projects.

Features:

- Both Analog and digital signal can be read by the IDE.
- Directly connected to the microcontroller over a USB.

- Arduino IDE supports different languages for writing the code -C, C++, JAVA.

PROTEUS

Proteus Professional is a comprehensive EDA tool that includes a schematic capture module, a PCB layout module, and a simulation module. The schematic capture module allows users to create and edit electronic schematics, while the PCB layout module enables users to design printed circuit

boards (PCBs) with ease. The simulation module allows users to test and validate their circuit designs before they are fabricated, saving both time and money.

Proteus PCB Design is a more simplified version of the software, which is designed specifically for designing and editing PCB layouts. It includes a powerful auto-router and a design rule checker, which helps users ensure that their designs are manufacturable.

One of the unique features of Proteus is its ability to simulate microcontroller-based designs. It includes a large library of microcontroller models, which can be used to simulate the behaviour of microcontroller-based circuits. This is particularly useful for embedded systems design, as it allows engineers to test their designs without the need for physical hardware.

Overall, Proteus is a powerful and versatile tool for electronic design and simulation, and is widely used by engineers, hobbyists, and students alike.

Features:

- 15 million library parts integrated and on demand
- Dedicated reporting module for project documentation
- Hybrid circuit stimulation and accurate analysis

4.1.2 BASIC ARCHITECTURE

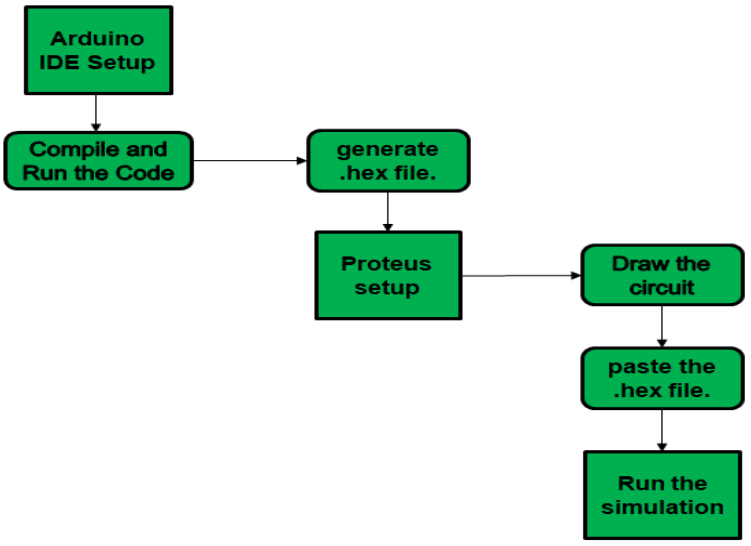

Fig 4.1 simulation process

4.1.3 WORKING

Step 1: Arduino IDE Setup

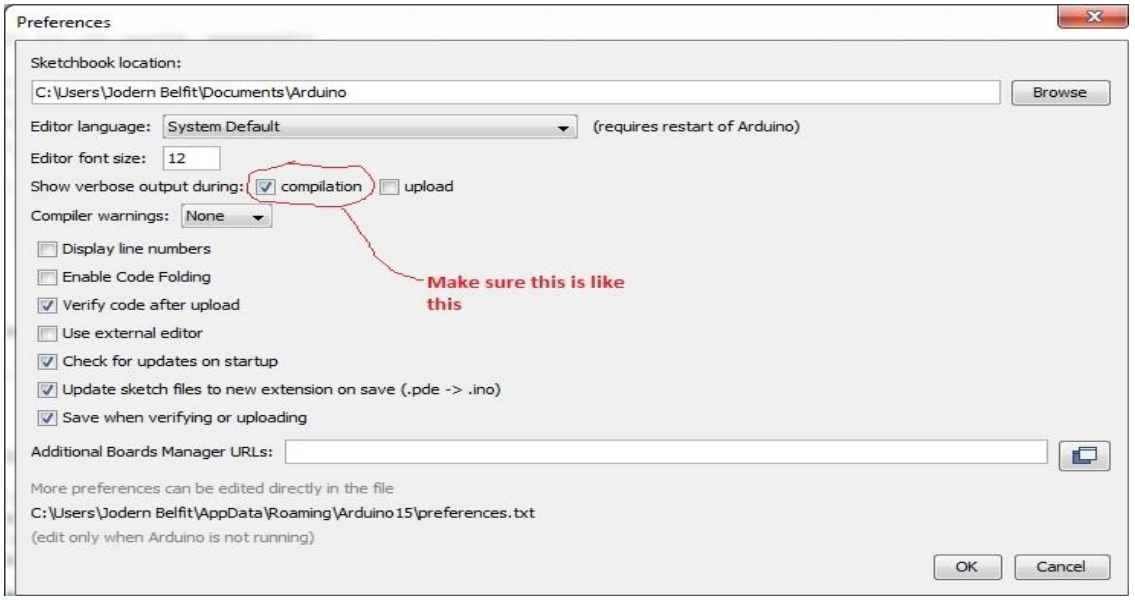

Fig 4.2 Arduino ide setup

Before start simulation need to make sure that in File>>Preferences, compilation is marked because "compilation" compile the code and generate .hex file. This hex file is needed for running the Proteus simulation.

Step 2: Proteus Setup

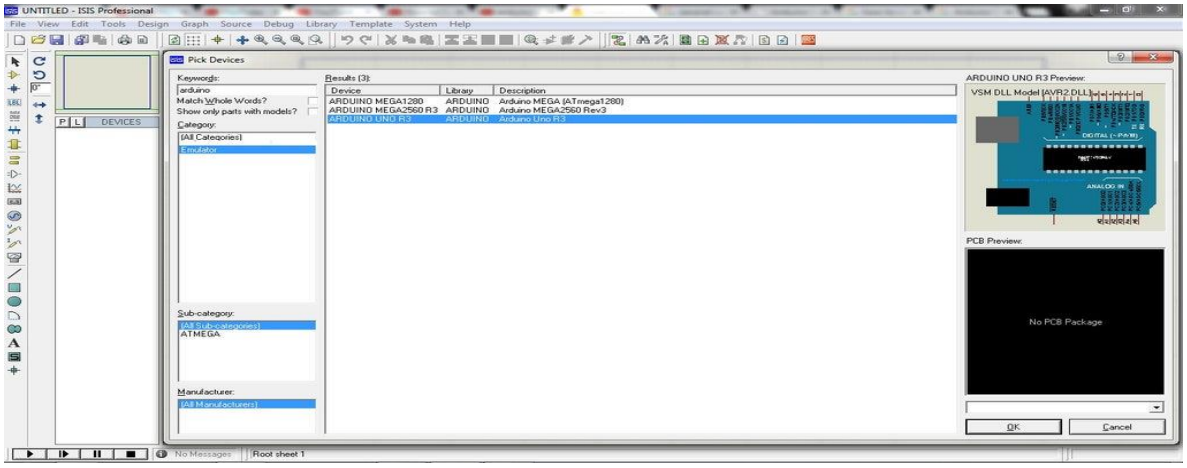

Fig 4.3 proteus setup

Proteus is the software where we run our simulation. First, make sure that you have Proteus installed in your operating system. If not, then download and install Proteus. After run the Proteus software, If you don't find Arduino in the library, then there is a .rar file download it and copy/cut the file. After that, paste it into the Proteus library. I am using windows 7 operating system. In my case the location of the Proteus library is, C drive>Program Files>Lab centre Electronics>Proteus 7 Professional>LIBRARY. After that you will find Arduino in your library.

Step 3: Arduino UNO programming

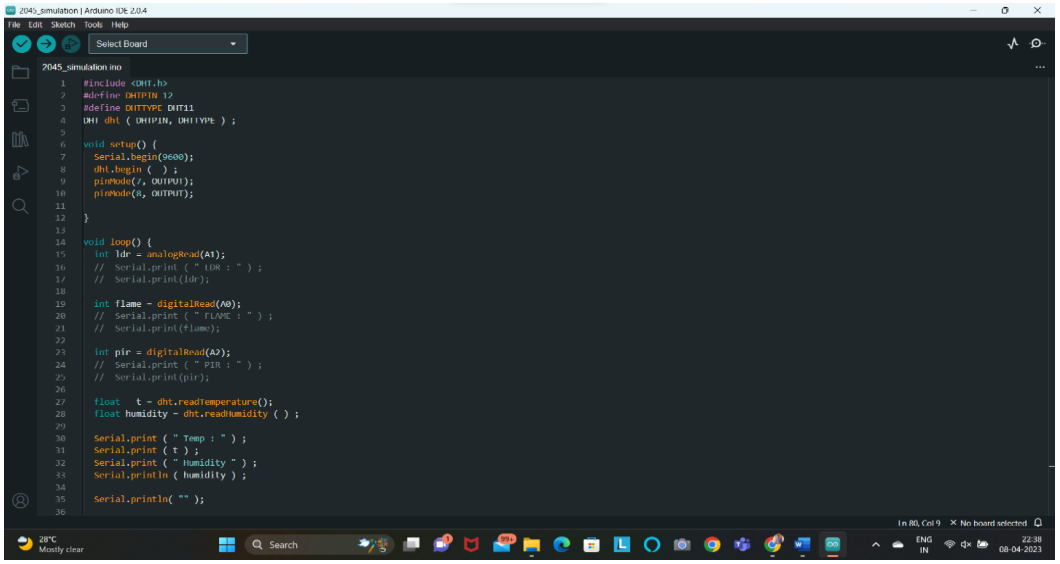

Fig 4.4 Arduino code compilation

Run Arduino IDE and go to File>Examples>01.Basics>Blink and open it. Click on "Verify" button, Then copy (Ctrl+ C) the .hex file.

Step 4: Proteus Simulation

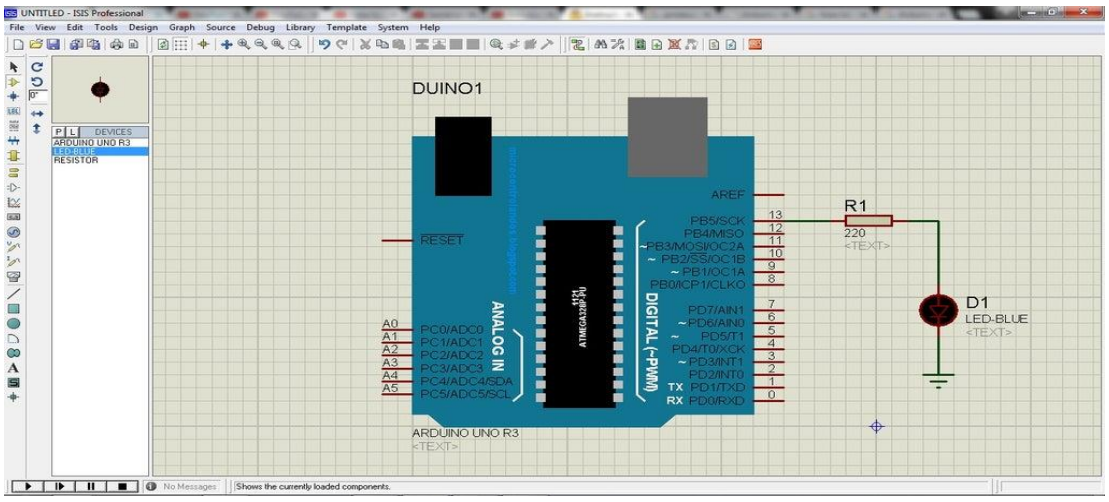

Fig 4.5 proteus circuit setup

Run the Proteus and draw the circuit like the picture. Double click on Arduino and paste the .hex file in "Program File: Run the simulation by clicking "Run the simulation" button.

4.1.4 SIMUALTION OUTPUT

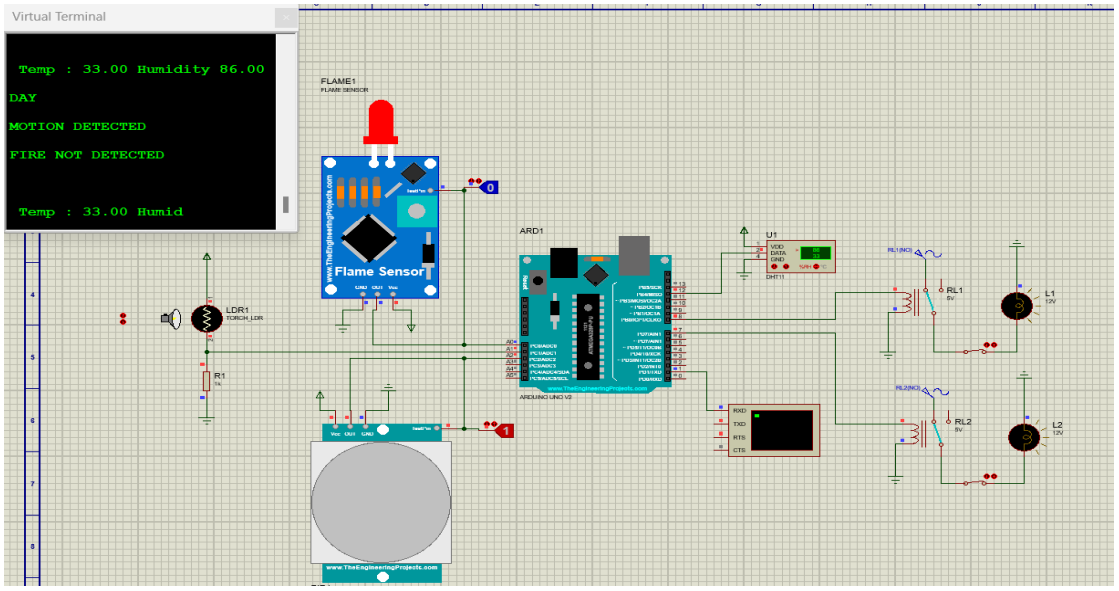

Fig 4.6 Output of simulation

The fig 4.6 shows the output of simulation done using the Proteus

4.2 PROGRAM FOR ARDUINO IDE:

```
#include <DHT.h>
#define DHTPIN 12
#define DHTTYPE DHT11
DHT dht ( DHTPIN, DHTTYPE ) ;

void setup() {
  Serial.begin(9600);
  dht.begin (  ) ;
  pinMode(7, OUTPUT);
  pinMode(8, OUTPUT);

}

void loop() {
  int ldr = analogRead(A1);
  //  Serial.print ( " LDR : " ) ;
  //  Serial.print(ldr);

  int flame = digitalRead(A0);
  //  Serial.print ( " FLAME : " ) ;
  //  Serial.print(flame);

  int pir = digitalRead(A2);
  //  Serial.print ( " PIR : " ) ;
  //  Serial.print(pir);

  float   t = dht.readTemperature();
  float humidity = dht.readHumidity ( ) ;

  Serial.print ( " Temp : " ) ;
  Serial.print ( t ) ;
```

```
 Serial.print ( " Humidity " ) ;
 Serial.println ( humidity ) ;

 Serial.println( "" );

 if (ldr > 300)
 {
   Serial.println( "DAY " );
   Serial.println( "" );
 }
 else  {
   Serial.println( "NIGHT " );
   Serial.println( "" );
 }
 if (pir == 1)

{
   Serial.println ( "MOTION DETECTED" ) ;

Serial.println( "" );
 }
 else  {
   Serial.println ( "MOTION NOT DETECTED" ) ;
   Serial.println( "" );
 }

 if (flame == 1)
 {
   Serial.println ( "FIRE DETECTED" ) ;
   Serial.println( "" );
 }
 else  {
   Serial.println ( "FIRE NOT DETECTED" ) ;
   Serial.println( "" );
```

```
  }

  if (flame == 0) {
    if (ldr < 300 || pir == 1)
    {
      digitalWrite(7, HIGH);
      digitalWrite(8, HIGH);
    }
    else {
      digitalWrite(7, LOW);
      digitalWrite(8, LOW);
    }
  }
  else {
    digitalWrite(7, LOW);

 digitalWrite(8, LOW);
  }
  Serial.println( "" );
  Serial.println( "" );
  delay(1000);

}
```

4.3 SOURCE CODE USED FOR HARDWARE:

```
#include <ESP8266WiFi.h>
#include <ESP8266HTTPClient.h>
#include <WiFiClient.h>
#include <ArduinoJson.h>
#include <LiquidCrystal_I2C.h>
```

```
LiquidCrystal_I2C lcd(0x27, 16, 2);
const char* ssid     = "iot";
const char* password = "12345678";
const char* serverName = "http://iotcloud22.in/2045_smarthome/post_value.php";

WiFiClient client;
HTTPClient http;

int flag;
int Hum, Fire, Temp, Ldr, Pir;
int len, h;

int cnt = 0;
String inString = "";
void setup()
{
  pinMode(D6, OUTPUT);
  pinMode(D5, OUTPUT);
  Serial.begin(9600);

  digitalWrite(D6, LOW);
  digitalWrite(D5, LOW);
  lcd.init();
  lcd.backlight();
  lcd.setCursor(0, 0);
  lcd.print(" IoT BASED SMART");
  lcd.setCursor(0, 1);
```

```
  lcd.print(" HOME AUTOMATION");

  WiFi.begin(ssid, password);
  Serial.println("Connecting");
  while (WiFi.status() != WL_CONNECTED) {
    Serial.print(".");
    delay(500);
  }
  Serial.println("");
  Serial.print("Connected to WiFi network with IP Address: ");
  Serial.println(WiFi.localIP());

  lcd.clear();
  lcd.setCursor(0, 0);
  lcd.print(" WiFi Connected ");
  lcd.setCursor(1, 1);
  lcd.print( WiFi.localIP());
  delay(3000);
  lcd.clear();
}

void loop ()
{

  //  Serial.print("T"); Serial.println(temp);
  while (Serial.available() > 0) {
```

```
char c = Serial.read();
Serial.print(c);
if (c == '\n' || c == '\r') {
  if (cnt >= 1) {

    status_filter(inString);

    //Serial.println(inString);
    inString = "";
    cnt = 0;
  }

   else
  {
   inString = "";
   cnt = 0;
  }
  }
  else
  {
  inString += c;
  cnt++;
 }
 }
}

void sending_to_db()
```

```
  {
   if (WiFi.status() == WL_CONNECTED)
  {
   http.begin(client, serverName);
   http.addHeader("Content-Type", "application/x-www-form-urlencoded");


String httpRequestData = "&value1=" + String(Temp) + "&value2=" + String(Hum) +
"&value3=" + String(Fire) + "&value4=" + String(Ldr) + "&value5=" + String(Pir) + "";
   //    Serial.print("httpRequestData: ");
   //    Serial.println(httpRequestData);
   int httpResponseCode = http.POST(httpRequestData);


    if (httpResponseCode > 0) {
     Serial.print("HTTP Response code: "); +
     Serial.println(httpResponseCode);
   }
   else {
     Serial.print("Error code: ");
     Serial.println(httpResponseCode);
   }
   http.end();
  }
  else {
   Serial.println("WiFi Disconnected");
   lcd.clear();
   lcd.setCursor(0, 0);
   lcd.print("      WiFi      ");
```

```
    lcd.setCursor(0, 1);
    lcd.print("  Disconnected  ");
    delay(1000);
  }
  getdata();
  //Send an HTTP POST request every 3 seconds
  delay(1500);

}



void status_filter(String buff)
{
  len = buff.length();
  //Serial.println(len);
  if (buff[0] == 'T')
    if (buff[6] == 'H')
      if (buff[12] == 'F')
        if (buff[14] == 'L')
          if (buff[16] == 'P')
            if (buff[18] == '#')

              //B17.00H00.00F0L0P0#
              //0123456789012345678
            {
```

```
String temp = buff.substring(1, 6);
String hum = buff.substring(7, 12);
String fire = buff.substring(13, 14);
String ldr = buff.substring(15, 16);
String pir = buff.substring(17, 18);

Temp = temp.toInt();
Hum = hum.toInt();
Fire = fire.toInt();
Ldr = ldr.toInt();
Pir = pir.toInt();

Serial.print("Temperature = "); Serial.println(Temp);
Serial.print("HUMIDITY = "); Serial.println(Hum);
Serial.print("FIRE = "); Serial.println(Fire);
Serial.print("LDR = "); Serial.println(Ldr);
Serial.print("PIR = "); Serial.println(pir);

lcd.setCursor(0, 0);
lcd.print("T: ");
lcd.print(Temp);
lcd.setCursor(7, 0);
lcd.print(" H: ");
lcd.print(Hum);
lcd.setCursor(0, 1);
lcd.print("F: ");
lcd.print(Fire);
```

```
            lcd.print(" L: ");
            lcd.print(Ldr);
            lcd.print(" P: ");
            lcd.print(Pir);

            sending_to_db();
          }
}

void getdata() {
  if (WiFi.status() == WL_CONNECTED) {

   //HTTPClient http;  //Object of class HTTPClient
    http.begin(client, "http://iotcloud22.in/2045_smarthome/light.json");
    int httpCode = http.GET();
    //Check the returning code
    if (httpCode > 0) {
      // Parsing
    }
  }
  StaticJsonDocument<256> doc;

  DeserializationError error = deserializeJson(doc, http.getString());
  Serial.println(http.getString());
  if (error) {
    Serial.print(F("deserializeJson() failed: "));
    Serial.println(error.f_str());
```

```
  return;
}
//StaticJsonDocument<256> doc;
//      deserializeJson(doc, json);
//     auto error = deserializeJson(doc, json);
if (error) {
  Serial.print(F("deserializeJson() failed with code "));
  Serial.println(error.c_str());
  return;
}
String light1 = doc["light1"]; // "on"
 // Extract values
//Serial.print(F("Response:"));
//Serial.println(light);
if (light1 == "on1")
{
  digitalWrite(D6, LOW);
}
if (light1 == "off1")
{
  digitalWrite(D6, HIGH);
}
String light2 = doc["light2"]; // "on"
 // Extract values
//Serial.print(F("Response:"));
 //Serial.println(light);
 if (light2 == "on2")
```

```
  {
    digitalWrite(D5, LOW);
  }
  if (light2 == "off2")
  {
    digitalWrite(D5, HIGH);
  }
 String light = doc["light"]; // "on"
  // Extract values
  //Serial.print(F("Response:"));
 //Serial.println(light);
  if (light == "on")
  {
     automode();
  }
  if (light == "off3")
  {
    Serial.println("MANUAL");
  }
  http.end();   //Close connection
  //Serial.println(flag);
  delay(1000);
}
void automode()
{
  if (Pir == 0 && Ldr < 4 && Fire < 8)
  {
```

```
    lcd.setCursor(0, 1);
    lcd.print(" NIGHT  MOTION  ");
    digitalWrite(D5, LOW);
    digitalWrite(D6, LOW);
  } else if (Pir == 0 && Ldr > 4 && Fire < 8)
{
    digitalWrite(D5, HIGH);
    digitalWrite(D6, LOW);
    lcd.print("  DAY   MOTION  ");
  }
  else if (Pir == 1 && Ldr < 4 && Fire < 8)
  {
    digitalWrite(D5, LOW);
    digitalWrite(D6, HIGH);
    lcd.print(" NIGHT  CLEAR   ");
  }
  else if (Pir == 1 && Ldr > 4 && Fire < 8)
  {
    digitalWrite(D5, LOW);
    digitalWrite(D6, HIGH);
    lcd.print("  DAY   CLEAR  ");
  }
  else
  {
    lcd.print("  FIRE DETECTED  ");
    digitalWrite(D5, HIGH);
    digitalWrite(D6, HIGH);
```

}

CHAPTER 5
HARDWARE DESCRIPTION AND RESULTS

5.1 SYSTEM REQUIREMENTS

5.1.1 HARDWARE REQUIREMENT

- Arduino uno
- Node MCU
- DHT 11 Sensor
- LCD display
- PIR Sensor
- Flame Sensor
- LDR Sensor
- 2 Channel relay
- Connecting wires
- Power supply unit

5.1.2 SOFTWARE REQUIREMENTS

- Embedded C
- Arduino IDE 1.8 version
- PHP MYSQL

5.2 COMPONENTS USED:

5.2.1 ARDUINO-UNO

Arduino Uno is a single-board microcontroller intended to make the application of interactive objects or environments more accessible. The board is based on the Atmega328. Current models feature a USB interface, a power jack, 6-analog input pins, a 16MHz ceramic resonator, an ICSP Header and a reset button. It comes with a simple integrated development environment (IDE) that runs on regular personal computers and allows users to write programs for Arduino using C or C++.

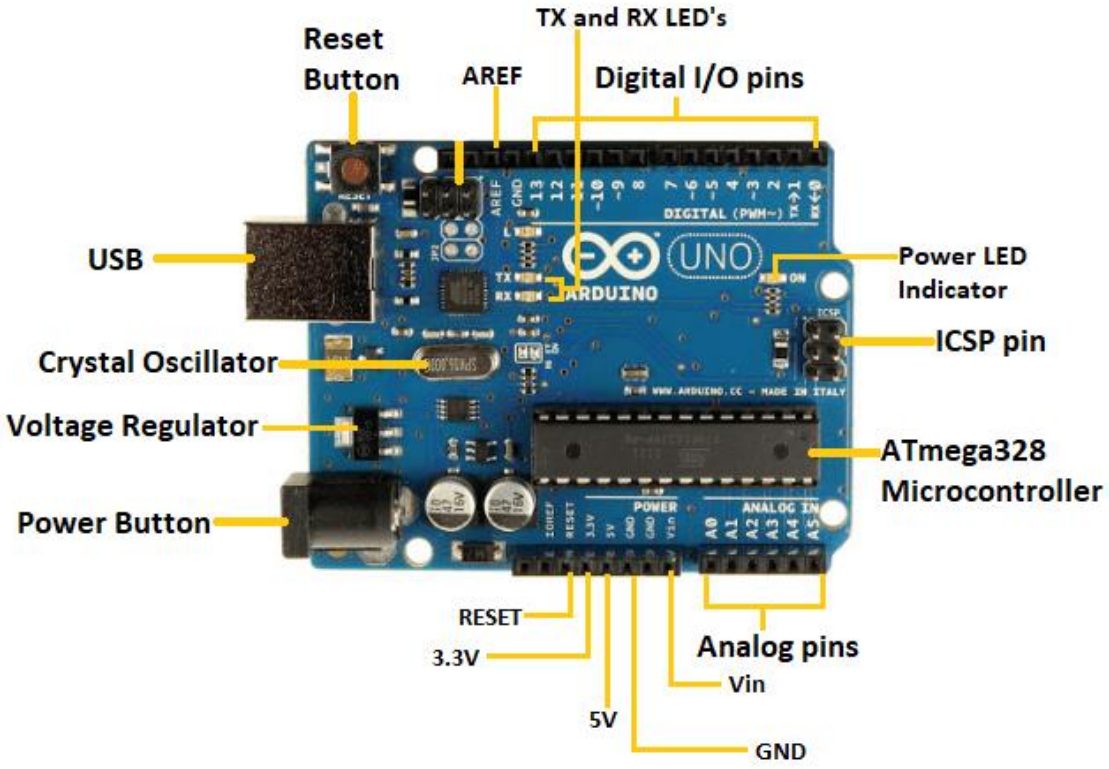

Fig 5.1 Arduino Uno board

- Microcontroller: Arduino Uno
- Operating Voltage: 5V
- Input Voltage: (recommended) 7-12V
- Input Voltage: (limits) 6-20V
- Digital I/O Pins: 14(of which 6 provide PWM Output)
- Analog Input Pins: 6
- DC Current per I/O Pin: 40mA
- DC Current for 3.3v Pin: 50mA
- Flash Memory: bootloader

- SRAM: 2 KB
- EEPROM: 1 KB
- Clock Speed: 16 MHz

5.2.2. NODE-MCU

“Node-MCU” naturally alludes to the firmware instead of the dev units. The firmware utilizes the Lua scripting language. It depends on the eLua project and based on the Espressif Non-OS SDK for ESP8266. It utilizes many open-source projects, for example, Lua-cjson and spiffs. LUA based natural firmware for Expressif ESP8622 Wi-Fi SoC, similarly as an open source-gear board that despite the $3 ESP8266 Wi-Fi modules consolidates a CP2102 TTL to USB chip for programming and exploring, is breadboard-obliging, and can essentially be constrained through its small USB port.

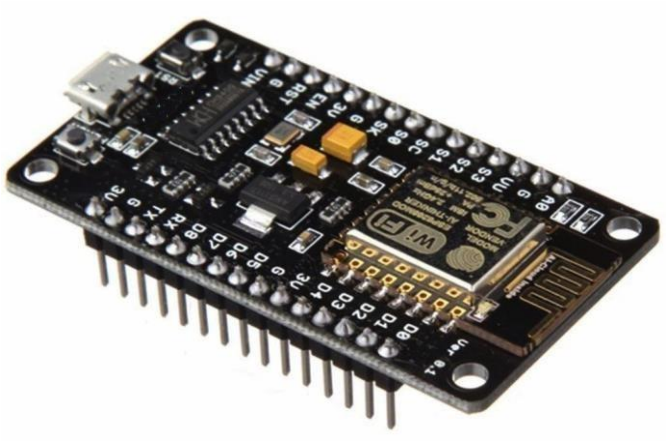

Fig 5.2 Node MCU Development Board

PIN NAME ON NODE MCU DEVELOPMENT KIT	ESP8266 INTERNAL GPIO PIN NUMBER	PIN NAME ON NODE MCU DEVELOPMENT KIT	ESP8266 INTERNAL GPIO PIN NUMBER
0 [*]	GPIO16	7	GPIO13
1	GPIO5	8	GPIO15
2	GPIO4	9	GPIO3
3	GPIO0	10	GPIO1
4	GPIO2	11	GPIO9
5	GPIO14	12	GPIO10
6	GPIO12		

Fig 5.3 Node MCU index ↔ GPIO mapping

5.2.3 LCD DISPLAY

LCD (liquid crystal display) is the technology used for displays in notebook and other smaller computers. Like light-emitting diode (LED) and gas-plasma technologies, LCDs allow displays to be much thinner than cathode ray tube (CRT) technology.

Flat screen LCD and plasma screens work in a completely different way. In a plasma screen, each pixel is a tiny fluorescent lamp switched on or off electronically. In an LCD television, the pixels are switched on or off electronically using liquid crystals to rotate polarized light

Fig 5.4 16X2 LCD Display

LCD stands for liquid crystal display. They come in many sizes 8x1, 8x2, 10x2, 16x1, 16x2, 16x4, 20x2, 20x4, 24x2, 30x2, 32x2, 40x2 etc. Many multinational companies like Philips Hitachi Panasonic make their own special kind of LCD'S to be used in their products. All the LCD'S performs the same functions (display characters numbers special characters ASCII characters etc). Their programming is also same and they all have same 14 pins (0-13) or 16 pins (0 to 15). Alphanumeric displays are used in a wide range of applications, including palmtop computers, word processors, photocopiers, point of sale terminals, medical instruments, cellular phones, etc.

This is an LCD Display designed for E-blocks. It is a 16 character, 2-line alphanumeric LCD display connected to a single 9-way D-type connector. This allows the device to be connected to most E-Block I/O ports. The LCD display requires data in a serial format, which is detailed in the user guide below. The display also requires a 24V power supply. Please take care not to exceed 5V, as this will cause damage to the device. The 24V is best generated from the E-blocks Multi programmer or a 24V fixed regulated power supply.

The 24 x 8inch intelligent alphanumeric dot matrix displays is capable of displaying 224 different characters and symbols. A full list of the characters and symbols is printed on pages 7/8 (note these symbols can vary between brand of LCD used). This booklet provides all the technical specifications for connecting the unit, which requires a single power supply (+24V)

FEATURES

- Input voltage: 24v
- E-blocks compatible
- Low cost
- Compatible with most I/O ports in the E-Block range
- Ease to develop programming code using Flow code icons

APPLICATIONS

- Monitoring

5.2.4 DHT 11 SENSOR

A DHT11 SENSOR (or hygrometer) senses, measures and reports the relative DHT11 in the air. It therefore measures both moisture and air temperature. Relative DHT11 is the ratio of actual moisture in the air to the highest amount of moisture that can be held at that air temperature.

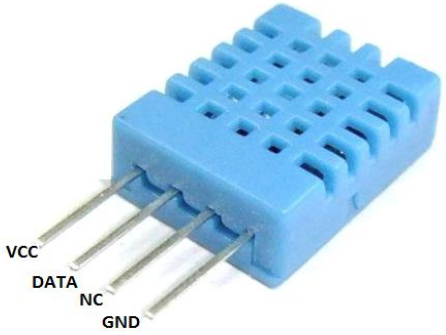

Fig 5.5 DHT 11 Sensor

A DHT11 SENSOR senses, measures both moisture and air temperature. The sensor is composed of two metal plates and contains a non-conductive polymer film between them. This film collects moisture from the air, which causes the voltage between the two plates to change. These voltage changes are converted into digital readings showing the level of moisture in the air. DHT11 measurement can be done using electronic hygrometers. Electronic type hygrometers or DHT11 SENSORs can be broadly divided into two categories namely capacitive sensing effects and resistive sensing effects. Resistive type DHT11 sensor's picks up changes in the resistance value of the sensor element in response to the change in the humidity. Thick film conductor of precious metals like gold, ruthenium oxide is printed and culminated in the shape of the comb to form an electrode. Then a polymeric film is applied on the electrode; the film acts as a DHT11 sensing film due to the existence of movable ions. Change in impedance occurs due to the change in the number of movable ions.

FEATURES

- Input Voltage: 5v
- Output: Analog (0-5v)
- High Performance
- Long Term Stability
- Close tolerances
- Low cost

APPLICATIONS

- Air conditioners
- Climate control for green houses
- Storage and warehouses
- Meteorological applications

5.2.5 FIRE SENSOR

A flame detector is a sensor designed to detect and respond to the presence of a flame or fire. Responses to a detected flame depend on the installation, but can include sounding an alarm, deactivating a fuel line (such as a propane or a natural gas line), and activating a fire suppression system.

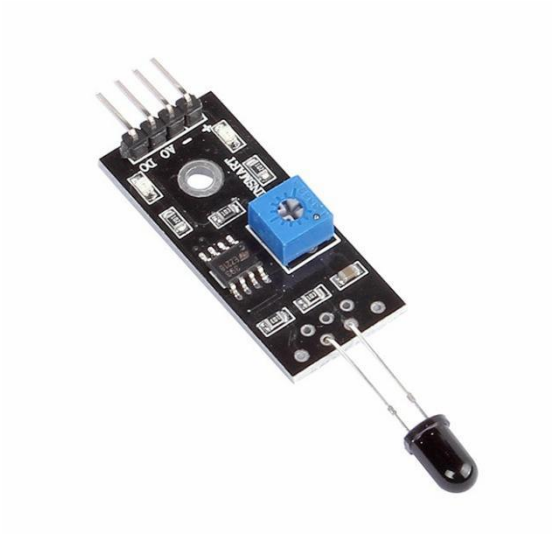

Fig 5.6 Fire Sensor

A flame detector is a sensor designed to detect and respond to the presence of a flame or fire. It also can detect ordinary light source in the range of a wavelength 760nm-1100 nm. The detection distance is up to 100 cm. The Flame sensor can output digital or analog signal. It can be used as a flame alarm or in fire-fighting robots.

The flame sensor is most sensitive to ordinary light. In this, a small panel output interface can be directly connected with the microcontroller IO port. The sensor and the flame have to maintain a certain distance of 80cm, so as not to damage the sensor temperature of the test flame lighters. As the flame increases, the distance also increases. It also has small plate analog output mode and the A/D conversion process is possible to get a higher accuracy. It has a black LED which indicates the power and the output signal.

FEATURES

- Operating Voltage: 3.3V to 5V DC
- Operating Current: 15Ma
- Output Digital: 0V to 5V, Adjustable trigger level from preset
- Output Analog: 0V to 5V based on infrared radiation from fire
- flame falling on the sensor Detection angle about 60 degrees, it is sensitive to the flame spectrum.
- Comparator chip LM393 makes module readings stable.

APPLICATIONS

- Gas-fueled cookers
- Industrial heating and drying systems
- Domestic heating systems
- Industrial gas turbines

5.2.6 PIR SENSOR

A passive infrared sensor (PIR sensor) is an electronic sensor that measures infrared (IR) light radiating from objects in its field of view. They are most often used in PIR-based motion detectors.

A PIR sensor is generally known to the world as motion sensor or motion detector. We can actually build motion sensors or motion sensing lights we get on market with the help of Arduino and PIR sensors. So, this tutorial is also a beginning guide to build motion sensor or a motion detector based on Arduino. PIR is a PYROELECTRIC (“Passive”) INFRARED SENSOR. It is based on infrared technology, automatic control module, high sensitivity, high reliability, ultra-low-voltage operating mode, widely used in various auto-sensing electrical equipment, especially for battery-powered automatic controlled products.

Fig 5.7 PIR Sensor

In a practical aspect, all objects emit heat energy in the form of radiation. The theory behind this concept is that all objects with a temperature above absolute zero (absolute zero is -273.15 degree Celsius or zero Kelvin) emit heat energy in the form of radiation at infra-red wavelengths (invisible to human eyes). These emitted infra-red radiations can be detected with the help of electronics and this principle is employed in the design of a PIR sensor. A PIR sensor does not emit Any kind of radiation for detection purposes but they just measure the infra-red radiation emitted by other objects inside its field or range of measurement

FEATURES

- Sensing range: less than 120degree, within 7 meters.

- Temperature: – 15 ~ +70
- Lock time: 0.2 sec
- Power Consumption: 65Ma

APPLICATIONS

- Automatically sensing light for floor, bathroom, basement, porch,
- warehouse, garage etc, Ventilator, alarm, etc.

5.2.7 LDR SENSOR

A photoresistor (or light-dependent resistor, LDR, or photoconductive cell) is a light-controlled variable resistor. The resistance of a photoresistor decreases with increasing incident light intensity; in other words, it exhibits photoconductivity.

Fig 5.8 LDR Sensor

A light dependent resistor works on the principle of photo conductivity. Photo conductivity is an optical phenomenon in which the materials conductivity is increased when light is absorbed by the material. When light falls i.e., when the photons fall on the device, the electrons in the valence band of the semiconductor material are excited to the conduction band. These photons in the incident light

should have energy greater than the band gap of the semiconductor material to make the electrons jump from the valence band to the conduction band. Hence when light having enough energy strikes on the device, more and more electrons are excited to the conduction band which results in large number of charge carriers. The result of this process is more and more current starts flowing through the device when the circuit is closed and hence it is said that the resistance of the device has been decreased. A Light Dependent Resistor (LDR) or a photo resistor is a device whose resistivity is a function of the incident electromagnetic radiation

Hence, they are light sensitive devices. They are also called as photo conductors, photo conductive cells or simply photocells. They are made up of semiconductor materials having high resistance.

FEATURES

- Input voltage: 5v
- Output: analog
- Highly sensitivity to light
- Output voltage: 5v

APPLICATIONS

- No need to detect absences or presences of light like in a camera light meter.
- Used in street lamps, alarm clock, burglar alarm circuits, light intensity meters

5.2.8 2 -CHANNEL RELAY

A relay is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid-state relays. Relays are used where it is necessary to control a circuit by a separate low-power signal, or where several circuits must be controlled by one signal. The first relays were used in long distance telegraph circuits as amplifiers: they repeated the signal coming in from one circuit and re-transmitted it on another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations.

Relays are simple switches which are operated both electrically and mechanically. Relays consist of a n electromagnet and also a set of contacts. The switching mechanism is carried out with the help of the electromagnet. The main operation of a relay comes in places where only a low-power signal can be used to control a circuit. It is also used in places where only one signal can be used to control a lot of circuits.

Fig 5.9 2-Chanel relay board

They were used to switch the signal coming from one source to another destination. The high-end applications of relays require high power to be driven by electric motors and so on. Such relays are called contactors. A relay is an electromechanical switch which is activated by an electric current. A two--relay board arrangement contains driver circuit, power supply circuit and isolation circuit. A relay is assembled with that circuit. The driver circuit contains transistors for switching operations. The transistor is use for switching the relay. An isolation circuit prevents reverse voltage from the relay which protects the controller and transistor from damage. The input pulse for switching the transistor is given from the microcontroller unit. It is used for switching of a two device.

FEATURES

- Input voltage: 12VDC
- Driver unit: ULN2003A
- Isolation unit: In4007
- Fast switching
- Motor forward and reverse operation

APPLICATIONS

- Ac load Switching applications
- Dc load Switching applications
- Motor switching applications

5.2.9 POWER SUPPLY UNIT

Every Electronic device or product requires a reliable power supply unit (PSU) to operate it. Almost all devices in our home, like TV, Printer, Music Player etc. A power supply unit (or PSU) converts mains AC to low-voltage regulated DC power for the internal components of a computer. Modern personal computers universally use switched-mode power supplies. Some power supplies have a manual switch for selecting input voltage, while others automatically adapt to the mains voltage. A power supply is used to reduce the mains electricity at 240 volts AC down to something more useable, say 12 volts DC. There are two types of power supply, linear and switch mode. A linear power supply uses a transformer to reduce the voltage. The AC signal is rectified and regulated to produce a high DC voltage. An AC adapter, AC/DC adapter, or AC/DC converter is a type of external power supply, often enclosed in a case similar to an AC plug. Adapters for battery-powered equipment may be described as chargers or rechargers (see also battery charger). AC adapters are used with electrical devices that require power but do not contain internal components to derive the required voltage and power from main power. The internal circuitry of an external power supply is very similar to the design that would be used for a built-in or internal supply. The below fig 5.10 shows a pictorial representation of a 12V 1Amp Adapter.

Fig 5.10 Adapter (12V 1AMP)

An adapter is a device that converts attributes of one electrical device or system to those of an otherwise incompatible device or system. Some modify power or signal attributes, while others merely adapt the physical form of one electrical connector to another. In a computer, an adapter is often built into a card that can be inserted into a slot on the computer's mother board.

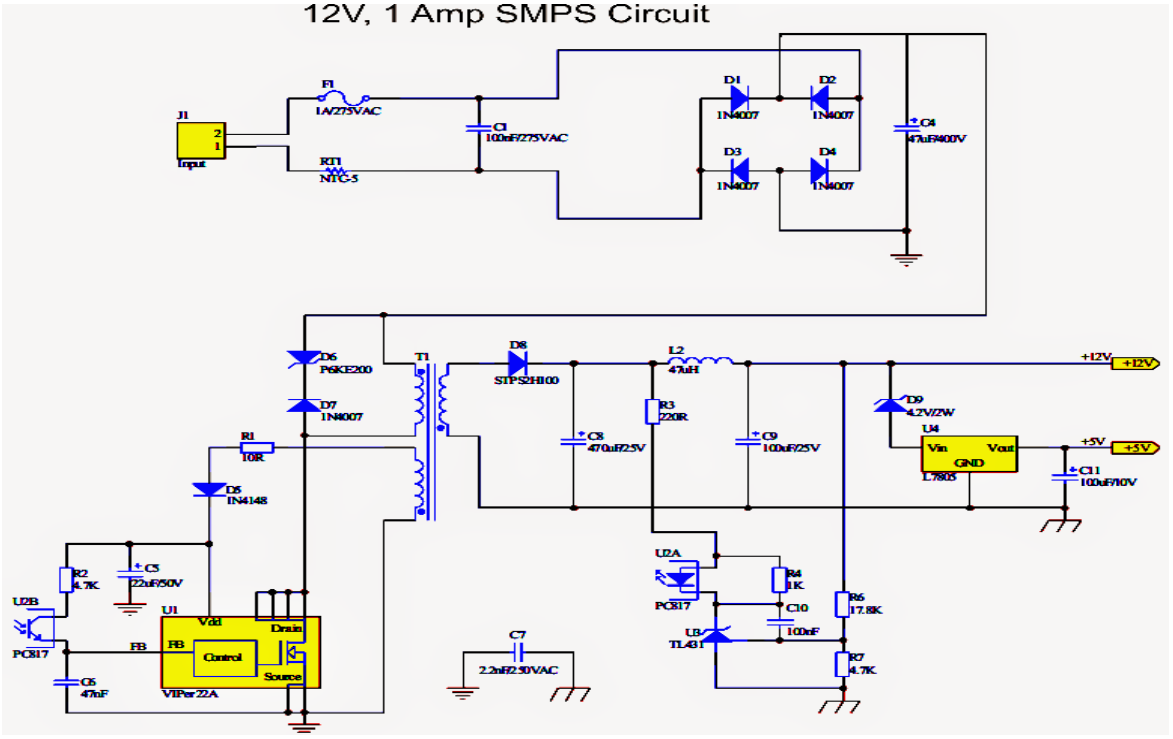

Fig 5.11 Current flow chart in a 12v adapter

Fig 5.11 shows the current flow in a 12V adapter, An electric power adapter may enable connection of a power plug, sometimes called, used in one region to an AC power socket used in another, by offering connections for the disparate contact arrangements, while not changing the voltage. An AC adapter, also called a "recharger", is a small power supply that changes household electric current from distribution voltage) to low voltage DC suitable for consumer electronics.

Some modify power or signal attributes, while others merely adapt the physical form of one electrical connector to another. For computers and related items, one kind of serial port adapter enables connections between 25-contact and nine-contact connectors, but does not affect electrical power signaling related attributes

FEATURES

- Output current:1A
- Supply voltage: 220-230VAC
- Output voltage: 12VDC
- Reduced costs
- Increased value across front-office and back-office functions
- Access to current, accurate, and consistent data
- It generates adapter metadata as WSDL files with J2CA extension.

APPLICATIONS

- Back-end systems which need to send purchase order data to oracle applications send it to the integration service via a integration server client.
- SMPS applications.

5.3 HARDWARE KIT AND RESULTS

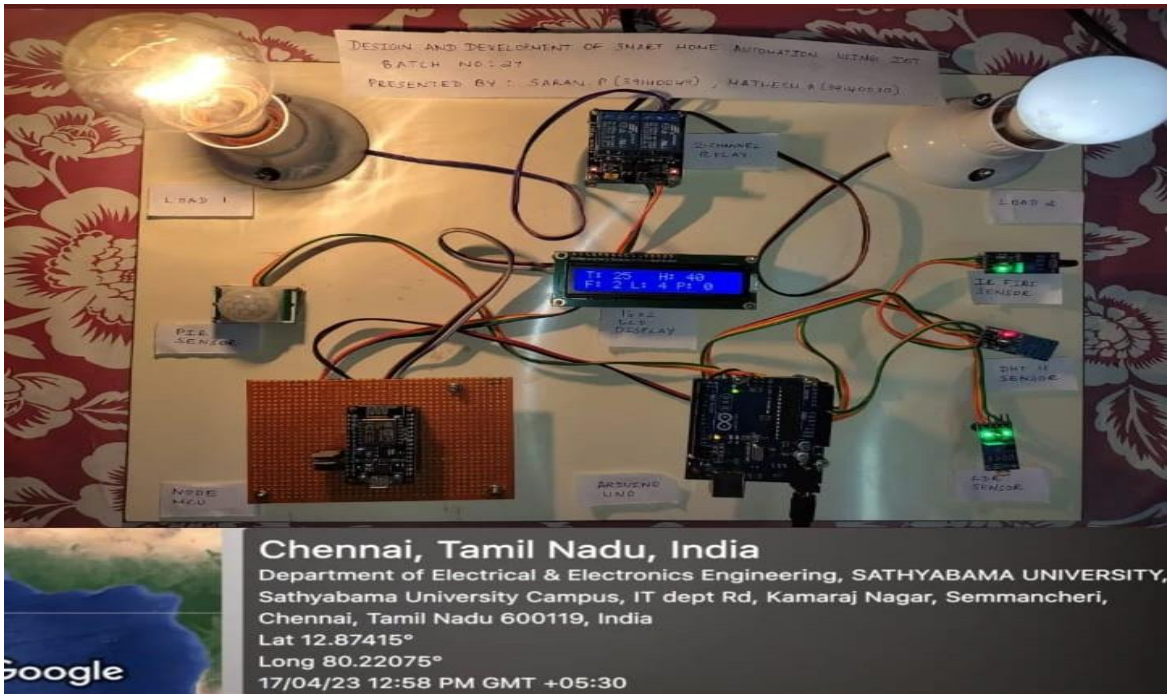

Fig 5.12 Photocopy of our project's hardware kit

The fig 5.12 shows the final outcome of the hardware kit, where all the sensors, microcontroller and other hardware's are connected and programmed accordingly.

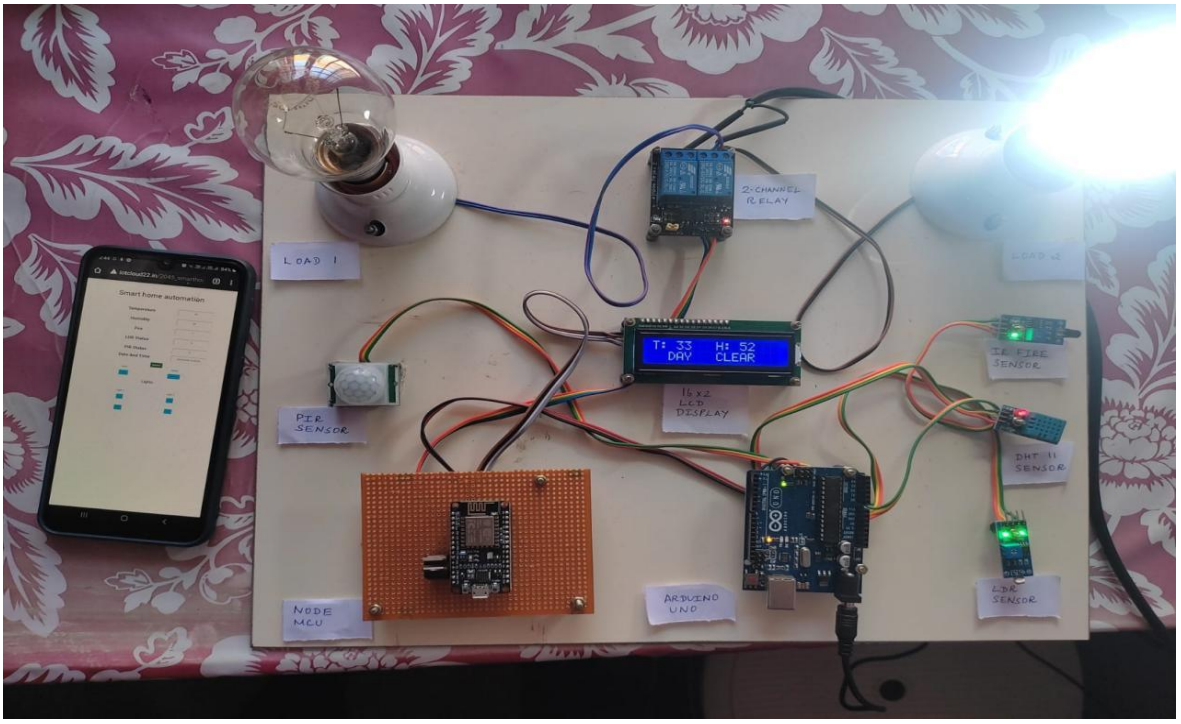

Fig 5.13 Photocopy of the output During day time when no motion is detected

During the day time, where the sunlight is detected by the LDR sensor and no motion is detected by the PIR sensor, LOAD 2 alone lights up

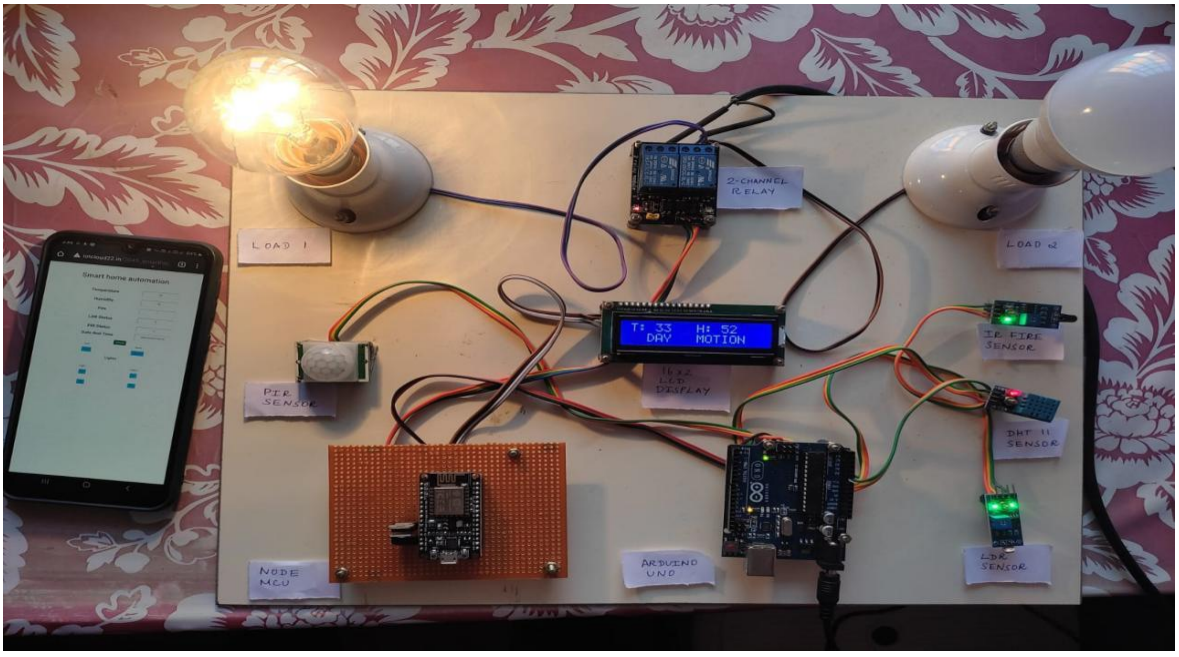

Fig 5.14 Photocopy of the output During day time when motion is detected

During the day time, where the sunlight is detected by the LDR sensor and motion is detected by the PIR sensor, LOAD 1 alone lights up.

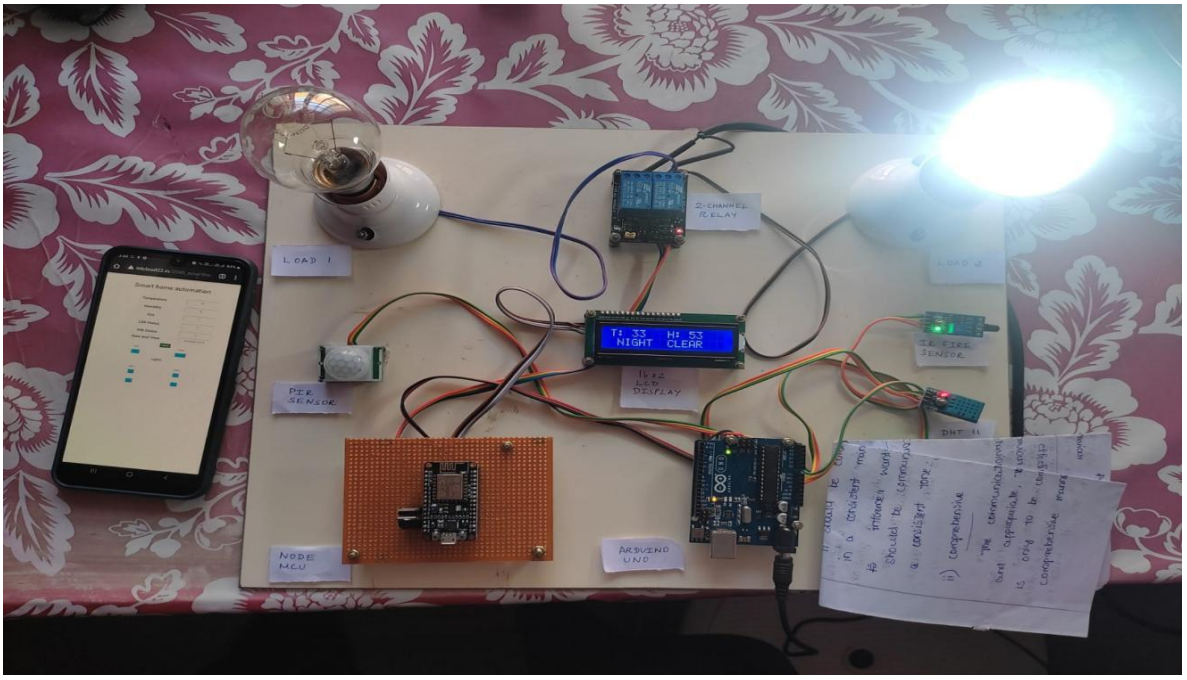

Fig 5.15 Photocopy of the output During night time when no motion is detected

During the night time, where there is no sunlight is detected by the LDR sensor and

no motion is detected by the PIR sensor, LOAD 2 alone lights up.

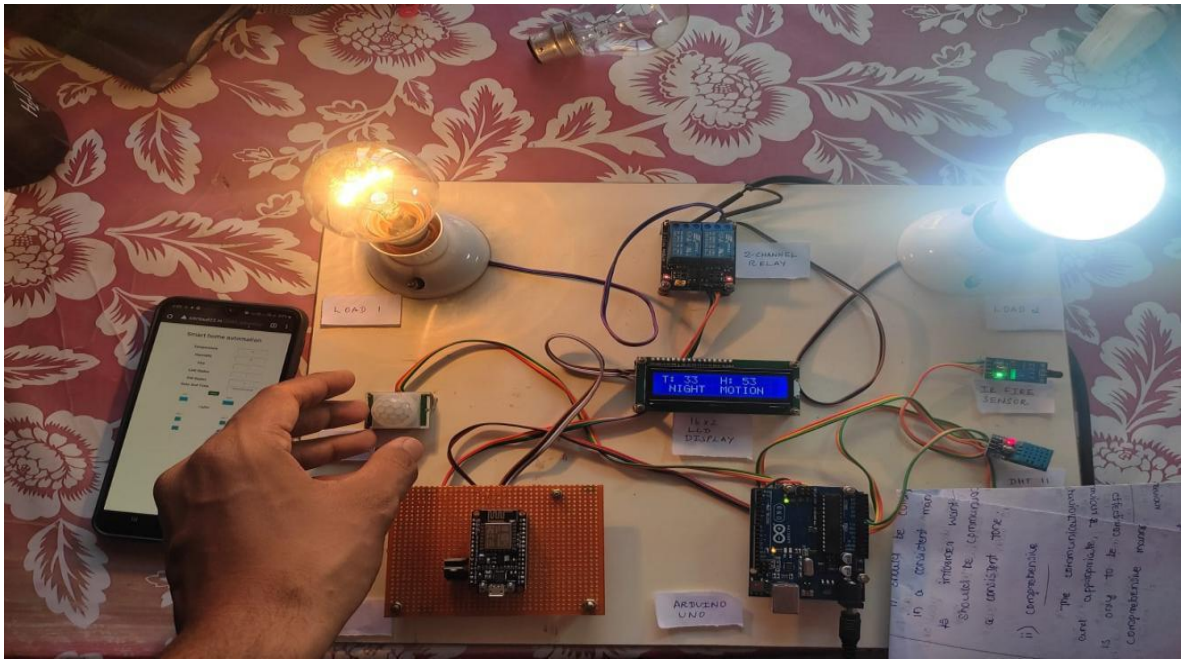

Fig 5.16 Photocopy of the output During night time when motion is detected

During the night time, where there is no sunlight is detected by the LDR sensor and motion is detected by the PIR sensor, LOAD 1 as well as LOAD 2 alone lights up.

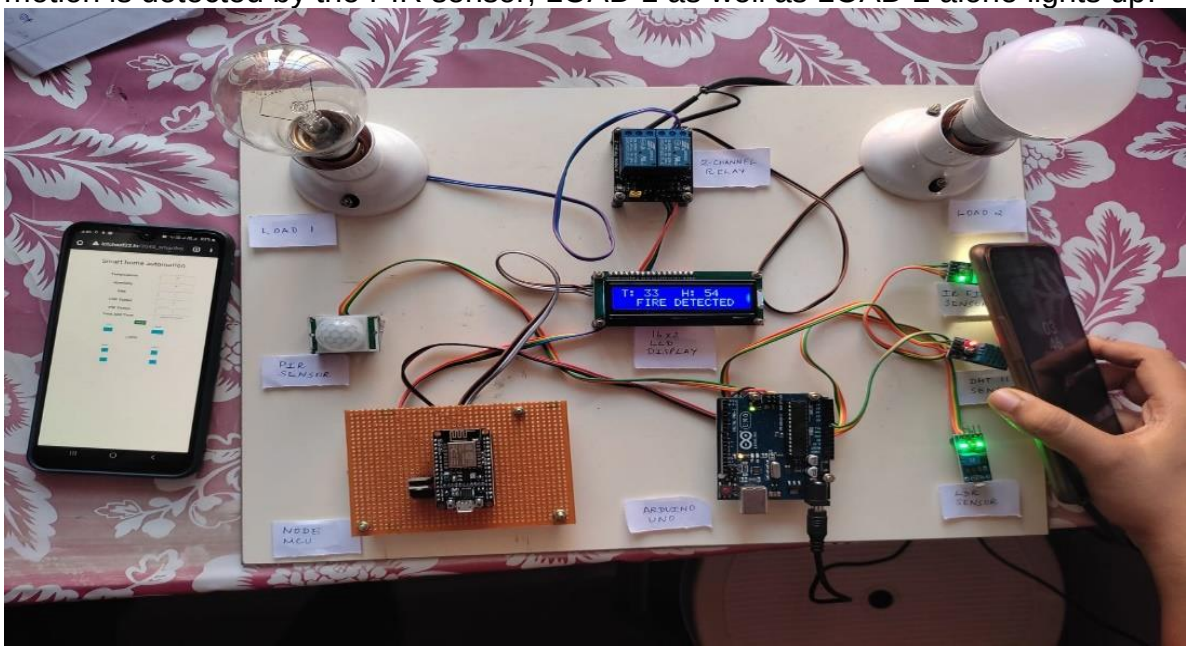

Fig 5.17 Photocopy of the output when fire is detected, the supply is turned OFF

During any emergency situation When fire is present, the Arduino is programmed in a such a way that it will automatically turn off the supply.

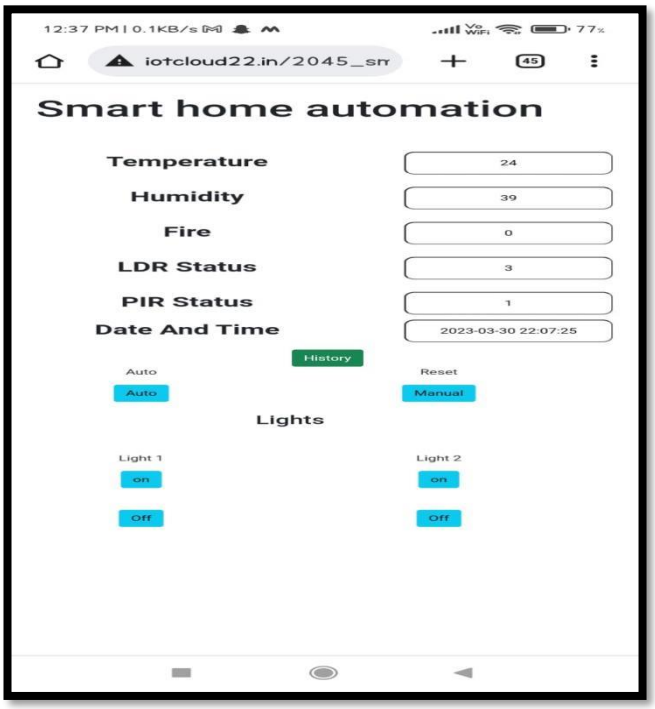

Fig 5.18 User web page

Fig 5.17 shows the software outcome of the study. All the outputs received from the sensors are displayed in this web page and updated continuously with the help of Node MCU.

CHAPTER 6
SUMMARY AND CONCLUSION

6.1 CONCLUSION

In this project, a home automation system was designed and implemented using Node-MCU as the microcontroller and Wi-Fi as the method of monitoring and controlling the home appliances which enables the user to remotely access the system from anywhere around the world. This project can be implemented in homes, offices or in any consumer locations (IEEE 1621-2004). The system is capable of automating the operation of the appliances by analyzing the regular usage patter of the appliances by the user. This not just saves a lot of human effort, but also helps in conserving energy. Also, it can help the differently abled and the elderly in performing basic tasks at home such as switching on/off the light, fan, and so on without having to depend on others.

6.2 SCOPE FOR FUTURE WORK

Integration of Artificial Intelligence (AI): The integration of AI in home automation systems can make them more intelligent and adaptive to changing circumstances. AI can be used to predict user behavior, optimize energy usage, and improve security.

Voice-activated assistants: Voice assistants like Amazon Alexa, Google Assistant, and Apple Siri are already widely used in homes. Future work in this area includes improving their accuracy and expanding their capabilities to include more complex tasks.

Home health monitoring: Home automation systems can be used to monitor the health of people in the home. Future work in this area includes developing sensors that can detect changes in vital signs and alert healthcare providers if there are any concerns.

Energy management: Home automation systems can be used to optimize energy usage and reduce waste. Future work in this area includes developing more sophisticated algorithms for energy management and integrating renewable energy sources into home automation systems.

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