CHAPTER: 1

INTRODUCTION

The project aims at designing an advanced home automation system using normal web server and Wi-Fi technology. The devices can be switched ON/OFF and sensors can be read using a Personal Computer (PC) through Wi-Fi. Automation is the most frequently spelled term in the field of electronics. The hunger for automation brought many revolutions in the existing technologies. These had greater importance than any other technologies due to its user-friendly nature. These can be used as a replacement of the existing switches in home which produces sparks and also results in fire accidents in few situations. Considering the advantages of Wi-Fi an advanced automation system was developed to control the appliances in the house.

Wi-Fi (Short for Wireless Fidelity) is a wireless technology that uses radio frequency to transmit data through the air. Wi-Fi has initial speeds of 1mbps to 2mbps. Wi-Fi transmits data in the frequency band of 2.4 GHz. It implements the concept of frequency division multiplexing technology. Range of Wi-Fi technology is 40-300 feet. The controlling device for the automation in the project is a ESP8266. The data sent from PC over Wi-Fi will be received by Wi-Fi module connected to ESP8266. ESP8266 reads the data and decides the switching action of electrical devices connected to it through Relays.

LiFi is a wireless optical networking technology that uses light-emitting diodes (LEDs) for data transmission.

LiFi is designed to use LED light bulbs similar to those currently in use in many energy-conscious homes and offices.

However, LiFi bulbs are outfitted with a chip that modulates the light imperceptibly for optical data transmission.

LiFi data is transmitted by the LED bulbs and received by photoreceptors

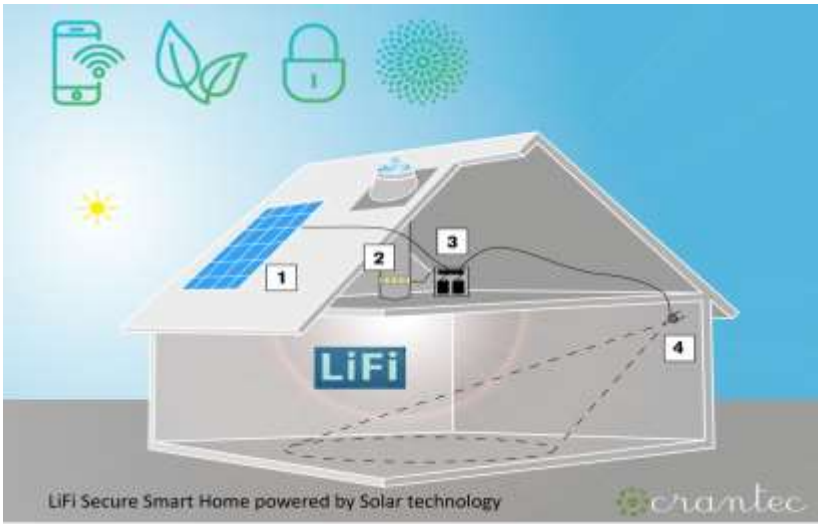


Diagram clearly explain the about the future smart house

In recent years, wireless systems like Wi-Fi have become more and more common in home networking. Also in home and building automation systems, the use of wireless technologies gives several advantages that could not be achieved using a wired network only.

- Reduced installation costs: First and foremost, installation costs are significantly reduced since no cabling is necessary. Wired solutions require cabling, where material as well as the professional laying of cables (e.g. into walls) is expensive.

- System scalability and easy extension: Deploying a wireless network is especially advantageous when, due to new or changed requirements, extension of the network is necessary. In contrast to wired installations, in which cabling extension is tedious. This makes wireless installations a seminal investment.

- Aesthetical benefits: Apart from covering a larger area, this attribute helps to full aesthetical requirements as well. Examples include

representative buildings with all-glass architecture and historical buildings where design or conservatory reasons do not allow laying of cables.

- Integration of mobile devices: With wireless networks, associating mobile devices such as PDAs and Smartphones with the automation system becomes possible everywhere and at any time, as a device's exact physical location is no longer crucial for a connection (as long as the device is in reach of the network).

CHAPTER: 2

LITERATURE SURVEY

CHAPTER: 3

REQUIREMENT SPECIFICATION

3.1 HARDWARE REQUIREMENTS:

ARDUINO BOARD : NODU MCU ESP8266

POWER REGULATOR : 230V

RELAY : 4 CHANNEL RELAY MODULE

3.2 SOFTWARE REQUIREMENTS:

ARDUINO SOFTWARE : ARDUINO IDE

LANGUAGE : C,C++,ANSIC

ANDROID : BLYNK APP

3.3 NODU MCU ESP8266

The NodeMCU [3] (Node MicroController Unit) is an open source software and hardware development environment that is built around a very inexpensive System-on-a- Chip (SoC) called the ESP8266. The ESP8266 is designed and manufactured by Express, contains all crucial elements of the modern computer: CPU, RAM, networking (wi-fi), and even a modern operating system and SDK. When purchased at bulk, the ESP8266 chip costs only $2 USD a piece. That makes it an excellent choice for this system design.

The NodeMCU aims to simplify ESP8266 development. It has two key components.

i. An open source ESP8266 firmware that is built on top of the chip manufacturer's proprietary SDK. The firmware provides a simple programming environment based on eLua (embedded Lua), which is a very simple and fast scripting language with an established developer

community. For new comers, the Lua scripting language is easy to learn. And to add on NodeMCU can be programmed with the Android IDE too.

ii. A development kit board that incorporates the ESP8266 chip on a standard circuit board. The board has a built-in USB port that is already wired up with the chip, a hardware reset button, Wi-Fi antenna, LED lights, and standard-sized GPIO (General Purpose Input Output) pins that can plug into a bread board. Figure 2 below shows the NodeMCU development board.

Fig: NodeMCU (ESP8266) Development Board

3.4 RELAY BOARD

A relay is an electromagnetic switch. It is activated when a small current of some microampere is applied to it. Normally a relay is used in a circuit as a type of switch, an automatic switch. There are different types of relays and they operate at different voltages. When a circuit is built the voltage that will trigger it has to be considered. In this system the relay circuit is used to turn the appliances ON/OFF. The high/low signal is supplied from the NodeMCU microcontroller. When a low voltage is given to the relay of an appliance it is turned off and when a high voltage is given it is turned on. The relay circuit to drive four appliances in the Home automation system is shown below in figure 3. The number of appliances can be modified according to the user's requirements.

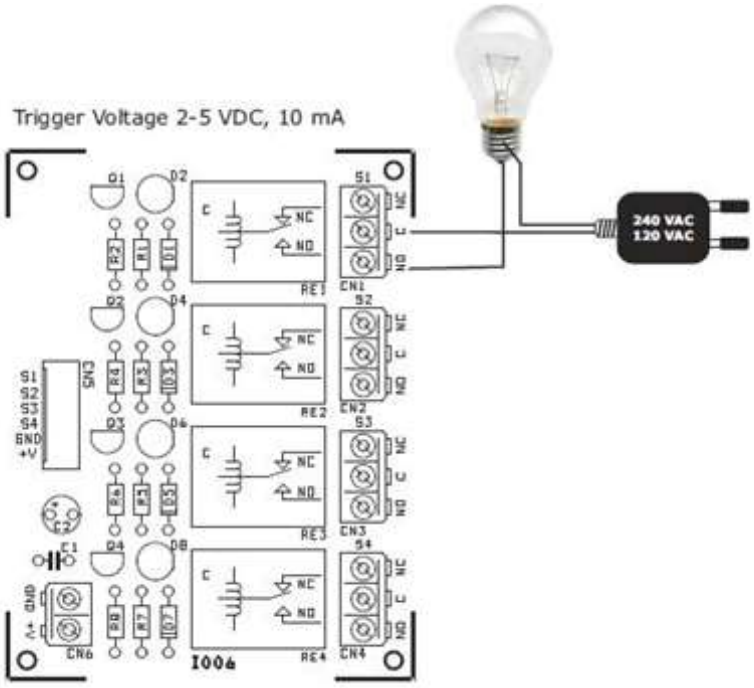


Fig -3: Relay Board Wiring Diagram

CHAPTER: 4

SYSTEM ANALYSIS

4.1 EXISTING SYSTEM:

A. Bluetooth based home automation system

Home automation systems using smartphone, Arduino board and Bluetooth technology are secured and low cost. A Bluetooth based home automation system proposed by R.Piyare and M.Tazil. The Bluetooth system uses a PC or smartphone as receiver device. It has a high communication rate, great security and low cost, so it can be implemented as a real time system. Bluetooth network has limited range of 10 meters if the smartphone is out of range, then it will not be able to control the home appliances, this is one of the main disadvantages of Bluetooth based home automation system

B. Voice recognition based home automation

A voice recognition based home automation system proposed and implemented by a researcher. The wireless communication between the smartphone and the Arduino UNO is done through Bluetooth technology. This will be more helpful for handicapped and aged people who wants to control appliances by speaking voice command The main drawback of this system is that communication between user and voice recognition tool depends on signal to noise ratio (SNR), if voice signal is noisy then communication can highly effect and the system will fail to show accuracy.

C. ZigBee Based Wireless Home Automation System

ZigBee based wireless home automation system has also been studied [4], ZigBee is similar to Bluetooth technology. It is one of the broadly used transceiver standard with low data rate and power. It has physical range is between 10 to 20 meters, which can increase up to 150 meters by using direct sequence spread spectrum (DSSS). It is ideal for developing prototypes and research related activities.

D. GSM Based Home Automation System

A smart home automation system implemented by using Global System for Mobile communication (GSM) [5]. In GSM based home automation systems, communication between main module and appliances is done through text messages. The main drawback of GSM based home automation system is that, there is no guarantee text message deliver to the system every time so it is not a reliable system.

These are the drawbacks of existing methods, To overcome that drawbacks we are implementing “IOT Based Smart security and Smart Home Automation”.

4.2 PROPOSED SYSTEM:

- Home automation has become more and more popular in recent years.
- **Home automation** is building automation for a home, called a **smart home** or **smart house**. A home automation system will control lighting, climate, entertainment systems, and appliances. It may also include home security such as access control and alarm systems. When connected with the Internet, home devices are an important constituent of the Internet of Things.
- Home automation with full security and controlling the home light system using wireless communication as **Wi-Fi.**
- In the era of overcrowded (data communication) world, **Li-Fi** is a new way of wireless communication that uses LED lights to transmit data wirelessly.
- Transmission of data is one of the most important day to day activities in the fast growing world.
- The future **smart home** or **smart house** will step towards smartest light ever.

ADVANTAGES OF PROPOSED SYSTEM

a) Efficiency: Energy consumption can be minimised with the use of LED illumination which are already available in the home, offices and Mall etc. for lighting purpose. Hence the transmission of data requiring negligible additional power, which makes it very efficient in terms of costs as well as energy.

b) High speed: Combination of low interference, high bandwidths and high-intensity output, help Li-Fi provide high data rates i.e. 1 Gbps or even beyond.

c) Availability: Availability is not an issue as light sources are present everywhere. Wherever there is a light source, there can be Internet. Light bulbs are present everywhere – in homes, offices, shops, malls and even planes, which can be used as a medium for the data transmission.

d) Cheaper: Li-Fi not only requires fewer components for its working, but also uses only a negligible additional power for the data transmission.

e) Security: One main advantage of Li-Fi is security. Since light cannot pass through opaque structures, Li-Fi internet is available only to the users within a confined area and cannot be intercepted and misused, outside the area under operation.

f) Li-Fi technology has a great scope in future. The extensive growth in the use of LEDs for illumination indeed provides the opportunity to integrate the technology into a plethora of environments and applications.

4.3 TECHNOLOGIES USED:

- IoT
- LiFi

INTERNET OF THINGS (IOT)

The term "The Internet of Things" (IoT) was coined by **Kevin Ashton** in a presentation to Proctor & Gamble in 1999. He is a co-founder of MIT's Auto-ID Lab. He pioneered RFID (used in bar code detector) for the supply-chain management domain. He also started Zensi, a company that makes energy sensing and monitoring technology.

So, let me first take you through a quote by Kevin Ashton, which he wrote in 2009 for RFID journal. This will help you in understanding IoT from its core.

If we had computers that knew everything there was to know about things using data they gathered without any help from us we would be able to track and count everything, and greatly reduce waste, loss and cost. We would know when

things needed replacing, repairing or recalling, and whether they were fresh or past their best.

We need to empower computers with their own means of gathering information, so they can see, hear and smell the world for themselves, in all its random glory.

The above Kevin's quote would have given you an idea about the ideologies behind the development of IoT. Let's now try to further simplify this term and understand IoT fundamentally. After this, we will be moving forward and looking towards the benefits of IoT.

specifying hardware and system requirements and helps in defining the overall system architecture.

Definition:

IOT is the network of devices, vehicles and home appliances that contain electronic, software, actuator and connectivity which allows these things to connect, interact and exchange data.

Live Examples

- Nest Smart Home. ...
- Kisi Smart Lock. ...
- Canary Smart Security System. ...
- DHL's IOT Tracking and Monitoring System. ...
- Cisco's Connected Factory. ...
- Pro Glove's Smart Glove. ..

2.2 Benefits of IOT

Since IOT allows devices to be controlled remotely across the internet, thus it created opportunities to directly connect & integrate the physical world to the computer-based systems using sensors and internet. The interconnection of these multiple embedded devices will be resulting in automation in nearly all fields and also enabling advanced applications. This is resulting in improved accuracy, efficiency and economic benefit with reduced human intervention. It encompasses technologies such as smart grids, smart homes, intelligent transportation and smart cities. The major benefits of IoT are:

1. **Improved Customer Engagement** – IOT improves customer experience by automating the action. For e.g. any issue in the car will be automatically detected by the sensors. The driver, as well as the manufacturer, will be notified about it. Till the time driver reaches the service station, the manufacturer will make sure that the faulty part is available at the service station.
2. **Technical Optimization** – IOT has helped a lot in improving technologies and making them better. The manufacturer can collect data from different car sensors and analyze them to improve their design and make them much more efficient.
3. **Reduced Waste –** Our current insights are superficial, but IoT provides real-time information leading to effective decision making & management of resources. For example, if a manufacturer finds fault in multiple engines, he can track the manufacturing plant of those engines and can rectify the issue with manufacturing belt.

Nowadays, we are surrounded by lots of IOT enabled devices which are continuously emitting data and communicating through multiple devices. Moving ahead, let’s discuss the required hardware for building an IOT application. We will also look at the IOT devices which we are using in our day to day life.

2.3 Applications of IOT

Energy Applications: The energy rates have raised to a great instinct. Individuals and Organizations, both are searching ways to reduce and control the consumption. IOT provides a way to not only monitor the energy usage at the appliance-level but also at the house-level, grid level or could be at the distribution level. Smart Meters & Smart Grid are used to monitor energy consumption. It also detects threats to the system performance and stability, which protect appliances from downtime and damages.

1. **Healthcare Application**: Smart watches and fitness devices have changed the frequency of health monitoring. People can monitor their own health at regular intervals. Not only this, now if a patient is coming to the hospital by ambulance, by the time he or she reaches the hospital his health report is diagnosed by doctors and the hospital quickly starts the treatment. The data gathered from multiple healthcare applications are now collected and used to analyze different disease and find its cure.

2. **Education**: IOT provides education aids which helps in fulfilling the gaps in the education industry. It not only improves the quality of education but also optimizes the cost and improves the management by taking into consideration students response and performance.

3. **Government**: Governments are trying to build smart cities using IOT solutions. IOT enhances armed force systems and services. It provides better security across the borders through inexpensive & high-performance devices. IOT helps government agencies to monitor data in real-time and improve their services like healthcare, transportation, education etc.

4. **Transportation**: IOT has changed the transportation sector. Now, we have self-driving cars with sensors, traffic lights that can sense the traffic and switch automatically, parking assistance, giving us the location of free parking space etc. Also, various sensors in your vehicle indicate you about the current status of your vehicle, so that you don't face any issues while travelling.

5. **Marketing your product**: Using IOT, organizations can better analyze & respond to customer preferences by delivering relevant content and solutions. It helps in improving business strategies in the real-time.

Now that we are aware of the powerful IOT solutions that have been astoundingly impacting various domains, let's take a deep dive and understand Raspberry Pi, which is commonly used to prepare IOT solutions. After understanding Raspberry Pi we will be creating an IOT application.

Fig: 2.3.1 Connecting multiple devices

I hope that now you would have got an idea of what IOT really is. Now advancing in our IOT tutorial, we will discuss the benefits of IOT and the hardware used in IOT application.

2.4 Internet of Things (IOT) Characteristics

Some of the general and key characteristics identified during the research study are as follows:

1. **Intelligence**

IOT comes with the combination of algorithms and computation, software & hardware that makes it smart. Ambient intelligence in IOT enhances its capabilities which facilitate the things to respond in an intelligent way to a particular situation and supports them in carrying out specific tasks. In spite of all the popularity of smart technologies, intelligence in IOT is only concerned as means of interaction between devices, while user and device interaction is achieved by standard input methods and graphical user interface.

2. Connectivity

Connectivity empowers Internet of Things by bringing together everyday objects. Connectivity of these objects is pivotal because simple object level interactions contribute towards collective intelligence in IOT network. It enables network accessibility and compatibility in the things. With this connectivity, new market opportunities for Internet of things can be created by the networking of smart things and applications.

3. Dynamic Nature

The primary activity of Internet of Things is to collect data from its environment, this is achieved with the dynamic changes that take place around the devices. The state of these devices change dynamically, example sleeping and waking up, connected and/or disconnected as well as the context of devices including temperature, location and speed. In addition to the state of the device, the number of devices also changes dynamically with a person, place and time.

4. Enormous scale

The number of devices that need to be managed and that communicate with each other will be much larger than the devices connected to the current Internet. The management of data generated from these devices and their interpretation for application purposes becomes more critical. Gartner (2015) confirms the enormous scale of IoT in the estimated report where it stated that 5.5 million new things will get connected every day and 6.4 billion connected things will be in use worldwide in 2016, which is up by 30 percent from 2015. The report also forecasts that the number of connected devices will reach 20.8 billion by 2020.

5. Sensing

IOT wouldn't be possible without sensors which will detect or measure any changes in the environment to generate data that can report on their status or even interact with the environment. Sensing technologies provide the means to create capabilities that reflect a true awareness of the physical world and the people in it. The sensing information is simply the analogue input from the physical world, but it can provide the rich understanding of our complex world.

6. Heterogeneity

Heterogeneity in Internet of Things as one of the key characteristics. Devices in IOT are based on different hardware platforms and networks and can interact with other devices or service platforms through different networks. IOT architecture should support direct network connectivity between heterogeneous networks. The key design requirements for heterogeneous things and their environments in IOT are scalabilities, modularity, extensibility and interoperability.

7. Security

IOT devices are naturally vulnerable to security threats. As we gain efficiencies, novel experiences, and other benefits from the IOT, it would be a mistake to forget about security concerns associated with it. There is a high level of transparency and privacy issues with IOT. It is important to secure the endpoints, the networks, and the data that is transferred across all of it means creating a security paradigm.

There are a wide variety of technologies that are associated with Internet of Things that facilitate in its successful functioning. IOT technologies possess the above-mentioned characteristics which create value and support human activities; they further enhance the capabilities of the IOT network by mutual cooperation and becoming the part of the total system.

LiFi (Light Fidelity)

In the era of overcrowded (data communication) world, Li-Fi is a new way of wireless communication that uses LED lights to transmit data wirelessly. Transmission of data is one of the most important day to day activities in the fast growing world. The current wireless networks that connect us to the Internet are very slow when multiple devices are connected.

Also with the increase in the number of devices which access the Internet, the availability of fixed bandwidth makes it much more difficult to enjoy high data transfer rates and to connect a secure network. Radio waves are just a small part of the electromagnetic spectrum available for data transfer. Li-Fi has got a much broader spectrum for transmission compared to conventional methods of wireless communications that rely on radio waves. The basic ideology behind this technology is that the data can be transferred through LED light by varying light intensities faster than the human eyes can perceive. This technology uses a part of the electromagnetic spectrum that is still not greatly utilized- The Visible Spectrum, instead of Gigahertz radio waves for data transfer.

The idea of Li-Fi was introduced for the first time by a German physicist Harald Hass in the TED (Technology, Entertainment, Design) Global talk on Visible Light Communication (VLC) in July 2011, by referring to it as “data through illumination”. He used a table lamp with an LED bulb to transmit a video of a blooming flower that was then projected onto a screen. In simple terms, Li-Fi can be thought of as a light-based Wi-Fi i.e. instead of radio waves it uses light to transmit data. In place of Wi-Fi modems, Li-Fi would use transceivers fitted with LED lamps that could light a room as well as transmit and receive information. By adding new and unutilized bandwidth of visible light to the currently available radio waves for data transfer, Li-Fi can play a

major role in relieving the heavy loads which the current wireless system is facing.

Thus it may offer additional frequency band of the order of 400 THz compared to that available in RF communication which is about 300 GHz. Also, as the Li-Fi uses the visible spectrum, it will help alleviate concerns that the electromagnetic waves coming with Wi-Fi could adversely affect our health. By Communication through visible light, Li-Fi technology has the possibility to change how we access the Internet, stream videos, receive emails and much more. Security would not be an issue as data can't be accessed in the absence of light. As a result, it can be used in high security military areas where RF communication is prone to eavesdropping.

2. Architecture of Li-Fi system

Li-Fi which can be the future of data communication appears to be a fast and cheap optical version of Wi-Fi. Being a Visible Light Communication (VLC), Li-Fi uses visible light of electromagnetic spectrum between 400 THz and 800 THz as optical carrier for data transmission and illumination. It uses fast pulses of light to transmit information in wireless medium. The main components of a basic Li-Fi system may contain the following:

a) A high brightness white LED which acts as transmission source.

b) A silicon photodiode with good response to visible light as the receiving element. Switching the LEDs on and off can make them generate digital strings with different combination of 1s and 0s. To generate a new data stream, data can be encoded in the light by varying the flickering rate of the LED. In this way, the LEDs work as a sender by modulating the light with the data signal. The LED output appears constant to the human because they are made to flicker at a phenomenal speed (millions of times per second) and it's impossible

for human eye to detect this frequency. Communication rate more than 100 Mbps can be achieved by using high speed LEDs with the help of various multiplexing techniques. And this VLC data rate can be further increased to as high as 10 Gbps via parallel data transmission using an array of LED lights with each LED transmitting a different data stream.

Working of Li-Fi

Light Fidelity (Li-Fi) technology is a wireless communication system based on the use of visible light between the violet (800 THz) and red (400 THz). Unlike Wi-Fi which uses the radio part of the electromagnetic spectrum, Li-Fi uses the optical spectrum i.e. Visible lighpart of the electromagnetic spectrum. The principle of Li-Fi is based on sending data by amplitude modulation of the light source in a well-defined and standardized way. LEDs can be switched on and off faster than the human eyes can detect since the operating speed of LEDs is less than 1 microsecond. This invisible on-off activity enables data transmission using binary codes. If the LED is on, a digital '1' is transmitted and if the LED is off, a digital '0' is transmitted. Also these LEDs can be switched on and off very quickly which gives us a very nice opportunity for transmitting data through LED lights, because there are no interfering light frequencies like that of the radio frequencies in Wi-Fi. Li-Fi is thought to be 80% more efficient, which means it can reach speeds of up to 1Gbps and even beyond. Li-Fi differs from fibre optic because the Li-Fi protocol layers are suitable for wireless communication over short distances (up to 10 meters).

This puts Li-Fi in a unique position of extremely fast wireless communication over short distances.

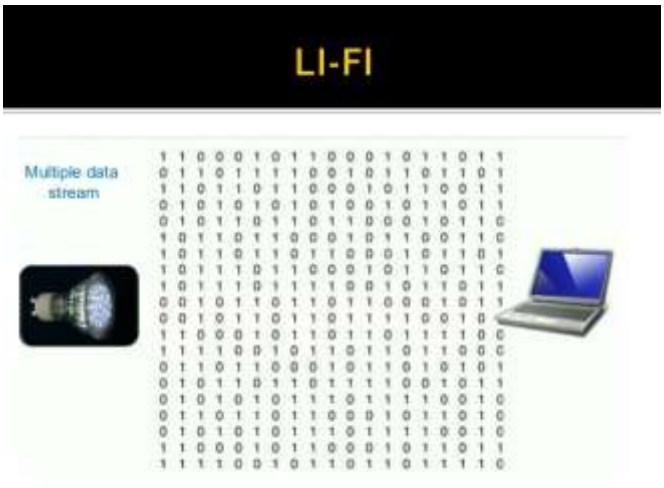


Fig 5: Li-Fi Transmission

How it Works:

The working of Li-Fi is very simple. There is a light emitter on one end i.e. an LED transmitter, and a photo detector (light sensor) on the other. The data input to the LED transmitter is encoded in to the light (technically referred to as Visible Light Communication) by varying the flickering rate at which the LEDs flicker ‘on’ and ‘off’ to generate different strings of 1s and 0s. The onoff activity of the LED transmitter which seems to be invisible (The LED intensity is modulated so rapidly that human eye cannot notice, so the light of the LED appears constant to humans), enables data transmission in light form in accordance with the incoming binary codes: switching ON a LED is a logical '1', switching it OFF is a logical '0'. By varying the rate at which the LEDs flicker on and off, information can be encoded in the light to different combinations of 1s and 0s.

In a typical setup, the transmitter (LED) is connected to the data network (Internet through the modem) and the receiver (photo detector/light sensor) on the receiving end receives the data as light signal and decodes the information, which is then displayed on the device connected to the receiver. The receiver (photo detector) registers a binary ‘1’ when the transmitter (LED) is ON and a

binary ‘0’ when the transmitter (LED) is OFF. Thus flashing the LED numerous times or using an array of LEDs (perhaps of a few different colours) will eventually provide data rates in the range of hundreds of Mbps.

Applications of Li-Fi

There are numerous applications of Li-Fi technology, from public Internet access through existing lighting (LED) to auto-piloted cars that communicate through their headlights (LED based). Applications of Li-Fi can extend in areas where the Wi-Fi technology lacks its presence like aircrafts and hospitals (operation theatres), power plants and various other areas, where electromagnetic (Radio) interference is of great concern for safety and security of equipments and people. Since Li-Fi uses just the light, it can be used safely in such locations or areas. In future with the Li-Fi enhancement all the street lamps can be transformed to Li-Fi connecting points to transfer data. As a result of it, it will be possible to access internet at any public place and street.

Some of the future applications of Li-Fi could be as follows:

a) Education systems: Li-Fi is the latest technology that can provide fastest speed for Internet access. So, it can augment/replace Wi-Fi at educational institutions and at companies so that the people there can make use of Li-Fi with the high speed.

b) Medical Applications: Operation theatres (OTs) do not allow Wi-Fi due to radiation concerns. Usage of Wi-Fi at hospitals interferes/blocks the signals for monitoring equipments. So, it may have hazardous effect to the patient's health, due to improper working of medical apparatus. To overcome this and to make

OT tech savvy Li-Fi can be used to access internet and also to control medical equipments. This will be beneficial for conducting robotic surgeries and other automated procedures.

c) Cheaper Internet in Aircrafts: The passengers travelling in aircrafts get access to low speed Internet that too at a very high price. Also Wi-Fi is not used because it may interfere with the navigational systems of the pilots. In aircrafts Li-Fi can be used for data transmission. Li-Fi can easily provide high speed Internet via every light source such as overhead reading bulb, etc. present inside the airplane.

d) Underwater applications: Underwater ROVs (Remotely Operated Vehicles) operate from large cables that supply their power and allow them to receive signals from their pilots above. But the tether used in ROVs is not long enough to allow them to explore larger areas. If their wires were replaced with light — say from a submerged, highpowered lamp — then they would be much freer to explore. They could also use their headlamps to communicate with each other, processing data autonomously and sending their findings periodically back to the surface. Li-Fi can even work underwater where Wi-Fi fails completely, thereby throwing open endless opportunities for military underwater operations.

e) Disaster management: Li-Fi can be used as a powerful means of communication in times of disaster such as earthquake or hurricanes. The average people may not know the protocols during such disasters. Subway stations and tunnels, common dead zones for most emergency communications, pose no obstruction for Li-Fi.

f) Applications in sensitive areas: Power plants need fast, inter-connected data systems so that demand, grid integrity and core temperature (in case of nuclear power plants) can be monitored. The Radio communication interference is considered to be bad for such sensitive areas surrounding these power plants.

Li-Fi can offer safe, abundant connectivity for all areas of these sensitive locations. Also, the pressure on a power plant's own reserves (power consumption for Radio communications deployments) will be lessened.

g) Traffic management: In traffic signals Li-Fi can be used to communicate with passing vehicles (through the LED lights of the cars etc) which can help in managing the traffic in a better manner resulting into smooth flow of traffic and reduction in accident numbers. Also, LED car lights can alert drivers when other vehicles are too close.

h) Mobile Connectivity: Mobiles, laptops, tablets, and other smart phones can easily connect with each other. The short-range network of Li-Fi can yield exceptionally high data rates and higher security.

i) Replacement for other technologies: Li-Fi doesn't work using radio waves. So, it can be easily used in the places where Bluetooth, infrared, Wi-Fi, etc. are banned.

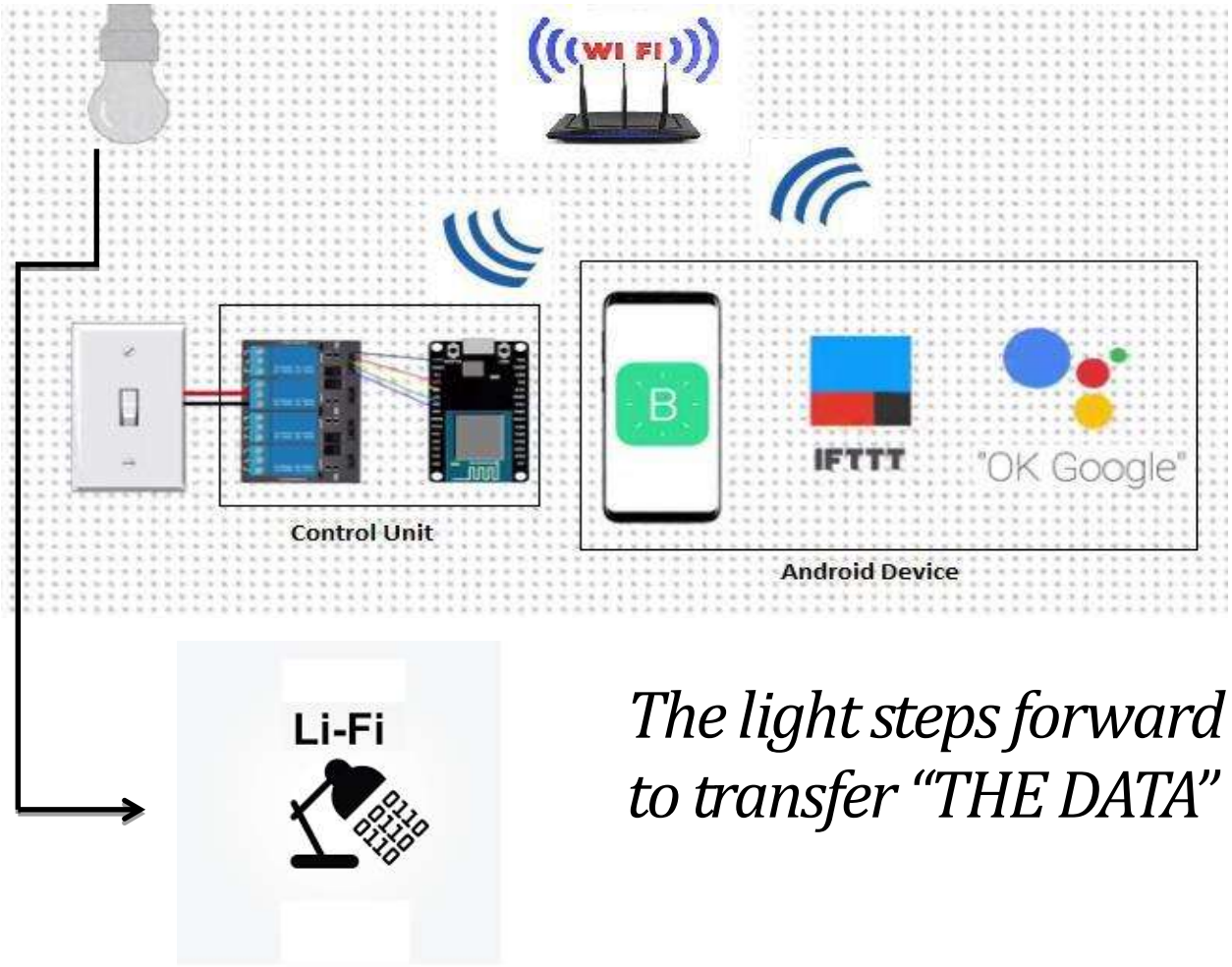
4.4 TOOLS USED:

- **BLYNK APPLICATION**
- **IFTTT APPLICATION**
- **ARDUINO IDE**

CHAPTER: 5

SYSTEM DESIGN

5.1 SYSTEM ARCHITECTURE



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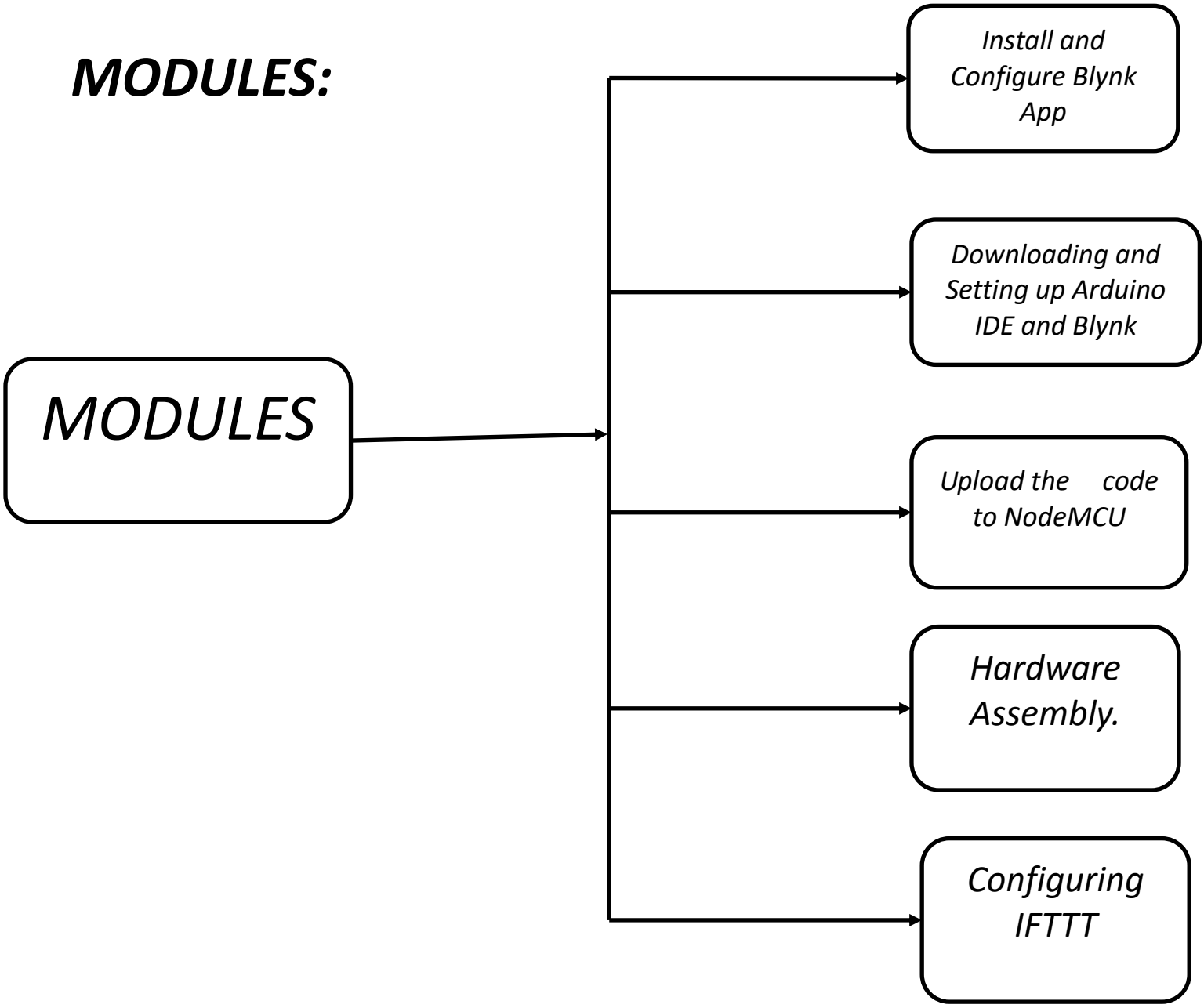
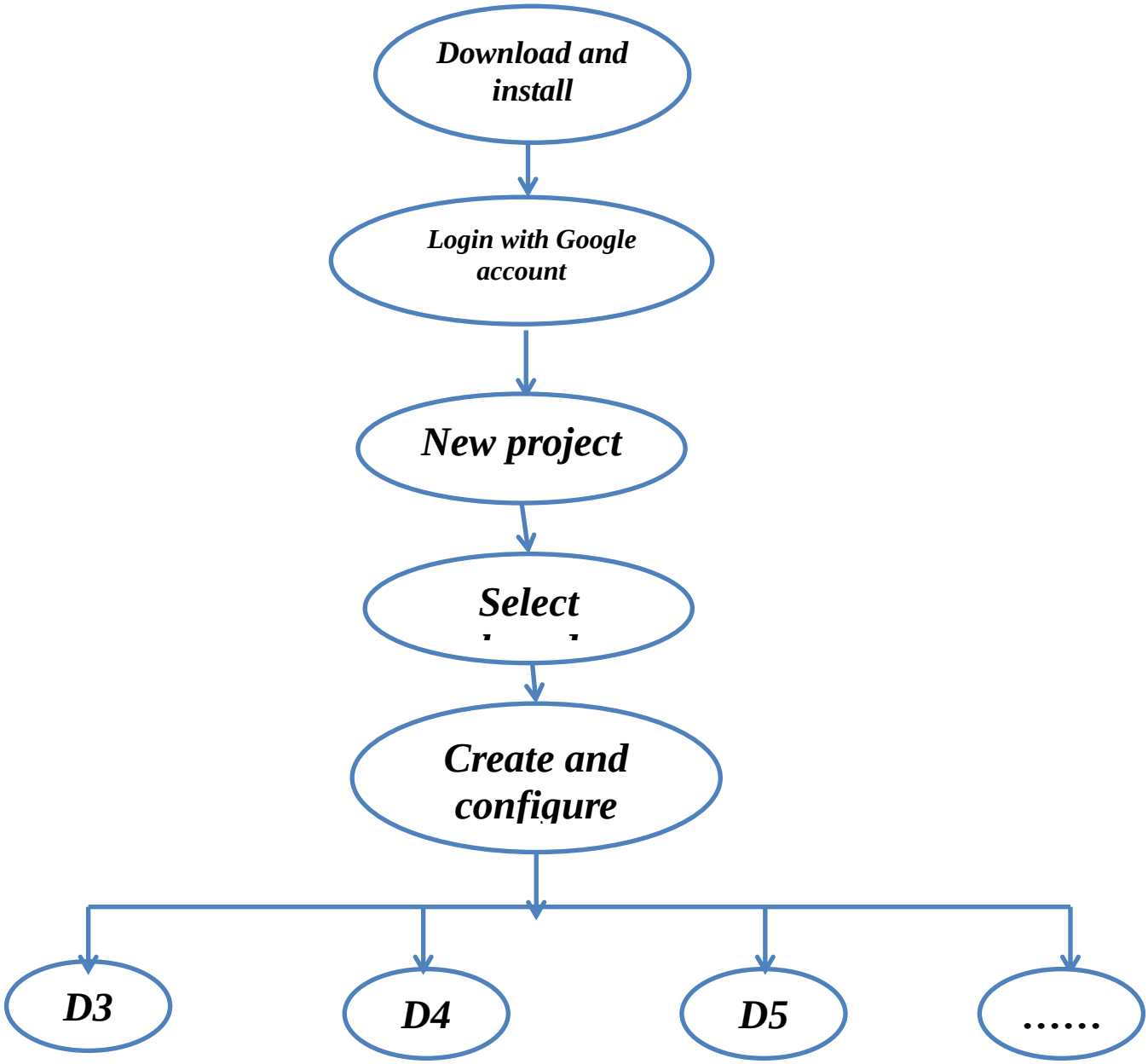
MODULES:

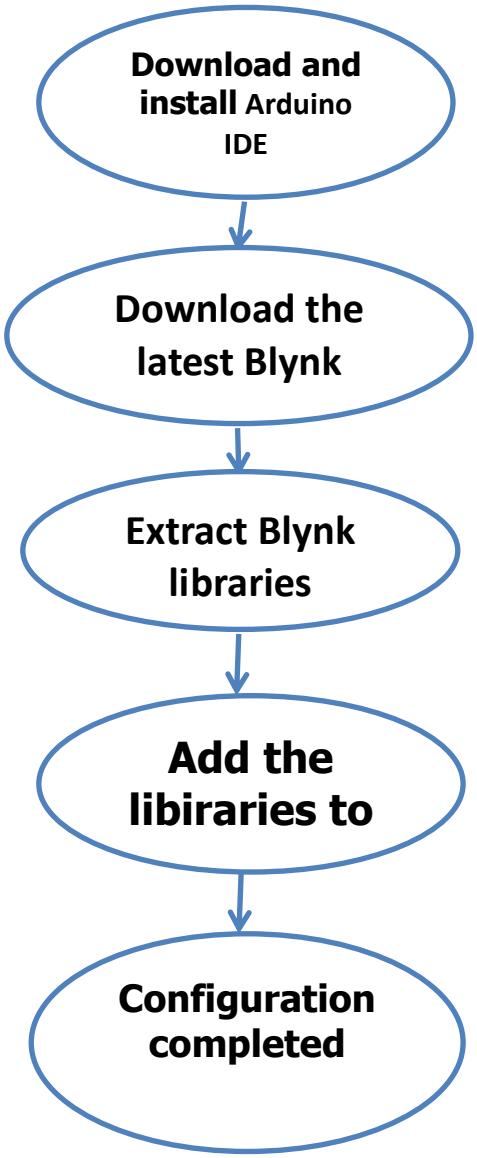

MODULES
Install and Configure Blynk App
Downloading and Setting up Arduino IDE and Blynk
Upload the code to NodeMCU
Hardware Assembly.
Configuring IFTTT

5.2. DATA FLOW DIAGRAM:

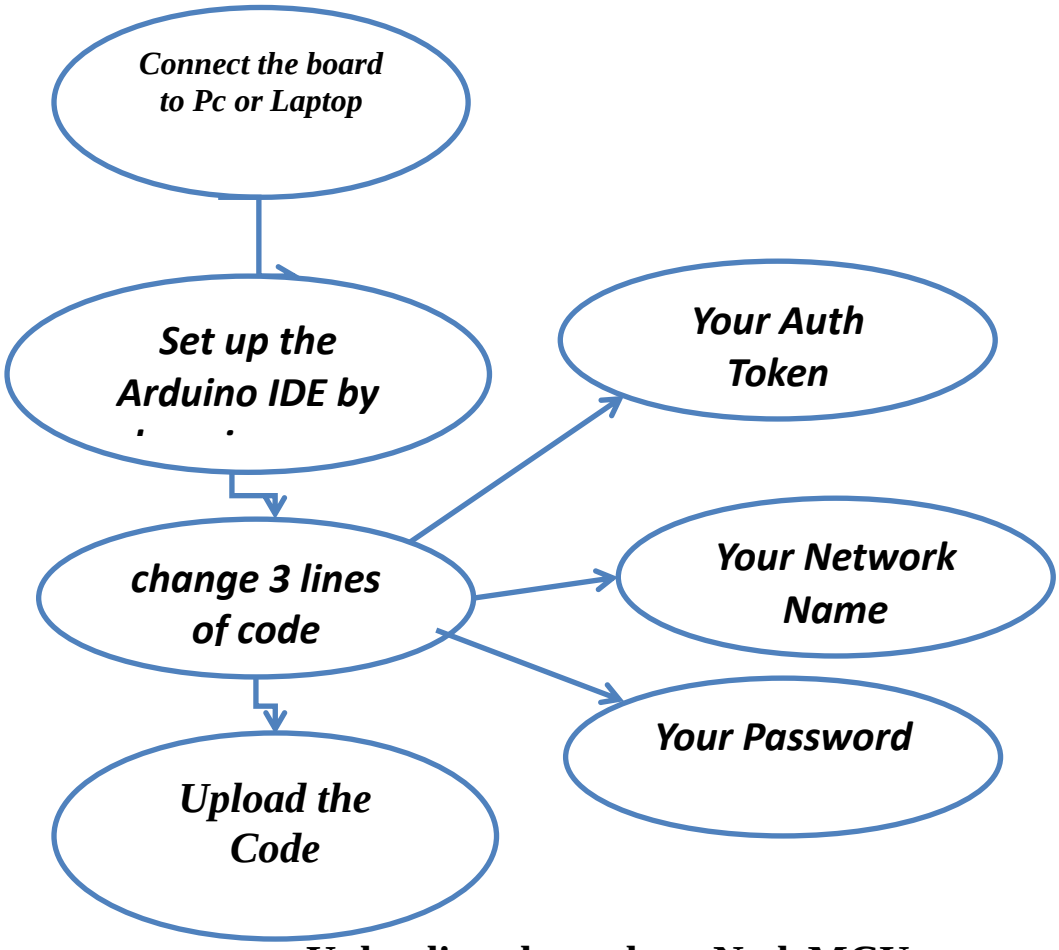
- The DFD is also called as bubble chart. It is a simple graphical formalism that can be used to represent a system in terms of input data to the system, various processing carried out on this data, and the output data is generated by this system.
- The data flow diagram (DFD) is one of the most important modeling tools. It is used to model the system components. These components are the system process, the data used by the process, an external entity that interacts with the system and the information flows in the system.



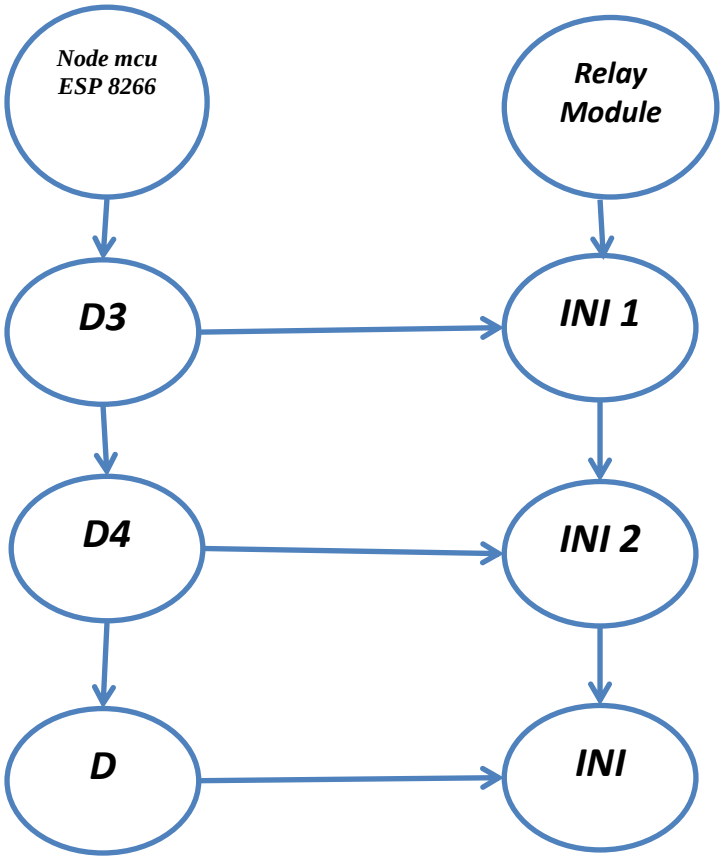
Install and Configure Blynk App.



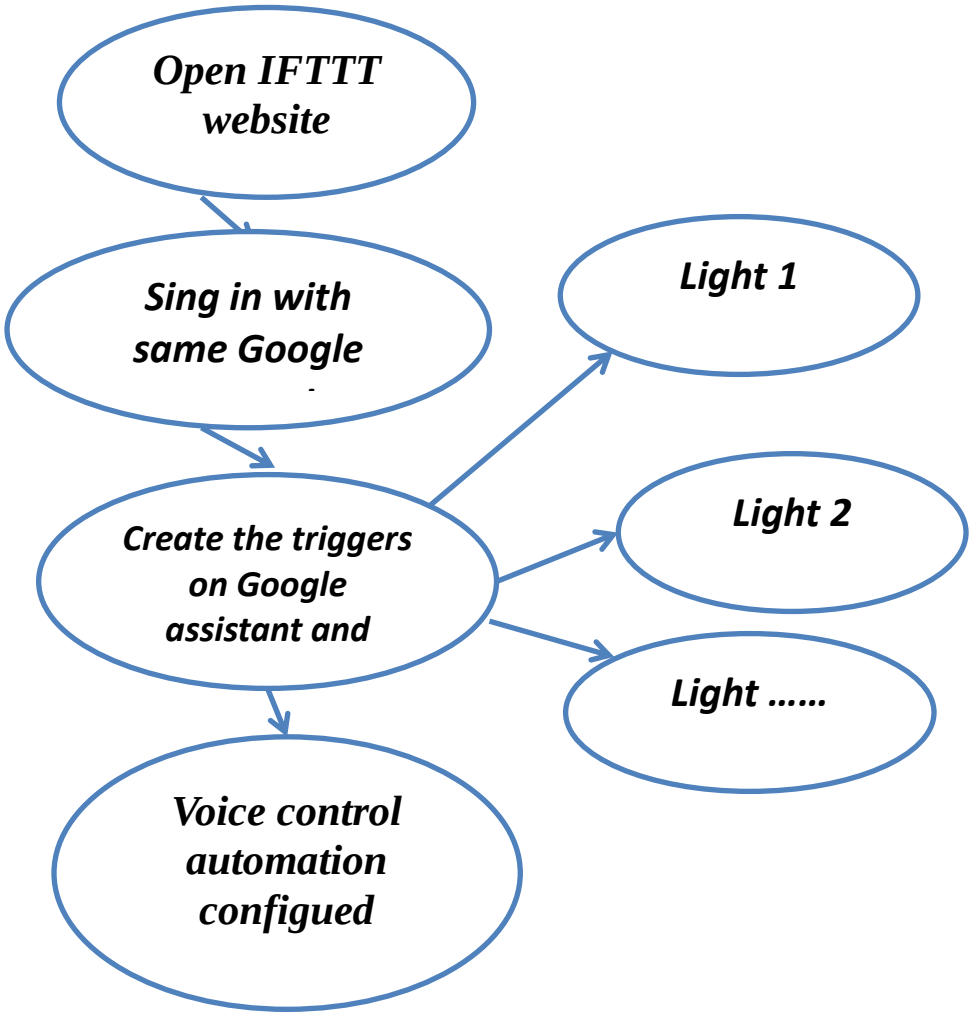
Downloading and Setting up Arduino IDE and Blynk Libraries.



Uploading the code to NodeMCU.



Hardware Assembly.



Configuring IFTTT.

5.3 USE CASE DIAGRAM:

A use case diagram in the Unified Modeling Language (UML) is a type of behavioral diagram defined by and created from a Use-case analysis. Its purpose is to present a graphical overview of the functionality provided by a system in terms of actors, their goals (represented as use cases), and any dependencies between those use cases. The main purpose of a use case diagram is to show what system functions are performed for which actor. Roles of the actors in the system can be depicted.

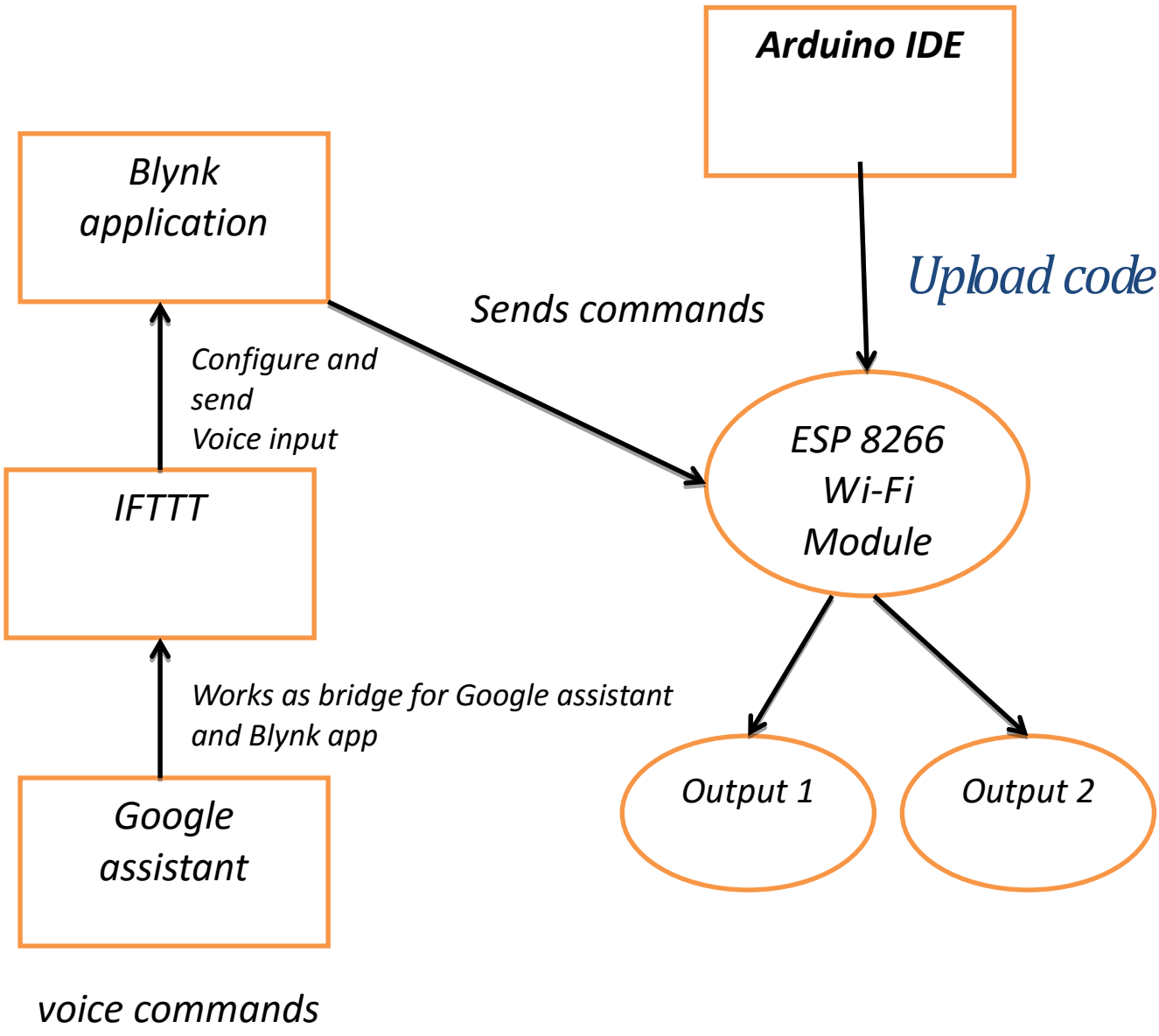


Figure 2: Use Case Diagram

5.6 ACTIVITY DIAGRAM:

Activity diagrams are graphical representations of workflows of stepwise activities and actions with support for choice, iteration and concurrency. In the Unified Modeling Language, activity diagrams can be used to describe the business and operational step-by-step workflows of components in a system. An activity diagram shows the overall flow of control.

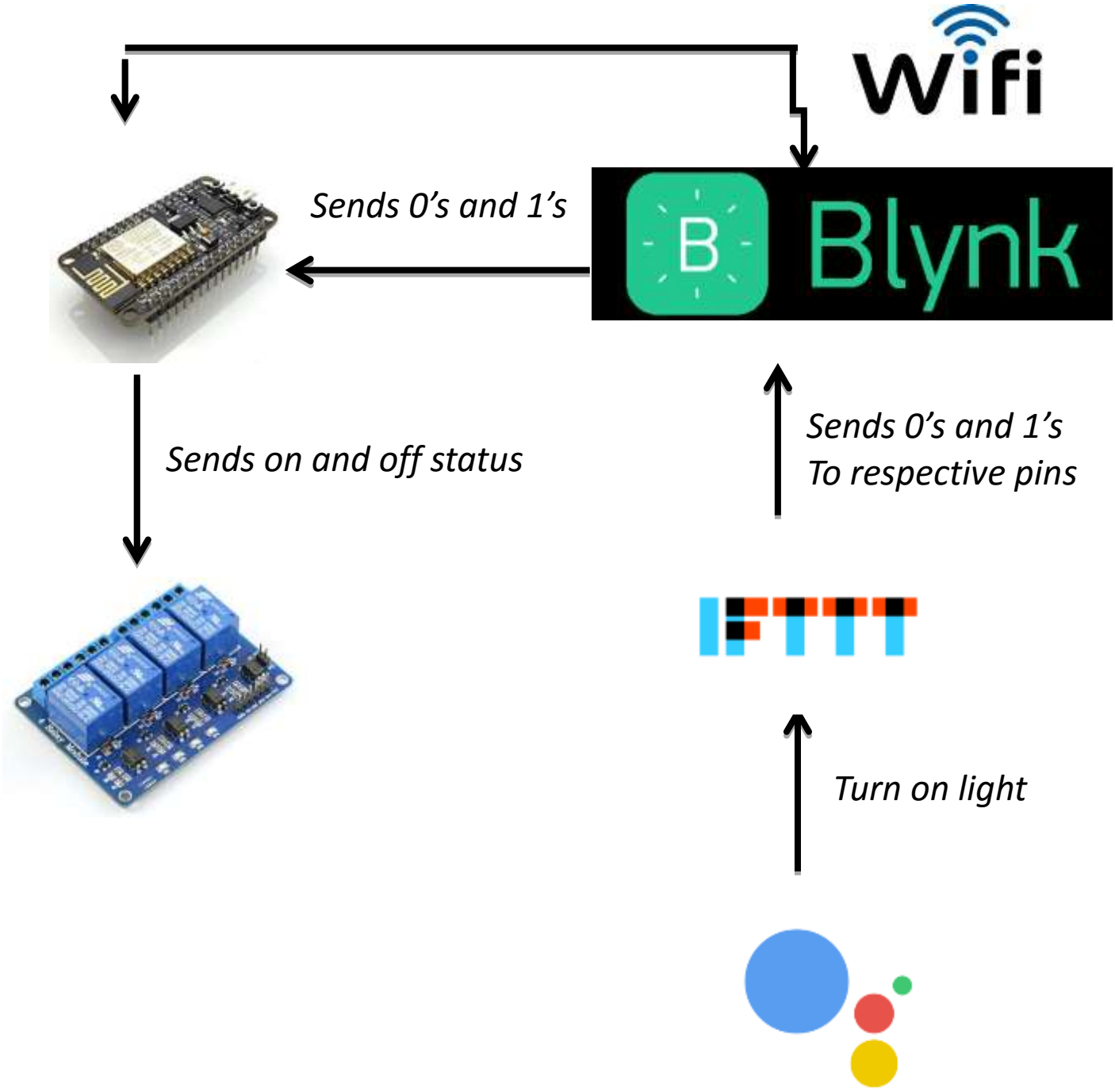


Figure : Activity Diagram

CHAPTER: 6

IMPLEMENTATION

It has been modularized into following modules:

- Install and Configure Blynk App.
- Downloading and Setting up Arduino IDE and Blynk Libraries.
- Upload the code to NodeMCU
- Hardware Assembly.
- Configuring IFTTT

6.1 Install and Configure Blynk App.

1) install the Blynk App. Once the app is installed create a new account on Blynk and login using that.

2) After logging in, create a new project by clicking ‘New Project’. At this point Blynk will send an *Auth token* to your email id.

3) Click on the Button and give it a name. choose their Digital Pins as *D4*, *D5* and *D6* respectively.

4) Now, the Blynk app is all set.

6.2 Downloading and Setting up Arduino IDE and Blynk Libraries

1) Download the Arduino IDE and latest Blynk libraries from Github
2) Add the Blynk libraries to Arduino IDE

6.3 Upload the code to NodeMCU

1) Connect the NodeMCU to your PC using a USB cable.
2) Now, set up the Arduino IDE by changing some settings.
    - Port
    - select 'NodeMCU 1.0 (ESP-12E Module)' as the board.

3) Now, in this file we only need to change 3 lines of code
    - "YourAuthToken"
    - "YourNetworkName"
    - "YourPassword"
4) Upload the Code

6.4 Hardware Assembly.

1) We'll have to connect the NodeMCU with the Relay board
2) Connect
    - D3 pin of NodeMCU with Pin 1 of Relay.
    - Similarly connect D4 pin of NodeMCU with Relay pin 2,
    - D5 with Relay 3
    - D6 with Relay 4…….
3) Connect Ground Pin of Relay with Ground Pin of NodeMCU.
4) Now to power up the NodeMCU and to power up the Relay board
5) Connect lights

6.5 Configuring IFTTT

1) Go to IFTTT's website and sign up to it using your Google Account.
2) After Signing in create *New Applet*
3) Search for *Google Assistant* and select it. And then Click on *Connect*.
4) Select the card that says "Say a simple phrase" and create a trigger.
5) Type webhooks select it, and click connect. Webhooks will allow us to send commands to the Blynk Server.
6) Now, in the URL field type this URL:

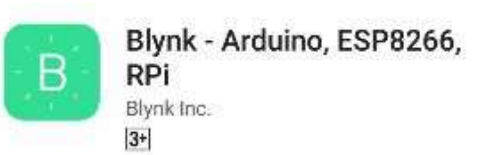
https://188.166.206.43/ YourAuthTokenHere / update / DigitalPinToBeUpdateHere

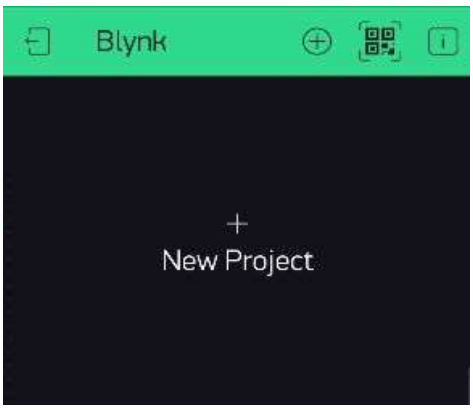
7) Select method as PUT
8) Now click on 'Create Action' and then Finish.

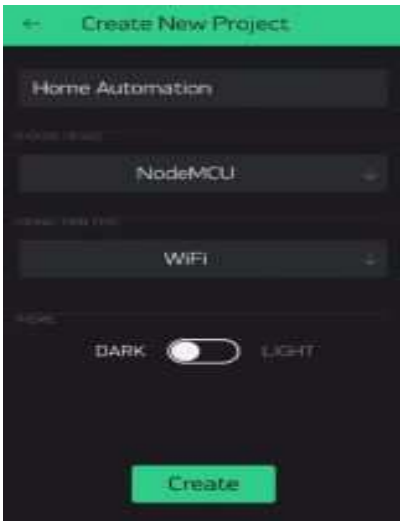
CHAPTER: 7

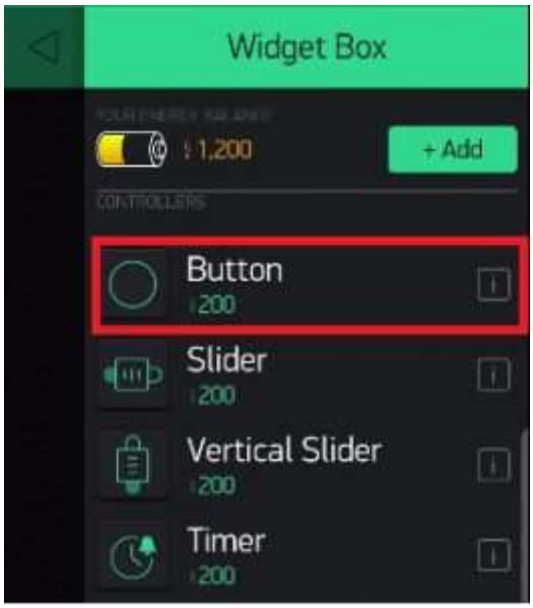
SCREEN SHOTS

Install and Configure Blynk App.

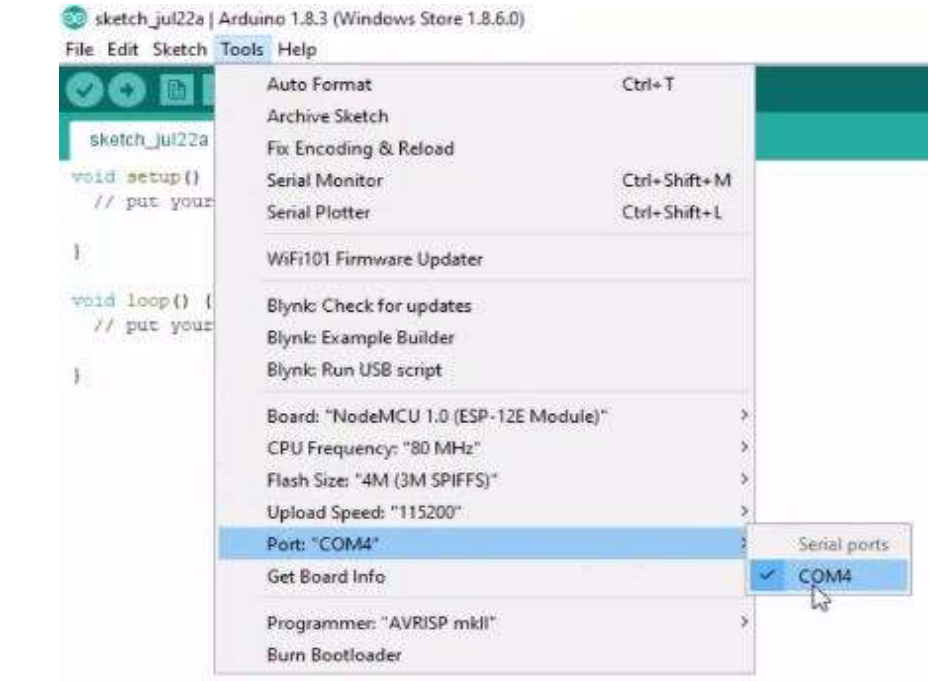


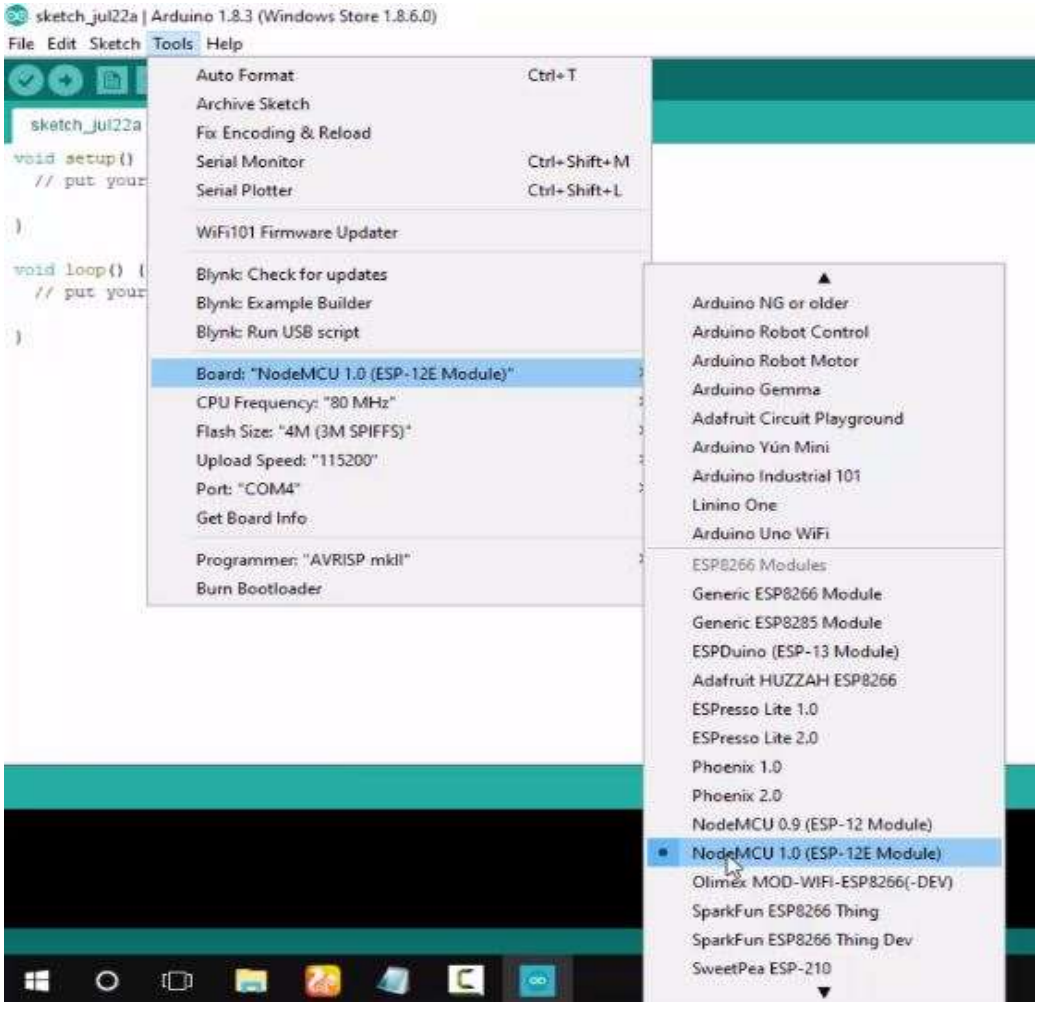




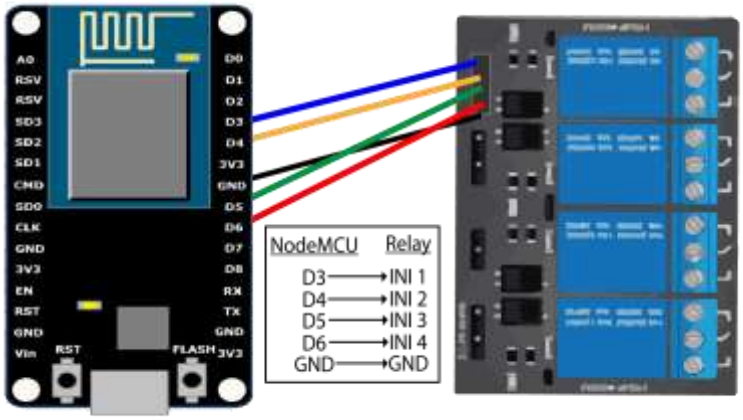


Uploading the code to NodeMCU.

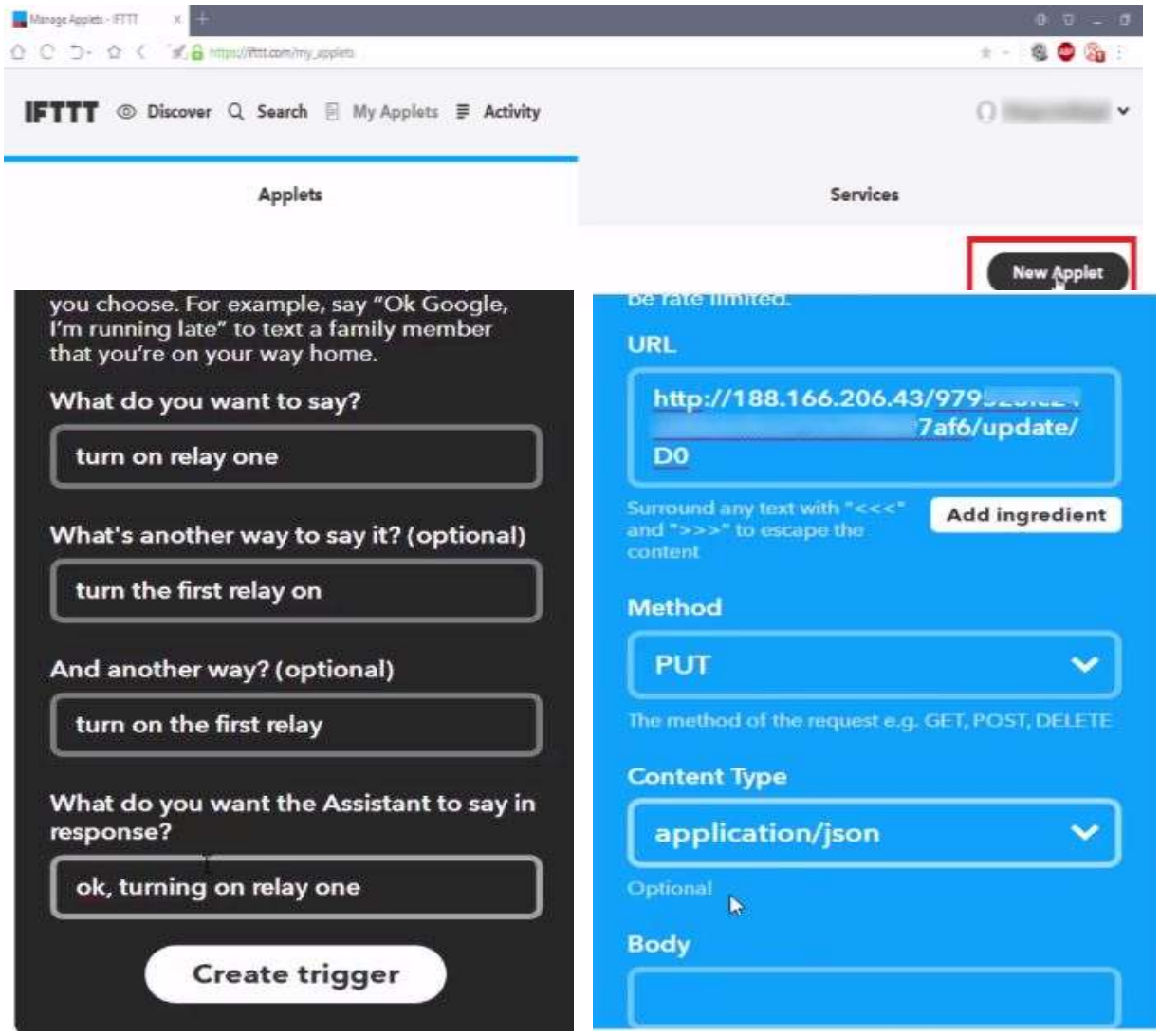




Hardware Assembly.



Configuring IFTTT.



Source Code

```
#define BLYNK_PRINT Serial

#include <ESP8266WiFi.h>

#include <BlynkSimpleEsp8266.h>

// You should get Auth Token in the Blynk App.

// Go to the Project Settings (nut icon).

char auth[] = "84be7102a7e44c9c970c54f214a1e922";

// Your WiFi credentials.

// Set password to "" for open networks.

char ssid[] = "dark_knob";

char pass[] = "123456789";

void setup()

{

  // Debug console

  Serial.begin(9600);

  Blynk.begin(auth, ssid, pass);

}

void loop()

{

  Blynk.run();

}
```

CHAPTER: 9

CONCLUSION

The aim of this paper was to propose a cost effective voice controlled (Google Assistant) home automation controlling general appliances found in one's home. The approach discussed in the paper was successful as GACHA's (Google Assistant Controlled Home Automation) design was successfully implemented. This system is highly reliable and efficient for the aged people and differently abled person on a wheel chair who cannot reach the switch for the switching ON/OFF the device and are dependent on others.

The future scope for GACHA can be huge. There are many fators to improve on to make GACHA more powerful, intelligent, scalable, and to become better overall for home automation. For example, controlling the speed of the fan, more number of devices can be integrated, like a coffee machine, air conditioner etc. To make the system respond more faster own private Blynk server can be made. Well, no system is ever perfect. It always has a scope for improvement. One just needs to put on a thinking cap and try and make the system more better.

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CHAPTER: 10

BIBLIOGRAPHY

References: