

# Acknowledgement

First I express my heartiest thanks and gratefulness to almighty God for His divine blessing makes us possible to complete the final year project successfully.

***“Presentation, inspiration and motivation have always played a key role in the success of any venture”.***

This major project would not have been possible without the valuable assistance of many people to whom we are indebted, in particular, our project coordinator **Prof. Shahbuddin Ansari** of **Al-Kabir Polytechnic** for his endless patience ,scholarly guidance ,continual encouragement , constant and energetic supervision, constructive criticism , valuable advice ,reading many inferior draft and correcting them at all stage have made it possible to complete this project. We would also like to thank **“Department of Electrical Engineering”, Al-Kabir Polytechnic** for providing us with the opportunity for our project.

Our thank also goes to all the teachers and **HOD , Department of Electrical Engineering** who helped us in many difficult situations regarding the project and provided with the necessary advice. A special word of thanks is to our group members for their elevating inspiration, encouraging guidance and kind supervision in the completion of our project.

Last but not least, I want to thank our families whose valuable guidance and kind supervision throughout the course shaped the present work as it's show and also for providing us the moral support. A word of thanks to our friends who helped us in many ways.

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*Scan this code to download  
our Smarthome App*



# Introduction

## **Home Automation:**

The “Home Automation” concept has existed for many years. The terms “Smart Home”, “Intelligent Home” followed and has been used to introduce the concept of networking appliances and devices in the house. Home automation Systems (HASs) represents a great research opportunity in creating new fields in engineering, and Computing. HASs includes centralized control of lighting, appliances, security locks of gates and doors and other systems, to provide improved comfort, energy efficiency and security system. HASs becoming popular nowadays and enter quickly in this emerging market. However, end users, especially the disabled and elderly due to their complexity and cost, do not always accept these systems.

## **Implementation Method:**

Due to the advancement of wireless technology, there are several different type of connections are introduced such as GSM, WIFI, and Bluetooth. Each of the connection has their own unique specifications and applications. Among these popular wireless connections that often implemented in HAS project, WIFI is being chosen with its suitable capability. The capabilities of WIFI are more than enough to be implemented in the design. Also, most of the current laptop/notebook or Smartphone come with built-in WIFI adapter. It will indirectly reduce the cost of this system.

## **Smartphones as a Switch/Control Board (SB/CB):**

Smartphones have allowed people to connect to the internet without the need for a computer, while still offering the same functionality but through different means. With the introduction of better hardware and better software, smartphones have become powerful devices and have become an important part of people's daily lives. A major aspect is how the smartphone is able to connect and communicate with other devices. For example, smartphones can be used as a mouse for a computer, or it can connect to the speakers of cars allowing consumers to play their own music. There are many applications of this sort. A field that is recently gaining popularity is home automation which can also use smartphones as information or functionality hubs.

## **Implementation Summary:**

This project forwards the design of home automation and security system using Arduino and ESP microcontrollers, a credit sized computer. Arduino provides the features of a mini computer, additional with its GPIO pins where other components and devices can be connected. GPIO pins of Arduino are used for the output purposes. We have designed a circuit that can be easily connected to GPIO Pins of the the microcontroller. The home appliances are connected to the input/output ports of microcontroller along with the power supply and their status is passed to the ESP through Google Firebase using internet. The specific android based app in any phone connected to a network can access the status of the home appliances via a secure channel powered by a authentication process from Google Firebase Auth. It presents the design and implementation of automation system that can monitor and control home appliances via android phone or tablet.

## **Problem Description:**

Many home devices now have WiFi and can interact with other home devices, smartphone applications and home computers. An issue is that these devices cannot communicate with each other or require an additional device to do so and need an individual application on the smartphone to be controlled. A much better option is to unify these devices into one program/device that controls them. As an example, one can control the lights, microwave, oven, tv, air-conditioning and door locks through one application on the smartphone. This gives the consumer more control of their home, for example, it allows them to set up conditions for when the lights turn on, or if they are on their way home, to preheat the oven before they get home. Therefore, home automation can simplify many manual actions.

# Introduction <Contd.>

## Remote Control:

The other main characteristic of cutting-edge home automation is remote monitoring and access. While a limited amount of one-way remote monitoring has been possible for some time, it's only since the rise in smartphones and tablets that we've had the ability to truly connect to our homenetworks while we're away. With the right home automation system, you can use any Internetconnected device to view and control the system itself and any attached devices. Even simple notifications can be used to perform many important tasks. You can program your system to send you a text message or email whenever your security system registers a potentialproblem, from severe weather alerts to motion detector warnings to fire alarms. You can also get notified for more mundane events, such as programming your "smart" front door lock to let you know when your child returns home from school.

## Objective:

One home automation application that has recently started to become mainstream is the ability to control door locks using a smartphone application or through the internet (web application). This project aims to develop a prototype of a product capable of locking/unlocking a door, with an emphasis on low cost and open source configurability. The end goal beyond this project would be a product that would hopefully allow people to connect to many other home devices through WiFi.

People are early and late running from place to place, working to accomplish everything on our never ending to-do list. Because of the HA system. We never have to take tension about opening the door, switching off the appliances and so on. In short we can save valuable time and experiences more daily productivity.

## Motivation:

The motivation for radiating smart home systems comes from mores reasons, but maximum great are benefit, security, energy management, connectivity and luxury. Smart Home systems are one of the modern areas of test that have not been completely integrated into our society. This is because the test requires many other rules of test and engineering to generate a functional smart home. The additional cost of the install is from the fact that even though a majority of homes were built in the near past, technology has been growing exponentially. This means that most homes were built before this technology was available, and this creates a defenses for the development and sales of smart home systems. However the technology is becoming better and cheaper, and this will help to make smart home systems a consumption worth having when upcoming homes are being built. The biggest motivation backward smart home systems is the benefit. Benefit is really another way of saying "time saver", and into day's world where everything is moving faster, every second has value. Most of the technology we use today is based of benefit, for example cars get us where we need to go faster, phones get us information from other people faster, and computer's get work done faster. Smaller conveniences in the home will be charming because they allow the home to save the user time as well. There are already many convenient technologies in the home like the dishwasher, washing machine, and microwave ovens. These technologies are more mechanical in nature and often there are much less computerized conveniences in the home. A Smart home systems goal is to introduce the benefits of computerized technology. For example, when using the smart home system, the user will not need to walk around turning off lights, they can save that little bit of extra time by just pressing a button on their phone, or even have the lights programmed to shut off after a certain amount of time.

**THIS IS THE INTRO PART OF THE PROJECT. I THINK YOU HAVE SUCCESSFULLY UNDERSTOOD THE PRINCIPLE AND WORKING OF THE PROTOTYPE. SO WITH THAT BEING SAID, LET'S JUMP RIGHT INTO THE MAIN PART.**

# The I.O.T

1. The Internet of Things (IoT) describes the network of physical objects, so known as, "things" that are embedded with sensors, software, and other technologies that is used for the purpose of connecting and exchanging data with other devices and systems over the Internet.
2. Things have evolved due to the convergence of multiple technologies, real-time analytics, machine learning, ubiquitous computing, commodity sensors, and embedded systems. Traditional fields of embedded systems, wireless sensor networks, control systems, automation (including home and building automation), and others all contribute to enabling the Internet of things. In the consumer market, IoT technology is most synonymous with products pertaining to the concept of the "smart home", including devices and appliances (such as lighting fixtures, thermostats, home security systems and cameras, and other home appliances) that support one or more common ecosystems, and can be controlled via devices associated with that ecosystem, such as smartphones and smart speakers. The IoT can also be used in healthcare systems.
3. There are a number of serious concerns about dangers in the growth of the IoT, especially in the areas of privacy and security, and consequently industry and governmental moves to address these concerns have begun including the development of international standards.

The main concept of a network of smart devices was discussed as early as 1982, with a modified Coca-Cola vending machine at Carnegie Mellon University becoming the first ARPANET-connected appliance, able to report its inventory and whether newly loaded drinks were cold or not. Mark Weiser's 1991 paper on ubiquitous computing, "The Computer of the 21st Century", as well as academic venues such as UbiComp and PerCom produced the contemporary vision of the IoT. In 1994, Reza Raji described the concept in *IEEE Spectrum* as "[moving] small packets of data to a large set of nodes, so as to integrate and automate everything from home appliances to entire factories". Between 1993 and 1997, several companies proposed solutions like Microsoft's Work or Novell's NEST. The field gained momentum when Bill Joy envisioned device-to-device communication as a part of his "Six Webs" framework, presented at the World Economic Forum at Davos in 1999.

The concept of the "Internet of Things" and the term itself, first appeared in a speech by Peter T. Lewis, to the Congressional Black Caucus Foundation 15th Annual Legislative Weekend in Washington, D.C., published in September 1985. According to Lewis, "The Internet of Things, or IoT, is the integration of people, processes and technology with connectable devices and sensors to enable remote monitoring, status, manipulation and evaluation of trends of such devices."

The term "Internet of Things" was coined independently by Kevin Ashton of Procter & Gamble, later MIT's Auto-ID Center, in 1999, though he prefers the phrase "Internet for things". At that point, he viewed radio-frequency identification (RFID) as essential to the Internet of Things, which would allow computers to manage all individual things. The main theme of the Internet of Things is to embed short-range mobile transceivers in various gadgets and daily necessities to enable new forms of communication between people and things, and between things themselves.

Defining the Internet of Things as "simply the point in time when more 'things or objects' were connected to the Internet than people", Cisco Systems estimated that the IoT was "born" between 2008 and 2009, with the things/people ratio growing from 0.08 in 2003 to 1.84 in 2010.

## **Advantages of IoT:**

- 1) Monitor Data
- 2) Ease of Access
- 3) Speedy Operation
- 4) Adapting to New Standards
- 5) Better Time Management
- 6) Overall, it is a clever time-saving tool
- 7) Automation and Control
- 8) Saving Money



# Existing Products

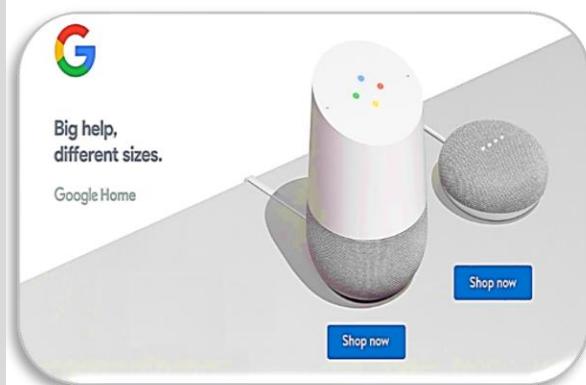
In this section, existing products are briefly introduced. The technologies which they are based upon and their security features are discussed.

## Home Automation Solutions:

Products that are out on the market or soon to be released are Amazon echo, Google Nest, Sonos One, ConnectSense Smart Outlet 2. This section will also introduce the functionalities and features of each of these products.

### Amazon Echo:

Amazon Echo, is an American brand of smart speakers developed by Amazon. Echo devices connect to the voice-controlled intelligent personal assistant service Alexa, which will respond when a user says "Alexa". The features of the device include voice interaction, music playback, making to-do lists, setting alarms, streaming podcasts, and playing audiobooks, in addition to providing weather, traffic and other real-time information. It can also control several smart devices, acting as a home automation hub. The smart speaker needs to use Wi-Fi to connect to the Internet as there is no Ethernet port.



Google Nest, previously named Google Home, is a line of smart speakers developed by Google under the Google Nest brand. The devices enable users to speak voice commands to interact with services through Google Assistant, the company's virtual assistant. Both in-house and third-party services are integrated, allowing users to listen to music, control playback of videos or photos, or receive news updates entirely by voice. Google Nest devices also have integrated support for home automation, letting users control smart home appliances with their voice command.

### ConnectSense Smart Outlet:

1. Two Wi-Fi connected sockets that can be monitored and controlled individually.
2. Make everyday plug-in devices like lamps, fans, heaters and other small alliances smart.
3. Control from Anywhere with the free ConnectSense App for iOS or Android. No Hub or subscription required.
4. Control with your voice using Amazon Alexa, Apple HomeKit or the Google Assistant.
5. Simple Setup and Configuration.
6. Monitor Energy usage for your plug in devices.



## Door Lock Solutions:

Products that are out on the market or soon to be released are Lockitron, Unikey Kevo, August Smart Lock and Goji Smart Lock. This section will introduce the functionalities and features of each of these products. A smart lock is an electromechanical lock which is designed to perform locking and unlocking operations on a door when it receives such instructions from an authorized device using a wireless protocol and a cryptographic key to execute the authorization process. It also monitors access and sends alerts for the different events it monitors and some other critical events related to the status of the device. Smart locks can be considered part of a smart home.

## Lockitron:

Lockitron is a device which can lock and unlock doors via remote control, typically via a smartphone., or via web page control. Phones with Bluetooth Low Energy (4.0) can also automatically unlock a door when an authenticated device is nearby.Virtual "keys" can also be created for guests or repair contractors etc, which allows access to the home. The virtual keys can be distributed over the internet on demand.The door can also be locked or unlocked via SMSfor those without smartphones. Lockitron allow for a traditional lock which continues to work with traditional metal keys.



## August Home:

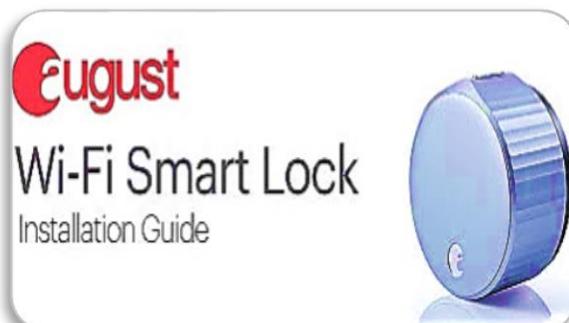
The lock had a metal frame and was controlled using Bluetooth 4.0 with a smartphone app. As with other August door locks, the device clips on to an existing deadbolt on the inside portion of a door, still allowing the use of a traditional key. A Wi-Fi bridge was later released allowing remote access to the lock, and the use of virtual assistants. In October 2015, the company debuted a suite of new products including a second generation smart lock, a smart doorbell, and a keypad for users without a phone. The company also announced August Access, a platform to let couriers from Postmates, Handy, and other services get access to the lock through a one time code. The service was later expanded to include Walmart in select U.S. markets. A HomeKit compatible version of the lock was also released the following year.



or change the electronic key parameters at any time. This is also a great feature for people who rent their homes to short-term guests through sites such as Airbnb. The Goji Smart Lock is optimized to be used with your smart phone, but you can also program Bluetooth Low Energy fobs that you can use to lock and unlock your door, with additional personalized time and date access rights. The Goji Smart Lock also comes with two mechanical keys as backups in case you ever need them.

## Kwikset Kēvo:

Kēvo has the ability to detect a user's compatible smartphone or tablet via an app, to lock and unlock the door. The deadbolt lock senses when the user's phone is nearby and when it's outside; the phone emits a low-energy Bluetooth signal, allowing the door to be unlocked when the lock face is touched, making it unnecessary to interact with the phone in order to open the door. Users can grant unrestricted or temporary access to other phones as well. Kēvo also comes with a keychain fob that provides the same touch-to-open function as an authorized smart phone. A prime security feature of the product is UniKey's Inside/Outside Intelligence, the system acts as a one-way filter that lets only authorized users pass through the entryway.



## Goji Smart Lock:

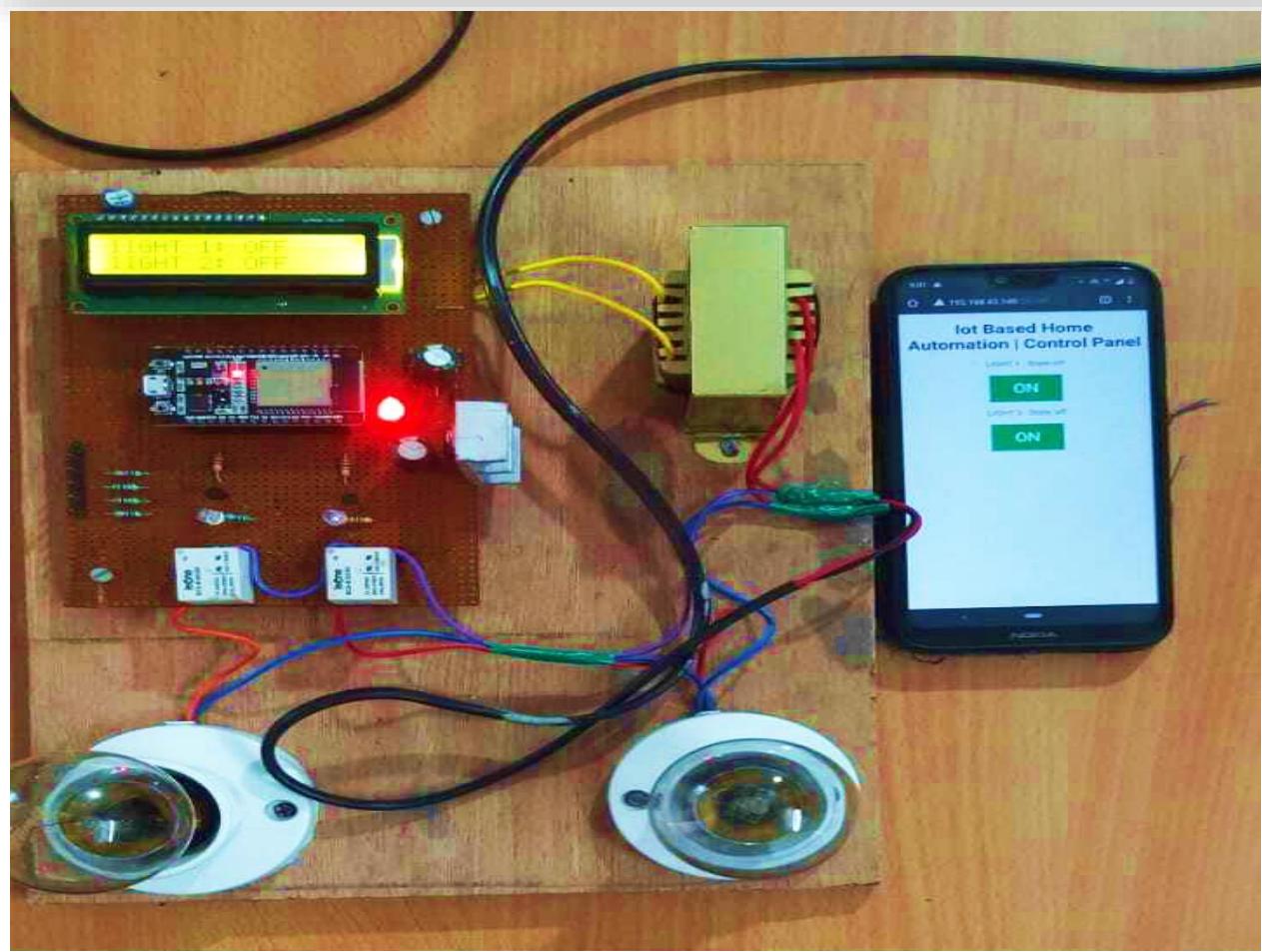
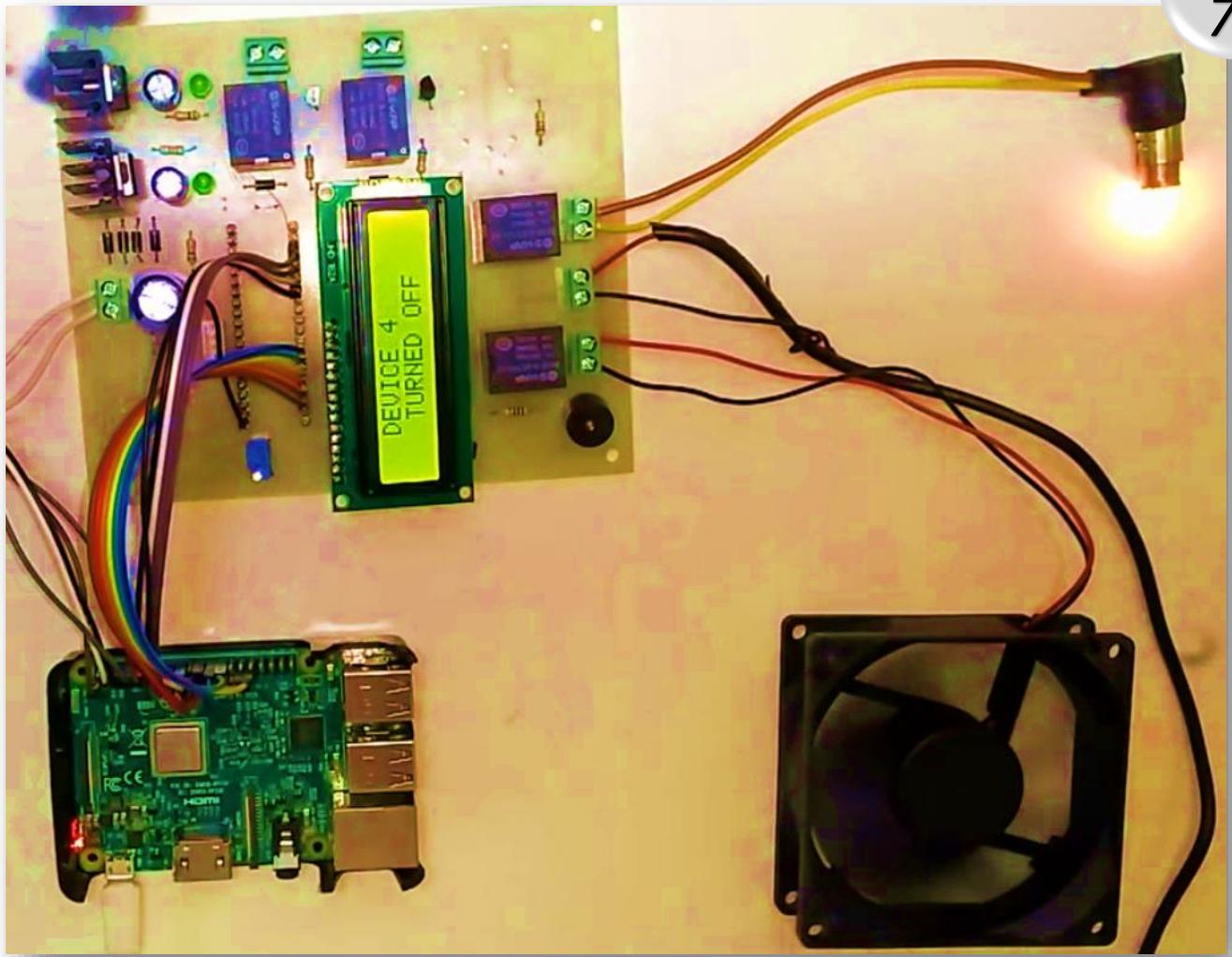
The Goji Smart Lock presents a contemporary new look for a deadbolt lock: a sleek, modern disc in brushed metal with a subtle blue-text LED display that welcomes users by name when the lock is activated. The display also shows the lock/unlock status, and dates and times of all entries and exits. With Goji, you can send electronic keys to anyone via text or email, and you can set up the access to be unlimited or to include specific date/day and time parameters. You can securely send electronic keys to houseguests or home service professionals ,so they can access your home using their mobile phones. You can cancel

# Our Prototype

- ❖ This further in the report, you might have already seen the previously available automation solutions in the market. Compared to those products we saw that none of them provide a complete resolution to our so called “Smart Home”.
- ❖ If some one wants to have their home automated they have to purchase a whole new set of bulbs, tubelights, appliances, so that they have Bluetooth or Wi-Fi compatibility, which enables them to be controlled via voice or application. This is why the home automation costs more than anticipated.
- ❖ The range of the above shown products combined can no doubt provide a solution for Home Automation but they cannot guarantee that solutions is reliable, feasible, easy to access, and most importantly future-proof among other emerging technologies.
- ❖ Keeping all of this in mind, we have made a solution that is **Reliable** – so that you can be stress free . **Feasible** - so that it doesn't burden your budget . **Easy to use**- so that small kids and old parents can easily access the system and lastly . **Future-proof**- so that you do not need to change or upgrade with time instead you can “pay as you go” for adding functionalities.
- ❖ Our solution works with the internet powered, latest Google Firebase's realtime database to store your appliance's current operation state. If our systems detect any change made in the previously existing data in the database it switches the particular load accordingly. One can easily switch any appliances operating state with a touch on the App from anywhere in the world and observe the state on the App with a smartphone or a personal computer.
- ❖ Our solution to “Smart Home” cannot only switch appliance's operating state but it can easily control the opening and closing of doors and alerts you with an instant SMS if there is someone lurking around your house. The doors will open only when you allow the same from your smartphone. With this said, you can say good bye to thieves ,burglars and other acts of intrusion, and welcome home your guests or professional workers like repairmen, relatives and others ,no matter how distant you actually are from your home.
- ❖ The project also includes timer switching function so that you can set a timer for appliances or loads to switch ON/OFF at a particular point in time. The timer function is also available from your smartphone, so that you can set an alarm for loads to switch operating state.

## **Our solution is better than the other similar products because:**

- 1) You do not need to change any of your home appliances or bulbs. We've got your back.
- 2) You do not need to invest on several different items. We've got your back
- 3) You do not need to take a sweat for maintenance.It's self maintainable. We've got your back



# Expense Report

## Final Year Project : IoT-Based Home Automation

Product Name	Quantity	Rating	Product Brand/Make	Price	Usage	Bought ?
Node MCU esp32	2	-	Node MCU esp32	1000	Wi-fi	✓
LCD panel	2	-	LCD panel	650	Display Stats	✓
Arduino UNO	1	-	Arduino UNO	500	Registering LCD and Serial Determination	✓
Power supply(5V)	1	5V	local	150	Supply	✓
Power supply(12V)	1	12V	local	180		✓
Jumper Wires	Set	-	Jumper Wires	199	Connection	✓
BreadBoard	1	L	local	110		✓
Bulb	3	any	local	245	Loads	✓
Fan	2	12V DC	local	435		✓
PlyBoard border	1	-	local	120	Base	✓
Paint	1	400ml	Nerolac Aerosol	175		✓
Wooden Base PlyBoard	1	-	local	360	Load	✓
Batten lamp Holder[ 90deg ]	3	-	Local	120		✓
PCB for PWM control	2	-	Custom	248	Fan Control	✓
Relay 4-channel	2	5V	Local	520	On/Off	✓
Motor Servo + Gear	1	90	Local	220	Door	✓
Resistors	(5+5+5)	-	Local	6	Indicator	✓
Indicator 5v LEDs	6	-	Local	20		✓
Firebase Realtime DB	1	-	Service Web	300	Control+Override	✓
SMS API	(Rs0.80P - Rs1.5) / sms	-	Service Web	297	Alerts	✓
M/F Headers	set	-	Local	50	Connection	✓
Proximity Sensor	set	-	Online	335	Door	✓
<b>Total</b>				<b>6240</b>		

### Disclaimer:

The expenditure given above is subject to change as per the price variation of local market or online stores.

The said expenditures are made by both the backend programmer and the connection experts in the project group.

Price and value of the investments referred to in this material are subject to volatility.

The investments discussed or recommended in this report may not be suitable for all investors.

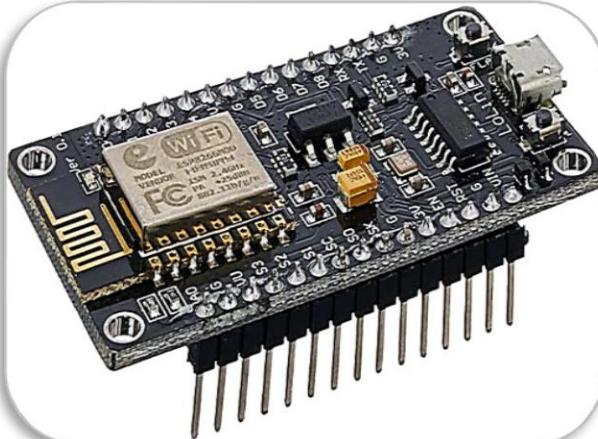
Product opinion expressed above is the current opinion as of the date appearing on the material only. As the future demands the product opinion are subject to volatility.

# Components

## ESP 8266- As The Brains:

The ESP8266 is a low-cost Wi-Fi microchip, with a full TCP/IP stack and microcontroller capability, produced by Espressif Systems in Shanghai, China.

The chip first came to the attention of Western makers in August 2014 with the ESP-01 module, made by a third-party manufacturer Ai-Thinker. This small module allows microcontrollers to connect to a Wi-Fi network and make simple TCP/IP connections using Hayes-style commands. However, at first, there was almost no English-language documentation on the chip and the commands it accepted. The very low price and the fact that there were very few external components on the module, which suggested that it could eventually be very inexpensive in volume, attracted many hackers to explore the module, the chip, and the software on it, as well as to translate the Chinese documentation.



The ESP8265 is an ESP8266 with 1 MiB of built-in flash, allowing the building of single-chip devices capable of connecting to Wi-Fi. These microcontroller chips have been succeeded by the ESP32 family of devices, including the pin-compatible ESP32-C3.

## Features of ESP-8266:

- Processor: L106 32-bit RISC microprocessor core based on the Tensilica Xtensa Diamond Standard 106Micro running at 80 MHz.
- 32 KiB instruction RAM.
- 32 KiB instruction cache RAM.
- 80 KiB user-data RAM.
- 16 KiB ETS system-data RAM.
- External QSPI flash: up to 16 MiB is supported (512 KiB to 4 MiB typically included).
- IEEE 802.11 b/g/n Wi-Fi.
- Integrated TR switch, balun, LNA, power amplifier and matching network.
- WEP or WPA/WPA2 authentication, or open networks.
- 17 GPIO pins.
- I<sup>2</sup>C (software implementation).
- I<sup>2</sup>S interfaces with DMA (sharing pins with GPIO).
- UART on dedicated pins, plus a transmit-only UART can be enabled on GPIO2.

## Pin-Outs of ESP8266:

The pinout is as follows for the common ESP-01 module:

1. GND, Ground (0 V)
2. GPIO 2, General-purpose input/output No. 2
3. GPIO 0, General-purpose input/output No. 0
4. RX, Receive data in, also GPIO3
5. VCC, Voltage (+3.3 V; can handle up to 3.6 V)
6. RST, Reset
7. CH\_PD, Chip power-down
8. TX, Transmit data out, also GPIO1



## I<sup>2</sup>C + LCD:

This is a 16x2 LCD display screen with I<sup>2</sup>C interface. It is able to display 16x2 characters on 2 lines, white characters on blue background.

Usually, Arduino LCD display projects will run out of pin resources easily, especially with Arduino Uno. And it is also very complicated with the wire soldering and connection. This I<sup>2</sup>C 16x2 Arduino LCD Screen is using an I<sup>2</sup>C communication interface. It means it only needs 4 pins for the LCD display: VCC, GND, SDA, SCL. It will save at least 4 digital/analog pins on Arduino. All connectors are standard XH2.54 (Breadboard type). You can connect with the jumper wire directly.

## I<sup>2</sup>C + LCD:

To avoid the confliction of I<sup>2</sup>C address with other I<sup>2</sup>C devices, such ultrasonic sensor, IMU, accelerometers, and gyroscope, the I<sup>2</sup>C address of the module is configurable from 0x20-0x27. And its contrast can be adjusted manually.

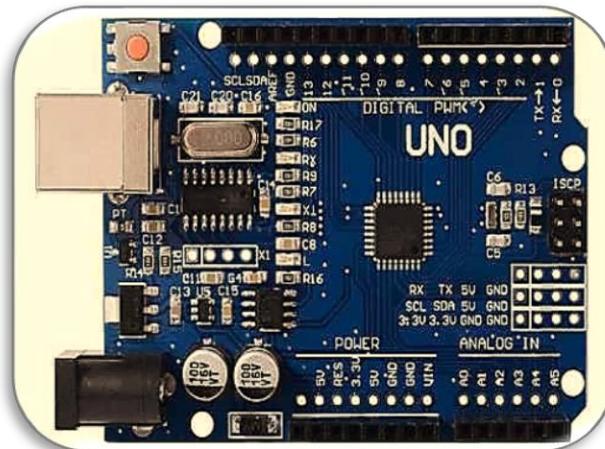
Another alternative option is I<sup>2</sup>C 20x4 Arduino LCD Display Module if more characters are required.

## Specifications of LCD:

- Compatible with Arduino/Genuino UNO, Leonardo, Mega, 101 (Intel Curie), Micro, Nano, Mini
- Supply voltage: 5V
- I<sup>2</sup>C Address: 0x20-0x27 (0x20 default)
- Interface: I<sup>2</sup>C/TWI x1, Gadgeteer interface x2
- Back lit (Blue with white char color)
- Adjustable contrast
- Size: 80x36x20mmz(3.1x1.4x0.7in)

## Arduino UNO:

Arduino Uno is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator (CSTCE16M0V53-R0), a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.. You can tinker with your Uno without worrying too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again. "Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases.



The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform; for an extensive list of current, past or outdated boards see the Arduino index of boards.

## Features of ESP-8266:

Microcontroller	<a href="#">ATmega328P</a>	DC Current for 3.3V Pin	50 mA
Operating Voltage	5V	Flash Memory	32 KB (ATmega328P) of which 0.5 KB used by bootloader
Input Voltage (recommended)	7-12V	SRAM	2 KB (ATmega328P)
Input Voltage (limit)	6-20V	EEPROM	1 KB (ATmega328P)
Digital I/O Pins	14 (of which 6 provide PWM output)	Clock Speed	16 MHz
PWM Digital I/O Pins	6	LED_BUILTIN	13
Analog Input Pins	6	Length	68.6 mm
DC Current per I/O Pin	20 mA	Width	53.4 mm
		Weight	25 g

## Pin-Outs of Arduino UNO:

Pins 0-13 of the Arduino Uno serve as digital input/output pins.

Pin 13 of the Arduino Uno is connected to the built-in LED.

In the Arduino Uno - pins 3,5,6,9,10,11 have PWM capability.

It's important to note that:

- Each pin can provide/sink up to 40 mA max. But the recommended current is 20 mA.
- The absolute max current provided (or sank) from all pins together is 200mA

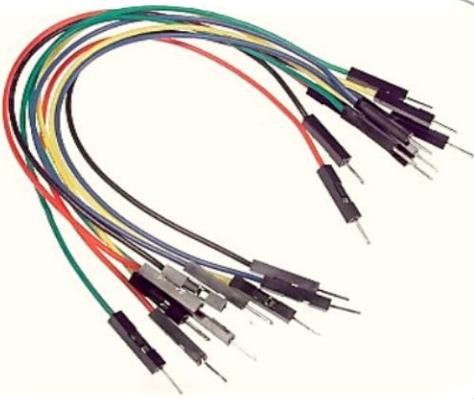
## Power Adapters:

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. Other common names include plug pack, plug-in adapter, adapter block, domestic mains adapter, line power adapter, wall wart, power brick, wall charger, and power adapter. Adapters for battery-powered equipment may be described as chargers or rechargers. AC adapters are used with electrical devices that require power but do not contain internal components to derive the required voltage and power from mains 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.

Power Adapter is a source of input supply to the project. It is an essential thing in any project. Power Adapter/ DC power supply with differential power output ratings ranging from 5V to 12V DC at 1A to 5A.

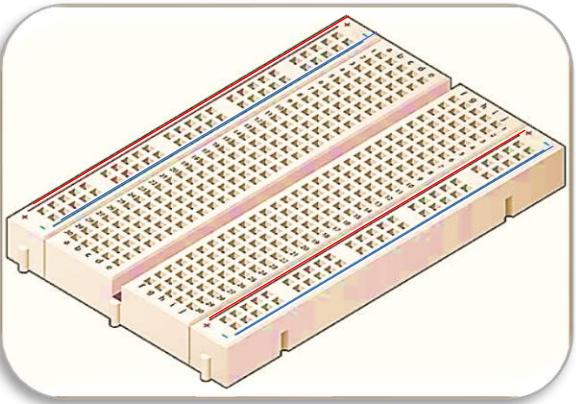
## Jumper Wires:

A jump wire (also known as jumper, jumper wire) is an electrical wire, or group of them in a cable, with a connector or pin at each end (or sometimes without them – simply "tinned"), which is normally used to interconnect the components of a breadboard or other prototype or test circuit, internally or with other equipment or components, without soldering. Individual jump wires are fitted by inserting their "end connectors" into the slots provided in a breadboard, the header connector of a circuit board, or a piece of test equipment.



## Breadboard:

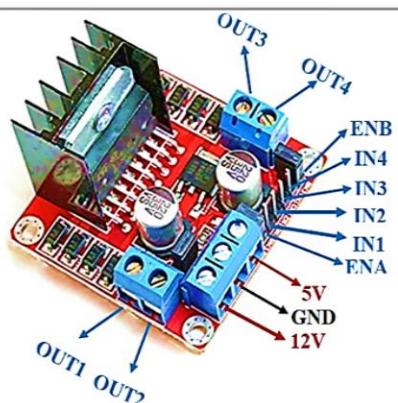
A breadboard, or protoboard, is a construction base for prototyping of electronics. Originally the word referred to a literal bread board, a polished piece of wood used when slicing bread. In the 1970s the solderless breadboard (a.k.a. plugboard, a terminal array board) became available and nowadays the term "breadboard" is commonly used to refer to these. Because the solderless breadboard does not require soldering, it is reusable. This makes it easy to use for creating temporary prototypes and experimenting with circuit design. For this reason, solderless breadboards are also popular with students and in technological education.



## PWM Control Microcontroller:

This L298N Motor Driver Module is a high power motor driver module for driving DC and Stepper Motors. This module consists of an L298 motor driver IC and a 78M05 5V regulator. L298N Module can control up to 4 DC motors, or 2 DC motors with directional and speed control. The L298N Motor Driver module consists of an L298 Motor Driver IC, 78M05 Voltage Regulator, resistors, capacitor, Power LED, 5V jumper in an integrated circuit. 78M05 Voltage regulator will be enabled only when the jumper is placed.

When the power supply is less than or equal to 12V, then the internal circuitry will be powered by the voltage regulator and the 5V pin can be used as an output pin to power the microcontroller.



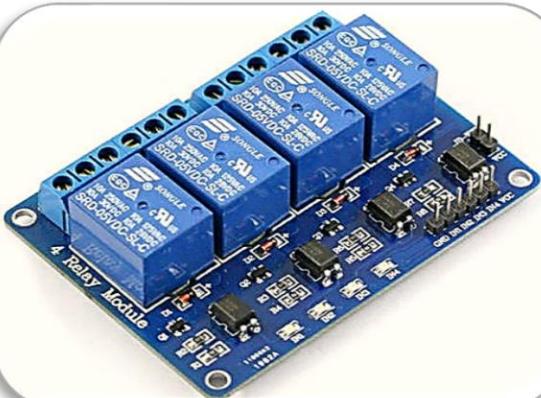
- ❑ The jumper should not be placed when the power supply is greater than 12V and separate 5V should be given through 5V terminal to power the internal circuitry.
- ❑ ENA & ENB pins are speed control pins for Motor A and Motor B while IN1& IN2 and IN3 & IN4 are direction control pins for Motor A and Motor B.

**❑ The applications of L298N module are as follows:**

- ❖ Drive DC motors.
- ❖ Drive stepping motors
- ❖ In Robotics

## **Specifications:**

- |  |                                     |
|--|-------------------------------------|
| 1. Driver Model: L298N 2A              | 7. Driver Current:2A                |
| 2. Driver Chip: Double H Bridge L298N  | 8. Logical Current:0-36mA           |
| 3. Motor Supply Voltage (Maximum): 46V | 9. Maximum Power (W):25W            |
| 4. Motor Supply Current (Maximum): 2A  | 10. Current Sense for each motor    |
| 5. Logic Voltage: 5V                   | 11. Heatsink for better performance |
| 6. Driver Voltage: 5-35V               | 12. Power-On LED indicator          |



## **5V-4CH Relay:**

The four-channel relay module contains four 5V relays and the associated switching and isolating components, which makes interfacing with a microcontroller or sensor easy with minimum components and connections. The contacts on each relay are specified for 250VAC and 30VDC and 10A in each case, as marked on the body of the relays.

The four-channel relay module contains four [5V relays](#) and the associated switching and isolating components, which makes interfacing with a [microcontroller](#) or [sensor](#) easy

with minimum components and connections. There are two terminal blocks with six terminals each, and each block is shared by two relays. The terminals are screw type, which makes connections to mains wiring easy and changeable.

The four relays on the module are rated for 5V, which means the relay is activated when there is approximately 5V across the coil. The contacts on each relay are specified for 250VAC and 30VDC and 10A in each case, as marked on the body of the relays.

The switching [transistors](#) act as a buffer between the relay coils that require high currents, and the inputs which don't draw much current. They amplify the input signal so that they can drive the coils to activate the relays. The freewheeling diodes prevent voltage spikes across the transistors when the relay is turned off since the coils are an inductive load. The indicator [LEDs](#) glow when the coil of the respective relay is energized, indicating that the relay is active. The [optocouplers](#) form an additional layer of isolation between the load being switched and the inputs. The isolation is optional and can be selected using the  $V_{CC}$  selector jumper. The input jumper contains the main  $V_{CC}$ , GND, and input pins for easy connection using female jumper wires.

Each relay on the board has the same circuit, and the input ground is common to all four channels.

The driver circuit for this relay module is slightly different compared to traditional relay driving circuits since there is an optional additional layer of isolation.

When the jumper is shorted, the relay and the input share the same  $V_{CC}$ , and when it is open, a separate power supply must be provided to the JD- $V_{CC}$  jumper to power the relay coil and optocoupler output.

The inputs for this module are active low, meaning that the relay is activated when the signal on the input header is low. This is because the indicator LED and the input of the optocoupler are connected in series to the  $V_{CC}$  pin on one end, so the other end must be connected to the ground to enable the current flow. The optocouplers used here are the PCF817, which is a common optocoupler and can also be found in through-hole packaging.

## Specifications:

1. Supply voltage – 3.75V to 6V
2. Trigger current – 5mA
3. Current when the relay is active - ~70mA (single), ~300mA (all four)
4. Relay maximum contact voltage – 250VAC, 30VDC
5. Relay maximum current – 10A

### **Servo SG90:**

Wire Number	Wire Colour	Description
1	Brown	Ground wire connected to the ground of system
2	Red	Powers the motor typically +5V is used
3	Orange	PWM signal is given in through this wire to drive the motor



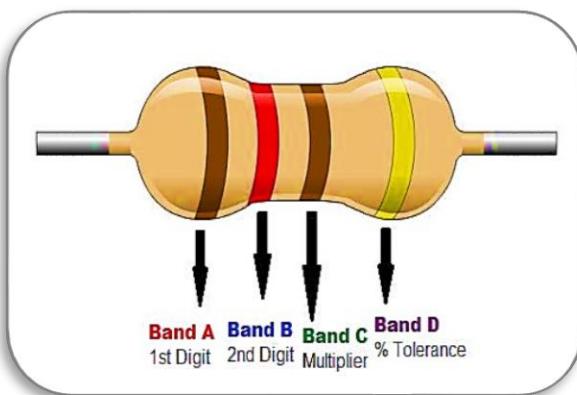
### Specifications:

- |                                       |   |
|---------------------------------------|---|
| 1. Operating Voltage is +5V typically | 5. Rotation : 0°-180°                     |
| 2. Torque: 2.5kg/cm                   | 6. Weight of motor : 9gm                  |
| 3. Operating speed is 0.1s/60°        | 7. Package includes gear horns and screws |
| 4. Gear Type: Plastic                 |   |

Servo motors operate from 4.8V to 6.5V, the higher the voltage higher the torque we can achieve, but most commonly they are operated at +5V. Almost all hobby servo motors can rotate only from 0° to 180° due to their gear arrangement so make sure your project can live with the half circle if no, you can prefer for a 0° to 360° motor or modify the motor to make a full circle. The gears in the motors are easily subjected to wear and tear, so if your application requires stronger and long running motors you can go with metal gears or just stick with normal plastic gear.

Next comes the most important parameter, which is the torque at which the motor operates. Again there are many choices here but the commonly available one is the 2.5kg/cm torque which comes with the Towerpro SG90 Motor. This 2.5kg/cm torque means that the motor can pull a weight of 2.5kg when it is suspended at a distance of 1cm. So if you suspend the load at 0.5cm then the motor can pull a load of 5kg similarly if you suspend the load at 2cm then can pull only 1.25. Based on the load which you use in the project you can select the motor with proper torque.

### Through Hole Resistors:



A resistor, from the point of view of math, is the simplest implementation of Ohm's law.

The law says the current flowing through a material is directly proportional to voltage applied across that material and the proportionality constant is the resistance of the material at a constant temperature.

In other words,  $V=IR$ .

Which is the classic formula we are all familiar with, where V is the voltage in Volts, I is the current in Amps and R is the resistance.

Resistance is measured in Ohms, after the discoverer of the formula. Since the Ohm is (for a change!) a rather small quantity circuit-wise, resistors are measured in hundreds of Ohms, thousands of Ohms (kiloOhms, kΩ), or millions of Ohms (megaOhms, MΩ). Saying 'through hole' might be a generalization, but if we categorically sorted all resistors by shape and size we would end up with a nearly endless list.

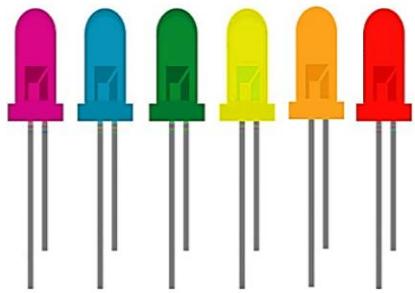
Through hole resistors, along with the resistance, are rated according to the power they dissipate. Probably the tiniest are 1/8W resistors, meaning they can dissipate 1/8 of a Watt or 125mW. On the other end of the scale you can find resistors that dissipate a massive 100W.

## 5mm LED:

An LED is a two-lead semiconductor light source, which emits lights when activated. When an appropriate voltage is applied to the LED terminal, then the electrons are able to recombine with the electron holes within the device and release energy in the form of photons. This effect is known as electroluminescence. The color of the LED is determined by the energy band gap of the semiconductor.

The forward voltage required to turn ON a LED, depends on the color of the LED.

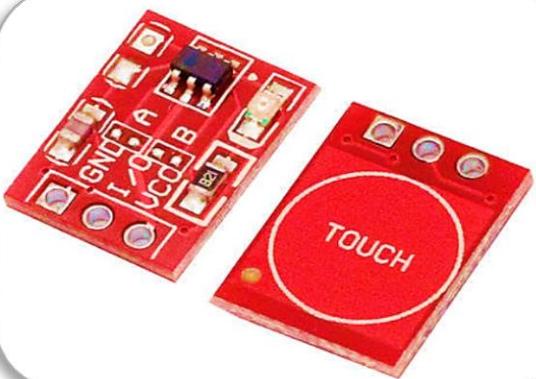
If you are feeding the exact value of forward voltage then you can connect a LED directly to the source. If the voltage is higher than use a resistance in series with the LED.



## Applications:

1. Indication
2. Toys & Games
3. Lighting Products
4. Electronic projects

Pin Name	Description
Anode(long)	Positive terminal of LED
Cathode(short)	Negative terminal of LED



## TTP223 Sensor:

The TTP223 touch controller is the exact non-contact alternative to traditional button switches. The IC uses an onboard sense pad that uses copper trace as a touch element and the touch sensitivity can be configured using an additional external capacitor ranging from 0 to 50pF.

There are two pins, AHLB and TOG that could be used to configure the output state either high or low or toggle mode enable option.

## Specifications:

- |  |  |
|--|--|
| 1. Single channel touch key sensing  | 5. Response time - 220ms at low power mode.                                    |
| 2. 2.0V - 5.0V Operating Voltage   | 6. Stable touch detection of human body  |
| 3. Operating current 1.5uA typically. Maximum operating current 3.0uA at Low power mode. | 7. All output modes can be configurable for high or active low by pad options. |
| 4. Adjustable sensitivity using external capacitor (0-50 pF)                             | 8. Direct mode and Toggle mode selection pin available                         |

## Pin Description of TTP223:

Pin Number	Pin Name	Description
1	Q	CMOS output pin
2	VSS	Power Supply negative pin
3	I	Input of the Sensor Port
4	AHLB	Output active high or low
5	VDD	Power Supply Positive pin
6	TOG	Output type option pin

# Realtime Database

A real-time database is a database system which uses real-time processing to handle workloads whose state is constantly changing.<sup>[1]</sup> This differs from traditional databases containing persistent data, mostly unaffected by time. For example, a stock market changes very rapidly and is dynamic. The graphs of the different markets appear to be very unstable and yet a database has to keep track of current values for all of the markets of the New York Stock Exchange.<sup>[2]</sup> Real-time processing means that a transaction is processed fast enough for the result to come back and be acted on right away.<sup>[3]</sup> Real-time databases are useful for accounting, banking, law, medical records, multi-media, process control, reservation systems, and scientific data analysis.

## Overview:

Real-time databases are traditional databases that use an extension to give the additional power to yield reliable responses. They use timing constraints that represent a certain range of values for which the data are valid. This range is called temporal validity. A conventional database cannot work under these circumstances because the inconsistencies between the real world objects and the data that represents them are too severe for simple modifications. An effective system needs to be able to handle time-sensitive queries, return only temporally valid data, and support priority scheduling. To enter the data in the records, often a sensor or an input device monitors the state of the physical system and updates the database with new information to reflect the physical system more accurately.<sup>[5]</sup> When designing a real-time database system, one should consider how to represent valid time, how facts are associated with real-time system. Also, consider how to represent attribute values in the database so that process transactions and data consistency have no violations.

When designing a system, it is important to consider what the system should do when deadlines are not met. For example, an air-traffic control system constantly monitors hundreds of aircraft and makes decisions about incoming flight paths and determines the order in which aircraft should land based on data such as fuel, altitude, and speed. If any of this information is late, the result could be devastating. To address issues of obsolete data, the timestamp can support transactions by providing clear time references.

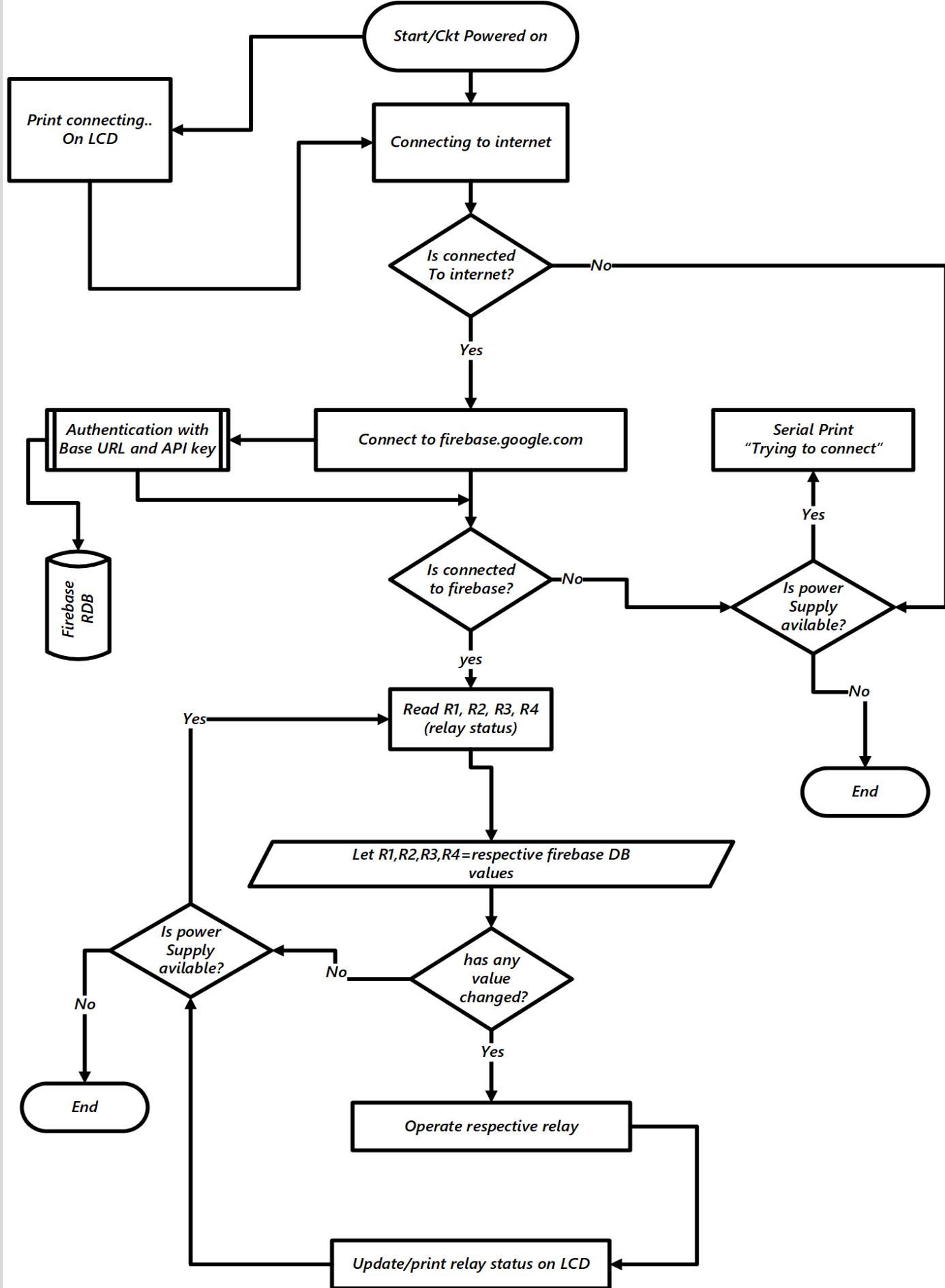
# API

An **application programming interface (API)** is a connection between **computers** or between **computer programs**. It is a type of software **interface**, offering a service to other pieces of **software**. A document or standard that describes how to build such a connection or interface is called an *API specification*. A computer system that meets this standard is said to *implement* or *expose* an API. The term API may refer either to the specification or to the implementation. In contrast to a **user interface**, which connects a computer to a person, an application programming interface connects computers or pieces of software to each other. It is not intended to be used directly by a person (the **end user**) other than a **computer programmer** who is incorporating it into software. An API is often made up of different parts which act as tools or services that are available to the programmer. A program or a programmer that uses one of these parts is said to *call* that portion of the API. The calls that make up the API are also known as **subroutines**, methods, requests, or **endpoints**. An API specification *defines* these calls, meaning that it explains how to use or implement them. One purpose of APIs is to **hide the internal details** of how a system works, exposing only those parts a programmer will find useful and keeping them consistent even if the internal details later change. An API may be custom-built for a particular pair of systems, or it may be a shared standard allowing **interoperability** among many systems.

**Web APIs** allow communication between computers that are joined by the **internet**. This is the most common meaning of the term API today.<sup>[2]</sup> There are also APIs for **programming languages**, **software libraries**, computer **operating systems**, and computer **hardware**. APIs originated in the 1940s, though the term did not emerge until the 1960s and 70s.

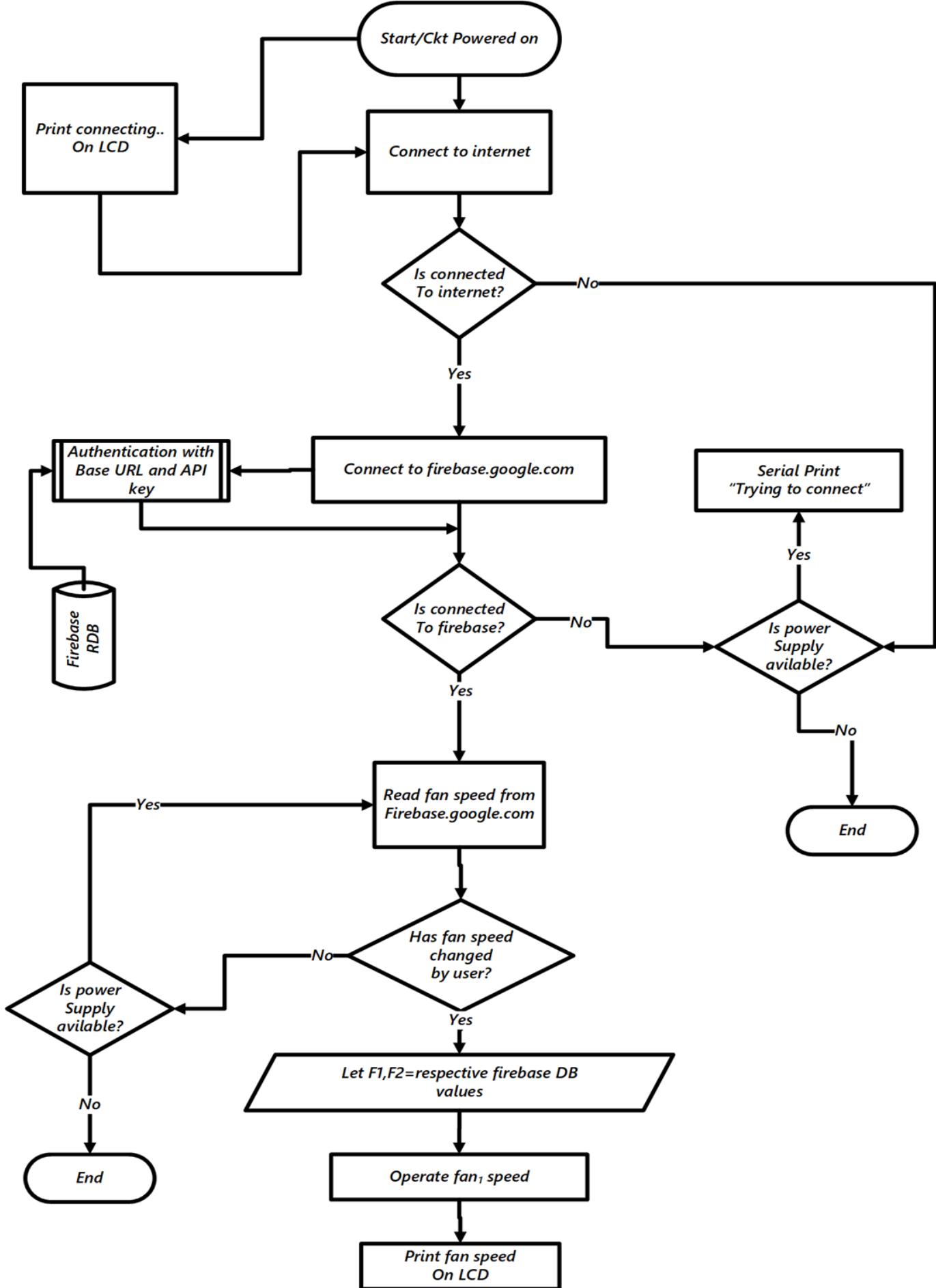
# How it works-1

**1. Relay Operation:** The following flowchart explains the working of relay connected to the MC



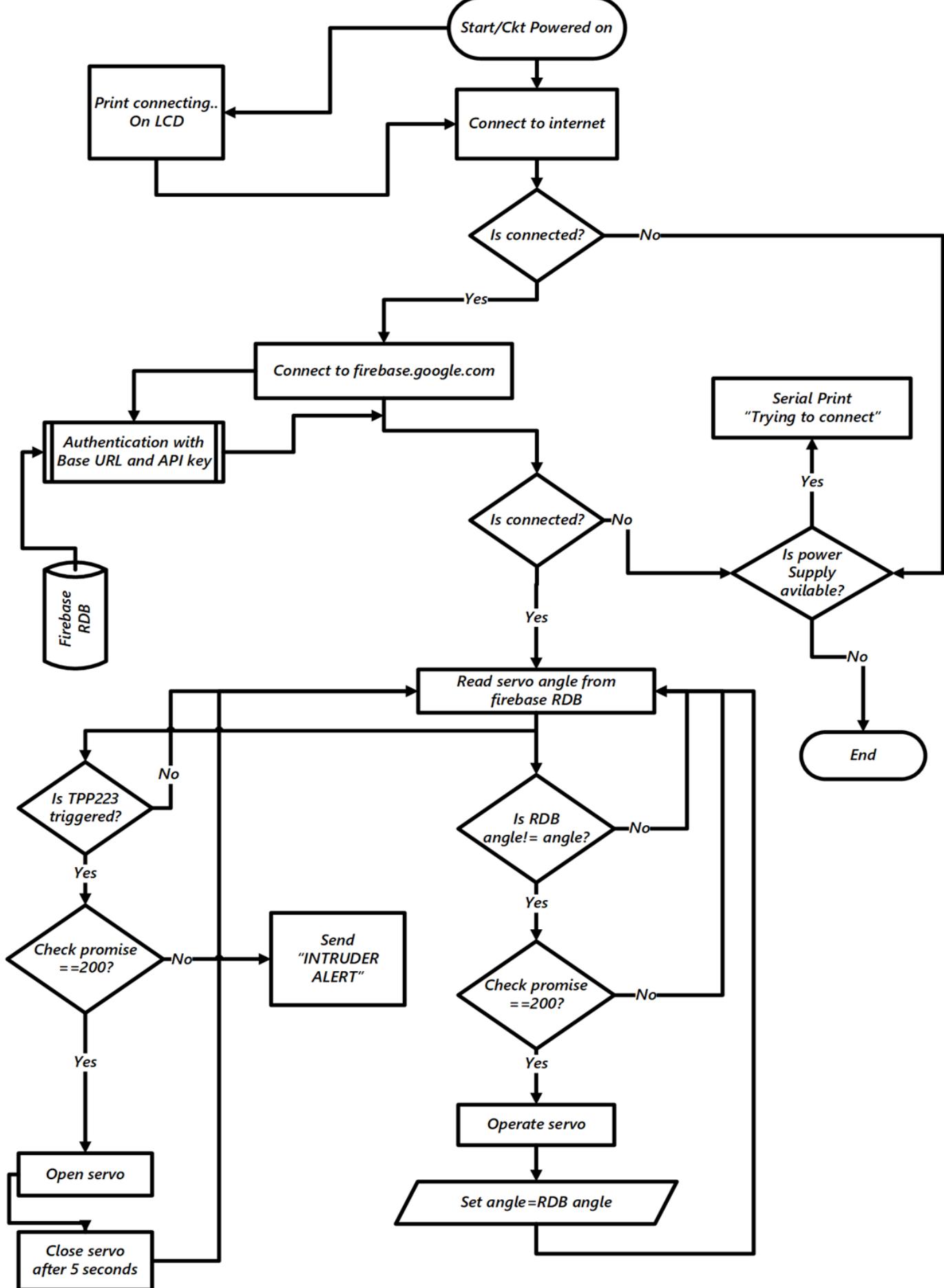
# How it works-2

**2. Fan Operation:** The following flowchart explains the working of fans connected to the MC

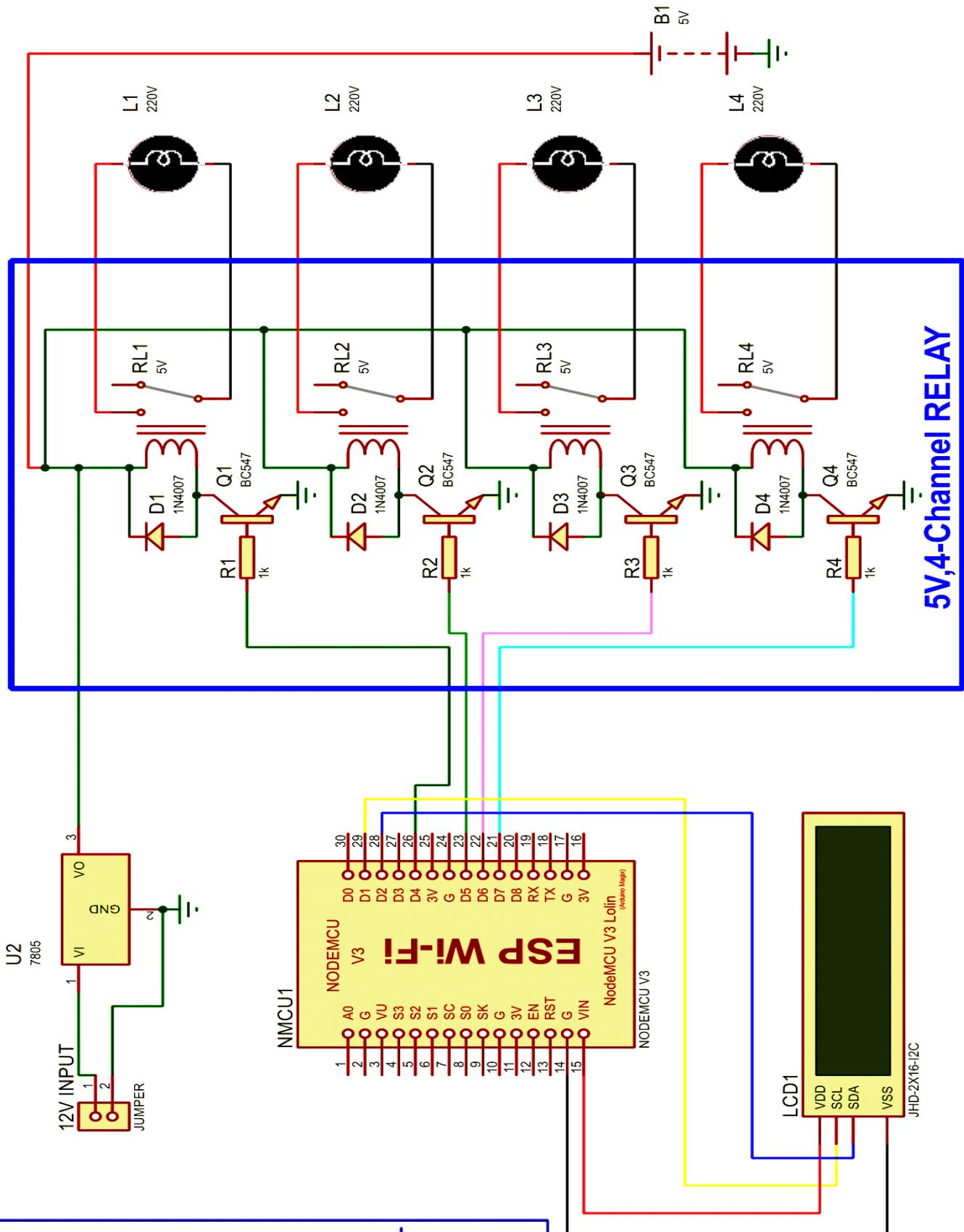


# How it works-3

**3. Door Operation:** The following flowchart explains the working of door connected to the MC



# Circuit 1: Relay ,LCD ,ESP-8266



FILE NAME: 1st Circuit

DESIGN TITLE: 1st-Circuit.pdsprj

PATH: C:\Users\Vivek Kumar\Documents\1st-Circuit.pdsprj

BY: VIVEK KR

REV:@REV

DATE:

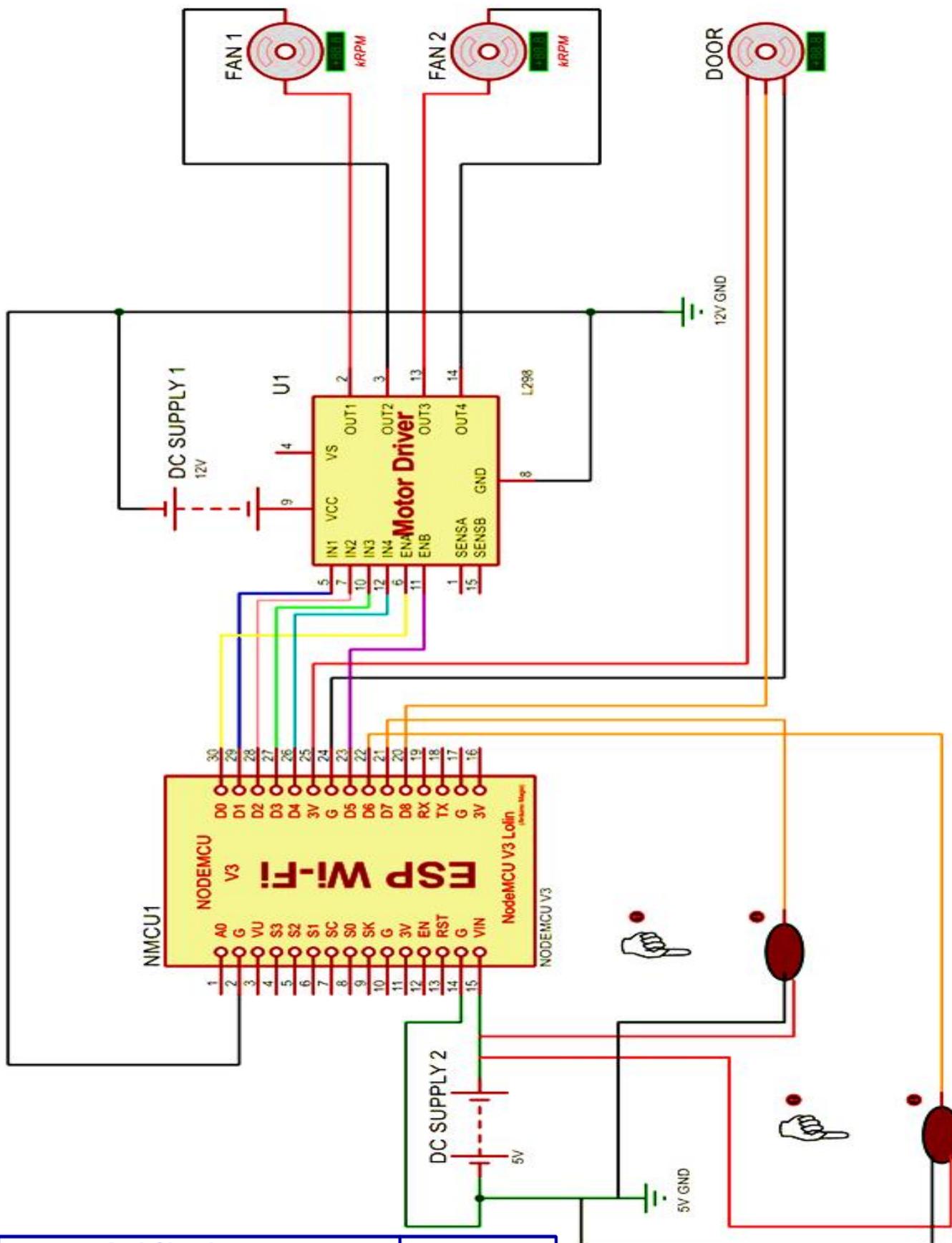
24-May-21

PAGE:

1 of 1

TIME: 10:57:22 AM

# Circuit 2: Fan ,Door ,ESP-8266



**FILE NAME:** 2nd Circuit

**DATE:**

24-May-21

PAGE:  
1 of 1

TIME: 12:56:56 PM

DATA OWNERSHIP

BY·VIVEK KR

REV:@REV

# Project Objectives

Android controlled Smart Home Automation should be able to control the home appliances wirelessly with effectively and efficiently.

## **1. Controlling Home Appliances via Application (Switch and Voice Mode):**

To develop an application that includes the features of switches and voice mode application. Switch Mode or Voice Mode can be used to control the switches of home appliances.

## **2. Secure Connection Channels between Application and ESP-8266:**

Use of secure protocols over Wi-Fi so that other devices cannot control the appliances. Options for secure connection is SSL over TCP, SSH.

## **3. Controlled by any device with internet functionality (Android, PC):**

To make the home appliances flexible in control, any device capable of Wi-Fi connectivity will be able to control the home appliances from remote location.

## **4. Extensible platform for future enhancement:**

The application is to be highly extensible, with possibility of adding features in the future as needed.

## **5. One-Signal integration for Home-Intruder alerts:**

The system uses the popular notification and in-app messaging provider “OneSignal” for delivering notifications when the system detects any tampering or unauthorized access to the premises.

## **6. The Google Firebase keeps you and your family synced:**

The Realtime Database service ensures less latency between actions even with a poor network connection.

## **7. SMS alerts for intruder detection:**

The application uses the SMS api to send messages and keeps you updated even when you are offline and away from your home.

## **8. Controlling the breeze is just a breeze:**

Fan speed control is just a click away with this system. Control your fan from anywhere in the world, just requires a small internet connection on your remote device.

## **9. Small power requirement for operation:**

Requires a very small power supply of +5V DC for operation of various relays and microcontrollers.

## **10. Changing the appliances to a network version isn't required:**

Unlike the other systems changing the appliances to their network version counterpart is not at all required.

## **11. Small initial setup cost:**

Initial installation cost are low as compared to other previous systems. Though the functionality is way more than what you would get in those systems.

# Scope of H.A.S

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. One can implement several of their tasks with just a single command of verbal instructions. These technologies can be 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 with such 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 free calling, Spotify, SoundCloud, 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 build 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. The smart 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 be used for social media. The refrigerator has been upgraded to sense the temperature outside and operate accordingly. The washing machine will wash the clothes according to the clothes material 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 home nearby and so on. They can also be used for monitoring the traffic in our locality.

One can build several amazing projects using the concepts of home automation. There are several projects already done by developers and available on the Internet. They might help you to start the work with IoT. You can add new skills to own smart device. You can make your smart home device work according to your life works and habits. Even we can build many projects around it by discovering new areas of the internet of things and make the world a smarter place to live in.

# Pros and Cons

• **Remote access:** Being able to control devices remotely means things like unlocking the door for a plant sitter without having to leave a key under the mat.

• **Comfort:** You know when you're all comfy in bed but realize you've left the bathroom light on? With smart light bulbs, you can turn them off from the comfort of your bed without having to leave those high thread count sheets.

• **Energy efficiency:** How many times have you left the heat on blast while you're out of the house for eight hours? With home automation, you can set things like thermostats on schedules to make sure you're not wasting energy. A study found that Nest thermostats in particular can save about 12 percent on heating and cooling costs, for example. That means that over time, these smart thermostats can actually pay for themselves in savings.

• **Convenience:** Being able to control devices remotely or via voice commands, set them on schedules, and even sync them with the sunrise and sunset is nothing is not convenient. Imagine being able to come down in the morning to freshly made toast without you having to push a button!

• **Safety:** Finally, there are many smart security products that can increase your home's safety, like sensors for doors and windows, security cameras that can detect people, and video doorbells that let you greet whoever's knocking from anywhere with Internet.

• **Costs:** IoT devices are certainly more expensive than their non-WiFi-connected counterparts. For example, the average smart bulb costs around \$32, while the average regular light bulb is about \$5. Of course, you have to factor in the additional features like remote control, dimming, 16 million different colors and voice integrations, to name a few, but overall, home automation isn't cheap, depending on where you shop.

• **Security issues:** It's scary but true: anything that has to do with the Internet, whether it's browsing Etsy for a new bedspread or checking in on a motion notification from a smart security camera, can be hacked, and that includes IoT devices. Unfortunately, we've seen a fair share of hackings and security breaches from large tech companies that manufacture IoT devices; Ring's cameras, for example, were famously hacked, allowing the live feeds to be compromised.<sup>7</sup> Of course, this is an issue you wouldn't have with devices that aren't connected to the Internet, but if you want IoT devices, you'll have to adhere to some best digital security practices, detailed later on.

• **New technology:** Since IoT is a relatively new technology, you may run into some bugs, like devices having trouble connecting to the Internet or experiencing lag, depending on the device's make and model.

• **Surveillance:** If privacy is a huge concern, then smart security is probably not for you, as users can livestream footage from the camera's respective app. Instead, you might want to opt for a local alarm system; SimpliSafe has an option if you don't pay for the monthly plan, detailed in our SimpliSafe security review.

# Is Home Automation Secure?

With some IoT devices, digital security can be more of an afterthought, not originally built into many first-generation models. However, as security breaches become more commonplace, many manufacturers are changing their ways, making their IoT devices less hackable. But ultimately, it's up to the user to take advantage of these digital security features. Here's how:

- I. **Secure router:** One of the most straightforward ways to secure your home automation system is to use a secure router from a company other than your Internet Service Provider; we recommend looking into routers from NETGEAR, Linksys, and TP-Link.
- II. **Privacy policy:** Sure, it may be time-consuming and more than a little bit boring, but it's important to actually read the company's privacy policy to see what customer data they keep and how they share it and sell it to third parties.
- III. **Name router:** Be sure to give your router a name other than the one that it came with.
- IV. **Encryption:** Choose a strong encryption method for your WiFi, like WPA2.
- V. **WiFi password:** Make sure your WiFi network has a long, complicated, and unique password. Of course, this makes it harder to add guests, but it also prevents others from hopping on (and hacking your IoT devices).
- VI. **Separate WiFi network:** For the most security for your IoT devices, consider getting a separate WiFi network for IoT devices only. This will also create faster Internet speeds all around.
- VII. **Password hygiene:** Aside from your WiFi network, your IoT account should have a password that's not repeated on any other account; no old, weak or repeated passwords allowed!
- VIII. **Device settings:** Often, devices have features enabled by default that aren't necessary, and that can make your IoT devices more hackable. Be sure to turn off these features when not in use, like WiFi, Bluetooth, and knowing your location.
- IX. **Software updates:** Although change can be scary, software updates are a good thing! They often include updates specifically targeted at improving digital security, so be sure to perform all software updates as soon as they're available.
- X. **Authentication:** Some companies like Ring have added two-factor authentication to their accounts, meaning to sign in, we had to enter a passcode that was sent to our phones. This made sure that only us, the authorized users, could access our accounts. For even more authentication, look for accounts that allow for fingerprint or facial ID, known as multi-factor authentication. You can also add on either type of authentication through a password manager; for example, we use LastPass' Touch ID to access all accounts on our iPhones.
- XI. **VPN:** Finally, if you're using an IoT device on a public Wi-Fi network, like a smart plug powering your laptop in a coffee shop, connect to a VPN, or Virtual Private Network, to encrypt your web traffic and hide your IP address. While no action can prevent hacking 100 percent, you can greatly reduce your likelihood of being hacked with only a few simple steps.

# Controversies

Home automation suffers from platform fragmentation and lack of technical standards a situation where the variety of home automation devices, in terms of both hardware variations and differences in the software running on them, makes the task of developing applications that work consistently between different inconsistent technology ecosystems hard. Customers may hesitate to bet their IoT future on proprietary software or hardware devices that use proprietary protocols that may fade or become difficult to customize and interconnect.

The nature of home automation devices can also be a problem for security, data security and data privacy, since patches to bugs found in the core operating system often do not reach users of older and lower-price devices. One set of researchers say that the failure of vendors to support older devices with patches and updates leaves more than 87% of active devices vulnerable. Concerns have been raised by tenants renting from landlords who decide to upgrade units with smart home technology. These concerns include weak wireless connections that render the door or appliance unusable or impractical; the security of door passcodes kept by the landlord; and the potential invasion of privacy that comes with connecting smart home technologies to home networks.

Researchers have also conducted user studies to determine what the barriers are for consumers when integrating home automation devices or systems into their daily lifestyle. One of the main takeaways was regarding ease of use, as consumers tend to steer towards "plug and play" solutions over more complicated setups. One study found that there were large gaps in the mental-models generated by users regarding how the devices actually work. Specifically, the findings showed that there was a lot of misunderstanding related to where the data collected by smart devices was stored and how it was used. For example, in a smart light setup, one participant thought that her iPad communicated directly with the light, telling it to either turn off or on. In reality, the iPad sends a signal to the cloud system that the company uses (in this case, the Hue Bridge) which then signals directly to the device.

Overall, this field is still evolving and the nature of each device is constantly changing. While technologists work to create more secure, streamlined, and standardized security protocols, consumers also need to learn more about how these devices work and what the implications of putting them in their homes can be. The growth of this field is currently limited not only by the technology but also by a user's ability to trust a device and integrate it successfully into his/her daily life.

# Applications

Home automation is prevalent in a variety of different realms, including:

- Heating, ventilation and air conditioning (HVAC): it is possible to have remote control of all home energy monitors over the internet incorporating a simple and friendly user interface.
- Lighting control system: a "smart" network that incorporates communication between various lighting system inputs and outputs, using one or more central computing devices.
- Occupancy-aware control system: it is possible to sense the occupancy of the home using smart meters and environmental sensors like CO<sub>2</sub> sensors, which can be integrated into the building automation system to trigger automatic responses for energy efficiency and building comfort applications.
- Appliance control and integration with the smart grid and a smart meter, taking advantage, for instance, of high solar panel output in the middle of the day to run washing machines.
- Home robots and security: a household security system integrated with a home automation system can provide additional services such as remote surveillance of security cameras over the Internet, or access control and central locking of all perimeter doors and windows.
- Leak detection, smoke and CO detectors
- Laundry-folding machine
- Indoor positioning systems (IPS).
- Home automation for the elderly and disabled.
- Pet and baby care, for example tracking the pets and babies' movements and controlling pet access rights.
- Air quality control (inside and outside). For example, Air Quality Egg is used by people at home to monitor the air quality and pollution level in the city and create a map of the pollution. Smart kitchen, with refrigerator inventory, premade cooking programs, cooking surveillance, etc.

# Conclusion

With all the details included in this project I would like to conclude this project. This project is wholly based on several books and research notes. Which can be concluded to some points as follows:

## **Scope Of Home Automation Systems:**

- 1) *Integration of Smart home devices*
- 2) *Smart spaces outside homes*
- 3) *Development of smart appliances*
- 4) *Personal home delivery*

## **Pros. Of Home Automation Systems:**

- 1) *Convenience*
- 2) *Safety*
- 3) *Energy efficiency*
- 4) *Comfort*
- 5) *Remote access*

## **Cons. Of Home Automation Systems:**

- 1) *Costs*
- 2) *Surveillance*
- 3) *Security issues*
- 4) *New technology*

## ***Our solution is better than the other similar products because:***

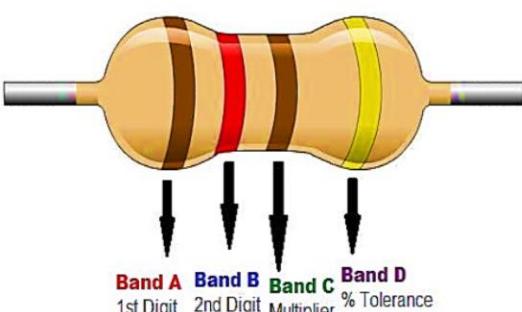
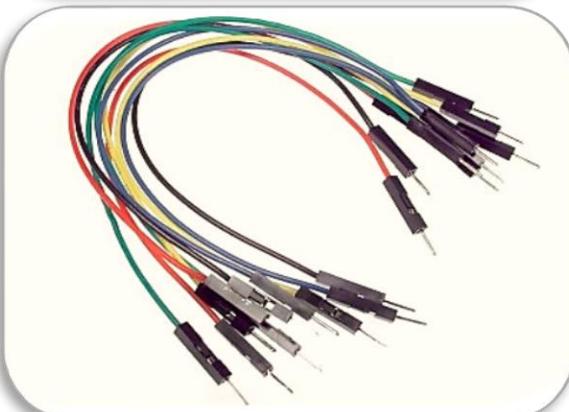
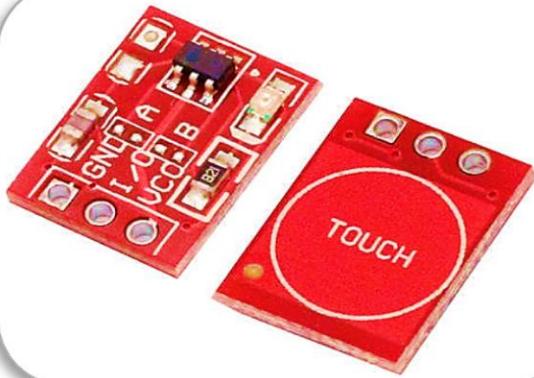
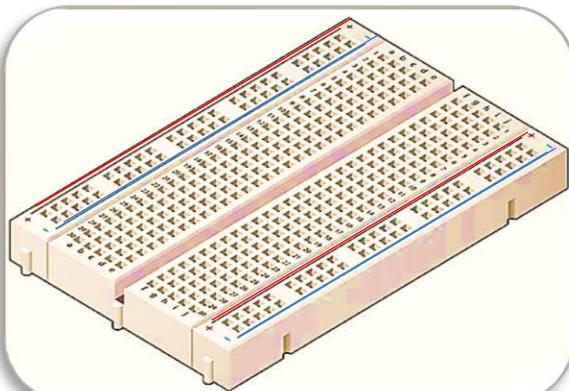
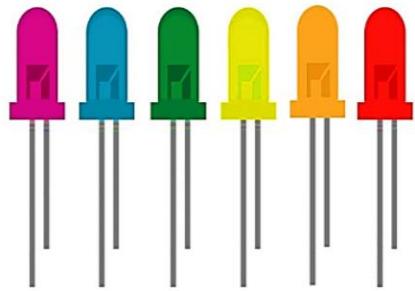
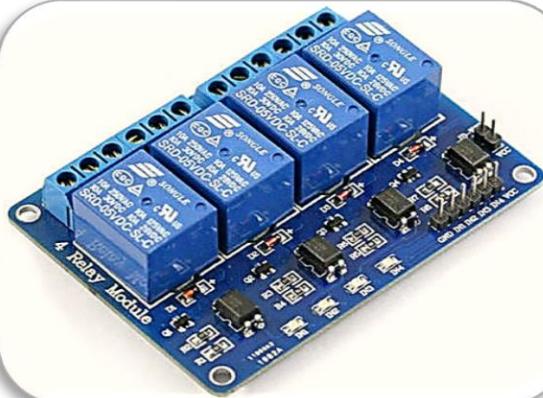
- 1) You do not need to change any of your home appliances or bulbs. We've got your back.
- 2) You do not need to invest on several different items. We've got your back.
- 3) You do not need to take a sweat for maintenance. It's self maintainable. We've got your back.

## ***Home automation is prevalent in a variety of different realms, including:***

- 1) Heating, ventilation and air conditioning (HVAC): it is possible to have remote control of all home energy monitors over the internet incorporating a simple and friendly user interface.
- 2) Lighting control system: a "smart" network that incorporates communication between various lighting system inputs and outputs.
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- 5) Home automation for the elderly and disabled.
- 6) Pet and baby care, for example tracking the pets and babies' movements and controlling pet access rights.

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