Home Automation System Based on IoT

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A thesis submitted to the Department of Computer Science and Engineering
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B.Sc. in Computer Science

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Declaration

It is hereby declared that

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2. The thesis does not contain material previously published or written by a third party, except where this is appropriately cited through full and accurate referencing.
3. The thesis does not contain material which has been accepted, or submitted, for any other degree or diploma at a university or other institution.
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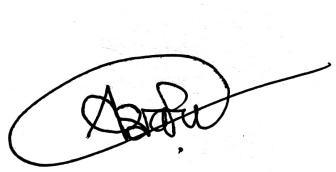

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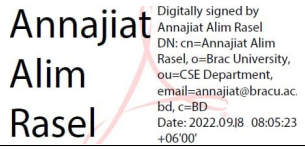

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Abstract

Home automation was created primarily to assist and support the elderly and disabled at home. Home appliances are designed based on a computer device platform to automate the use of a Bluetooth and wireless interface microcontroller to operate home appliances such as lights. This automated way of controlling household equipment can reduce the use of traditional electric switching methods. Internet of Things is going to be the best and most useful system for the next generation of science and technology based World. The IoT provides a very comfortable and easy way of life for human beings by being managed and consequently interfacing remotely control of home appliances. The system which is Home Automation is a newly evolving technology infrastructure (DHT11, Ultrasonic sensor, microcontroller like NodeMCU, Relay and Communication devices) without directly interacting with human beings. This kind of module and sensor is used to detect the temperature and control the light, fan, ac and other electronics devices at home automatically. Kind of short range wireless system. Also can fill up water tank automatically.

Keywords: IoT, Home Automation system, home appliances, Internet, Microcontroller, NodeMCU, Dht11, Ultrasonic.

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Chapter 1

Introduction

This is the era of science and technology, where everything is dependent on technology and science. From the invention of electricity to the invention of IoT , technology has spread its branches in every sector of life. One of the most important sectors of technology is IoT or also known as Internet of Things. The internet of things (IoT) is rapidly evolving and turning into a more increased topic of communicating in place of business and the outside world. It's an idea that has the capacity to affect how we live but also how we think. It is a theory of essentially connecting any tool with ongoing and off transfer to the internet. This concept also adds the whole thing from coffee makers, headphones, android phones, lamps, human wearable devices and sensors and actuators to directly connect to the internet in which the gadgets are related and allowing a new bureaucracy of communication amongst people and themselves. IoT includes many classes, which include clever grid, smart logistics, surroundings and safety checking out, smart transportation, industrial management and automation, finance and provider, military protection, fitness care, first-class agriculture, and clever home system. The survey Gartner says that with the aid of 2020 there will be over 26 billion to 64 billion connected devices. The IoT is a giant community connected to "matters", that is related with people-people, human beings-things, and matters-matters. enormous development of IoT over the past couple of years has created a brand new dimension to the world of records and communique technology. The increasing generation is main to all people, whenever, everywhere connectivity of things with expectation so that it will make bigger and create a completely advanced dynamic network of IoT[1]

Home automation is a system that requires sensors and actuators to connect with a device through IoT and creates a communication between humans and machines. This system consists of an exceptional microcontroller and it takes data and controls the house accordingly. The device uses a facility which watches over home-use devices by IoT instruments and devices and also different communication tools efficiently. For this system we will manage the devices with mobile devices and

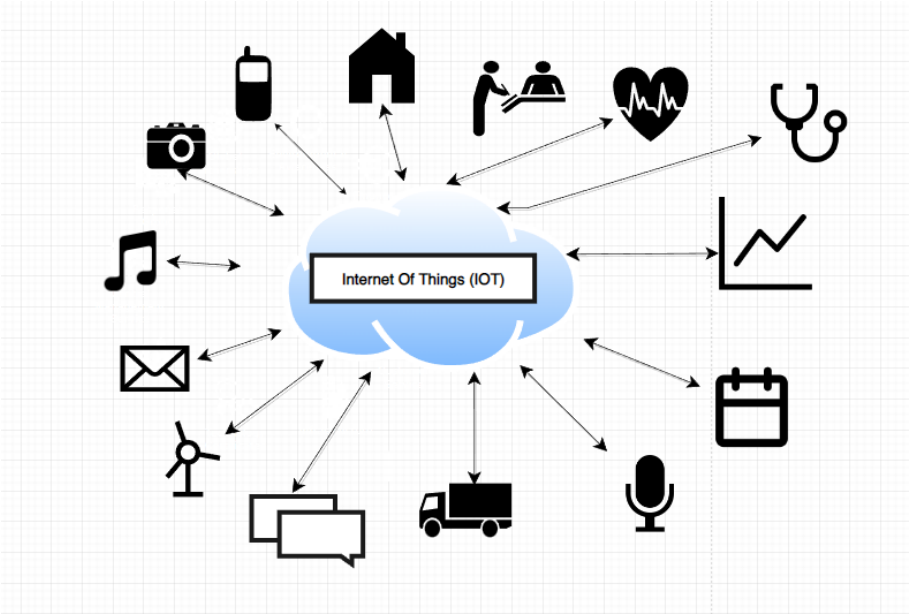

Figure 1.1: Internet of Things (IoT)

Desktop computers or laptops or over the internet anyplace inside the World wide web [2]. IoT or also known as Internet of things is going to be a system of different types of sensors and also actuators. The evolving IoT technology has spreaded in many sectors including smart logistics, industrial workplace, medical and health care, agriculture , military defense etc [3]. Smart homes are homes that integrate a communication network that connects key sensors and actuators and allows them to be accessed, monitored or controlled remotely [4]. In a super smart home there are certain features; the size of the network is small, the number of users is very low (as it is limited to family members only) and different network connections are used, such as 3G, 4G and Wi-Fi. Data management is done through a neighboring server; IoT devices use RFID or WSN wireless technology and bandwidth requirements are also low [3]. Smart homes are also known as home automation, in which indoor activities are made quieter, more convenient, safe and economical. As a result, home automation has gained popularity due to its many benefits.[5]

The device is used for dominant varied. A Home Automation System has 4 major elements. The first and foremost is the computer program, sort of a pc or android cell-phone accustomed to, provides orders and serials to the system. Another part is the transferral mode, that's the local area network(wired connection), or Bluetooth (wireless connection). The third one is the Main controller. It consists of a hardware interface which communicates with the computer program by controlling electronic devices. the last word part is varied electronic devices, like associate air-conditioner, a lamp, or a heater that square measure compatible with the mode of transmission, and connected to the central dominant system tube lights, enthusiasts, domestic

home instrumentation, electrical motors, air con, air heating structures then forth unit easily managed by victimization internet or internet enabled gadgets, these quite sorts of systems turning into a great deal of common due to its less worth of implementation and offers bendy capability which will be effortlessly configurable by victimization beat step with their would really like that's why all of the IoT device unit in exquisite demand and have several price due to the actual fact supporting individuals a small amount just like the people having disabilities, as they're in a very tough position to walk,so for that this machine is extremely useful to them and to boot for the patient or for the vintage aged person that remains fully on the bed or also useful for the young folks and ladies at their homes. This technique consists of planned system models that connect, communicate and coordinate to different types of communication devices through the internet for major home automation systems.

1.1 Project Objectives

This project focuses on the following objectives:

- Check the room temperature and humidity levels, and turn on/off the light, fan, ac based on the information.
- Also control the water pump automatically
- Can control all this component manually with the help of apps.

1.2 Research Problem

There are numerous challenges present in IoT systems, such as control, performance, privacy, and security. The safety challenges include authorization, authentication, and access control [6]. Consequently, there have been a number of times that the system malfunctioned , or even not recognizing or getting the information of the surrounding environment. Many times it was also noticed that the system was vulnerable to environmental hazards. One of those elements is that even if it got water in it the system malfunctioned. Another problem that was encountered was power supply. It was a highly sensitive system so it needed a sufficient amount of power to work properly. In this paper, we propose a user-friendly multi-factor authentication for the proposed smart home device. One of those is power supply and Electricity data gainer, like if there is no electricity it will run on backup power and also when the electricity comes data would be stored when electricity was gone

and what is the water level percentage and about in how much time the tank is going to be fulfilled. A clever system is very necessary for a well-functioning home environment. But only depending on human physical attributes is not enough , because a person sometimes won't be able to keep track of data , and it would diminish their comfort and will not be environmentally friendly in many cases. As when the outside environment gets hot and there is much more humidity level it is necessary to have AC turned on in time to keep a healthy body and mind. Also sometimes due to work and day to day chores and responsibilities we often forget to turn off the Fan or the AC or even the Water Pump and there is a lot of wastage of money. In order to prevent that this system works on a well built Eco-friendly sensors which will lessen the pressure for anyone and will also save a huge amount of money waste. [7]

1.3 Research Objective

This research aims to classify the economy and balance of modern lifestyle with technological Support. In this era people are more advanced and need to enjoy comfort and relaxation so the Smart Home automation system comes with the purpose of making life easier while also keeping little amount of electricity , time and water waste.

The Objectives of this research that indicates:

- To make human life more easier and dependable on technology.
- Develop a model that can reduce waste of money, electricity and essential parts of our life.
- Testing , collecting data and evaluating the model.
- Finding ways to improve and adopt the model according to the growing economy and society.

Chapter 2

Literature Review

The assessment and research article provides an overview of current knowledge regarding IoT and its uses in smart homes. We have studied multiple research papers and categorized them as follows

2.0.1 Bluetooth Based Smart Home

Bluetooth is short-range Wi-Fi technology commonly used to create communication between a number media transferral devices or guide. It uses radio waves with short frequencies large unrecoverable wave-length distance (up to 100m) It can be used for connecting devices. Works of N. Sriskanthan Et al. [7] hints of a crafty and disheveled servant using Bluetooth with a host controller done on a PC and connected to sensors and microcontroller-based systems remote controllers. It is suggested that communication between utilities is possible. This system give access to more than one machine controller connected to the host controller. In an ideal best blue-tooth condition to the range of 100m. Relative Bluetooth communication often consumes more power, so the device's battery needs to be regularly recharged or replaced. Bluetooth technology should be used only for the time when quick and short verbal exchange is necessary with very minor security problems.

2.0.2 GSM

The researcher of this article implemented a model which makes up the whole architecture. The software component (Arduino) programming and the creation of communication process. Through internet communication can be built with a system so that the owner of the home can issue orders or get SMS notifications from the system. When a GSM modem gets an SMS command, the microcontroller will carry it out and alter the appliances's current condition. Sensors like the MQ2, MQ7, and ultrasonic sensors are utilized for home security [8]. Since MQ2 and MQ7 are gas

detectors, when a dangerous scenario arises, the mcu generates an alarm and sends an SMS to a GSM phone through a GSM modem [9].

2.0.3 ARM9 and Bluetooth

Bluetooth is incredibly affordable, adaptable, and capable, according to the author. For ARM9 devices, this system uses the Wince 6.0 operating system [9]. To automate home appliances, Visual Basic.net is used to create a GUI. The software development environment for this particular project is called Micro - controller Dev Kit which is specifically created for use with microcontroller applications. You can use the actuators along with sensing devices people need with MDK-ARM and microcontroller devices. Light and temperature sensors are included in this. Bluetooth is utilized to communicate commands to the microcontroller using a GUI that is VB.net developed. Appliances will be operated by a microcontroller based on commands received. Only those with authorization are granted control, and a security system's output is formatted. Only authorized people are allowed control, and a security system's output takes the form of LEDs [10].

2.0.4 IoT-based

The author of this work developed a wireless smart secure feature using the Launchpad. The TICC3200 Launchpad board, which will be utilized for home automation purposes, has a microcontroller and an inbuilt Wi-Fi shield. The intruder is also discovered using a PIR motion sensor. Motion sensors detect attempts by intruders to enter a home while the owner is away and send a text to the user. The user then sends an order through a device which switches the house's bulbs and sounds an alarm to alert any intruders. An example of how a home automation system works is when a guest comes over while the owner is away. In that case, the owner receives a notification. After identifying that individual, the owner can turn off all the systems including bulbs, fans, and other home equipment. With the aid of video calling, the owner will be informed if someone leaves the house. After that, he can enable the home security system and adjust the state of household appliances. So that they may be readily controlled with the aid of a microcontroller, here, devices are linked to the mains supply by a relay [11].

2.0.5 Microcontroller using Zigbee

The smart home system described by the author relied on some controllers and network modules [12]. To take orders, a voice recognition system is employed. As a central processing unit, a microcontroller is employed. ZigBee is a communication technology. Home appliances are controlled via relays. Signals are produced by smoke sensors when smoke is found. Data regarding the smoke sensor is sent by the PIC controller to RS 232. To inform the user in case of fire threats, one GSM module port is connected to RS232 [12].

Furthermore, we have been through more research work for our own convenience. IoT based smart home systems are the subject of two research. The implementations of IoT and its usage at home are covered in this part. The basic architecture of remote smart home is shown below:

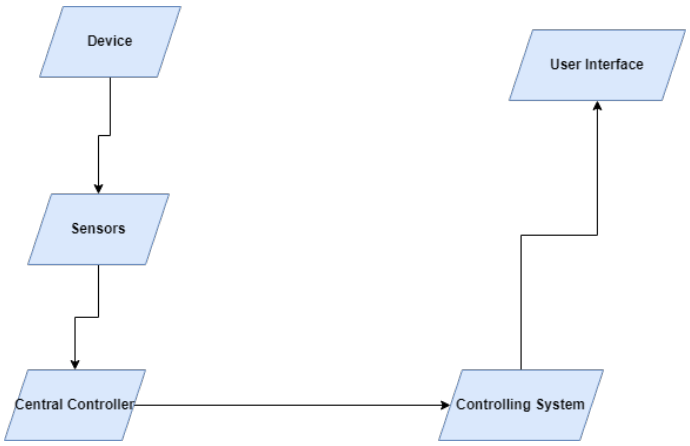

Figure 2.1: IoT Architecture

Different home automation systems have different smart features. Wireless is implemented in this smart home [13].Here, the prototype model consists of couple of parts: mesh cyberspace which shows functionality, it also handles all the other feature, and an equipment terminal made up of an printed circuit board, one wireless protection circuit board, three alarm PCBs, actuator PCBs which helps the right feature for the system's sensing devices. The entire feature is available for all the smart homes. The person who uses the feature can monitor every single thing via the internet. So, the least requirement is to have an internet connection to notice anything from a long distance.

Based on the Android operating system, the application has been created [14]. To make certain that devices are connected with one another and household equipment, a communication process has been set up. To run the shutter, a software is imple-

mented which operates via a smart phone. A has been developed which monitors the signal and operates the entire system.

A model for controlling along with monitoring household equipment that is cloud-based. Construct a house entrance that can gather information from household equipment, send it to the server to be set on a file distributed system, analyze it and then use it so that the equipment can allow it to run from long distance [15]. Using this algorithm and reading email subject lines, it has been put into practice using a specific model. This model platform demonstrates as a potent, affordable, and effective one for implementing smart home automation [16]. In numerous aspects, smart home uses this model is superior compared to other smart home techniques. DTMF (dual tone multi-frequency), for instance, is used in home automation [17]. In contrast to their suggested approach, the call tariff is a significant drawback. Additionally, the Web server used for home automation uses the memory space needed and the web server's design is discharged by this approach, as it only utilizes the Gmail currently offers a web server service. Using LEDs, used to denote the switching process. The interactivity of the system is versatile and effective.

The modules and microcontroller connect to the web server and then they create a straightforward managing system through the microcontroller. The motion sensing, as well as all other devices which are sent to the web server using a computer host as a data collector. The user can monitor or control the house's energy-saving measures online using a PC or Android smartphone. An Ethernet shield will be used to send commands from the user to the Arduino microcontroller. Both the wired X10 and wireless ZigBee equipment were used in this model [18]. This model was addressed by this feature using a process. In the house, devices are connected with the main controller wirelessly or B cord. It interacts with the applications through a very customizable process.

The feature that connects the equipment with the sensor systems and the server that shares information by receiving info [19]. A huge prototype which connects all the features. The smart home application and an Ethernet micro module to control the entire system flow [20]. The main controller is directly interfaced along with all the main components along with all the sensors, manages the process and controls the total flow.

The feature will work as an inter-connected device for Konnex-Bus (KNX) home automation systems and mobile devices [21]. Instead of having distinct profiles, a smart home will store the data of all actors and sensors. ensures that energy use

could be lower than with a regular desktop PC. Telephone lines employ DTMF, or dual tone multi frequency. The system is made of a couple of components: a PC, an IO interface unit, and a data signal which interchanges information and also confirms the user's identity, and uses the keypad tones to operate the devices as needed. It is decided to use a stepper motor control example. This method benefits from being safe and enabling global system models.

Because of having multiple frequency systems they are very compatible in size. But there are some limitations for this model to set up in our houses. The semi controllers used in our houses control these equipment also referred to as pic 16f887 [21]. It can cover a huge area through a very strict and secure system. By giving proper manual instructions the user can control it. The process does not store and share any personal information of the user.

For setting up devices the components we have used is an Arduino board. To accomplish this interface, specific peripheral drivers and relays are used. Based on user input, the smartphone application creates alert services to notify the user and then it sends all the necessary data related to security issues to the user [22]. The system's costs and SMS delivery dependability are downsides. Device-based customization of an interface is not possible.

To implement smart home features in devices the author used a module that was built that relied on a cell tower network the interfacing manual consists of programming language in the background which is python. For controlling and monitoring the datas and information it has multiple input and output ports.For safety protocols the range of this device is kept from 10 to 100.

References for internet of things based softwares for household equipment includes cc camera, transport navigation weather forecast System, networking devices. The smart home equipped devices are being selected in this part. A platform like this is shown in the primary step of this project. Also in 2.2 we can see some features.

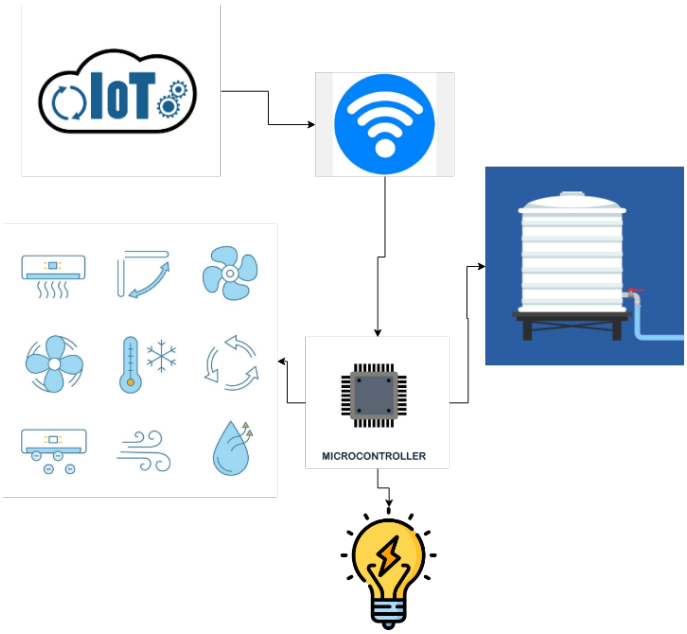

Figure 2.2: IoT Features

2.1 Data acquisition and sensing

First temperature , are the typical monitored factors in homes, as shown in Fig. 3, to make it more understandable [23]. The term "Big Data" is typically related to the IoT and explains the volume of data that must be processed from many different sensors and devices, as is the case in this instance. In fact, a significant amount of data may be generated and transferred over the internet , which should be able to manage such a huge amount of archiving data, depending on the number of sensor samples.

2.2 Data Transmission

Data is transmitted through one or more communications technology between devices and controllers. These features includes multiple smart algorithm to maintain the connection between devices.These data transmission methods are well-liked because of their low power requirements and ease of usage [24] [25]. Additionally, IoT

requires Ethernet or Wi-fi to connect to the web. Although Ethernet is significantly quicker than a Wi-fi connection, applications for home automation do not necessarily require a high data rate. Wi-fi also provides the benefit of mobility, which makes it increasingly common. Wireless components uses more energy than Bluetooth or ZigBee competitors. Lowering the data upload frequency will reduce power consumption.

2.3 Data Processing (Microcontroller)

A microcontroller like the Arduino, Raspberry Pi, or NodeMCU often processes and manages the data gathered in a home automation system. Raspberry Pi is a small equipment with a single microprocessor. It can do more sophisticated tasks than other controllers because of its bigger RAM of 256MB or 512MB, depending on the model, and is mostly employed as a central processing unit for numerous devices. It is convenient to upload data to the internet because the majority of Raspberry Pi module have USB and Ethernet connectors [26].

However, the single-boarded mcu may be easily programmed to carry out any task, commands. Many variations of Arduino are available with onboard flash memory with capacities between 32 kB and 512 kB. Commonly a 2kB RAM. Evidently, this controller is less more potent than a Raspberry Pi model. But most Arduino device models are more accessible, less expensive, and powerful enough to handle home automation-related duties.

Utilizing the NodeMCU is an additional choice. The ESP8266 Wi-Fi chipset has been added to the microcontroller, which is based on the Arduino platform. This mcu has a 4MB storage space and a 128kB memory. It is typically employed to replace the need for a centralized unit or for a single IoT software. This also reduces the complexity of the code and the connection chain because any component of the system can upload the information to the server independently. The NodeMCU has a substantial economic advantage over the competition because it can connect to the web via Wi-fi without the use of any additional peripherals or modules, giving it this advantage over the competition. The NodeMCU board's single analog input confines its use to a single data monitoring system, which is a problem. The ASD115 analog to digital converter, which has four analog input ports , can be used to overcome this disadvantage.

2.4 Data Display & User Interface

The user can interact utilizing this method. Utilizing an application is one option. Even someone with no experience in programming can construct a mobile or computer app to show information using a variety of straightforward methods. Another control method is via mobile internet, also the user is capable of sending microcontroller instructions in code. A unique GSM module must be introduced to the circuit in order to use this control mechanism. Emails can also be used with this technique [27].

Chapter 3

Work Methodology

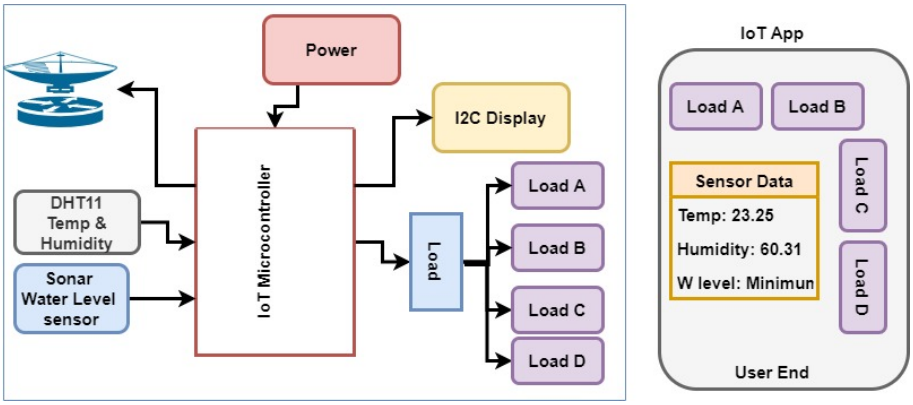

Figure 3.1: Block Diagram

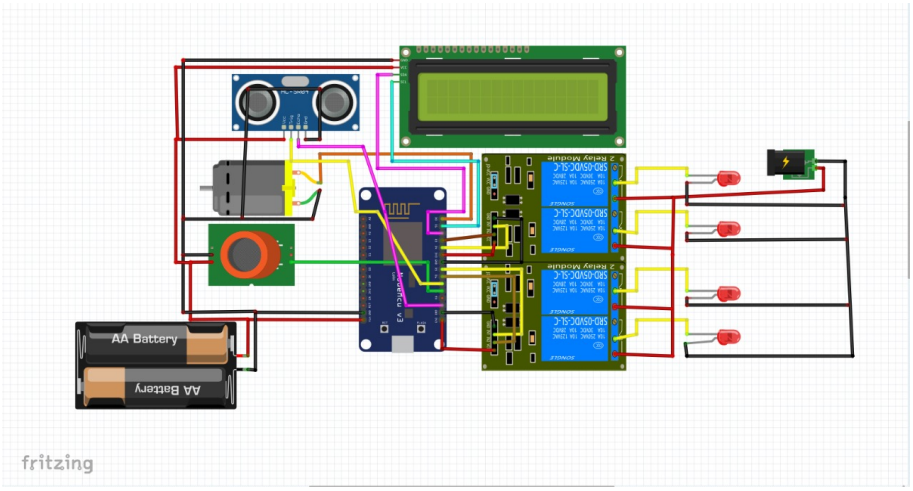

Figure 3.2: Circuit Diagram

Our prototype is powered by a SMPS power supply.WE are converting Ac to 12v Dc.This 12v is converting to 5v using 2 Buck converter to power-up the Nodemcu ESP8266 and water pump. Next we use 4 channel Relay to control the power flow of the components. And also a one channel relay is connected with the pump.Our

prototype has one fan, two lights, an air conditioner and water pump.Now to control all the components, we used the Nodemcu microcontroller which has built in Wifi. A D0 pin is used to control the pump. D3 and D4 are used to control commands for the lights and D5 pin is defined to control the fan. Also the D6 pin will control the air conditioner. We also have a LCD display in our system to show the current system status.

The functionality of the motor depends on the water level in the tank. The water level is detected using a sonar sensor. If the water level is below 25% the pump will be automatically turned on and if the level reaches 90% then the pump will be turned off. Then we are measuring the temperature and humidity with a DHT11 sensor. Whenever the temperature reaches 25 degrees, the fan will be automatically turned on. And if the temperature reaches 30 degrees or more than that then the air conditioner will be automatically turned on. All these components are also manually controllable with an app. The app will be contacted through wifi with the microcontroller and each of the components can be manually turned on and turned off using the app. We used the blynk web interface for the app. Our system will automatically connect to our home wifi and we can control everything in our system from anywhere using the app.

3.1 Hardware Components

The control scheme makes use of a variety of electronic components that are interconnected in some way. An analog electrical signal, such as a voltage, current, or change in resistance, is produced by a sensor when a physical quantity, such as temperature or humidity, is applied [28]

The controller sends an output to the relay to apply the system's modifications after the programming has examined the recorded values. In this manner, depending on the level of water determined by the ultrasonic sensor, the relay will shut off the water pump. By adjusting the settings in response to new information, the user can change and adapt the decision-making processes. A nodemcu Board is served here as the main hosting (server) for all functions necessary including data transfer, processing, display as well as backup in the context of this project.

3.1.1 NodeMCU ESP8266

With a built-in flash-based SPIFFS file system, NodeMCU is freely available. It is also an Espressif's Lua-based firmware which is compatible with the ESP32 and ESP8266 WiFi SOCs. We have used ESP 32 while doing our project. The Espressif ESP-IDF is stacked with the NodeMCU, which is implemented in C programming.

3.1.2 Input/Output Pins

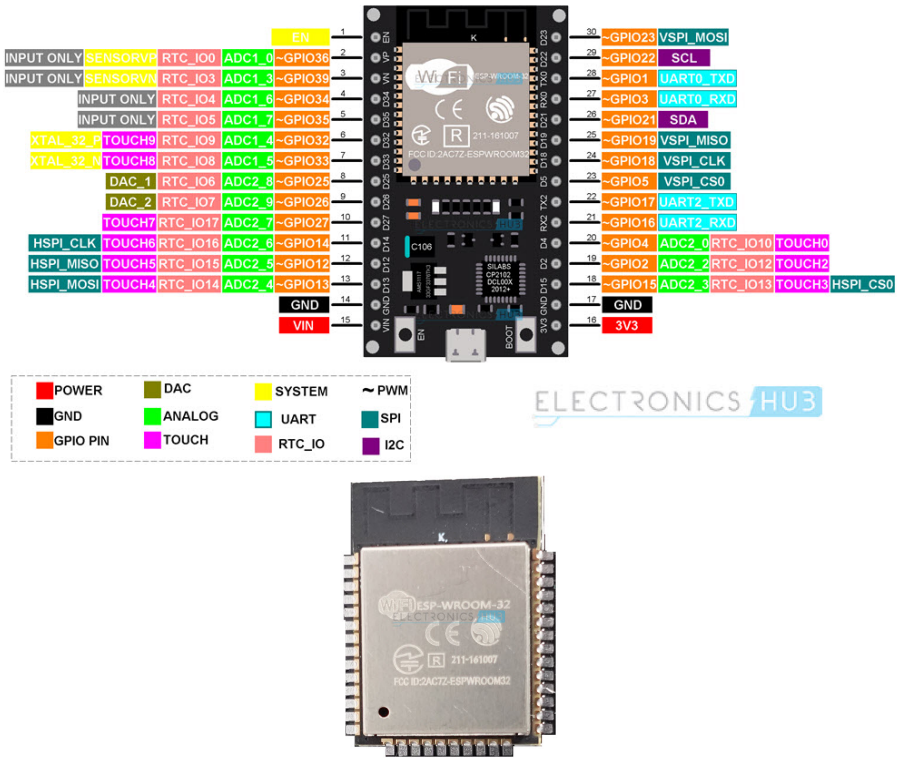

Figure 3.3: The ESP32 Pin layout Diagram

There are 39 overall digital pins on the ESP32, 34 of them are GPIOs, while the remaining pins give only input. Eighteen channels of 12 bit are ADC and the other two channels of eight bit DAC are supported by the device [Figure 1.1]. Additionally, it contains 10 GPIO pins that provide capacitive touch functionalities and 16 channels for the creation of PWM signals. With the ESP32's multiplexing functionality, any GPIO pin may be set up for PWM or other serial communication using a program. Moreover, the ESP32 wifi module includes 3 SPI interfaces, 2 I2C interfaces, 2 I2S interfaces, 3 UART communication protocols and with a CAN protocol[29].

- **3 URAT interfacing:** Three UART interfaces are supported for TTL communication by the ESP32. In our project model, there are 3 sets of TX and RX pin which would be needed for the interfacing. As all the six GPIO pins are software-configurable, hence this pin can be used to work with UART.

- **External Interrupt:** Any GPIO pin may be built to work as an interrupt pin.
- **GPIO18, GPIO19, GPIO23 and GPIO5 :** These were employed for SPI communication.
- **GPIO13, GPIO12, GPIO14 and GPIO15 :** SPI communication makes advantage of it.
- **GPIO21, GPIO22:** Communicate through wire library.
- **Reset :** It has an enable pin which is used as the reset pin [29].

3.1.3 Relay Module

In our Smart Home Automation Project, we had to use 4 channel relay of 5 volt which will automatically turn off/on AC using by taking data from the temperature sensor. We have also used a 1 channel relay to turn on/off the water pump. It is basically used in our project to control high voltage. It can be used to control both DC and Ac voltage by using 5v current. It has a principle of electromagnetism. It is designed in such a way so that it can create an interface with a microcontroller such as Arduino. 3 high - voltage power terminals which are NC, C, and NO on the four-channel relay module connect to the object which we would like to operate. Moreover, 3 low power pins which are Ground, Signal , and VCC on the reverse side interface to the Arduino.

This lower voltage of four channel relay module which is 5 volt,the system needs a 15-20mA controller power for each channel. This can also be utilized to run a number of high-voltage equipment and devices. It contains high-current relays which can run at 250 AC voltages or 30 DC voltages and 10 amperes. It has a programming environment that a microcontroller can use to control it effectively. For safety reasons, this module is optically separated from the high voltage side to prevent ground loops whenever connected to a microcontroller.

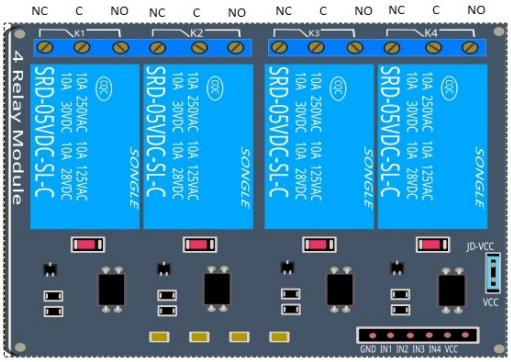

Figure 3.4: 4 Channel relay

3.1.4 DHT11

It is a widely used humidity and temperature sensor which has an exclusive NTC for measuring temperature and an eight - bit microprocessor to transmit the humidity and temperature measurements as serial data. We have used this sensor because with an accuracy of 5%, it can measure relative humidity between 20 and 90% RH in the 0 to 50°C temperature range. A 2 °C accuracy is used to measure temperature in the range of 0 to 50°C. We have used one single wired data pin for data transmission in arduino. We have also connected the GND and VCC pin to the the GND and five volt of arduino board. In this way VCC can supply the power. We know from our research that it has 3 pins and among two of them are called power pin and the rest one is called communication pin.There seem to be two variations of the DHT11 that you might encounter. The first kind contains four pins, whereas the second kind has three pins and also attached to the little PCB. The pinouts for both variants are shown below (Figure 3.5):

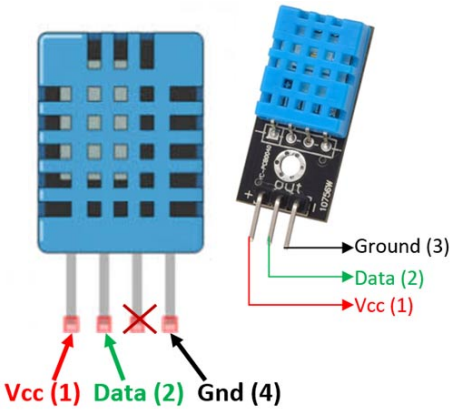

Figure 3.5: DHT11 Pin Out

Table 3.1: DHT11 Pinout Configuration

NO:	Pin Name	Description
1	VCC	It supplies power which is between 3.5 to 5.5 Volt.
2	Data	This pin shows the output of the sensor through serial data.
3	NC	No connection, so there is no use of this pin.
4	Ground	Connects to the ground.

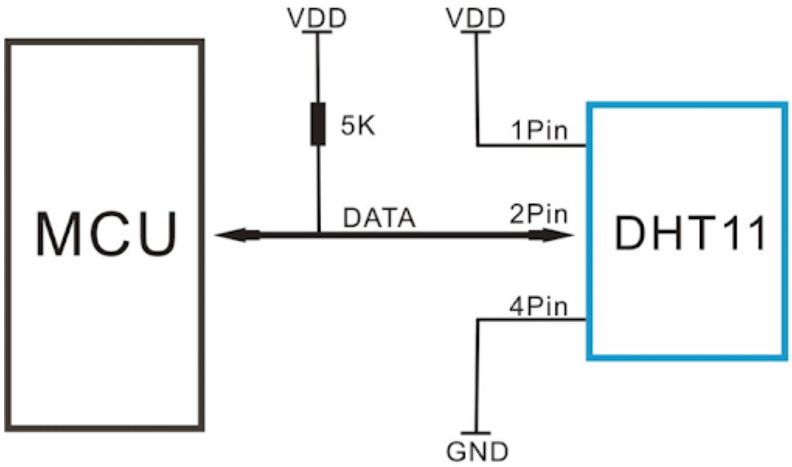

Figure 3.6: Typical Application

A 5K pull-up resistor is advised for connecting cables under 20 meters in length; for cables longer than 20 meters, select the proper pull-up resistor as required.

3.1.5 Overall Communication Process of DHT11

In response to a Microcontroller start signal, the sensor (DHT11) enters the operating point and awaits for the Microcontroller to finish the clock pulse before switching back. In addition to data on the temperature and moisture, the DHT11 delivers a reply message with 40 bit data towards the Microcontroller after the process is done. Clients can choose to acquire particular information. But without start signal from the Microcontroller, DHT11 can't even deliver the feedback signal towards the Microcontroller. Following the collection of information, the sensor will enter a low power state till it again gets a clock pulse from the Microcontroller. After identifying the clock pulse, DHT will release an 80us minimal response output. In addition, It will change the data single bus voltage from low to high.

Whenever the terminal voltage of the data single bus is lower, hence the sensor transmits the feedback message. Then it will pull up power and preserves this to 80µs before getting prepared to send information after sending its feedback message. Each bit of data transmitted from the DHT11 to the Microcontroller begins with a

50µs lower voltage, as well as its length of its subsequent higher voltage signal determines whether the bit is a 1 or a 0. The DHT will not response properly whenever the return signal remains at a higher voltage. So we have to check the connectivity again. DHT11 lowers the line voltage and keeps it there for 50us after the last bit of information is sent. Its voltage will then be pulled up by the resistor, returning it to its new state. [30]

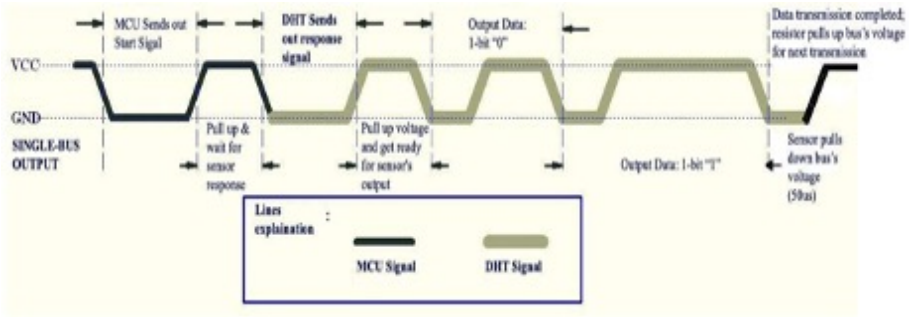

Figure 3.7: Overall Communication Process

3.1.6 Water Level Detect (Ultrasonic Sensor)

In our Project we have used an ultrasonic sensor to detect the water level of a tank by measuring distance. This method relies on a measurement of the permanent distance from the tank's highest point to the leftover water surface to determine the water depth within the tank. We measured the tank height to 6 cm in our project. To ensure the ideal water level, the water pump will immediately change on or off if the predicted distance reaches the specified maximum or minimum limit. The HC-SR04 ultrasonic sensor, depicted in Figure 11, is one instrument that satisfies the specifications for this task. The sensor works essentially like sonar and generates ultrasound at a frequency of about 40 kHz [31].

During the first ten seconds, the trigger pin has to be at high stage. Moreover, It responds when a 8 burst of ultrasonic data at a rate of of forty (40) kHz. These were primarily designed for this 8 pattern to enable its recipient to determine between both the transmitted beats as well as surrounding ultrasonic noise. The air helps the 8 sonar pulses travel further from the emitter. In the interval, the echo pin goes UP to initiate the sound waves.

If these beats really aren't reflected back within 38 milliseconds, the echo sound fades out and turns low. Because there is no obstruction visible inside the sensor's range of vision, a signal of 38 ms indicates as much. Even if these pulses are reflected, then echo pin input is low when this data is received (Figure 3.8). This results in either an audio signal pin wave which lasts between 150 µs or 25 ms, based on how long this will take to capture the reflected signal.[32]

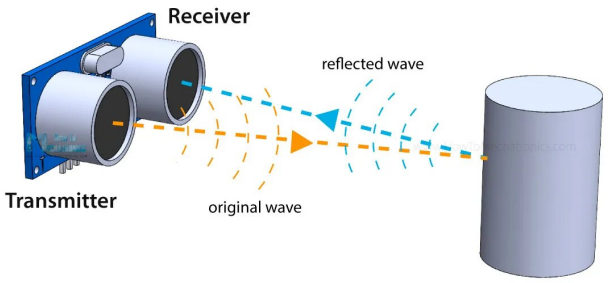

Figure 3.8: Ultrasonic sensor Work method

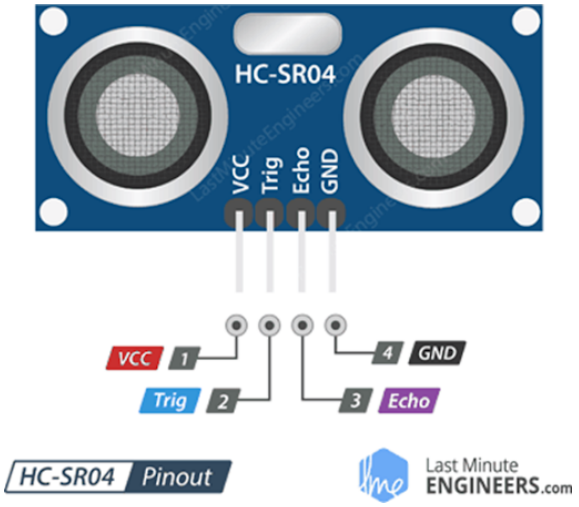

Figure 3.9: HC-SR-04 Pinout

VCC: It enables the sensor to the power. In this project, we have attached it to our Arduino's 5V output while doing the project.
Trigger: To start ultrasonic sound pulses, a pin is being used. The sensor starts ultra - sonic bursts by holding this pin HIGH for 10 µs.
Echo: Whenever the sonic burst is produced, that pin gets higher and stays high till the HC-SR04 hears an echo, at this point it will turn low. The length can still be determined by counting the number of seconds the Echo pin remains up.
GND: We have used this pin to connect to the ground of arduino. [32]

3.1.7 LM2596 Buck Converter

In our project, we have used LM2596 Buck Converter to convert 12 volt to 5 and 6.5 volt. The buck converter, sometimes referred to as a step-down voltage regulator, LM2596, is typically also used to step down voltage or to drive loads that draw less than 3A. As it comes with a customized output version, so we have set the voltage as per our requirement for this project.

Figure 3.10: LM2596 Buck Converter

3.1.8 Switch Mode Power Supply

We have used SMPS to convert AC supply to DC supply. In SMPS, filters and rectifiers are used to do this conversion. The impacted power factor correction circuits get this unmanageable DC voltage. This is due to the fact that the rectifier experiences a brief low current pulse just before the voltage peak. High-frequency energy is among them, as it impacts the power factor to decrease. This is a result of power conversion, although AC input rather than Input dc supply was employed. In order to convert AC to DC, this block diagram uses a rectifier and filter combination. A power muffle amplifier is then utilized to switch an operation. The transformer's output must receive this Ac signal as illustrated in the figure 2.3, once more to maintain the current level. The Outcome filter and corrector is then used to correct and regulate the output of this transformer. In contrast to the reference voltage, the response circuit regulates the voltage output.[33]

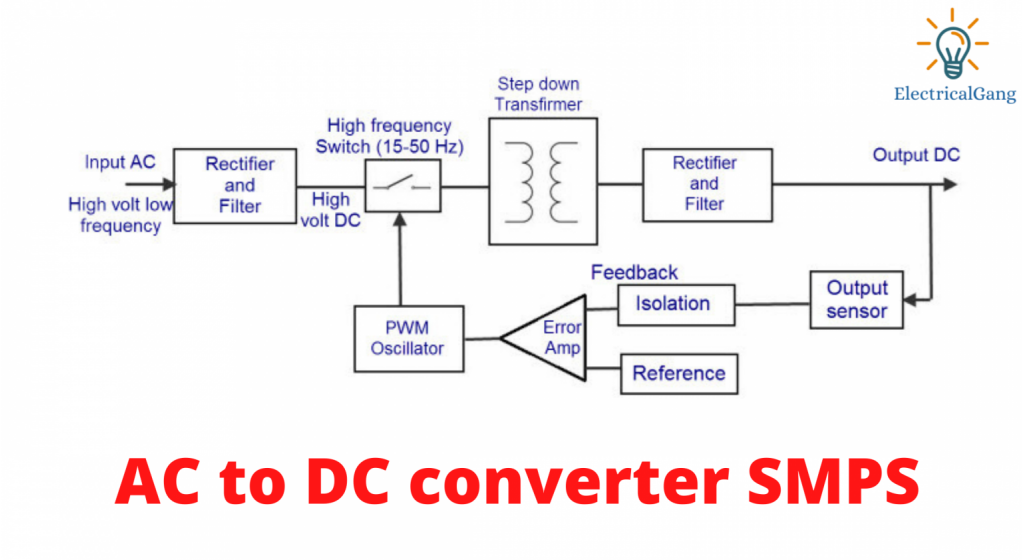

Figure 3.11: AC to DC Converter

3.1.9 I2C Display

We have used a 16 x 4 I2C display to show the output from the sensors. We have used an I2C display over a standard LCD display because an I2C display is easier to connect rather than a standard LCD display. Besides, in an I2C display we only need to connect 4 pins which are GND, VCC, SDA, SLC. The working method of this pins are given below:

GND: It connects it to the ground of the Arduino board.
VCC: It is the power supplier pin. Basically, It supplies power to the module and LCD and also makes a connection with 5V Arduino output.
SDA: It is a data pin which connects it to the Arduino data pin.
SLC: It is a clock pin which connects to the Arduino clock pin. [34]

Figure 3.12: 16x4 I2C Display

Chapter 4

Result

The image 4.1 below is our the final prototype of our work. We have the LCD display in the middle to show the overall system status. The plastic jar is with tube representing the water tank. The four compartments represent four rooms in the house. And in the middle there is the DTH11 sensor to determine temperature and humidity. We have connected three bulbs that represents two lights and one fan. All of these components can be controller by the app while the pump can be operated automatically by determining the water level by Ultrasonic sensor. The fan and AC can also operate automatically depending on the temperature reading.

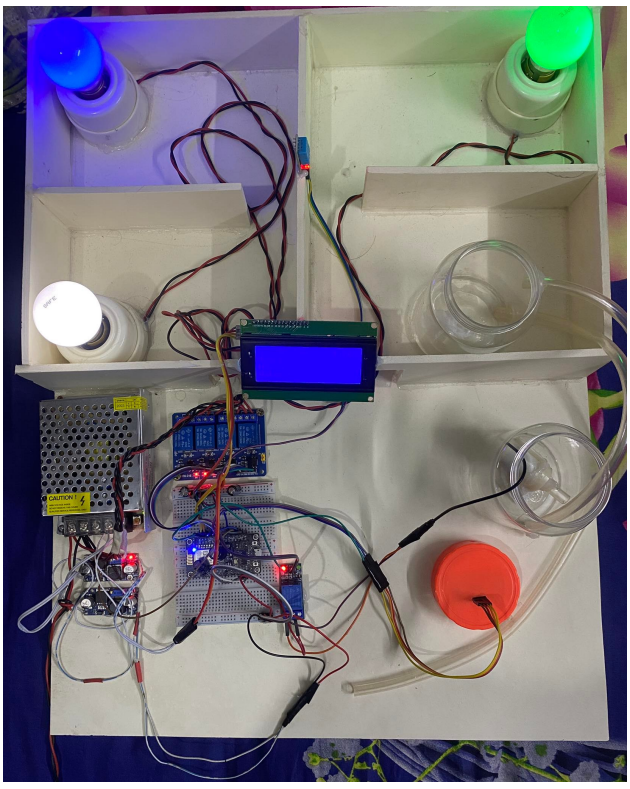

Figure 4.1: Final prototype of the project

Chapter 5

Conclusion

This projected domestic automation machine will be scaled upto residences however while it'll be disbursed on giant scale then the security problems are passed off, correct moves needs to be taken like buzzing the bell to alert the owner in order to overlook issues that can arise at home. Many of the workplace or home components like fan, lights, air conditioning machine could also be casually managed by the approach of net enabled tools. The house doorways can routinely be managed on remote with the help of the movable web enabled. This system offers for the owner for the account creation, authentication and authorization on each and every account so that the legal individual will manipulate, show and can also take movements per what they need consequently the house automation system might have AN increasing variety of choices for creating, updating, editing or creating it smarter. In future, we want to upgrade the prototype to real life implementation. IoT based home automation system is widely used in developed countries but no much seen in Bangladesh. We want to introduce cost effective home automation system that will be affordable by all class of people. Also home automation system can be used to tackle the current electricity supply shortage of our country. We really look forward to contribute in solving this problem.

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