A SEMINAR REPORT ON

IOT based smart dustbin with monitoring and tracking

SUBMITTED TO THE SAVITRIBAI PHULE PUNE UNIVERSITY,
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IN

ELECTRONICS AND TELECOMMUNICATION ENGINEERING

BY

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CERTIFICATE

This is to certify that ,the project report entitled

"IOT based smart dustbin ,monitoring and tracking"

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Is a bonafide work carried out him/ her under the guidance of Prof.S.S.Vasekar and it is approved for the partial fulfillment of the requirement of the Savitribai Phule Pune University for the award of the Degree of Bachelor of Engineering Electronics And Telecommunication Engineering.

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Place: Pune Date:

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Abstract

Every person in this world throws waste in the form of plastics, wet waste, dry waste and etc. Also, every person looks for a place or a plastic container to dispose that waste, that plastic container is the Dustbin which they look for. Dustbin is a plastic container where everyone can dispose their waste. Dustbin is used as a storage place to dispose waste, but we cannot estimate the exact amount of waste disposed by a society, and the dustbin cannot take more waste as the space should be available in it to take more. We need to know the level of waste in the dustbin and based on that we can intimate people to use the dustbin or not. In this Smart Dustbin project, we have designed a prototype where the lid of the dustbin is opened, on detection of human hand and waste, and the level of waste available inside the dustbin is sent as notification in the form of LED. The main components we used in making this prototype are Arduino, Servo Motor and Ultrasonic Sensors.

This dustbin can be a start to Smart Waste Management System where the officials can clean or empty the dustbin which depends on the notification received by them and not waiting for a call from a person of a society who informs the garbage trucks to come and take the waste from them.

This technology can be used in public areas such as hospitals, schools, multiplexes and buildings to improve the security system and also to spread awareness in an emergency. The objective of this paper is to analysis the various proposals and technologies of a SMS controlled wireless display board that may eventually replace with the presently used paper based and programmable notice board.

1. INTRODUCTION

Garbage becomes a serious problem not only in Ivndia, but also throughout the world. The increase in the population results in the increase of human activities, which in turn can also cause an increase in the volume of Garbage. The amount of waste which are some of the by-products produced from urban lifestyles, are growing faster than the rate of urbanization growth.

Sixteen years ago there were 2.9 billion urban residents who produced around 0.64 kg of solid waste per person per day (0.68 billion tons per year). In 2012, this number has increased to around 3 billion people which produces 1.2 kg of waste per person per day (1.3 billion tons per year). In the year 2025, it is likely that it will increase to 4.3 billion urban population which produces around 1.42 kg/capita/day of municipal solid waste (2.2 billion tons per year) In other case, garbage can also cause unpleasant odors that often disturb the community, especially for those who live in areas not far from the Final Disposal Site.The unpleasant odor caused by this garbage can certainly disrupt human health.

The Smart Cities Mission is an innovative and new flagship initiative by the Government of India to drive economic growth and improve the quality of life of people by enabling local development and harnessing technology as a means to create smart outcomes for citizens.Based on the background described above, in this study, an innovation was proposed to increase public awareness and concern about garbage ,it will automate the process of waste management which is need of current situation

1.1 The problem

Nowadays, there are tons of flats and apartments which have been built in the rapid urbanization area. This is due to high housing demands which have been drastically risen as a result of migration from villages to cities to find work. In order to accommodate the growing population in the urban area, the government has also constructed more apartment complexes.

There are several issues faced by the residents of the flats. One of them is disposal of solid waste. Unlike private houses, the residents of all the apartments use a common dustbin, which tends to fill up very quickly. This overflowing of garbage is a sanitary issue which might cause diseases like cholera and dengue. Moreover it is a waste of fuel to travel around a complex or an area to find that some of the garbage are filled and some are not.Also, on rare days, problems might arise that there is so much garbage that the truck doesn’t have enough capacity. The idea struck us when we observed that the garbage truck use to go around the town to collect solid waste twice a day. Although this system was thorough it was very inefficient.

What our system does is it gives a real time indicator of the garbage level in a trashcan at any given time. Using that data we can then optimize waste collection routes and ultimately

reduce fuel consumption. It allows trash collectors to plan their daily/weekly pick up schedule. An Ultrasonic Sensor is used for detecting whether the trash can is filled with garbage or not. Here Ultrasonic Sensor is installed at the top of Trash Can and will measure the distance of garbage from the top of Trash can and we can set a threshold value according to the size of trash can. If the distance will be less than this threshold value, means that the Trash can is full of garbage and we will print the message "Basket is Full" on the message and if the distance will be more than this threshold value, then we will print the distance remaining for the garbage vat to be full.

1.2 Objective of Project:

- To make a system which can .Automatically opens up by sensing when someone wants to throw garbage into it
- to make a system which Provide info if it is full(depth of garbage)
- To make a system which is Battery powered or solar powered (may be both depending upon cost effectiveness).
- To provide the position of garbage collector
- To track location of system.
- To track Temperature and humidity monitoring or smell monitoring.
- To Store the the data on iot platform .
- To provide the information about smelling,to avoid public discomfort

2. Literature Survey

The major incapabilities of present waste bin collection systems are:

1 .Lack of information about the collecting time and area.

2. Lack of proper system for monitoring, tracking the trucks and trash bin that have been collected in real time.

3 .There is no estimation to the amount of solid waste present inside the bin and the surrounding area due to the scattering of waste.

4 .Public discomfort regarding odour at community dustbin.

Related Work:

sr.no	Title	Name of Author & Publisher	Methodologies	Observations
1	Garbage Box (G-Box) Designing and Monitoring	Nyayu Latifah Husni1 , Ade Silvia Handayani2 , Firdaus3 , Selamet Muslimin4 , Niksen Alfarizal5 , Uwais6 1, 2, 4, 5, 6 Electrical Department, State Polytechnic of Sriwijaya, Indonesia IEEE June 2016	Android Monitoring Display Arduino mega	sensors of the G-Box (distance sensor) could detect everyone who got closer to it and gave information to the controller, in which gave command to the final control. research can also be monitored well using the android
2	IOT Based Smart Dustbin Monitoring With Tracking System	Mohammad Abbas Hussain,Kvs.Nikhil,Koppuravuri Yaswanth Pavan Kalyan,India. (University of Exeter, June 06,2020 ,IEEE Xplore	ATMega 2560 Microcontroller Thinspeak cloud	ThingsSpeak software there monitored the graphical and nongraphical representation of the sensors at the different conditions such as distance, flame, and moisture

Sr.No	Title	Name of author	Methodologies	Observations
3	Smart Bin To Help Doctors Fight COVID-19 (Ally)	Punjab's Lovely Professional University Students .(2020)	Artificial intelligence sensory system Lithium ion battery	Lithium ion battery Automatically opens path learning
4	Internet of Things Based Wireless Garbage Monitoring System	Amit Yadav,Asif Khan Proceedings of the Third International Conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud) (I-SMAC 2019) IEEE Xplore Part Number:CFP19OSV-ART; ISBN:978-1-7281-4365-1	Internet of Things(IoT) bottom-up sensing, network, and application service wireless communication Mysql,Java,Socket programming	data trend graph of the garbage amount for nearly 24 hours, status of garbage bin and its surrounding; temperature, humility, garbage depth, tilted or not, on fire or not

3. System Overview

Block diagram:

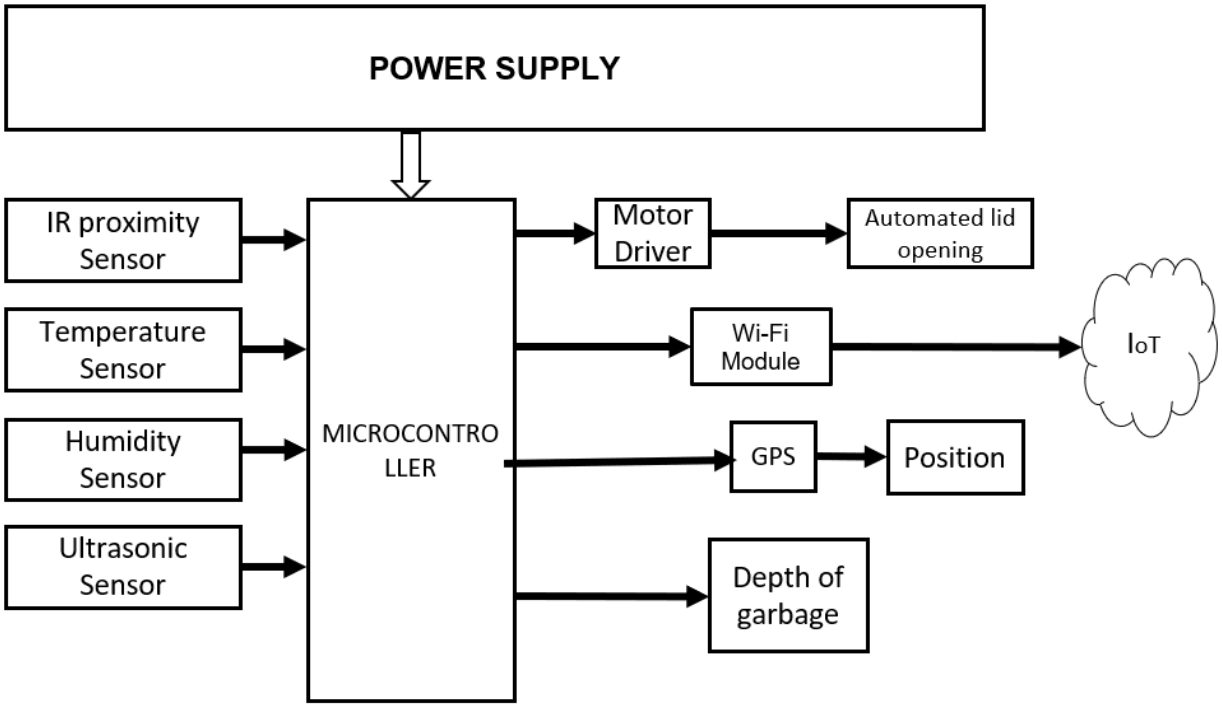


Fig:3:Block Diagram

Main Components of system:

1. Arduino Sensor
2. Ultrasonic sensor
3. Temperature sensor And Humidity sensor
4. IR Proximity sensor
5. Servo Motor
6. GPS
7. Wi-Fi module
8. IoT

3.1 ARDUINO UNO :

- Arduino is an open-source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board.
- The Arduino platform has become quite popular with people just starting out with electronics, and for good reason. Unlike most previous programmable circuit boards, the Arduino does not need a separate piece of hardware (called a programmer) in order to load new code onto the board – you can simply use a USB cable. Additionally, the Arduino IDE uses a simplified version of C++, making it easier to learn to program. Finally, Arduino provides a standard form factor that breaks out the functions of the micro-controller into a more accessible package. The Arduino is a microcontroller board based on the ATmega8. It has 14 digital -input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a16 MHz ceramic resonator, 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 ACto-DC adapter or battery to get started .The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter .Revision 2 of the Uno board has a resistor pulling the 8U2HWB line to ground, making it easier to put into DFU mode. Revision of the board has the following new features:
- Pin out: added SDA and SCL pins that are near to the AREF pin and two other new pins placed near to the RESET pin, the IOREF that allow the shields to adapt to the voltage provided from the board. In future, shields will be compatible with both the board that uses the AVR, which operates with 5V and with the Arduino Due that operates with 3.3V. The second one is a not connected pin that is reserved for future purposes.
- Stronger RESET circuit. • AT mega 16U2 replace the 8U2. "Uno" means one in Italian and is named to mark the upcoming release of Arduino 1.0. The Uno and version 1.0 will be the reference versions of Arduino, moving forward. The Uno is the latest in a series of USB Arduino boards, and the reference model for the Arduino platform.

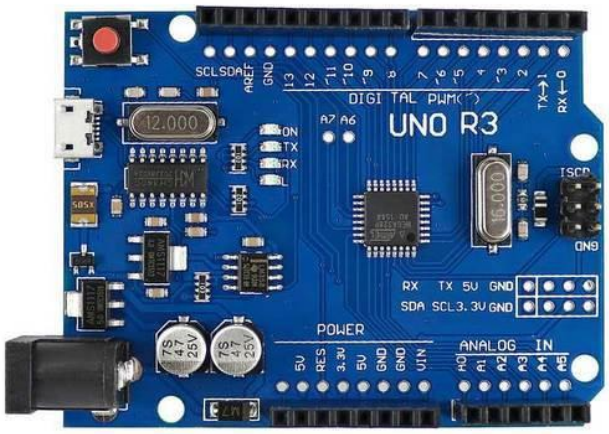


Fig:3.1: Arduino UNO

Pin Description :-

Pin Category	Pin Name	Details
Power	Vin, 3.3V, 5V, GND	Vin: Input voltage to Arduino when using an external power source. 5V: Regulated power supply used to power microcontroller and other components on the board. 3.3V: 3.3V supply generated by on-board voltage regulator. Maximum current draw is 50mA. GND: ground pins.
Reset	Reset	Resets the microcontroller.
Analog Pins	A0 – A5	Used to provide analog input in the range of 0-5V

Input/Output Pins	Digital Pins 0 - 13	Can be used as input or output pins.
Serial	0(Rx), 1(Tx)	Used to receive and transmit TTL serial data.
External Interrupts	2, 3	To trigger an interrupt.
PWM	3, 5, 6, 9, 11	Provides 8-bit PWM output.
SPI	10 (SS), 11 (MOSI), 12 (MISO) and 13 (SCK)	Used for SPI communication.
Inbuilt LED	13	To turn on the inbuilt LED.
TWI	A4 (SDA), A5 (SCA)	Used for TWI communication.
AREF	AREF	To provide reference voltage for input voltage.

Parameters For Arduino UNO Description :-

Microcontroller	ATmega328
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limits)	6-20V
Digital I/O Pins	14
Analog Input Pins	6
DC Current per I/O Pin	40 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32KB(ATmega328) of which 0.5KB used by bootloader
SRAM	2 KB (ATmega328)
EEPROM	1 KB (ATmega328)
Clock Speed	16MHz

3.2 HC-SR04 Ultrasonic Sensor :-

HC-SR04 Sensor Features :-

- Operating voltage: +5V
- Theoretical Measuring Distance: 2cm to 450cm
- Practical Measuring Distance: 2cm to 80cm
- Accuracy: 3mm
- Measuring angle covered: <15°
- Operating Current: <15mA
- Operating Frequency: 40Hz

Fig 3.2 HC-SR04 Ultrasonic Sensor

As shown above the **HC-SR04 Ultrasonic (US) sensor** is a 4 pin module, whose pin names are VCC, Trigger, Echo and Ground respectively. This sensor is a very popular sensor used in many applications where measuring distance or sensing objects are required. The module has two eyes like projects in the front which forms the Ultrasonic transmitter and Receiver. The sensor works with the simple high school formula that

Distance = Speed × Time

How to use the HC-SR04 Ultrasonic Sensor :-

HC-SR04 distance sensor is commonly used with both microcontroller and microprocessor platforms like Arduino, ARM, PIC, Raspberry Pie etc. The following guide is universally since it has to be followed irrespective of the type of computational device used.

Power the Sensor using a regulated +5V through the VCC ad Ground pins of the sensor. The current consumed by the sensor is less than 15mA and hence can be directly powered by the on

board 5V pins (If available). The Trigger and the Echo pins are both I/O pins and hence they can be connected to I/O pins of the microcontroller. To start the measurement, the trigger pin has to be made high for 10uS and then turned off. This action will trigger an ultrasonic wave at frequency of 40Hz from the transmitter and the receiver will wait for the wave to return. Once the wave is returned after it getting reflected by any object the Echo pin goes high for a particular amount of time which will be equal to the time taken for the wave to return back to the sensor.

The amount of time during which the Echo pin stays high is measured by the MCU/MPU as it gives the information about the time taken for the wave to return back to the Sensor. Using this information the distance is measured as explained in the above heading.

Ultrasonic Sensor Pin Configuration :-

Pin Number	Pin Name	Description
1	VCC	The VCC pin powers the sensor, typically with +5V
2	Trigger	Trigger pin is an Input pin. This pin has to be kept high for 10us to initialize measurement by sending US wave.
3	Echo	Echo pin is an Output pin. This pin goes high for a period of time which will be equal to the time taken for the US wave to return back to the sensor.
4	Ground	This pin is connected to the Ground of the system.

3.3 DHT11 Temperature And Humidity Sensor :-

The **DHT11** is a commonly used **Temperature and humidity sensor.** The sensor comes with a dedicated NTC to measure temperature and an 8-bit microcontroller to output the values of temperature and humidity as serial data. The sensor is also factory calibrated and hence easy to interface with other microcontrollers.

The sensor can measure temperature from 0°C to 50°C and humidity from 20% to 90% with an accuracy of ±1°C and ±1%.

DHT11 Specifications:

- Operating Voltage: 3.5V to 5.5V
- Operating current: 0.3mA (measuring) 60uA (standby)
- Output: Serial data
- Temperature Range: 0°C to 50°C
- Humidity Range: 20% to 90%
- Resolution: Temperature and Humidity both are 16-bit
- Accuracy: ±1°C and ±1%

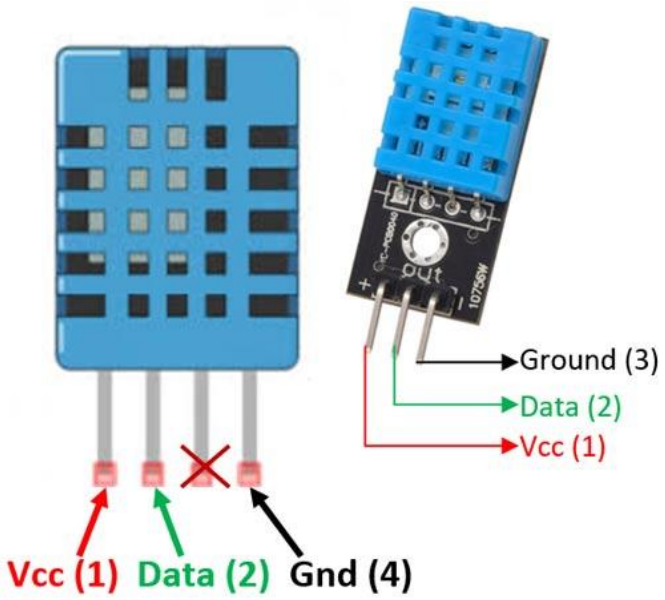


Fig. 3.3 DHT11 Temperature And Humidity Sensor

Pin Configuration :-

No:	Pin Name	Description
1	Vcc	Power supply 3.5V to 5.5V
2	Data	Outputs both Temperature and Humidity through serial Data
3	NC	No Connection and hence not used
4	Ground	Connected to the ground of the circuit

3.4 IR Proximity Sensor :-

IR Sensor Module Features :-

- Operating voltage
- I/O pins are 5V and 3.3V compliant
- Range: Up to 20cm
- Adjustable Sensing range
- Built-in Ambient Light Sensor
- 20mA supply current
- Mounting hole

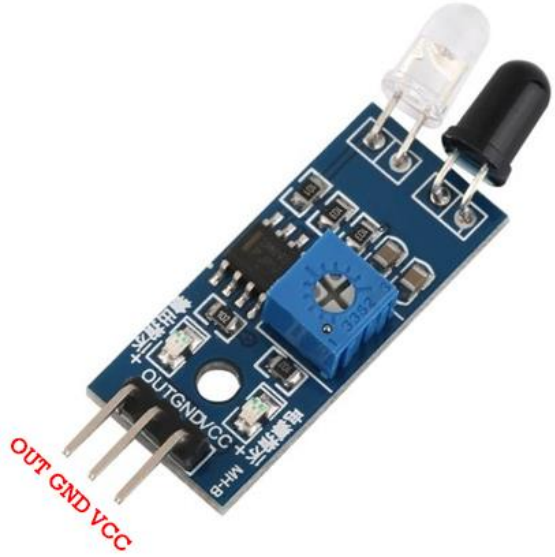


Fig. 3.4 IR Proximity Sensor

The IR sensor module consists mainly of the IR Transmitter and Receiver, Opamp, Variable Resistor (Trimmer pot), output LED in brief.

IR LED Transmitter

IR LED emits light, in the range of Infrared frequency. IR light is invisible to us as its wavelength (700nm – 1mm) is much higher than the visible light range. IR LEDs have light emitting angle of approx. 20-60 degree and range of approx. few centimeters to several feets, it depends upon the type of IR transmitter and the manufacturer. Some transmitters have the range in kilometers. IR LED white or transparent in colour, so it can give out amount of maximum light.

Photodiode Receiver

Photodiode acts as the IR receiver as its conducts when light falls on it. Photodiode is a semiconductor which has a P-N junction, operated in Reverse Bias, means it start conducting the

current in reverse direction when Light falls on it, and the amount of current flow is proportional to the amount of Light. This property makes it useful for IR detection. Photodiode looks like a LED, with a black colour coating on its outer side, Black colour absorbs the highest amount of light.

LM358 Opamp :-

LM358 is an Operational Amplifier (Op-Amp) is used as voltage comparator in the IR sensor. the comparator will compare the threshold voltage set using the preset (pin2) and the photodiode's series resistor voltage (pin3).

Photodiode's series resistor voltage drop > Threshold voltage = Opamp output is High

Photodiode's series resistor voltage drop < Threshold voltage = Opamp output is Low

When Opamp's output is **high** the LED at the Opamp output terminal **turns ON** (Indicating the detection of Object).

Variable Resistor

The variable resistor used here is a preset. It is used to calibrate the distance range at which object should be detected.

Pin Configuration :-

Pin Name	Description
VCC	Power Supply Input
GND	Power Supply Ground
OUT	Active High Output

3.5 Servo Motor :-

Servo Motor Features :-

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

Fig. 3.5 Servo Motor

Servo motors operates 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 you 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.

Wire Configuration :-

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

3.6 GPS:-

The GPS (Global Positioning System) is a "constellation" of approximately 30 well-spaced satellites that orbit the Earth and make it possible for people with ground receivers to pinpoint their geographic location. The location accuracy is anywhere from 100 to 10 meters for most equipment. Accuracy can be pinpointed to within one (1) meter with special military-approved equipment. GPS equipment is widely used in science and has now become sufficiently low-cost so that almost anyone can own a GPS receiver.

The **NEO-6MV2** is a **GPS** (Global Positioning System) module and is used for navigation. The module simply checks its location on earth and provides output data which is longitude and latitude of its position.It is from a family of stand-alone GPS receivers featuring the high performance u-blox 6 positioning engine. These flexible and cost effective receivers offer numerous connectivity options in a miniature (16 x 12.2 x 2.4 mm) package. The compact architecture, power and memory options make **NEO-6 modules** ideal for **battery operated mobile devices** with very strict cost and space constraints. Its Innovative design gives **NEO-6MV2** excellent navigation performance even in the most challenging environments.

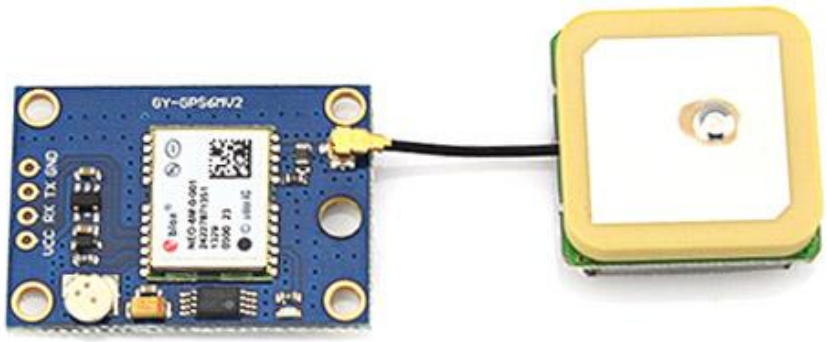


Fig. 3.6 NEO-6MV2 GPS

GPS Features :-

- Standalone GPS receiver
- Anti-jamming technology
- UART Interface at the output pins (Can use SPI ,I2C and USB by soldering pins to the chip core)
- Under 1 second time-to-first-fix for hot and aided starts
- Receiver type: 50 Channels - GPS L1 frequency - SBAS (WAAS, EGNOS, MSAS, GAGAN)
- Time-To-First-fix: For Cold Start 32s, For Warm Start 23s, For Hot Start <1s
- Maximum navigation update rate: 5Hz
- Default baud rate: 9600bps
- EEPROM with battery backup
- Sensitivity: -160dBm
- Supply voltage: 3.6V
- Maximum DC current at any output: 10mA
- Operation limits: Gravity-4g, Altitude-50000m, Velocity-500m/s
- Operating temperature range: -40ºC TO 85°C

GPS Module Pin Configuration :-

The module has four output pins and we will describe the function each pin of them below. The powering of module and communication interface is done through these four pins.

Pin Name	Description
VCC	Positive power pin
RX	UART receive pin
TX	UART transmit pin
GND	Ground

3.7 Wi-Fi Module :-

The module can work both as a Access point (can create hotspot) and as a station (can connect to Wi-Fi), hence it can easily fetch data and upload it to the internet making **Internet of Things** as easy as possible. The **ESP8266 module** works with 3.3V only, anything more than 3.7V would kill the module hence be cautions with your circuits. The best way to program an **ESP-01** is by using the FTDI board that supports 3.3V programming. If you don't have one it is recommended to buy one or for time being you can also use an Arduino board. One commonly problem that every one faces with ESP-01 is the powering up problem. The module is a bit power hungry while programming and hence you can power it with a 3.3V pin on Arduino or just use a potential divider. So it is important to make a small voltage regulator for 3.31v that could supply a minimum of 500mA.

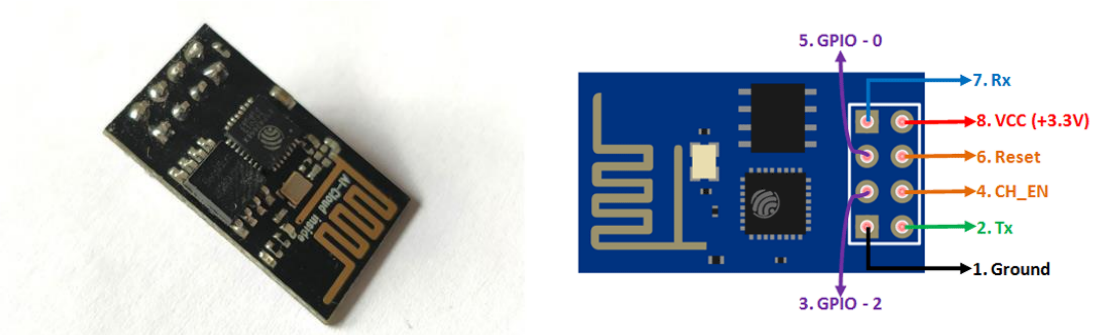


Fig. 3.7 ESP8266 Wi-Fi Module

ESP8266 Wi-Fi Module Features :-

- Low cost, compact and powerful Wi-Fi Module
- Power Supply: +3.3V only
- Current Consumption: 100mA
- I/O Voltage: 3.6V (max)
- I/O source current: 12mA (max)
- Built-in low power 32-bit MCU @ 80MHz
- 512kB Flash Memory
- Can be used as Station or Access Point or both combined
- Supports Deep sleep (<10uA)
- Supports serial communication hence compatible with many development platform like Arduino
- Can be programmed using Arduino IDE or AT-commands or Lua Script

ESP8266 Pin Configuration :-

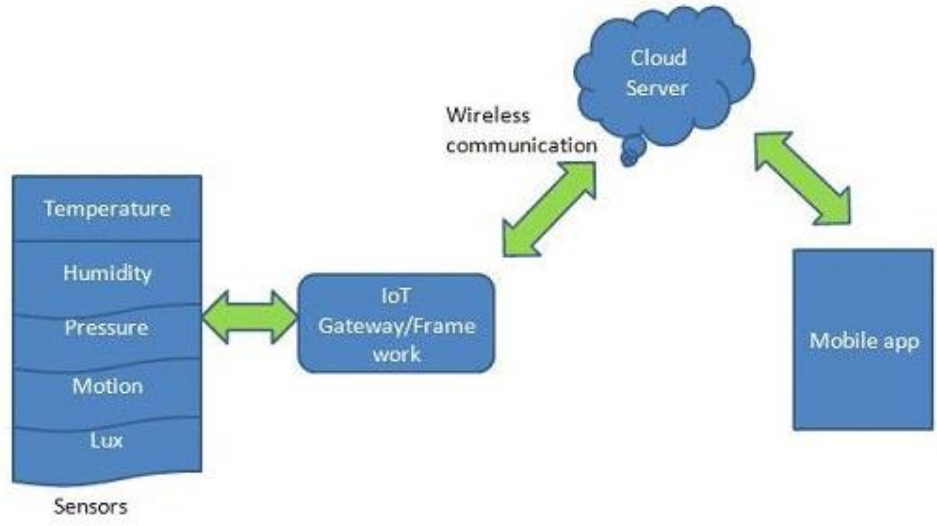
Pin Number	Pin Name	Alternate Name	Normally used for	Alternate purpose
1	**Ground**	-	Connected to the ground of the circuit	-
2	**TX**	GPIO – 1	Connected to Rx pin of programmer/uC to upload program	Can act as a General purpose Input/output pin when not used as TX
3	**GPIO-2**	-	General purpose Input/output pin	-
4	**CH_EN**	-	Chip Enable – Active high	-
5	**GPIO - 0**	Flash	General purpose Input/output pin	Takes module into serial programming when held low during start up
6	**Reset**	-	Resets the module	-
7	**RX**	GPIO - 3	General purpose Input/output pin	Can act as a General purpose Input/output pin when not used as RX
8	**Vcc**	-	Connect to +3.3V only	

3.8 IoT :-

What Is IoT?

The Internet of Things (IoT) describes the network of physical objects—"things"—that are embedded with sensors, software, and other technologies for the purpose of connecting and exchanging data with other devices and systems over the internet. These devices range from ordinary household objects to sophisticated industrial tools. With more than 7 billion connected IoT devices today, experts are expecting this number to grow to 10 billion by 2020 and 22 billion by 2025.

Fig.1. Definition of IOT



What is an IoT Platform?

A multi-layer technology which is used to manage and automate the connected devices is known as the **IoT platform.** In other words, it is a service which helps you in bringing the physical objects online. This platform will provide you with the services to connect the devices for a machine to machine communication.

Types of Internet of Things Platforms:

- End to end
- Connectivity
- Cloud
- Data

IoT platform	Services	Device management platform	Price
Google Cloud Platform	Organizing, managing, and sharing documents. Solutions for smart cities and buildings, and real-time asset tracking.	Yes	Price starts at $1758 per month.
IRI Voracity	Runtime aggregation on the edge, and/or analytics in hub.	--	Affordable annual or perpetual (wide range).
Particle	Hardware, Connectivity, Device Cloud, and Apps.	Yes	Wi-Fi: Starts at $25 per device. Cellular: Starts at $49 per device. Mesh: Starts at $15 per device.

IoT platform	Services	Device management platform	Price
Salesforce IoT Cloud	Data from customers, partners, devices, and sensors.	--	Contact them.
ThingWorx	End-to-end Industrial IoT platform.	Yes	Contact them.
IBM Watson IoT	Connection Service, Analytics Service, Blockchain Service.	Yes	Starts at $500 per instance/month.

IOTGecko : Open Source IoT Development Platform :-

Monitor and operate your **IoT** system with desired GUI using IOTGecko. Choose from a wide variety of **IoT** themes ranging from Home automation to liquid sensing and pollution monitoring. IOTGecko offers the largest platform to operate and develop internet of things based systems with ease.

Blynk IoT Platform (Blynk App) :-

Blynk is a new platform that allows you to quickly build interfaces for controlling and monitoring your hardware projects from your iOS and Android device. After downloading the **Blynk app**, you can create a project dashboard and arrange buttons, sliders, graphs, and other widgets onto the screen. **IOTGecko : Open Source IoT Development Platform :-**

Monitor and operate your **IoT** system with desired GUI using IOTGecko. Choose from a wide variety of **IoT** themes ranging from Home automation to liquid sensing and pollution monitoring. IOTGecko offers the largest platform to operate and develop internet of things based systems with ease.

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What Technologies Have Made IoT Possible?

While the idea of IoT has been in existence for a long time, a collection of recent advances in a number of different technologies has made it practical.

- **Access to low-cost, low-power sensor technology.** Affordable and reliable sensors are making IoT technology possible for more manufacturers.
- **Connectivity.** A host of network protocols for the internet has made it easy to connect sensors to the cloud and to other "things" for efficient data transfer.
- **Cloud computing platforms.** The increase in the availability of cloud platforms enables both businesses and consumers to access the infrastructure they need to scale up without actually having to manage it all.
- **Machine learning and analytics.** With advances in machine learning and analytics, along with access to varied and vast amounts of data stored in the cloud, businesses can gather insights faster and more easily. The emergence of these allied technologies continues to push the boundaries of IoT and the data produced by IoT also feeds these technologies.
- **Conversational artificial intelligence (AI).** Advances in neural networks have brought natural-language processing (NLP) to IoT devices (such as digital personal assistants Alexa, Cortana, and Siri) and made them appealing, affordable, and viable for home use.

Applications:-

The ability of IOT to provide sensor information as well as enable device-to-device communication is driving a broad set of applications. The following are some of the most popular applications and what they do.

- Create new efficiencies in manufacturing through machine monitoring and product-quality monitoring. Machines can be continuously monitored and analyzed to make sure they are performing within required tolerances. Products can also be monitored in real time to identify and address quality defects.
- Improve the tracking and "ring-fencing" of physical assets. Tracking enables businesses to quickly determine asset location. Ring-fencing allows them to make sure that high-value assets are protected from theft and removal.

- Use wearables to monitor human health analytics and environmental conditions. IoT wearables enable people to better understand their own health and allow physicians to remotely monitor patients. This technology also enables companies to track the health and safety of their employees, which is especially useful for workers employed in hazardous conditions.
- Drive efficiencies and new possibilities in existing processes. One example of this is the use of IoT to increase efficiency and safety in fleet management. Companies can use IoT fleet monitoring to direct trucks, in real time, to improve efficiency.
- Enable business process changes. An example of this is the use of IoT devices to monitor the health of remote machines and trigger service calls for preventive maintenance. The ability to remotely monitor machines is also enabling new product-as-a-service business models, where customers no longer need to buy a product but instead pay for its usage.

4 System Implementations(Circuit Diagram)

4.1 circuit diagram

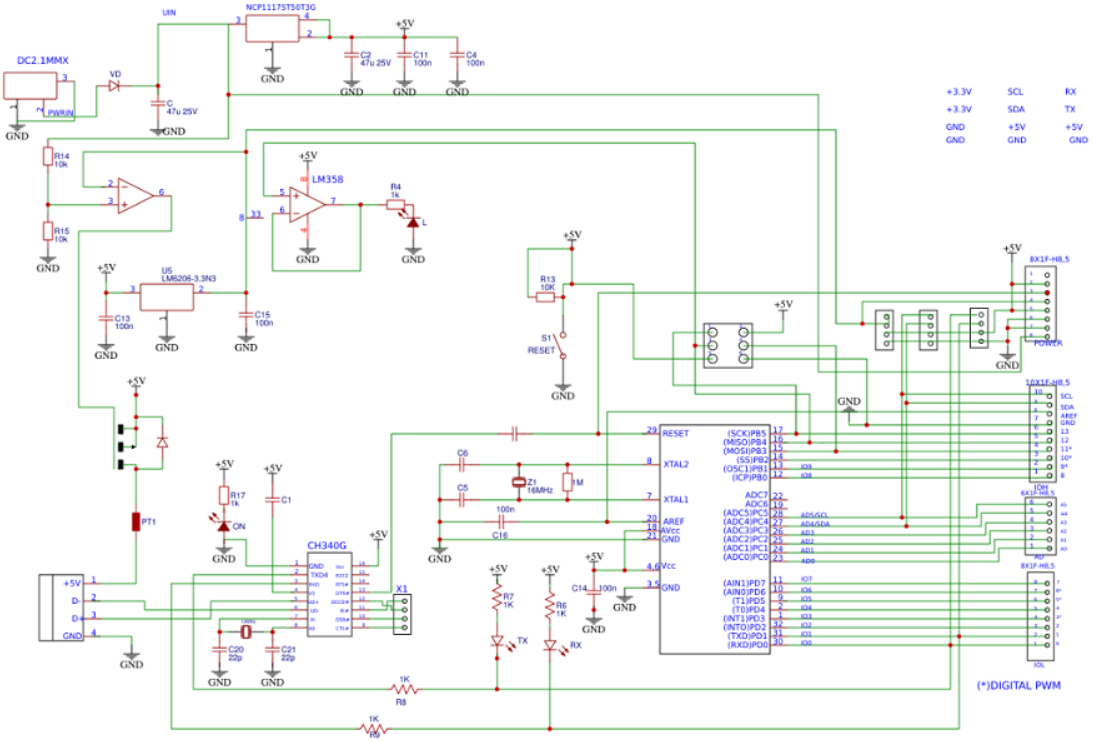


Fig . 4.1 Circuit Diagram of Arduino UNO R3

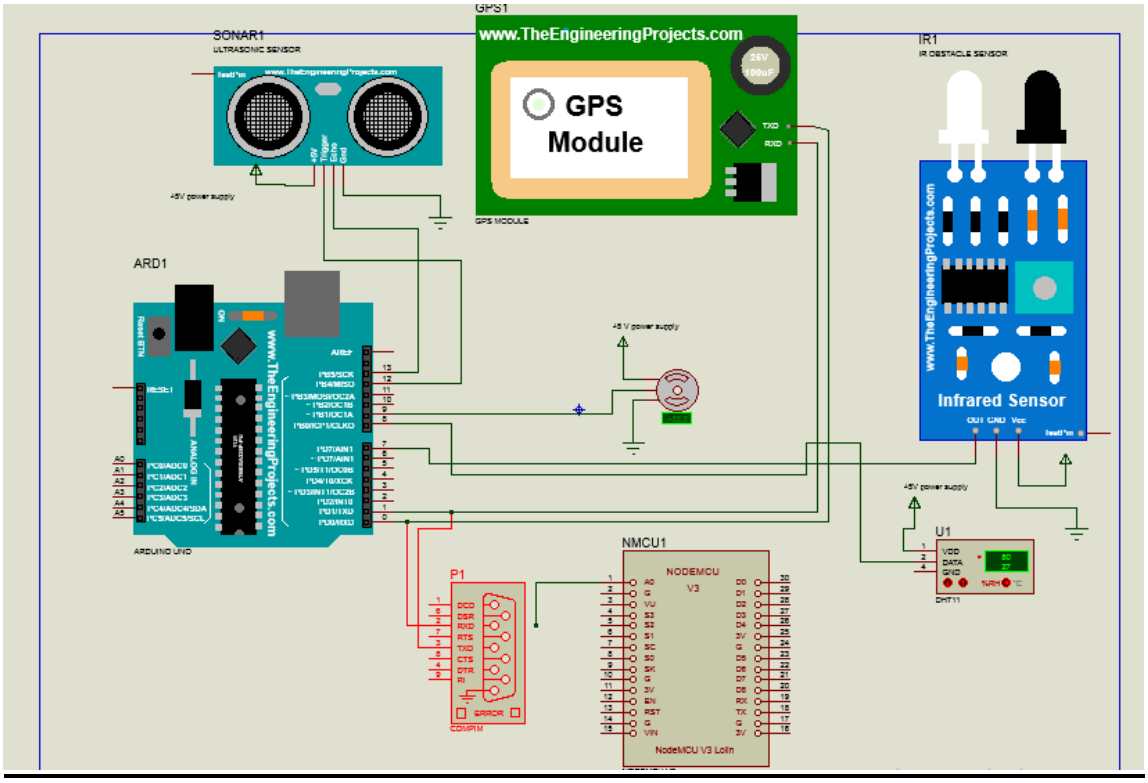


fig:4.2:Circuit Diagram

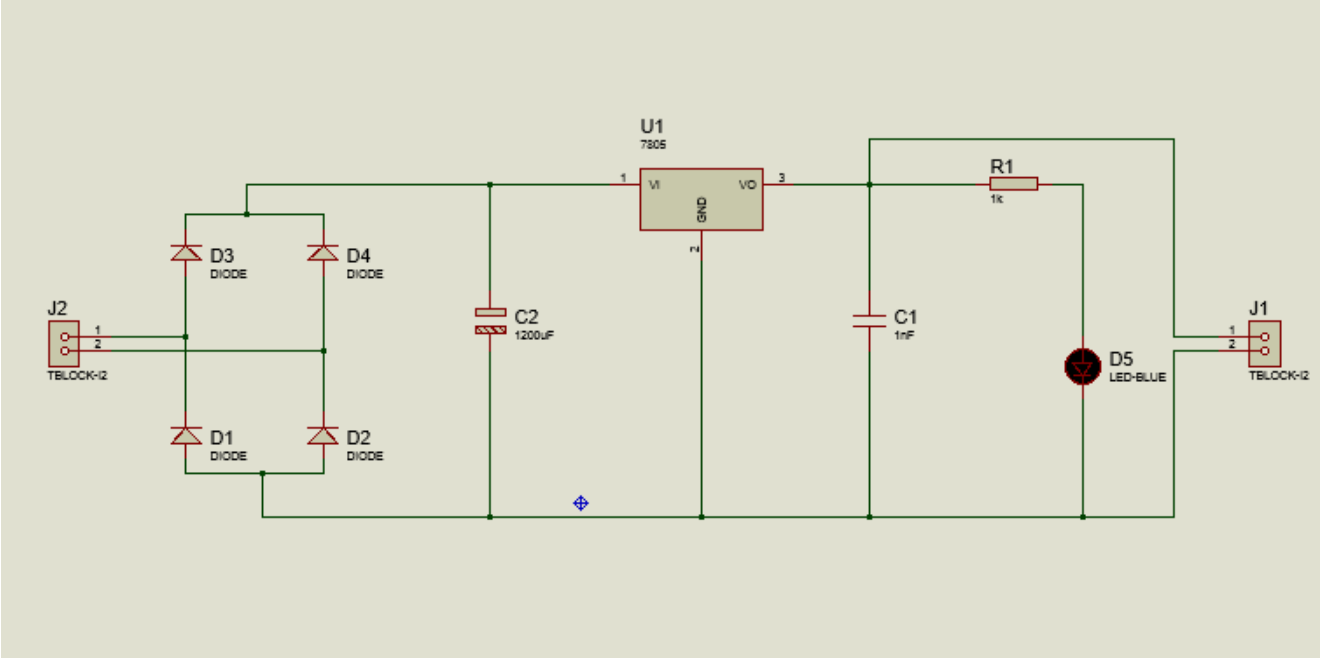


fig:4.3:Circuit Diagram power supply

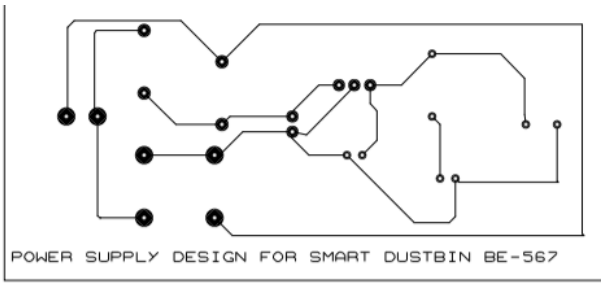
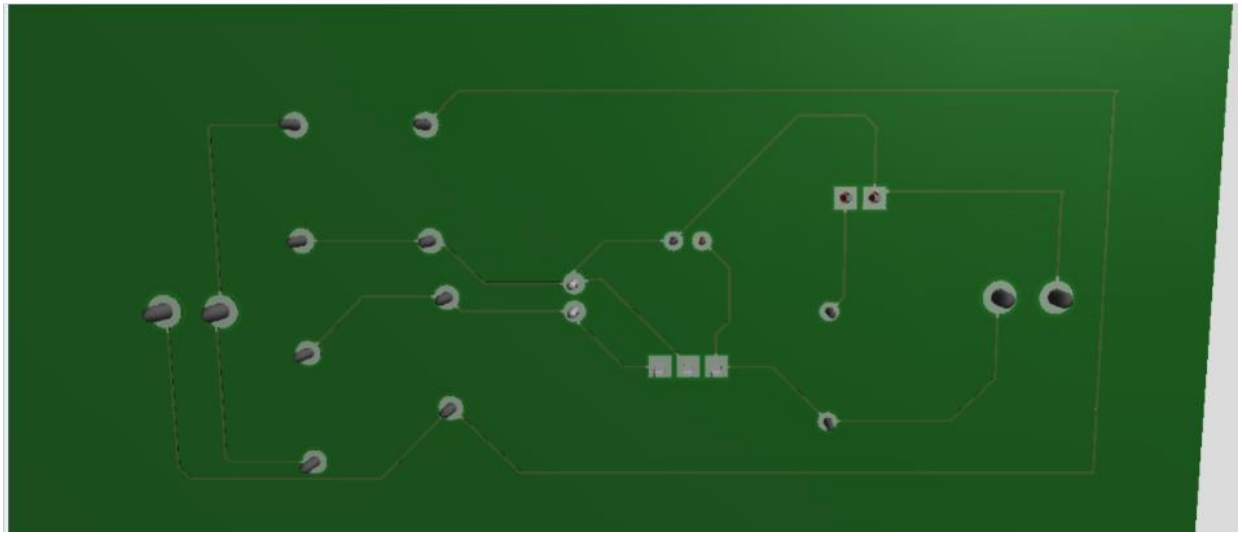


Fig: 4.4 : Layout of Power Supply



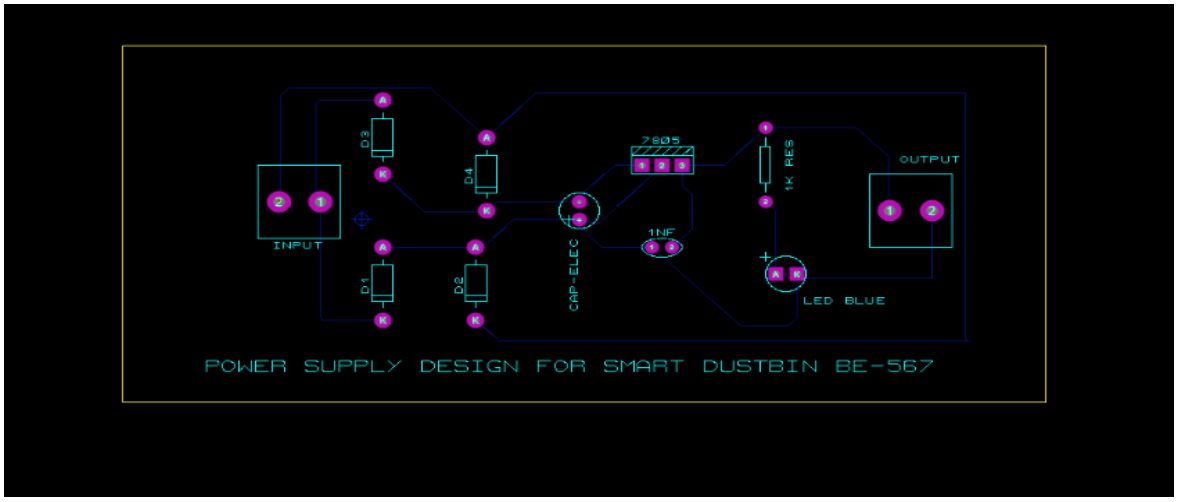


Fig: 4.5: Layout of Power Supply

4.2 simulation :

1. **<u>servo motor</u>**

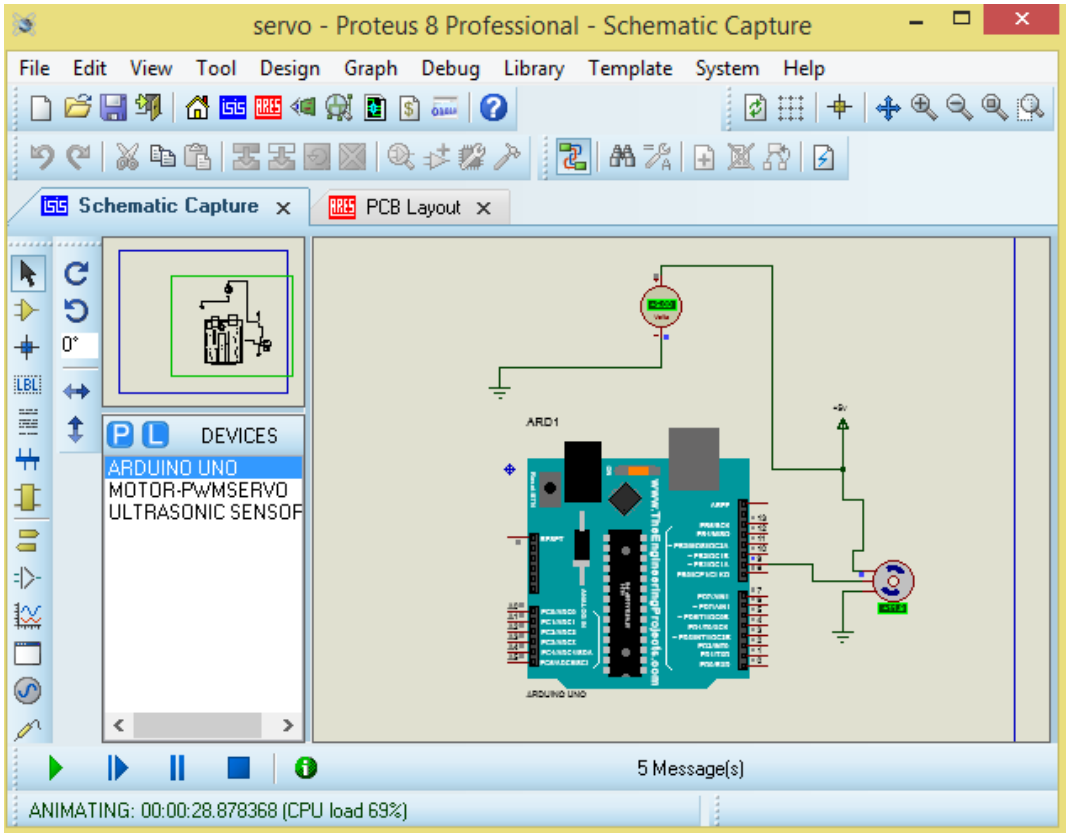


Fig: 4.2: Proteus Simulation servo motor

2. Ultrasonic sensor

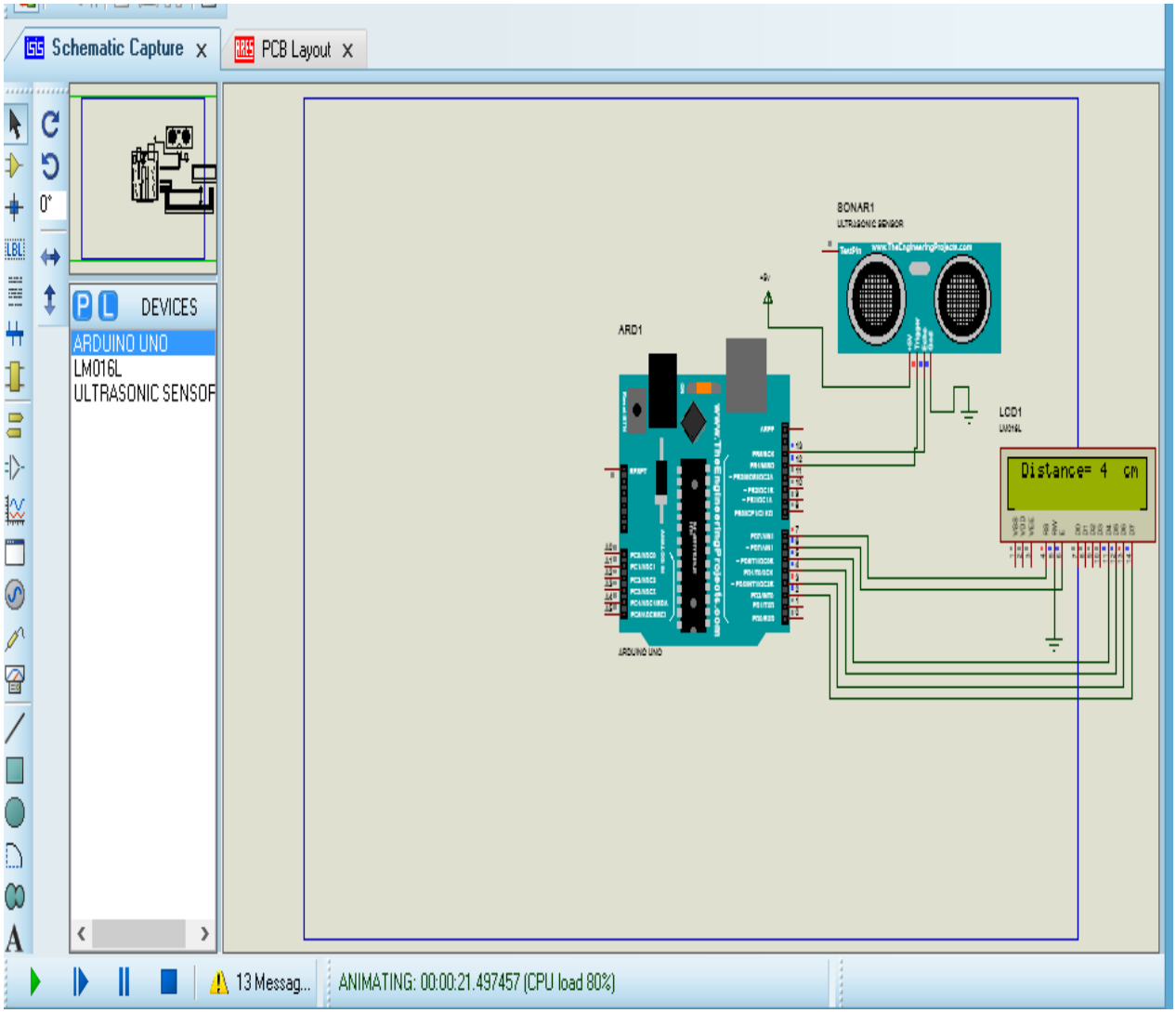


Fig: 4.3: Proteus Simulation

3. IR sensor

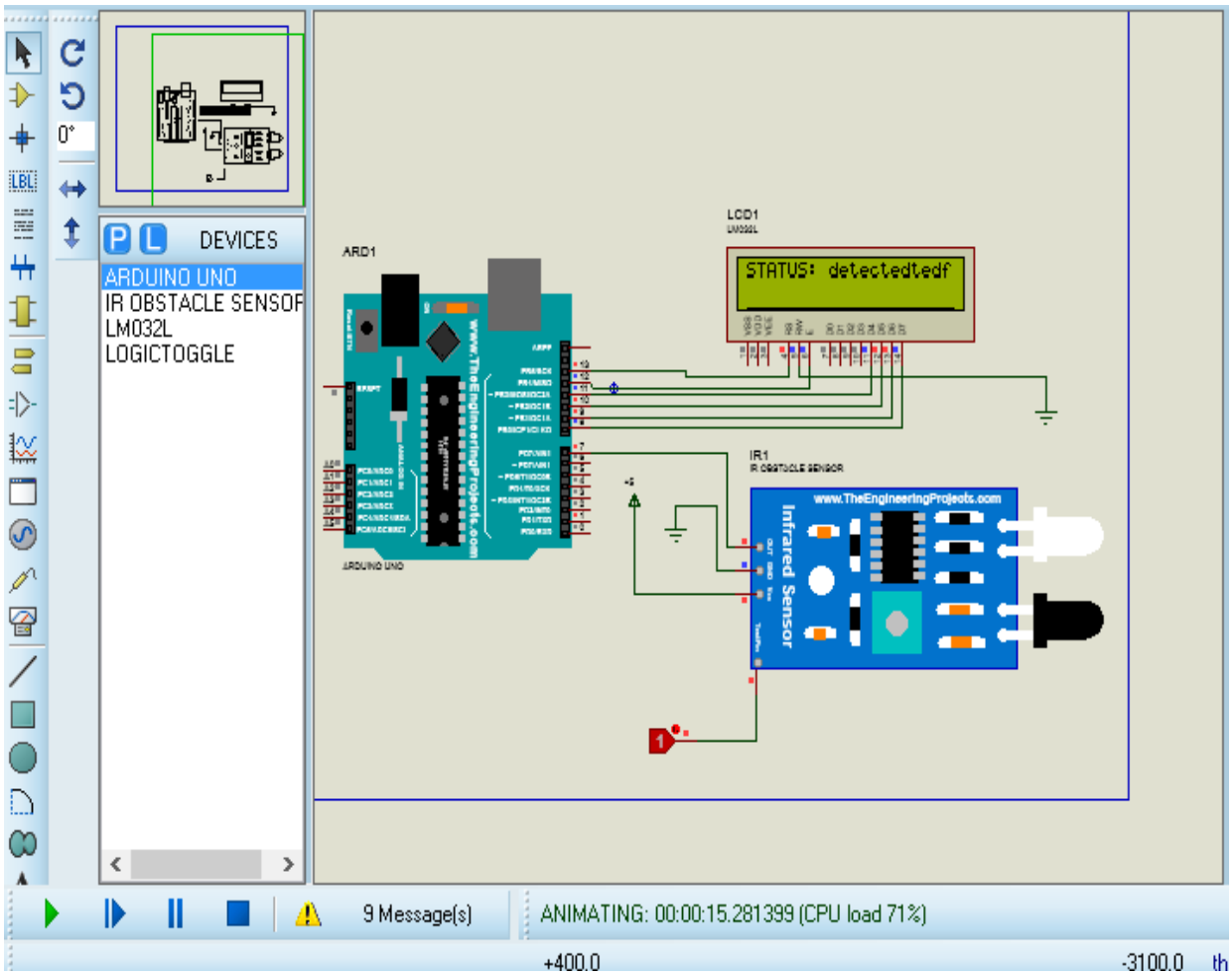


Fig: 4.4: Proteus Simulation

4. GPS module

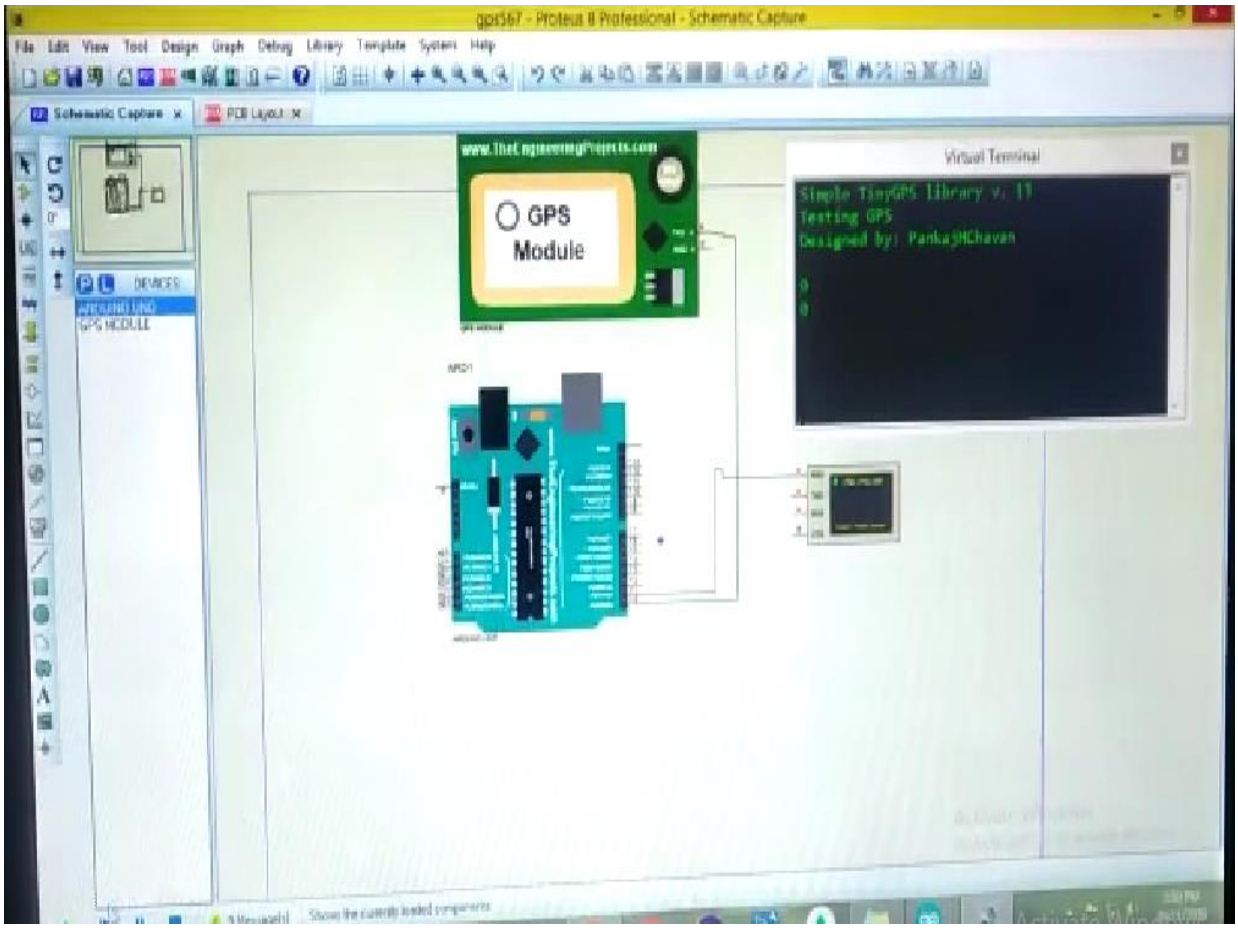


Fig: 4.5: Proteus Simulation

5.Temperature and humidity sensor

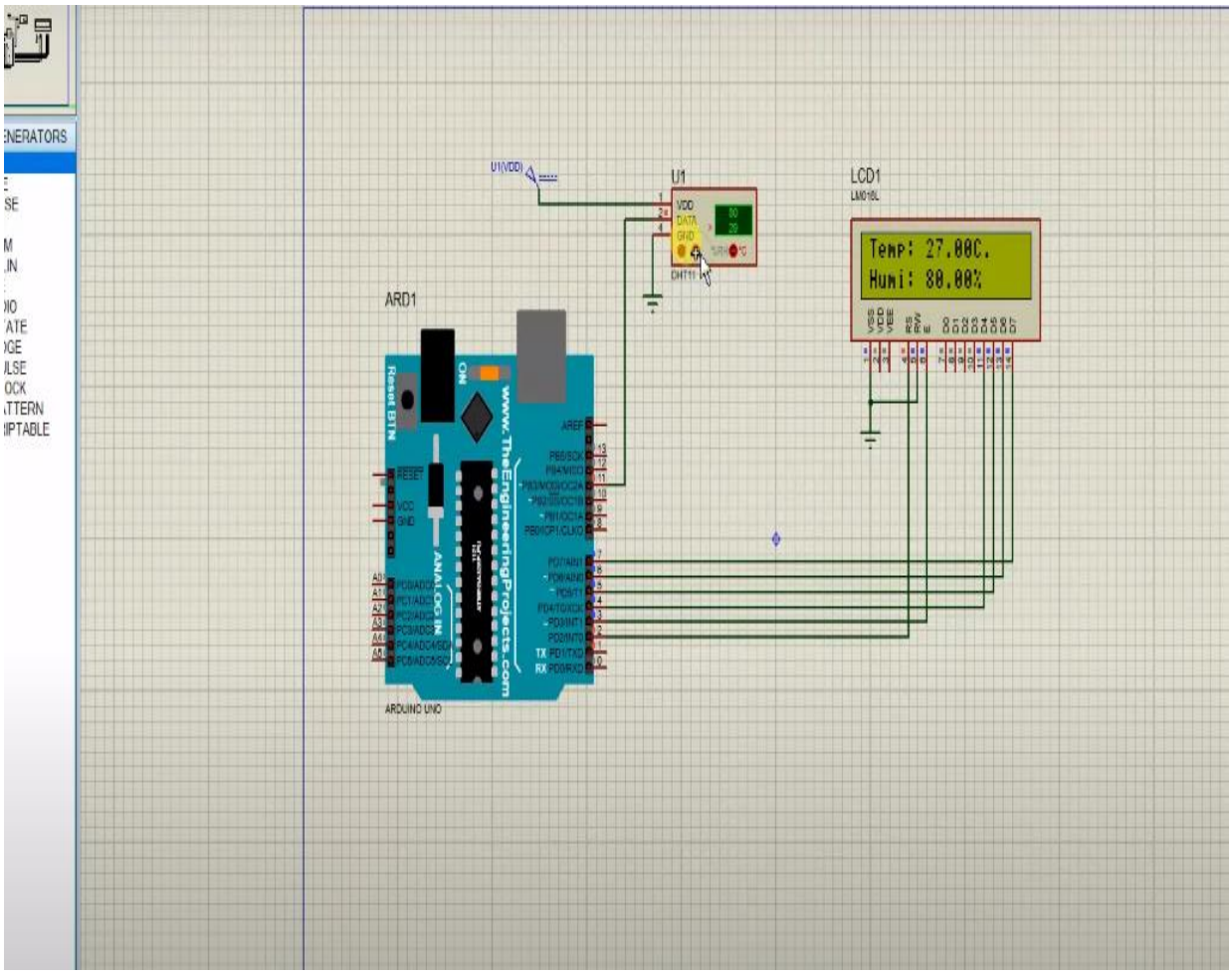


Fig: 4.6: Proteus Simulation

4.3 FLOWCHART

The flowchart given below represents the working of the system.

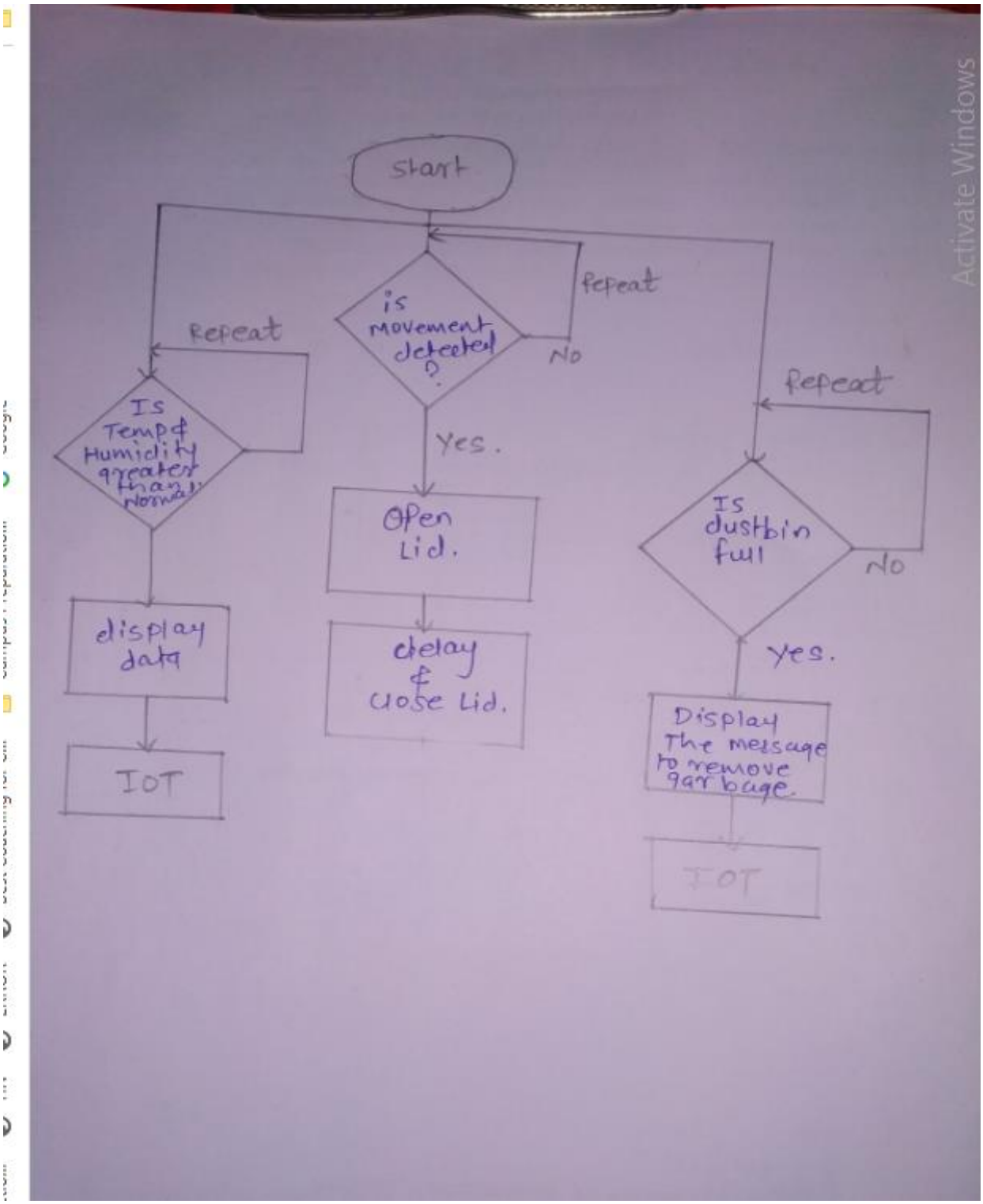


Fig: 4.7: Flowchart of overall working

5. System Overview

Fig: 5.1: expected Overview of IOT system

5.2 expected overview dustbin

Conclusion:-

1. Automatically opens up by sensing when someone wants to throw garbage into it
2. Provide info if it is full
3. Battery powered or solar powered (may be both depending upon cost effectiveness).
4. GPS for tracking location
5. Temperature and humidity monitoring or smell monitoring.
   Store the the data on IOT platform like IOT gecko

Advantages:

- Very simple circuit.
- The HCSR04 sensor is very rugged.
- Helps monitor garbage levels.
- Uses very small amount of electricity.
- Ultimately helps in better planning of garbage pickups.
- Can help in reducing overflowing bins.
- Reduces trips to areas where the bins still have a lot of capacity.

Disadvantages:

- Cannot detect liquid waste.
- Only detects the top of the garbage level.
- It wouldn't realize if there is space left.

APPLICATIONS:-

- vast usage in offices, homes and even in public places for garbage management
- No physical contact
- Fully automatic ,suited to smart city
- Allows for automated garbage cleaning.
- Real time tracking of garbage collection and area.

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