

**POLITEKNIK SULTAN SALAHUDDIN ABDUL AZIZ SHAH**

**IOT GARBAGE MONITORING SYSTEM**

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08DEP19F2010**

**JABATAN KEJURUTERAAN ELEKTRIK**

**SESI 2 2022/2023**

**POLITEKNIK**

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**IOT GARBAGE MONITORING SYSTEM**

NAME `AMAR HAZIQ HUSNI  
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This report submitted to the Electrical Engineering Department in fulfillment of the requirement for a Diploma in Electrical Engineering

**JABATAN KEJURUTERAAN ELEKTRIK**

**SESI 2 2022/2023**

## CONFIRMATION OF THE PROJECT

The project report titled "IOT Garbage Monitoring System" has been submitted, reviewed and verified as a fulfills the conditions and requirements of the Project Writing as stipulated

Checked by:

Supervisor's name :

Supervisor's signature:

Date :

  
**ZABIDAH BT HARON**  
**PENSYARAH DH44**  
**Jabatan Kejuruteraan Elektrik**  
**Politeknik Sultan Salahuddin**  
**Abdul Aziz Shah**

Verified by:

Project Coordinator name :

Signature of Coordinator :

Date :

“I acknowledge this work is my own work except the excerpts I have already explained to our source”

1. Signature

: 

Name : **Amar Haziq Husni Bin Azam Husni**

Registration Number : **08DEP19F2010**

Date : 26/12/2022

## DECLARATION OF ORIGINALITY AND OWNERSHIP

TITLE : IOT GARBAGE MONITORING SYSTEM

SESSION: DECEMBER 2017

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2. I acknowledge that 'The Project above' and the intellectual property therein is the result of our original creation /creations without taking or impersonating any intellectual property from the other parties.
3. I agree to release the 'Project' intellectual property to 'The Polytechnics' to meet the requirements for awarding the Diploma in Electrical Engineering to me.

Made and in truth that is recognized by;

a) (Amar Haziq  
Husni Bin Azam  
Husni)

(Identification card No: -  
011124140317)

.....  .....  
( `Amar Haziq Husni )

In front of me, ( )  
( ZABIDAH BINTI HARON )  
As a project supervisor,  
on the date:

.....  .....  
(ZABIDAH BT HARON)  
PENSYARAH DH44  
Jabatan Kejuruteraan Elektrik  
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Abdul Aziz Shah

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My thanks and appreciations also go to my colleague in developing the Project and people who have willingly helped me out with their abilities.

## **ABSTRACT**

Nowadays certain actions are taken to improve the level of cleanliness in the country. People are getting more active in doing all the things possible to clean their surroundings. Various movements are also started by the government to increase cleanliness. We will try to build a system which will notify the corporations to empty the bin on time. In this system, we will put a sensor on top of the garbage bin which will detect the total level of garbage inside it according to the total size of the bin. When the garbage will reach the maximum level, a notification will be sent to the corporation's office, then the employees can take further actions to empty the bin. This system will help in cleaning the city in a better way. By using this system people do not have to check all the systems manually but they will get a notification when the bin will get filled.

## **ABSTRAK**

Pada masa kini beberapa tindakan telah diambil untuk meningkatkan tahap kebersihan di Negara. Orang ramai semakin aktif dalam melakukan semua perkara yang mungkin untuk membersihkan persekitaran mereka. Pelbagai gerakan turut dimulakan oleh kerajaan untuk meningkat kebersihan. Kami akan cuba membina sistem yang akan memberitahu syarikat untuk mengosongkan tong sampah tepat pada masanya. Dalam sistem ini, kita akan meletakkan sensor di atas tong sampah yang akan mengesan jumlah paras sampah di dalamnya mengikut jumlah saiz tong. Apabila sampah akan mencapai tahap maksimum, pemberitahuan akan dihantar kepada pejabat perbadanan, maka pekerja boleh mengambil tindakan selanjutnya untuk mengosongkan tong sampah. Sistem ini akan membantu dalam membersihkan bandar dengan cara yang lebih baik. Dengan menggunakan sistem ini orang tidak perlu menyemak semua sistem secara manual tetapi mereka akan mendapat pemberitahuan apabila tong sampah akan terisi.



## TABLE OF CONTENTS

<b>CONFIRMATION OF THE PROJECT</b>	<b>i</b>
<b>DECLARATION OF ORIGINALITY AND OWNERSHIP</b>	<b>iii</b>
<b>ACKNOWLEDGEMENTS</b>	<b>iv</b>
<b>ABSTRACT</b>	<b>v</b>
<b>ABSTRAK</b>	<b>vi</b>
<b>TABLE OF CONTENTS</b>	<b>vii</b>
<b>LIST OF FIGURES</b>	<b>1</b>
<b>CHAPTER 1</b>	<b>2</b>
<b>1 INTRODUCTION</b>	<b>2</b>
1.1 Introduction	2
1.2 Background Research	2
1.3 Problem Statement	3
1.4 Research Objectives	3
1.5 Scope of Research	3
1.6 Project Significance	3
1.7 Chapter Summary	4
<b>CHAPTER 2</b>	<b>5</b>
<b>2 LITERATURE REVIEW</b>	<b>5</b>
2.1 Introduction	5
2.2 IOT Based Garbage Monitoring System and Sorting System	5
2.2.1 Previous Research	5
2.3 Drone Based Smart Garbage Monitoring System Using Computer Vision	5
2.4 Chapter Summary	6
<b>CHAPTER 3</b>	<b>7</b>
<b>3 RESEARCH METHODOLOGY</b>	<b>7</b>
3.1 Introduction	7
3.2 Project Design and Overview.	7
3.2.1 Block Diagram of the Project	7
3.2.2 Flowchart of the Project 2	7
3.2.3 Project Description	8
3.3 Project Hardware	9
3.3.1 Schematic Circuit	9
3.3.2 Description of Main Component	10
3.3.2.1 Arduino Uno	10
3.3.2.2 ESP8266(Wi-Fi module)	10
3.3.2.3 Ultrasonic sensor	10
<b>r! Bookmark not defined.</b>	<b>10</b>
3.3.3 Circuit Operation	12
3.4 Project Software	12
3.4.1 Flowchart of the System	13
3.4.2 Description of Flowchart	13
	vii

3.5	Prototype Development	14
3.5.1	Mechanical Design/Product Layout	14
3.6	Sustainability Element in The Design Concept	14
3.7	Chapter Summary	14
<b>REFERENCES</b>		<b>16</b>

## **LIST OF FIGURES**

<b>FIGURE</b>	<b>TITLE</b>	<b>PAGE</b>
Figure 3.1:	Block diagram	7
Figure 3.2:	Flow chart of operation of the system	8
Figure 3.3:	Circuit Diagram	9
Figure 3.5:	Circuit sketch	14

# CHAPTER 1

## 1 INTRODUCTION

### 1.1 Introduction

IoT or Internet of Things refers to the network of connected physical objects that can communicate and exchange data among themselves without the desideratum of any human intervention. It has been formally defined as an “Infrastructure of Information Society” because IoT sanctions us to amass information from all kind of mediums such as humans, animals, conveyances, kitchen appliances. Thus, any object in the physical world which can be provided with an IP address to enable data transmission over a network can be made part of IoT system by embedding them with electronic hardware such as sensors, software and networking gear. IoT is different than Internet as in a way it transcends Internet connectivity by enabling everyday objects that utilizes embedded circuits to interact and communicate with each other utilizing the current Internet infrastructure.

In this paper, we are going to propose a system for the immediate cleaning of the dustbins. As dustbin is considered as a basic need to maintain the level of cleanliness in the city, so it is very important to clean all the dustbins as soon as they get filled. We will use ultrasonic sensors for this system. The sensor will be placed on top of bin which will help in sending the information to the office that the level of garbage has reached its maximum level. After this the bin should be emptied as soon as possible. The concept of IoT when used in this field will result in a better environment for the people to live in. No more unsanitary conditions will be formed in the city. With the help of this system minimal number of smart bins can be used around the whole city and the city will still be much cleaner.

### 1.2 Background Research

Solid waste management in the majority of developing countries including Malaysia is dominated by open dumping due to lower capital, operational and maintenance cost in comparison with another disposal method. This non-sanitary and non-engineered approach are without appropriate liners, gas collection and leachate collection and treatment, thereby exposing the surrounding environment with multiple air, water, and soil pollution issues. The effects of the ineffective management of household solid waste on public health can be separated into physical, biological, non-communicable diseases, psychosocial and ergonomics health risks. Contaminated soil, air and water provide breeding ground to biological vectors such as flies, rodents, and insects pests. Many diseases are sequentially caused by these biological vectors, such as diarrhea, dysentery, gastrointestinal problems, worm infection, food poisoning, dengue fever, cholera, leptospirosis and bacterial infection; irritation of the skin, nose and eyes; as well as respiratory symptoms. Exposure to gases generated by landfill waste such as methane, carbon dioxide, sulphur dioxide and nitrogen dioxide can produce inflammation and bronchoconstriction and can affect the immune cell.

Hydrogen chloride and hydrogen fluoride released from the waste if deposited in the respiratory system, may cause cough, chest tightness and breathlessness.

### **1.3 Problem Statement**

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.

### **1.4 Research Objectives**

The main objective of this Project is manage waste disposal by monitoring and alerting the responsible organization to take action

More specifically the principle objective of this research are:

1. To design garbage monitoring system
2. To implement cleanliness in places secluded or not
3. To develop way to make garbage disposing much easier and consume less time

### **1.5 Scope of Research**

1. This Project is focusing on waste monitoring
2. It will cost around RM200 across 120 days
3. The main controller is using Internet to send notifications, Wi-Fi that requires login credentials will not work.

### **1.6 Project Significance**

We notice different studies that emphasize on the need to be able to manage the amount of waste being generated and what percent of people actually take up the responsibility and take steps to ensure this. Also we can see how IOT modules are used to detect or track the waste for different waste bins or locations to be specific. We can also observe how with the use of IoT we can communicate between different devices and provide better solutions. From [1] and [2] we can observe that a major percentage of waste is

generated by building in different forms. This tends to put forward a simple observation that a very minor percentage of people actually take up the responsibility and regulate the amount of waste being generated from these main sources. Therefore this issue needs a proper solution. In [3] and [4] we can see how the IR sensors placed at appropriate position and ideal conditions can help detect the level of the waste generated and so be used to detecting the amount generated and equally take action on the same. Also in [5] we can observe that minimal number of sensors placed at appropriate places can prove cost effective and very efficient but still a way for proper real time notification is not present. The paper [6] explains us how the wifi chip can be used to communicate between different devices and therefore bring about many solutions in embedded systems. Therefore our literature survey identifies

1. Need for solution to manage the amount of waste generated
2. Detection using load sensors present but no method of real time action to be taken on the same.

## **1.7 Chapter Summary**

This chapter includes the main idea of this project as well as its functions and benefits to all. Research has been done to know the implications if waste are not dispose of properly and orderly. Cost is discussed and few limitations of this project. Inspired by another studies in making this project and how to improve it later in the future.

## CHAPTER 2

### 2 LITERATURE REVIEW

#### 2.1 Introduction

Waste and waste management has given rise to many pressing issues such as expensive land prices, strict environmental regulations, health and safety issues, improper management of waste disposal sites, landfill spaces becoming limited, policy problems, and the unwillingness of local communities to accept new technologies and facilities in 'their own back yards'. Failing in managing solid waste leads to increased operation cost and damaging the environment. In Malaysia, waste management and waste minimization is not the sole responsibility of Local authorities but most government agencies like the Ministry of Housing and Local Government, Ministry of Environment, Ministry Of Health, the various academic institutions and NGOs should work together to achieve this.

#### 2.2 IOT Based Garbage Monitoring System and Sorting System

This system is based on the separation and monitoring of garbage using Arduino Uno, Wi-Fi-module, ultrasonic sensor, moisturized sensor, gas sensor.

##### 2.2.1 Previous Research

In this system an Ultrasonic Sensor is used for detecting whether the trash can is filled with garbage or not 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. We will use ESP8266 WiFi module for connecting the Arduino to the web server. Here we have used Local web server to demonstrate the working of this Garbage Monitoring System. This system monitoring the garbage bins and informs about the level of garbage collected in the garbage bins via a web page. The system makes use Arduino, LCD screen, Wi-Fi modem for sending data The LCD screen is used to display status of the level of garbage collected in the bins. Where the web page is built to show the status of user monitoring it. The web page gives a graphic view of the garbage level.

#### 2.3 Drone Based Smart Garbage Monitoring System Using Computer Vision

Drone will capture the images and with the help of Arduino microcontroller it will manage the images, with the help of GSM and GPS module it will send the images and location to the in charge person. Smart system for the detection of garbage using image processing, which uses the drone to capture images of places with garbage. To inform It send

the image and location of that place to nearest garbage collection authority using Global Positioning System (GPS) and Global System for Mobile (GSM) module.

## **2.4 Chapter Summary**

This section focusing on two different studies that has their own way of monitoring and managing waste. One studies figured out a way to monitor and sort the garbage accordingly. While the other one is using drones to monitor places that is secluded and using IoT to send images from the drone to them or the responsible organization.



## CHAPTER 3

### 3 RESEARCH METHODOLOGY

#### 3.1 Introduction

To realize this Project as a product that ready to use with safety characteristic, a very comprehensive plan is undertaking. A step by step procedure is done so that the Project can be completed in time. This include collecting data of waste disposal, design the mechanical part, circuit design testing and verification.

#### 3.2 Project Design and Overview.

The designed circuit is using Arduino as the main controller. The design of the controller circuit using Arduino realizes using Proteus Software and then convert to PCB circuit. Blynk app are use as our IoT element to monitor the garbage level wherever and whenever we are.

##### 3.2.1 Block Diagram of the Project

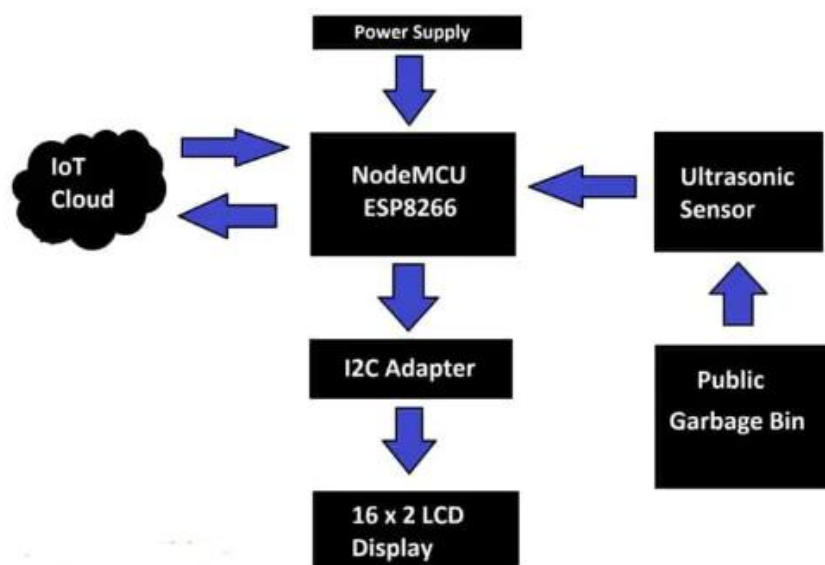


Figure 3.1 Block diagram

### 3.2.2 Flowchart of the Project 2

Figure 3.2 shows the circuit diagram of the whole system. It is show that it starts from the ultrasonic sensor sending the data to the microcontroller. Then the microcontroller will shows the data on the LCD display and the internet on Thingspeak using the WiFi module to connect to the Internet.

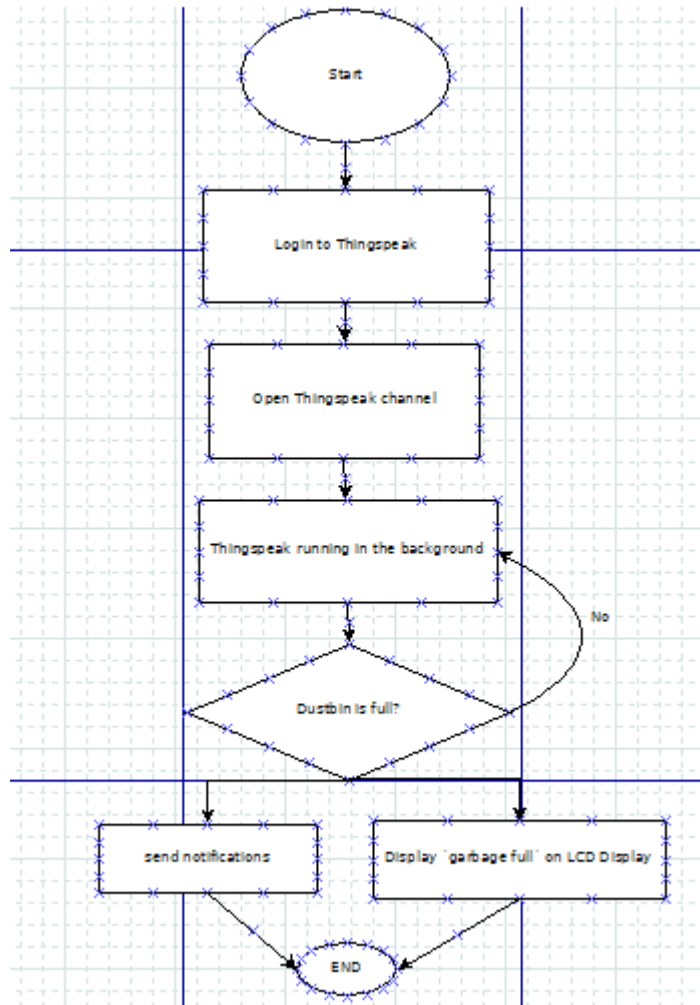


Figure 3.2: Flow chart of operation of the system

### **3.2.3 Project Description**

The existing system has the limitations as time consuming, trucks go and empty the containers, even they are empty. The cost is high with unhygienic environment. Even the bad odour causes the unhealthy environment. So, proposed model talks about how to make use of the recent advancements in technology to make our place clean and tidy. The implementation starts by setup ESP8266 by flashing the latest version of the firmware. This enable s the Blynk libraries efficiently communicate and avoid producing error.. To flash the latest firmware, download the ESP8266 flasher tool and the latest firmware from the internet which would be in the bin format and flash the ESP8266 with it. Once the ESP8266 flashing done, other components can be added to the configuration. we need a breadboard to connect the microcontroller, ultra sonic sensor, buzzer and the ESP8266 using the jumper wires. The breadboard is used to interface between the various components available. It also makes it easy to connect multiple inputs to a single pin on the arduino board. To connect to the internet we make use of a prebuilt platform called Blynk app. After the user installs the Blynk app on the smartphone, an account to be created in the app to access its services. The services are enabled for the signed users. A unique authentication code is used by the code to communicate with the project. The Blynk needs to be running in the background for the user to get real time notifications.

### **3.3 Project Hardware**

As mention in the previous chapter, this project uses ultrasonic sensor to monitor the garbage level and then sends the data to show the garbage level on the LCD display and on the internet using the Blynk app.

#### **3.3.1 Schematic Circuit**

Figure 3.3 shows the overall circuit diagram of this Project.....

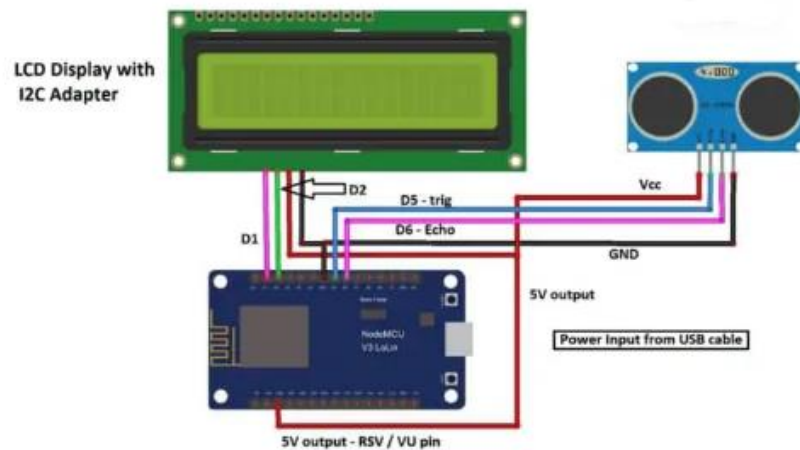


Figure 3.3: Circuit Diagram

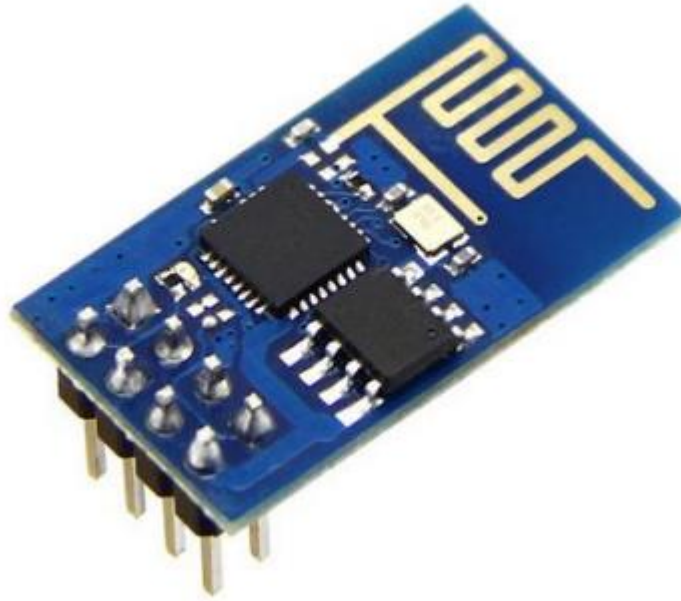
### 3.3.2 Description of Main Component

#### 3.3.2.1 LCD DISPLAY



The term LCD stands for liquid crystal display. It is one kind of electronic display module used in an extensive range of applications like various circuits & devices like mobile phones, calculators, computers, TV sets, etc. These displays are mainly preferred for multi-segment light-emitting diodes and seven segments. The main benefits of using this module are inexpensive; simply programmable, animations, and there are no limitations for displaying custom characters, special and even animations, etc.

### 3.3.2.2 ESP8266(Wi-Fi module)



ESP8266 is a Wi-Fi module which will give your projects access to Wi-Fi or internet. It is a very cheap device but it will make your projects very powerful. It can communicate with any microcontroller and make the projects wireless. It is in the list of most leading devices in the IOT platform. It runs on 3.3V and if you will give it 5V then it will get damage. The ESP8266 has 8 pins; the VCC and CH-PD will be connected to the 3.3V to enable the wifi. The TX and RX pins will be responsible for the communication of ESP8266 with the Arduino. The RX pin works on 3.3V so you will have to make a voltage divider for it as it used for implementation.

### 3.3.2.3 Ultrasonic Sensor



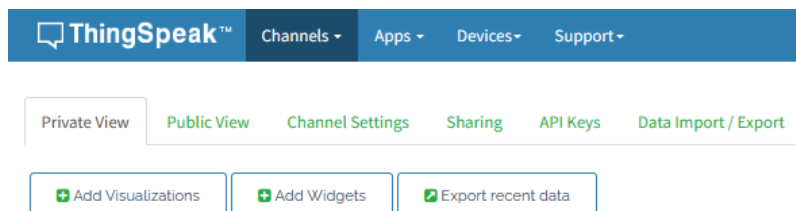
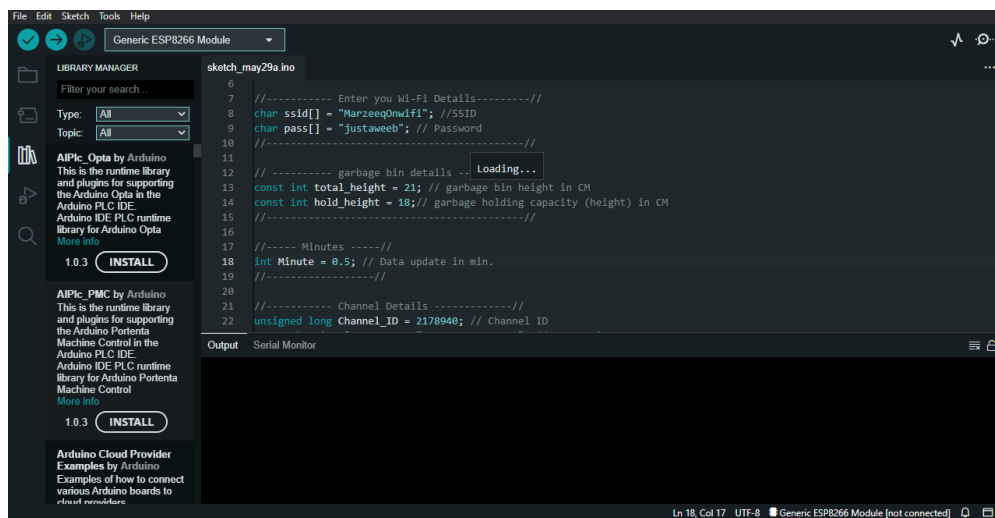
The Ultrasonic Sensor is used to measure the distance with high accuracy and stable readings. It can measure distance from 2cm to 400cm or from 1 inch to 13 feet. It emits an ultrasound wave at the frequency of 40KHz in the air and if the object will come in its way then it will bounce back to the sensor. By using that time which it takes to strike the object and comes back, you can calculate the distance. Distance can be measured by equation 1.

$$\text{Distance} = \text{Time} * \text{sound speed} / 2. \quad (1)$$

Where Time = the time between an ultrasonic wave is received and transmitted. It has four pins. Two are VCC and GND which will be connected to the 5V and the GND of the Arduino while the other two pins are Trig and Echo pins which will be connected to any digital pins of the Arduino. The trig pin will send the signal and the Echo pin will be used to receive the signal. To generate an ultrasound signal, you will have to make the Trig pin high for about 10us which will send a 8 cycle sonic burst at the speed of sound and after striking the object, it will be received by the Echo pin.

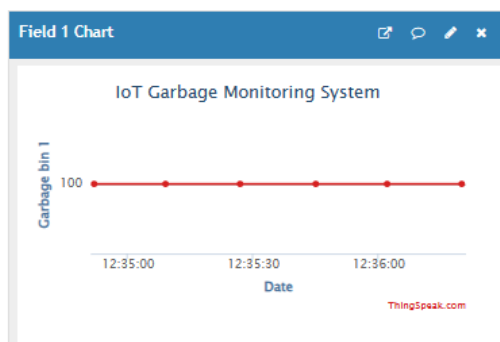
### 3.3.3 Circuit Operation

## 3.4 Project Software

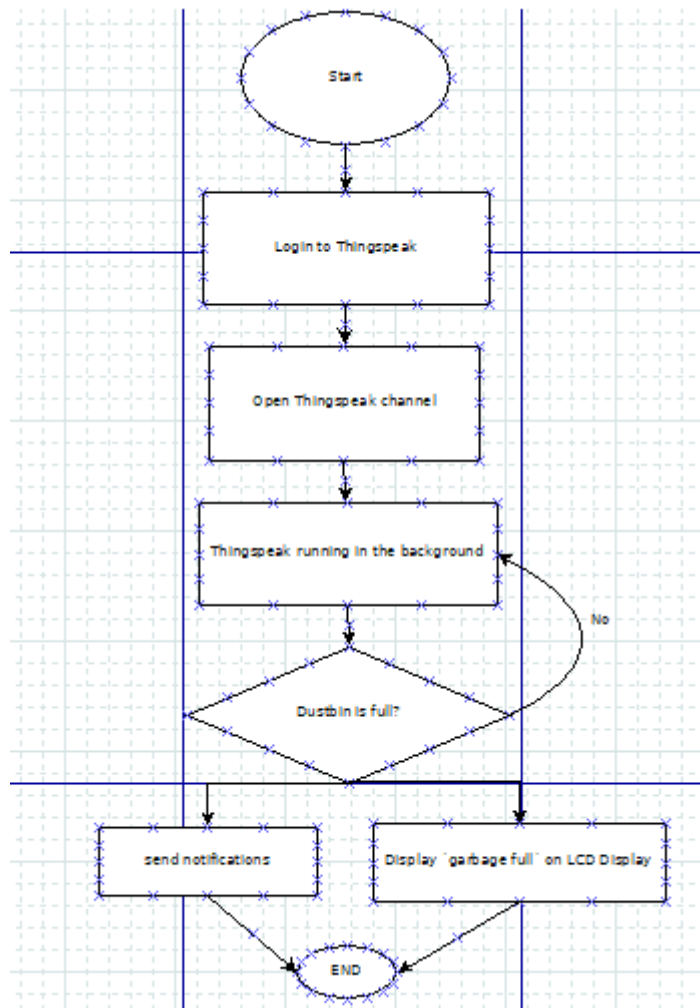


### Channel Stats

Created: [about a month ago](#)  
 Last entry: [27 days ago](#)  
 Entries: 6



### 3.4.1 Flowchart of the System



### 3.4.2 Description of Flowchart

First, login to Thingspeak and open the project. Leave the app running in the background. Next, power on your circuit and connect to a Wi-Fi. Make sure there are garbage level showing on the LCD display and the Blynk app. When the garbage bin is full the LCD display will show a text saying “Maximum level” and send a notification on the Thingspeak.

### 3.5 Prototype Development

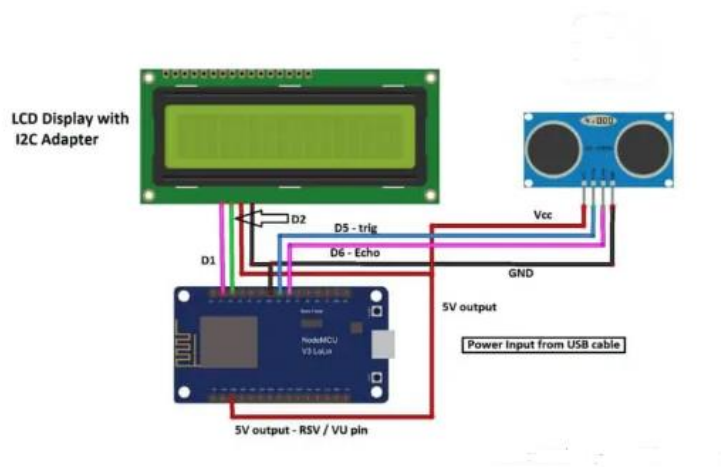


Figure 3.5 Circuit sketch

#### 3.5.1 Mechanical Design/Product Layout

Figure 3.5 shows the design of the product for now. The connections are done as shown.

#### 3.6 Sustainability Element in The Design Concept

This project can last 120 days as long as it has a power supply and Internet connection. This project can benefit every place no matter if its public or private area. It also reduce the cost and labour of garbage disposal organization.

#### 3.7 Chapter Summary

In this chapter, components are discussed and its functions. Project operations and its functions are shown above. Flowchart, schematic diagram, sketch are provided to show how this project should work.





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