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# PROCEEDINGS OF JOHOR INTERNATIONAL INNOVATION INVENTION COMPETITION AND SYMPOSIUM 2024 (JIICaS 2024)



*“Flourish and Nurturing Sustainable  
Innovation for a Prosperous Nation”*

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## **Preface**

**In the name of Allah, the Almighty who gives us the enlightenment, the truth, the knowledge and with regards to Prophet Muhammad (peace be upon him) for guiding us to the straight path. We thank to Allah for giving us guidance and strength to write this e-book.**

**This e-book compiles the extended abstracts that submitted to Johor International Innovation Invention Competition and Symposium 2024 (JIIICaS2024), where JIIICaS2024 is a virtual platform for all creative minds to share and present their invention and innovation. Each abstract gives a brief background on the innovation or project.**

**We hope that this e-book will help the readers to get to know the innovation done by the students and get some ideas to develop future innovation products.**



## Foreword Rector



Assalamualaikum warahmatullahi Wabarakatuh,  
Salam Sejahtera, Salam Malaysia MADANI and  
Salam UiTM Dihatiku.

In the name of Allah, the Most Gracious, the Most  
Merciful.

It is a great honor to welcome you to the Johor  
International Innovation, Invention, Competition, and  
Symposium 2024 (JIIICaS 2024). This event

connects various disciplines, focusing on education and engaging educators,  
students, researchers, and innovators from all walks of life.

Innovation is not just about ideas; it demands perseverance, creativity, and  
determination to turn those ideas into reality. The remarkable projects  
showcased today highlight the dedication and spirit of all participants.  
Initiatives like this not only explore new technologies but also cultivate skills  
and leadership among our youth. At Universiti Teknologi MARA (UiTM) Johor  
Branch, we are fully committed to fostering a dynamic culture of innovation,  
promoting the commercialization of new products, and encouraging  
meaningful collaborations with industry and society.

As we celebrate this event, I would like to extend my heartfelt gratitude to all  
sponsors, judges, the College of Computing, Informatics and Mathematics,  
UiTM Pasir Gudang Campus as the event organizer, as well as to the  
researchers and participants for their hard work in making this event a  
success. Let us continue striving for innovation and excellence. May the  
ideas presented today inspire us and lay the groundwork for future  
achievements.

Thank you.

**Associate Professor Dr. Saunah Zainon**  
**Rector**  
**Universiti Teknologi MARA (UiTM)**  
**Johor Branch**

**(A-ST017) WASTE MANAGEMENT SYSTEM FOR ANALYSING REAL-TIME DUSTBIN'S STATUS THROUGH TELEGRAM APP AND CENTRALIZED DISPLAY MONITOR**

Mohamad Muizzuddin Bin Saufi<sup>1</sup>, Hanunah Binti Othman<sup>1</sup>, Kamaru Adzha Bin Kadiran<sup>1</sup>

<sup>1</sup>Centre For Electrical Engineering Studies College Of Engineering,  
Universiti Teknologi MARA Johor Branch, Pasir Gudang Campus, 81750  
Masai, Johor

hanun204@uitm.edu.my

**ABSTRACT**

This project is developed to replace traditional waste collection method, allowing administrators to monitor dustbin conditions and reducing the need for constant cleaning. The primary parts of this project include hardware circuitry, ThingSpeak database channel, and Telegram app. Administrators and cleaners are able to get notifications regarding the status, location, slot, motion presence, and moisture level inside every dustbin via the ThingSpeak database channel and the Telegram app. The online ThingSpeak database channel is mostly used for verification with an ESP8266 NodeMCU. The input section integrates PIR, ultrasonic, and raindrop sensors, while the output port comprises an LCD, LED(s), servo motor, and buzzer. The ultrasonic sensor is used to determine the amount of space available inside the dustbin, whereas a PIR sensor detects the movement of any pest that could cause an unhealthy environment. Furthermore, the raindrop sensor implies the level of moisture inside the dustbin. In addition, a centralized information monitor is provided to consider some cleaners that might not have a smartphone to notify the status of the dustbin or does not even have the Telegram app. Therefore, this monitor is placed at a strategic location such as at ground floor and hallway so that everyone can see the notification clearly. ThingSpeak database channel platform enhances the collection of waste by storing, analyzing, and notifying in real time, conserving cleaners time and energy. As a result, a clean environment generates high profits for waste management organizations as well as benefits for UiTM community and society.

Keywords: Waste Management System, ThingSpeak Database Channel, Telegram App, Notification, Dustbin Status

**1.0 INTRODUCTION**

Waste management refers to the various recycling and disposal methods. They can be used to remove, treat, recycle, repurpose, and manage waste. The primary goals of waste management are to reduce waste while avoiding any potential hazards to human health and the environment [1]. An ineffective waste management system may cause the amount of waste in the dustbin to increase, resulting in an enormous amount of waste spilling out of the dustbin. Waste sorting can be time-consuming and energy-intensive, especially when dealing with huge areas like the UiTM campus that have lots of faculty buildings and dustbins. Therefore, this project aims to deal with a variety of environmental

issues, including an ineffective management system. The proposed project consists of three main components which are hardware, ThingSpeak database channel, and Telegram app. Administrators and cleaners are able to get real-time notifications about the dustbin's status, location, slot, motion, and moisture detection by connecting the ThingSpeak database channel to the Telegram app. The ESP8266 NodeMCU microcontroller is equipped with three inputs and six outputs. The input components consist of an ultrasonic, passive infrared (PIR), and raindrop sensors [2]. The ultrasonic sensor determines the amount of available space, the PIR sensor detects any motion [3], and the additional raindrop sensor implies the level of moisture within the dustbin. While the output components include an LCD, LED(s), servo motor, buzzer, Telegram application and a centralized monitor.

## 2.0 OBJECTIVES

- I. To construct a hardware system uses an ESP8266 NodeMCU microcontroller to measure the available space, motion, and moisture level inside a dustbin.
- II. To develop a ThingSpeak database channel that links to Telegram app which able to store, analyze, and to Telegram app which able to store, analyze, and process all the data in each dustbin.
- III. To create a central information monitor that will notify cleaners the status of the dustbin in real-time even if they are unable to access the internet.

## 3.0 METHODOLOGY

### HARDWARE

The project relied primarily on three different sensors to display and monitor the output responses. An ultrasonic sensor is used to measure the amount of space available, while a PIR sensor detects any motion within the dustbin. These sensors are set up beneath the dustbin cover for analyzing all data inside the dustbin. In addition, the raindrop sensor is installed at the bottom of the dustbin to determine its moisture level. Furthermore, this smart prototype, as shown in **Figure 3.1**, includes an LCD, LED(s), buzzer, and servo motor indicating whether the dustbin is full or still available, as well as detecting the motion of bugs and moisture level inside it.



Figure 3.1: The Proposed Project Prototype

## THINGSPEAK DATABASE CHANNEL

There are numerous useful platforms for data storage and analysis, including the Blynk app, Google Cloud IoT, Cisco IoT Cloud Connect, ThingSpeak Channel, and others [4]. This project utilizes ThingSpeak Channel as a key foundation for the Internet of Things component, as well as an IoT analytic platform service, to collect, visualize, and analyze data for the purpose of the waste management system [5]. A channel must be developed within a ThingSpeak database channel file, as shown in **Figure 3.2**, for storing, analyzing, processing, and monitoring all the data information sent by the sensors attached to the dustbin.

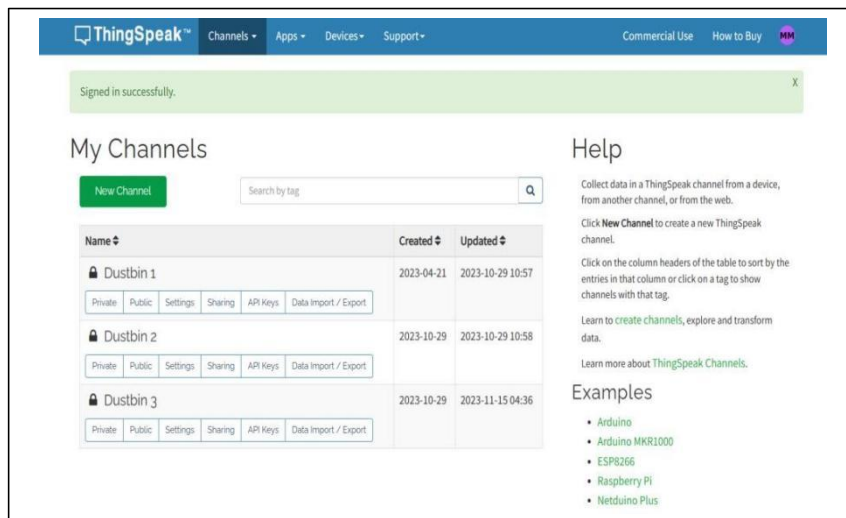


Figure 3.2: The Interface of ThingSpeak Database Channel

## TELEGRAM APPLICATION

In this project, the Telegram app connects with the ThingSpeak database channel because it is easily accessible. Telegram is a popular cross-platform messaging app that is widely used due to its improved privacy and encryption features, as well as support for large group chats. It also has no affiliations with other social media platforms, which makes it more appealing to some [6]. This can be achieved by connecting the Telegram app to the ThingSpeak channel. Thus, when ThingSpeak receives data that exceeds its threshold, messages will show up in a Telegram group created specifically for a waste management system. As shown in **Figure 3.3**, the notification displayed the status of a specific dustbin, including the slot, location, motion and moisture detection, and which dustbin needed to be collected.

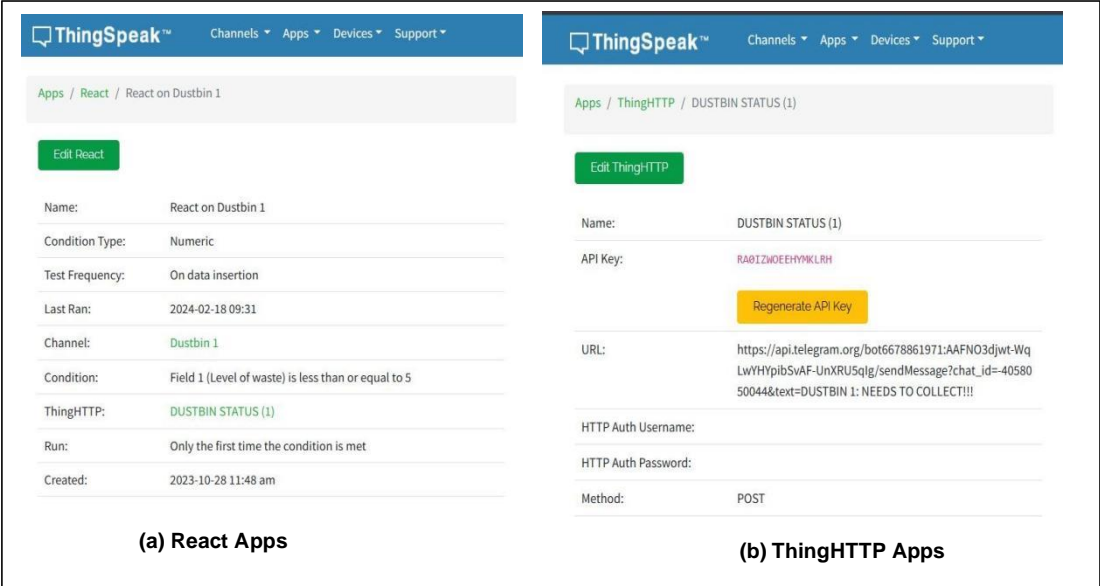


Figure 3.3: The Interface of Connecting ThingSpeak With Telegram App

## 4.0 RESULT

### HARDWARE OUTPUT

**Figure 4.1** depicts the entire circuit connection of the project, including the printed circuit board (PCB) and the three input connections. The circuit's input connections have been successfully verified to produce the indicated output.

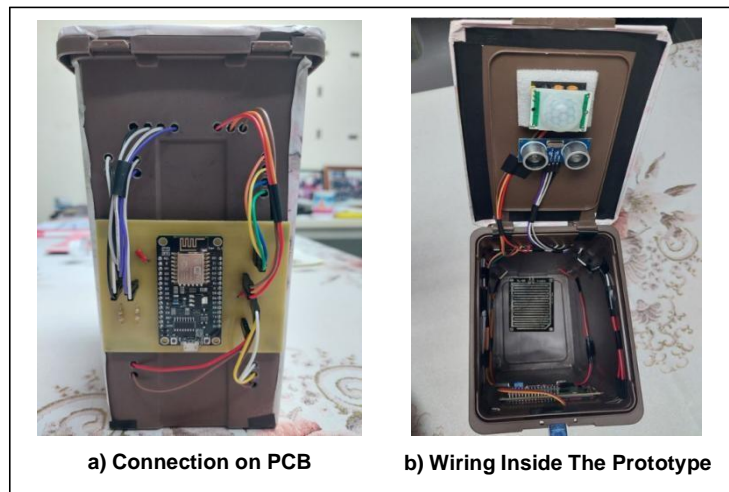


Figure 4.1: Circuit Connection onto Prototype

Referring to **Figure 4.2**, the condition displayed on the LCD indicates that the dustbin remains available in space with no motion present. The green LED indicates that the available space inside the dustbin is exceeding 5 cm from the lid. Both statuses can be detected by an ultrasonic and a PIR sensor. Meanwhile, the servo motor and buzzer are deactivated.



Figure 4.2: LCD Displays "Space Available and No Motion"

**Figure 4.3** depicts the status shown on the LCD, indicating that the dustbin is ready to collect with the presence of motion. When the dustbin reaches a spacing of less than 5 cm from the lid, the red LED indicates it is FULL. These outputs are obtained from an ultrasonic sensor and a PIR sensor, respectively. The servo motor rotates 90 degrees in order to secure the dustbin while the buzzer will be activated.



Figure 4.3: LCD Displays “Ready To Collect and Motion Detected

**Figure 4.4** illustrates the status indicated on the LCD when there is motion and moisture detected within the dustbin. When the dustbin reaches a distance of less than 5 cm from the lid, the red LED indicates that it is FULL. These outputs come from an ultrasonic sensor and a PIR sensor, respectively. The servo motor turns 90 degrees to lock the dustbin while the buzzer is activated.



Figure 4.4: LCD Displays the Moisture Level Detection

## SOFTWARE OUTPUT

The notification in **Figure 4.5** shows the status of a specific dustbin, including slot, location, motion and moisture detection, and which dustbin requires to be collected.

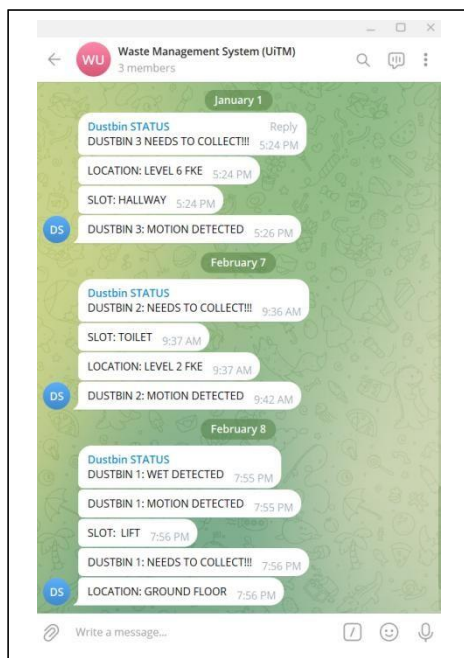


Figure 4.5: The Notification in Telegram App

**Figure 4.6** shows that the dustbin has 11 cm of available space from the dustbin's lid with no motion by displaying a value of 0. It means that the dustbin has not yet reached its capacity. As a result, the user is allowed to use the dustbin.

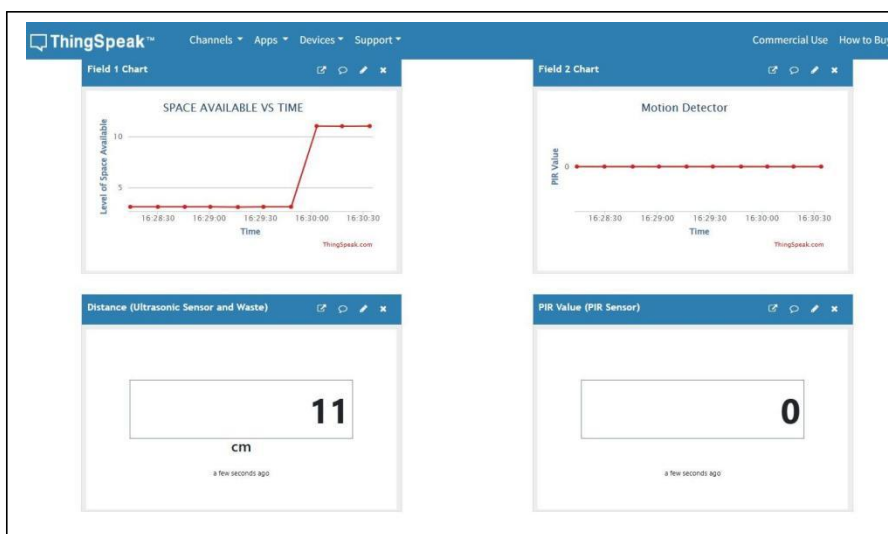


Figure 4.6: ThingSpeak Channel Analysis Shows The Dustbin is Still Available and No Motion Detected

In **Figure 4.7**, the data or measurement value indicates that the dustbin should be collected. This is because the dustbin has already reached its limit, which is less than 5 cm for the available space, and motion is detected by providing a PIR value of 1.

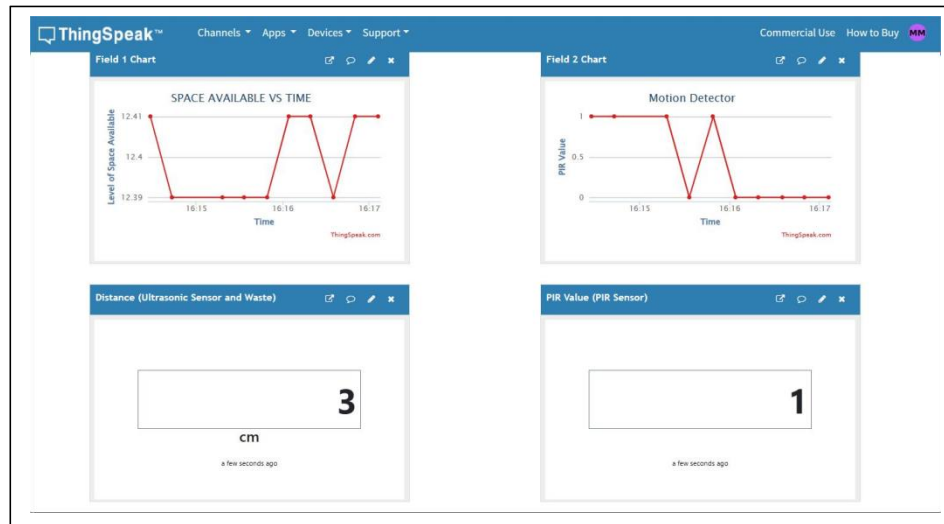


Figure 4.7: ThingSpeak Channel Analysis Shows The Dustbin is Full and Motion is Detected

The number of water droplets on the surface of raindrop sensor shown in **Figure 4.8** is 497 which means the dustbin is still dry. In this case, the threshold limit of raindrop sensor is set to lower than 300 to reach its maximum moisture level.



Figure 4.8: ThingSpeak Channel Analysis Shows the Moisture (wetness) Level inside the Dustbin. The threshold is set to number 300

The precise location of the dustbin implied in **Figure 4.9** is also possible to determined using the ThingSpeak channel, which is located at Pengajian Kejuruteraan Elektrik (PKE), UiTM Pasir Gudang, Bandar Seri Alam, Johor.

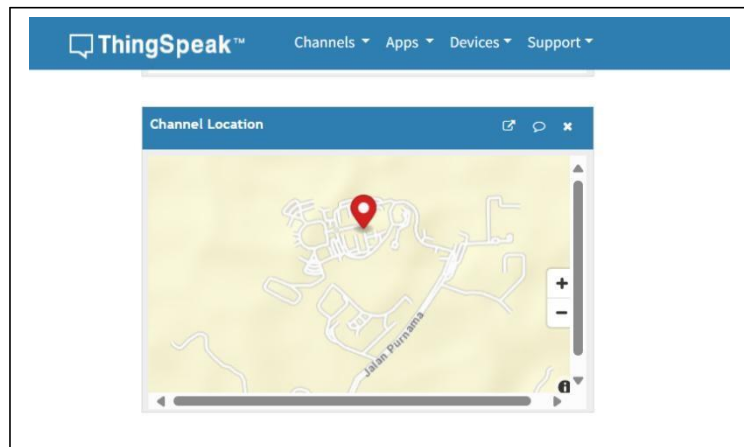


Figure 4.9: ThingSpeak Channel Analysis Shows The Channel Location of The Dustbin

## BLOCK DIAGRAM

**Figure 4.10** depicts the block diagram utilized in this project, which consists of three inputs and six outputs. The input section consists of an ultrasonic sensor, a PIR sensor, and a raindrop sensor. These sensors measure the amount of space available, as well as the presence of motion and wetness in the trash. Meanwhile, the output section consists of an LED, a buzzer, a servo motor, an LCD, the Telegram app for notification and a centralized LCD that act as a centralized monitor. The hardware components are connected to the ThingSpeak channel, transferring sensor data for storage and analysis in a database channel for graph representation and measurement value representation.

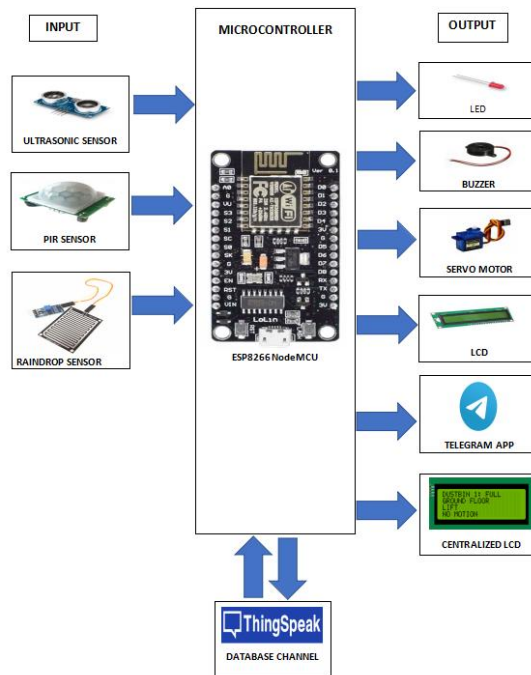


Figure 4.10: The Project System Block Diagram

## FLOWCHART

The project's flowchart is shown in **Figure 4.11**. It consists of three key inputs that will control the system's outputs. To begin, an ultrasonic sensor will measure the available space in the dustbin, and if the threshold limit is achieved, the LCD will show "READY TO COLLECT", the LED will turn red, the servo motor turns 90 degrees, the buzzer will sound and centralized LCD shows the status, location and slot of the dustbin. Otherwise, the LCD displays "SPACE AVAILABLE" and the LED turns green.

Besides that, PIR sensors detect any motion within the dustbin. If there is movement, the LCD and centralized LCD will show "MOTION DETECTED!". Otherwise, LCD will show "NO MOTION" while centralized LCD is deactivated. Furthermore, the raindrop sensor measures the moisture level in the dustbin. The maximum value is set at less than 300 to guarantee the dustbin is moist. This circumstance will cause both LCD and centralized LCD to show "WET DETECTED" while the servo motor to spin 90°. Apart from that, only the LCD will display "DRY" and the others will be deactivated.

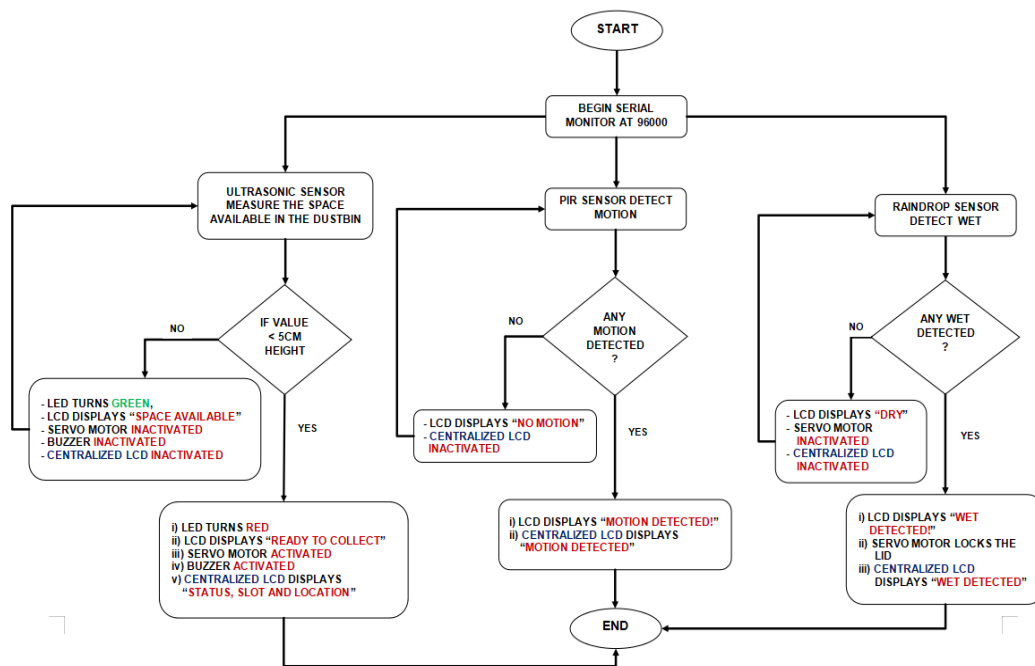


Figure 4.11: System Flowchart

## 5.0 CONCLUSION

This project can solve typical waste collection and disposal issues, particularly in large areas. Furthermore, the cleaners may become weary from routine physical inspection of each dustbin at all times, especially when the bins are located far apart in a large area such as a university campus. As a result, with this smart waste management system, cleaners will be able to collect waste in the dustbin more efficiently and with better management of human resources. This can be accomplished by sending cleaners a notification via smartphone to the Telegram app that includes the location, slot, motion and moisture detection (if applicable), and which dustbins need to be collected. Aside from that, the system may benefit the community by maintaining a clean and healthy environment through the use of the Internet of Things.

Furthermore, the system can benefit the community by keeping the environment in good shape and cleanliness. The project modified the dustbin by incorporating a locking mechanism. It can be set up to automatically shut the dustbin when it is full to prevent waste from pouring out and being overloaded.

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APPENDIX

GOLD Award Recognition Received from 9th EESEEE2023.

