Department of Computer and Communication Systems Engineering

Faculty of Engineering

Universiti Putra Malaysia

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Selangor

SMART GARBAGE MONITORING SYSTEM USING IOT

FINAL REPORT

Course Name : ECC4947 - Computer And Communication Systems Design Project

Semester **:** 1 (2023/2024)

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Group **:** 7

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1.0 Executive Summary

The project introduces an integrated waste management system that supplies IoT based smart waste bins. The project focuses mainly on sustainable development programs on domestic, institutional, commercial and industrial waste. It is ready to transform the way users manage waste in the communities. With cities getting bigger and worries about the environment getting stronger, there is a growing need for smart, demand for efficient and green methods to keep an eye on and improve how the companies collect waste. In this project, the features are involved are as follows:

1. Solar power energy sustainability system.
2. Real- time data monitoring system.
3. Application of IoT based integrated software platform
4. IoT based waste management system

This project highlights the characteristics of a smart waste management system bin using IoT including the mentioned features. Overall, the project is able to overcome the challenges in order to manage waste and succeed in building a sustainable, healthy environment for living beings.

2.0 Problem Statement

Urban trash management has numerous issues that require new solutions. Conventional waste collection techniques tend to operate on fixed schedules, resulting in inefficient or overflowing bins, increasing operational costs and considered environmental risks. Moreover, the absence of real-time monitoring worsens irregular waste collection, causing unsanitary conditions and aesthetic degradation of urban areas. The extensive dependence on non-renewable energy sources in conventional waste management systems interferes with sustainability, limiting the ability to expand and reduce environmental impact [1].

Several foundational assumptions underscore the scope and success of the proposed "Smart Garbage Monitoring System using IoT." Firstly, the project assumes the reliability and precision of sensor technologies such as ultrasonic, infrared, and weight-based sensors in accurately gauging waste levels within garbage bins. Secondly, it relies on the availability and effectiveness of communication infrastructure, especially Wi-Fi, ensuring seamless data transmission between IoT-enabled bins and the centralized web server.

Furthermore, the project assumes the viability and efficiency of solar power as an alternative energy source to sustain the IoT-enabled monitoring system, ensuring continuous functionality [2]. Consistent and reliable internet connectivity is assumed for real-time data transmission, crucial for efficient waste management. Active engagement and cooperation from both users and waste management authorities are pivotal assumptions for system efficacy. Users need to acknowledge notifications and take appropriate actions, while authorities must respond promptly to optimize waste collection processes.

3.0 Project Aim & Objectives

Project aims to the SDG goals:

1. SDG-9 (Industry, Innovation and Infrastructure)
2. SDG-11 (Sustainable Cities and Communities)
3. SDG-15 (Life on Land)

The objective of this project is:

I. **To identify a waste management system based on IoT technology**: Identify an IoT-enabled waste management solution. The system is designed to monitor, control, and optimize waste collection process, assuring efficiency and responsiveness to fill levels in garbage bins.

II. **To apply energy sustainability system :** Apply energy saving system enhanced with IoT capabilities which will follow energy sustainability of the ecosystem.

III. **To Implement Precision-Based, Real-Time Waste Monitoring:** Implement a smart garbage monitoring system based on IoT capabilities. This system will provide exact, real-time tracking of garbage levels in bins, enabling proactive waste collection strategies as well as prompt management fixes.

4.0 Scope and Limitations of the Project

The project scope includes the development and testing of the Smart Garbage Monitoring System using IoT. The focus of this project is to enhance and revolutionize the conventional waste management practices by introducing a real-time waste management model, with a particular focus on the perspective of citizens in urban areas. The development phase involved creating a prototype in a controlled environment, with testing conducted in the MKKK1 Lab of the Engineering Faculty and Tower Lab Level 4.

The key components of this system include two primary sensors which are for monitoring waste bin levels and weight. Additionally, this system employs the Blynk application as a monitoring tool for tracking waste bin levels and weights in real-time. This project was initiated with the aim of supporting waste management services and municipal authorities in achieving more efficient waste tracking and preventing overflowing trash bins. Therefore, upon reaching the specified garbage limit level, the system automatically sends a notification through the Blynk platform, ensuring timely communication regarding waste status.

Furthermore, in a sustainable approach, the system is powered by a solar energy system instead of relying on traditional battery solutions. This aligns with the project objectives of SDG 11, as it promotes the use of renewable energy sources, contributing to the development of environmentally friendly and resilient cities.

Despite the significant scope of this project, there are some limitations that need to be acknowledged. One notable constraint is the critical placement of the load cell beneath the waste bin for optimal performance. To ensure maximum accuracy and effectiveness, the load cell needs to be installed precisely at the center under the waste bin. Additionally, given that the load cell is highly sensitive to surrounding noise, heat, and shock, extra precautions are necessary to prevent unstable readings during prototype testing.

5.0 Solution & Significance of the Project

In Malaysia, the current waste monitoring system relies on traditional practices, causing significant inconveniences for users, waste collection services, and local authorities. The current approach involves manual monitoring and scheduled collections, leading to inefficiencies such as overflowing bins and uncertain collection times. Moreover, it is a common observation that trash bins placed in open spots are consistently overburdened, resulting in unsanitary conditions for the city. The inefficiencies in trash collection times not only result in unsightly conditions but also contribute to unpleasant smells and the presence of pests, which can significantly impact business operations. The issue is highlighted in recent news [3], citing unsatisfactory and ineffective cleaning operations that lack consistency, leading to a buildup of waste that emits bad odors, particularly when large waste bins are placed near market entrances.

To address these interconnected issues, the Smart Garbage Monitoring System using IoT offers a viable solution to enhance waste management practices. By providing real-time insights into waste levels and weights, this system not only improves efficiency but also alleviates the challenges posed by overflowing bins, promoting a cleaner and more organized urban environment.

6.0 Market Review and Client Validation Summary

6.1 Market Review

A market survey was conducted to gather feedback and preferences from potential users regarding the Smart Garbage Monitoring System based on IoT. The survey aims to shape the effectiveness and user-friendliness of the system for optimizing waste management and contributing to a cleaner environment. From the survey, most of the respondents agree that smart waste management system bins using IoT will fulfill the requirement of waste management, monitoring and alert, sustainability and efficiency more than standard waste bins.

The survey results indicate a strong interest in integrating a solar system into the Smart Garbage Monitoring System, with 77.1% of respondents expressing support. This suggests that incorporating renewable energy sources is perceived as beneficial for energy efficiency and sustainability. When it comes to the preference for integrating the system with existing bins or installing new ones, the majority (51.4%) favored integrating with existing bins. This may be attributed to a practical approach that minimizes additional infrastructure costs. Moreover, the survey revealed that many respondents (85.7%) have faced challenges with waste collection or disposal in their areas. Overflowing bins and inconsistent waste collection schedules were the most common problems identified, emphasizing the need for an efficient waste management solution.

Furthermore, real-time monitoring of waste bins is considered crucial by a vast majority (94.3%) of respondents. This aligns with the interest (91.4%) in a Smart Garbage Monitoring System utilizing IoT technology for real-time tracking and monitoring. Respondents are likely to invest in a Smart Garbage Monitoring System if it offers improved efficiency and accuracy in waste management, with 88.6% expressing interest.

The majority of respondents find the Smart Garbage Monitoring System using IoT to be very functional and meeting their needs (62.9%). There is room for improvement, as 22.9% believe it is somewhat functional but could be enhanced. Suggestions for additional features include a sanitization feature for bins after trash pickup, a voice functionality, affordability consideration, and addressing challenges posed by heavy rainfall in solar-powered systems.

To conclude, the survey indicates a positive reception towards the Smart Garbage Monitoring System based on IoT, with potential users recognizing its benefits in optimizing waste management, monitoring, and contributing to sustainability. Improving functionality, addressing specific challenges, and ensuring affordability are key considerations for successful adoption in the market.

6.2 Client Validation Summary

- **Pusat Pertanian Putra (PPP)**

  Problem: Received complaints from the responsibilities center (PTJ) regarding piles of garbage outside the provided bins.

  Expectation: A system inside the bins which will overcome the issue of liquid waste overflow.

  Project consideration: Smart lock system based on IoT platform when the bin is full.

- **Tenth College**

  Problem: Excessive trash piles and pests rummaging through the trash bins.

  Expectation: Implement a system on the garbage trucks to separate waste according to categories.

  Project consideration: Instead of focusing on their expectation, our project solves the problem through a smart lock system.

- **Faculty of Engineering**

  Problem: Overflow garbage in the cafeteria.

  Expectation: Implement sensors in the trash bins and set them with thresholds. If the trash bin exceeds the threshold, it will sound an alert and signal the contractor to collect the waste.

  Project consideration: Instead of sounding an alert, sensors with real-time data monitoring are implemented.

- **KDEB Waste Management Sdn Bhd**

  Problem: The timetable of the garbage collecting service does not support garbage fulfillment conditions.

  Expectation: Implement a system collecting on garbage fulfill data.

  Project consideration: Real-time garbage data monitoring system is fulfilled.

- **GSSS Debo Resources**

  Problem: No

Expectation: Update the progress using pictures before the garbage being taken out and after the garbage being taken out.

Project consideration: No, the suggested feature is not related to any current problem.

7.0 Final Product Design

7.1 Hardware and Software Setup

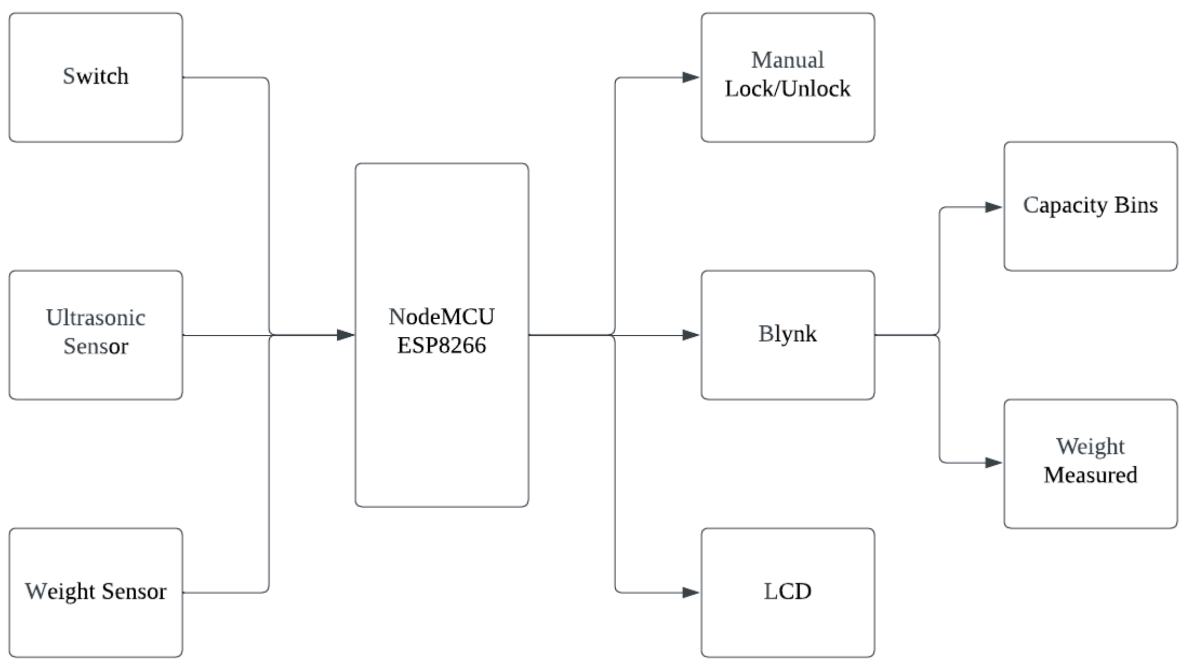


Figure 7.1.1: Block Diagram of the System.

From Figure 7.1.1, the system is being implemented using a garbage bin with a smart monitoring system. The system connects with NodeMCU ESP266 to connect with wifi connection to monitor the data in real time. It can monitor the capacity bins and weight measured via application Blynk through smartphone or laptop.

The smart garbage bin is sustainable and energy efficient due to the power supply using solar panels. The solar panel will charge the battery. The battery will provide power to the component of the system through NodeMCU ESP8266. Solar panel manager being used to regulate the charging of the battery to prevent overcharge. It also regulates the voltage that goes through NodeMCU ESP8266 to prevent any damage.

The ultrasonic sensor will measure the distance of waste in the garbage bin. It can detect capacity bins and display the status of capacity bins at the LCD. In addition, the data also can be accessed through the Blynk application. It will monitor the bin capacity remotely through a smartphone via application. The weight sensor can measure the weight of waste inside the garbage bin. The weight data information can be transmitted in real-time and show on the Blynk application. It will inform you about the current weight status of the bin.

The manual lock and unlock being implemented using servo motors. It will be controlled through the Blynk application function as a virtual switch. The locking and unlocking actions can be controlled remotely through the Blynk interface. It is a secure way to manage access to the corresponding system. It makes the overall function more flexible through the manual lock and unlock system.

The smart garbage bin monitoring system integrates ultrasonic sensor, weight sensor and servo motor with NodeMCU ESP8266 and Blynk application connectivity. It allows for real-time monitoring waste capacity and weight. It will be displayed on LCD and can be accessed remotely through smartphone. The system features a manual lock unlock mechanism using servo motors that can be controlled via the Blynk application.

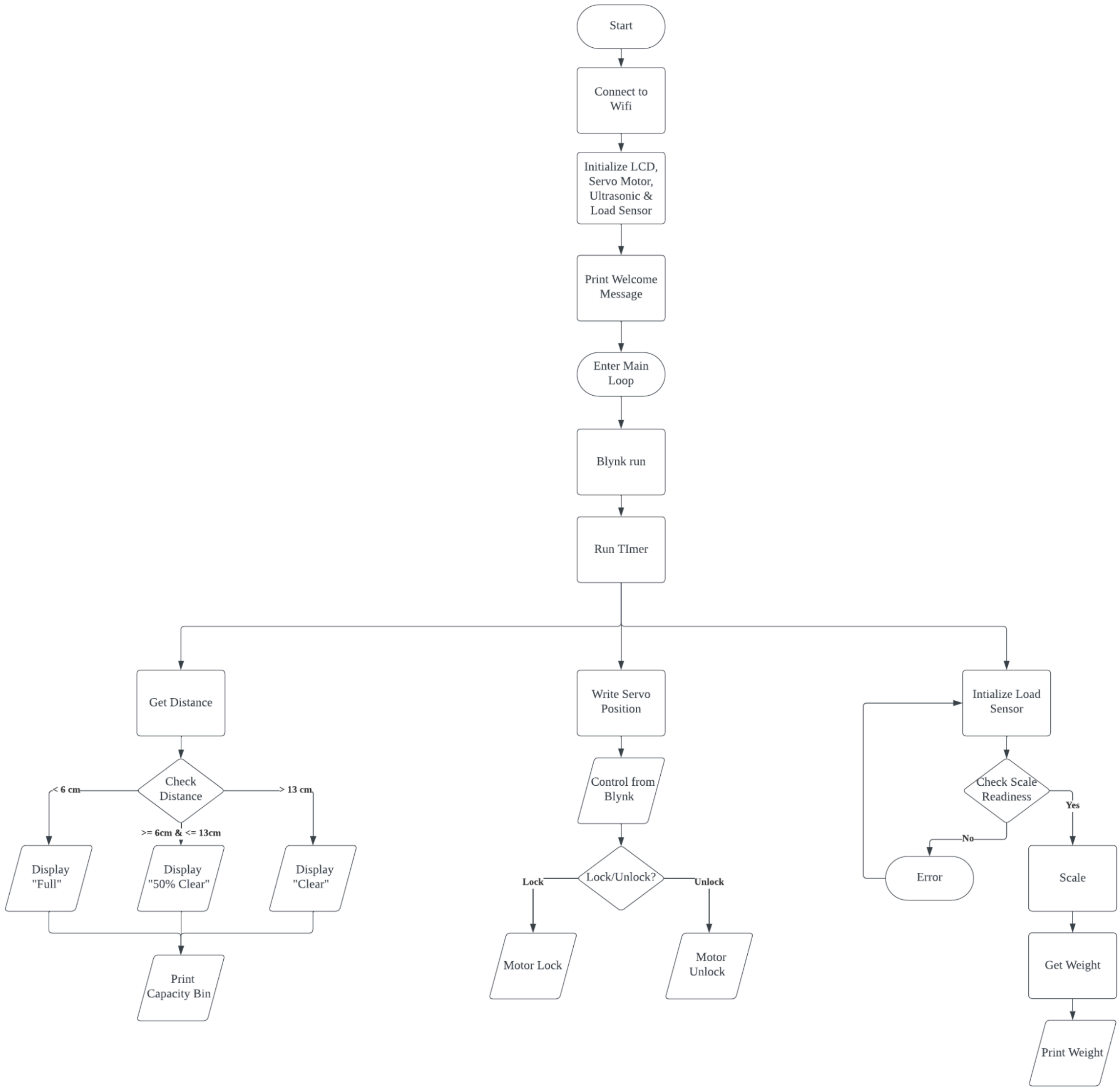


Figure 7.1.1: Flowchart of the Application.

From Figure Figure 7.1.1, show the flowchart of the application that shows the steps of the smart garbage monitoring system. This system consists of the ultrasonic sensor sensor to detect the distance measurement, weight sensor to weight measurement and servo motor to lock or unlock the bin. This system also consists of Wi-Fi connectivity which is controlled through Blynk application.

The system will initialize the LCD, servo motor, ultrasonic sensor and weight sensor then connect to Wi-Fi through wifi module ESP8266. Then it will start with a welcome message. After that it will enter the main loop to check scale readiness. When the scale is not ready, it will display an error message and keep looping until the scale is ready and systems will start to get the weight.

Then, when the bin is full which distance is less than or equal to 6 cm, the system will print “Full” at the LCD. When the bin is not full with a condition of distance greater than or equal to 6 cm and less than or equal to 13 cm, the system will print “50% Clear” at the LCD. Lastly, it will print “Clear” on the LCD when the distance is greater than 13 cm which shows that the bin is empty.

Furthermore, this system can be controlled by the Blynk application to lock or unlock the bin manually by the user. The system has a timer running in the background. The servo motor position is controlled by the Blynk application interface which makes the system lock or unlock the bin by servo motor based on the user command. This shows that smart garbage monitoring systems give a convenient and efficient way to manage waste bin levels which can reduce manual checking.

7.2 Prototype Design and Functionalities

Figure 7.2.1: Design Prototype.

The system design of the product is to monitor the level of waste in the capacity bins which give an alert relevant with the authorities when it needs to be clear. The smart garbage bin is designed with sustainable energy which utilizes solar panels for power supply. The solar panel charges the battery through the solar manager to give power to the system components through NodeMCU ESP8266. It also will regulate the charging battery in term to prevent overcharge. Thus, it will control the voltage supply into the NodeMCU ESP8266 to prevent any damage.

The ultrasonic sensor being used to measure the distance of the waste in the bin. The weight sensor being used to measure weight of waste in the bin. The NodeMCU microcontroller is used to read the information data from sensors, then send it to the Blynk application. The Blynk is used as a user interface for the system to display the level capacity of waste in the bin and weight of waste in the bin. The LCD being used to display the status of the waste in the bins. Lastly, the manual lock or unlock feature being included in the system.

Figure 7.2.2: Design Product

The level of capacity bins monitor is achieved by using the ultrasonic sensor while the weight of waste is achieved by using the weight sensor. These sensors can display the real-time data of the waste. The manual lock or unlock feature allows the user to lock and unlock the bin when necessary. The Blynk application will send the notification when the bin is full through application, user can lock the bin manually through the application. It shows that authorized personnel can access the bin.

The system includes a user interface that displays the fill level of the capacity bins and other relevant information such as weight of waste and lock or unlock virtual switch. This interface can be accessed via a computer or smartphone. It allows the relevant authorities to monitor the fill level of the capacity bins remotely. The system utilizes wireless connectivity provided by the ESP8266 WiFi module. This allows the system to transmit data from the sensors to the Blynk server and the user interface without the need for wired connections.

8.0 Final Results and Considerations

8.1 Data Collection Method and Considerations

The data collection process for the Smart Garbage Monitoring System with IoT followed a systematic approach focused on precision and reliability. Calibration of sensors, specifically the ultrasonic and weight sensors, played a crucial role in obtaining accurate measurements of garbage levels within the bins. The careful placement of the ultrasonic sensor, oriented towards the bin's inside bottom surface, ensured optimal readings. Simultaneously, the secure installation of the weight sensor prevented displacement, and considerations were made for load distribution to guarantee accurate weight measurements.

Connectivity and real-time monitoring data were collected through the Blynk application. The Blynk application, integrated into a cloud-based IT infrastructure, served as the primary interface for users and waste management authorities.

The results of the data collection process confirmed the precision of the ultrasonic and weight sensors, efficient solar panel performance, and reliable real-time monitoring through the Blynk application. Future considerations involve addressing calibration challenges, optimizing the auto-lock feature, and exploring alternative connectivity solutions for areas with limited internet infrastructure. The data collection process is vital for validating the functionalities of the system and provides insights for potential enhancements in subsequent iterations of the Smart Garbage Monitoring System with IoT.

8.2 Results

Table 8.2.1 The result of Status of Capacity Bins

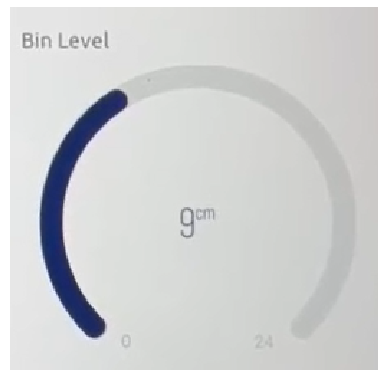
The Status of Capacity Bins	LCD Display	Blynk Application
If the bin is empty (distance is greater than 13 cm): The system displays "**Clear**" on the LCD.		
If the bin is not full but the distance is greater than or equal to 6 cm and less than or equal to 13 cm: The system displays "**50% Clear**" on the LCD, indicating that the bin is partially filled.		
If the bin is full (distance is less than or equal to 6 cm): The system displays "**Full**" on the LCD.		

Table 8.2.2 The result of Status of Servo Motor

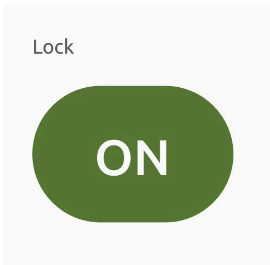
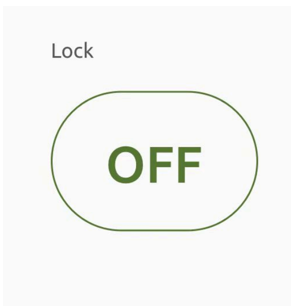
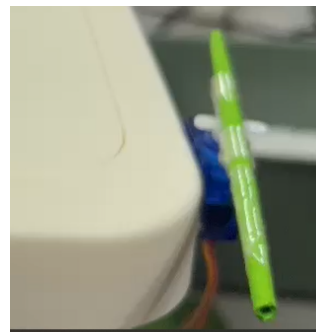
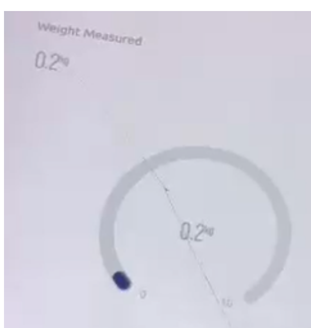
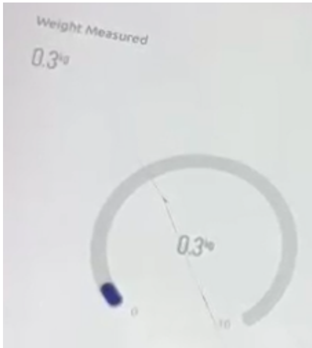
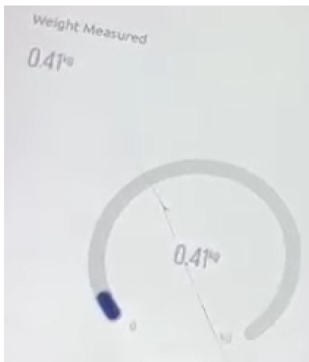
Blynk Application	Status	Servo Motor
	**LOCK**	
	**UNLOCK**	

Table 8.2.3 The result of Weight Sensor

Blynk Application	Weight
	**0.2kg**

	**0.3kg**
	**0.41kg**
	**0.79kg**

When the waste level reaches a predetermined threshold, as shown in Figure 8.2.4, a message reminder is automatically sent to the user through the Blynk application, and the user can lock the bins through Blynk.

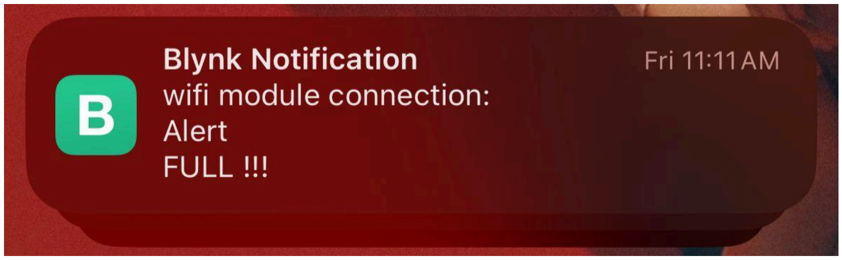


Figure 8.2.4: Pop-out notification from Blynk application

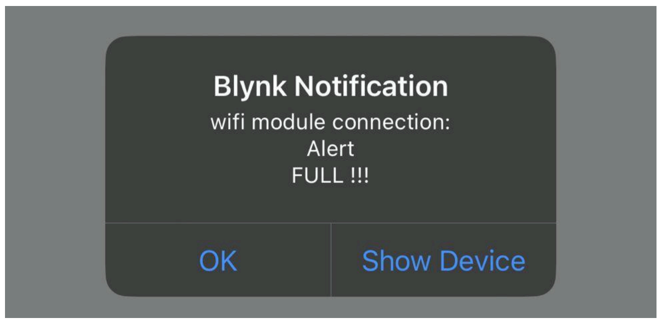


Figure 8.2.5: Alert message from Blynk Application.

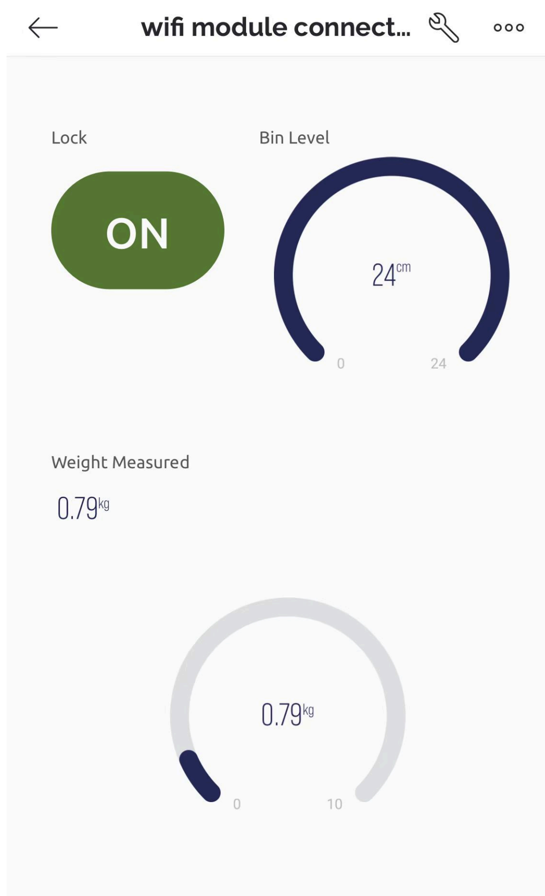


Figure 8.2.6: The Blynk Application Interface

8.3 Performance Test / Validation

During the development and implementation of our Smart Garbage Monitoring System using IoT, we undertook a comprehensive approach to performance testing and validation. This phase was crucial in ensuring that our system met its specified requirements and functioned effectively in real-world scenarios. Our process involved a series of methodical tests, each targeting different aspects of the system, from sensor accuracy to software integration and user experience.

Our testing methodology encompassed a variety of critical evaluations. We first conducted the Sensor Accuracy Test to validate the precision of ultrasonic and weight sensors in accurately measuring waste levels within bins. This involved repeated measurements under varying load conditions, with the readings compared against known standards to assess accuracy.

Secondly, we carried out the System Integration Test, aiming to ensure seamless integration of the hardware components like sensors, solar panels, and servo motors, with the software elements, particularly the Blynk application and the Wi-Fi module. This test simulated real-life scenarios to examine the system's response, data transmission reliability, and notification mechanisms.

An Energy Efficiency Test was also pivotal, given the system's reliance on solar power. This test evaluated the performance of solar power supply modules under different environmental conditions, monitoring energy consumption and output over extended periods and under varying light conditions. Additionally, the Connectivity and Real-time Data Transmission Test assessed the stability and speed of data transmission over the Wi-Fi network, crucial for real-time monitoring. We tested the system in areas with different Wi-Fi signal strengths to monitor any latency in data transmission. Lastly, the User Interface and Experience Test was conducted through user trials to gather feedback on the Blynk application's navigation, ease of use, and clarity of information displayed.

Throughout the testing phase, we encountered and addressed several challenges. The first major challenge was inaccurate sensor readings, which we resolved by implementing a calibration protocol. This enhanced both the accuracy and reliability of the sensor data. We also faced intermittent connectivity issues. To overcome this, we optimized the Wi-Fi module for more stable connections. The inefficiency in energy harvesting, particularly from the solar panels, was mitigated by improving the design and positioning of the panels and incorporating energy-saving algorithms.

The complexity of system integration posed a challenge, which we addressed by adopting a modular approach, simplifying the integration and troubleshooting of individual components. Finally, limitations in the user interface of the Blynk app were improved based on feedback, enhancing the functionalities of the application to include more intuitive controls and clearer displays.

In conclusion, the performance testing and validation phase was instrumental in identifying and addressing a variety of challenges associated with our Smart Garbage Monitoring System using IoT. Through rigorous testing and adaptive problem-solving, we significantly enhanced the system’s functionality, reliability, and user experience. This process not only improved our current system but also provided a robust foundation for future advancements and scalability in smart waste management solutions. The successful resolution of these challenges underscores our team's commitment to delivering an effective and efficient waste management system, paving the way for innovative developments in this field.

9.0 Project Costing & Potential Profit

9.1 Hardware Cost Estimation

Table 1. Hardware cost estimation.

Component name	Quantity	Unit Price (MYR)	Total Price (MYR)
ESP8266 Wi-Fi module	1	15.99	15.99
HC-SR04 Ultrasonic Sensor	1	3.30	3.30
Breadboard	1	3.90	3.90
Connecting wires	1	3.60	3.60
Trash bin	1	76.50	76.50
Solar panel	1	25.50	25.50
Solar panel manager	1	31.00	31.00
Battery	1	6.50	6.50
Weight sensor	1	7.90	7.90
LCD display	1	8.50	8.50
Servo motor	1	16.90	16.90
			Total = 199.59 MYR

9.2 Operating Cost Estimation

Table 2. Operating cost estimation.

Service	MYR
Transport	40.00
Repairs/Maintenance	140.00
Labor	120.00
Advertising	800.00
Promotion	500.00

9.3 Product Cost Estimation

Table 3. Product cost estimation.

No	**Others**	**MYR**
1	One-time purchase	500.00
2	Packaging	20.00
3	Monitoring [Monthly]	50.00
4	Tax (5%)	30
5	Profit (7%)	120.00
		Total cost: 720.00 MYR

10.0 Conclusion

The completion of the Smart Garbage Monitoring System with IoT project marks the end of a difficult but rewarding journey. The project revealed a number of problems, most notably in load sensor calibration, solar panel circuit performance, and an unexpected issue with the auto-lock feature. Furthermore, the system's current dependency on a constant online connection came out as a consideration for future improvements.

10.1 Reflections and Recommendations of the Project

The Smart Garbage Monitoring System with IoT has pushed our team into system development, where we hope to address waste management difficulties. This ground-breaking approach was created on a thorough understanding of market expectations and important feedback from waste management industry stakeholders. Potential end-users and industry experts have provided overwhelmingly favorable feedback, with strong recommendations for the design and development of a system capable of modernizing waste monitoring techniques.
Throughout the study, we identified a number of useful insights that indicated both successes and opportunities for improvement. Calibration concerns made it difficult to ensure the stability and accuracy of load sensor data. The solar panel circuit also became an important concern, necessitating special attention to fix any functioning concerns. There were some concerns with the auto-lock feature, which prompted a review of the system's locking mechanisms. Furthermore, the system's dependency on continuous internet connectivity generated certain issues, indicating the necessity for optimized performance to increase operational flexibility.

Moreover, the team expresses profound gratitude for the unwavering support received from project supervisor and coordinator Dr. Nadiah Husseini binti Zainol Abidin and Madam Roslizah binti Ali, played instrumental roles in guiding the project to success, providing invaluable mentorship and insights. Their commitment to excellence and encouragement fueled our perseverance through challenges. Additionally, the team extends appreciation to every single client whose valuable feedback demonstrates the transformative impact of the Smart Garbage Monitoring System. This collaborative viewpoint drives the team ahead, committed to

continuous refinement and collaborative growth as the Smart Garbage Monitoring System with IoT develops as a strong and effective answer to modern garbage management concerns.

10.2 Benefits of Project

Despite the encountered challenges, the Smart Garbage Monitoring System with IoT provides numerous benefits that highlight its potential impact on waste management practices. The system's cost-effectiveness is a notable advantage, as it utilizes the user's smartphone for data capture, eliminating the need for additional hardware costs. Real-time monitoring capabilities provide users with quick information on garbage levels, allowing for timely and effective waste management solutions. The automation of the system not only reduces labor costs but also significantly enhances grading accuracy compared to manual processes. Moreover, this approach contributes to a more sustainable waste management process by reducing the possibility of errors and increasing overall efficiency.

10.3 Potential Future Work

Looking ahead, potential future work involves implementing safety measures for solar panel components through protective enclosures, enhancing their durability, and safeguarding against environmental factors. The integration of a sanitation feature for waste bins post-trash pickup aims to ensure cleanliness and hygiene, addressing not only the monitoring but also the aftermath of the waste management process.

To further enhance the system's adaptability and operational independence, exploring alternative connectivity solutions, such as LoRaWAN or GSM modules, could mitigate challenges related to continuous online connection requirements. This strategic shift could broaden the applicability of the Smart Garbage Monitoring System in areas with limited internet infrastructure. Furthermore, the use of modern algorithms, such as machine learning, for predictive waste analysis and personalized collection strategies represents a possible route for system improvement. This would not only improve waste management processes but also contribute to resource efficiency.

In conclusion, the Smart Garbage Monitoring System with IoT has proved its potential, and future efforts will focus on improving its functionality, ensuring stability, and incorporating innovative features for an even more effective waste management solution. The dedication to continually improve clarifies our passion to offer a cutting-edge and meaningful answer to today's waste management concerns.

11.0 References

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12.0 Appendices

12.1 Individual Contributions

No.	Name	Contributions
1	Murni Nur Izzati binti Hairullizam	● Leader of the Group. ● Prepare project proposal, CVR report and proposal presentation slides. ● Contact and interview the potential clients for CVR. ● Responsible for buying the materials. ● Develop and design the prototype of the product. ● Finalize the design of the system. ● Prepare final report and final presentation slides.
2	Fatin Fadhlina binti Azhan	● Prepare project proposal, CVR report and proposal presentation slides. ● Contact and interview the potential clients for CVR. ● Responsible for buying and borrowing the components. ● Develop and design the prototype of the product. ● Finalize the design of the system. ● Prepare final report and final presentation slides
3	Muhammad Haziq Izzuddin bin Md Ridzaudin	● Prepare project proposal, CVR report and proposal presentation slides. ● Contact and interview the potential clients for CVR. ● Responsible for buying the components. ● Develop and design the prototype of the product. ● Finalize the design of the system. ● Prepare final report and final presentation slides

4	Tasnim Mahdiya	• Finance of the Project. • Prepare project proposal, CVR report and proposal presentation slides. • Contact and interview the potential clients for CVR. • Create the business website and business cards. • Prepare final report and final presentation slides
5	Chen Mingyue	• Prepare project proposal, CVR report and proposal presentation slides. • Contact the potential clients for CVR. • Prepare business cards for group members. • Design the appearance of the product. • Prepare final report and final presentation slides

12.2 Coding

```
#define BLYNK_PRINT Serial
#define BLYNK_TEMPLATE_ID "TMPL6bp-2PISy"
#define BLYNK_TEMPLATE_NAME "wifi module connection"
#define BLYNK_AUTH_TOKEN "Vjp9l79vn3IOhJ4g2QtWknde2RcTUGo2"
#include <ESP8266WiFi.h>
#include <BlynkSimpleEsp8266.h>
#include <Wire.h>
#include <LiquidCrystal_I2C.h>
#include <Servo.h>
#include <Arduino.h>
#include "HX711.h"

// WiFi credentials
char ssid[] = "haziqizz";
char pass[] = "1sampai8910";

// Blynk authentication
char auth[] = BLYNK_AUTH_TOKEN;
```

```
// Servo setup
Servo s1;
int lastPosition = 2000;
int onnPos = 1000; // clockwise direction
int offPos = 2000; // counter-clockwise direction

// HX711 setup
const int LOADCELL_DOUT_PIN = 2;
const int LOADCELL_SCK_PIN = 13;
HX711 scale;
float weight;
float calibration_factor = 238.974; // this value is obtained by
calibrating the scale with iPhone 13

// Ultrasonic sensor pins
#define trig 12
#define echo 14

// LCD setup
LiquidCrystal_I2C lcd(0x27, 16, 2);

BlynkTimer timer;

void setup() {
  Serial.begin(115200);
  Blynk.begin(auth, ssid, pass);

  s1.attach(0); // GPIO 0 (D03)

  lcd.begin();
  lcd.print("GarboGuard On");
  lcd.setCursor(0, 1);
  lcd.print("Your Service!");

  pinMode(trig, OUTPUT);
  pinMode(echo, INPUT);

  Serial.println("HX711 Demo");
```

```
  Serial.println("Initializing the scale...");

  // Initialize the scale
  scale.begin(LOADCELL_DOUT_PIN, LOADCELL_SCK_PIN);

  // Check if the scale is ready
  if (!scale.is_ready()) {
    Serial.println("Error: Unable to initialize the scale. Please check
your wiring.");
    while (1); // Hang in an infinite loop
  }

  scale.tare();                  // reset the scale to 0
  long zero_factor = scale.read_average(); // Get a baseline reading

  timer.setInterval(1000L, loop);
}

void loop() {
  Blynk.run();
  timer.run();

  scale.set_scale(calibration_factor);

  weight = scale.get_units(5) / 1000; // Convert to Kilograms
  Serial.print("Weight: ");
  Serial.print(weight);
  Serial.println(" KG");
  Serial.println();

  // Ultrasonic sensor readings
  digitalWrite(trig, LOW);
  delayMicroseconds(2);

  digitalWrite(trig, HIGH);
  delayMicroseconds(10);
  digitalWrite(trig, LOW);

  long duration = pulseIn(echo, HIGH);
```

```
  int distance = duration * 0.034 / 2;

    if(distance < 6){
    Blynk.logEvent("alert","FULL !!!");
    lcd.clear();
    lcd.print("Full");
    delay(1000);
  }
    else if(distance >= 6 && distance <= 13){
    lcd.clear();
    lcd.print("50% Clear");
    delay(1000);
  }

  else {
    lcd.clear();
    lcd.print("Clear");
    delay(1000);
  }

  // Blynk virtual writes
  Blynk.virtualWrite(V0, distance);
  Blynk.virtualWrite(V3, weight);
}

BLYNK_WRITE(V2) {
  int value = param.asInt();

  if (value == 1 && lastPosition != onnPos) {
    s1.writeMicroseconds(onnPos);
    delay(500);
    lastPosition = onnPos;
  } else if (value == 0 && lastPosition != offPos) {
    s1.writeMicroseconds(offPos);
    delay(500);
    lastPosition = offPos;
  }
}
```