# PROJECT REPORT IN COMPUTER

## “ LOVELY GARBAGE TRUCK “

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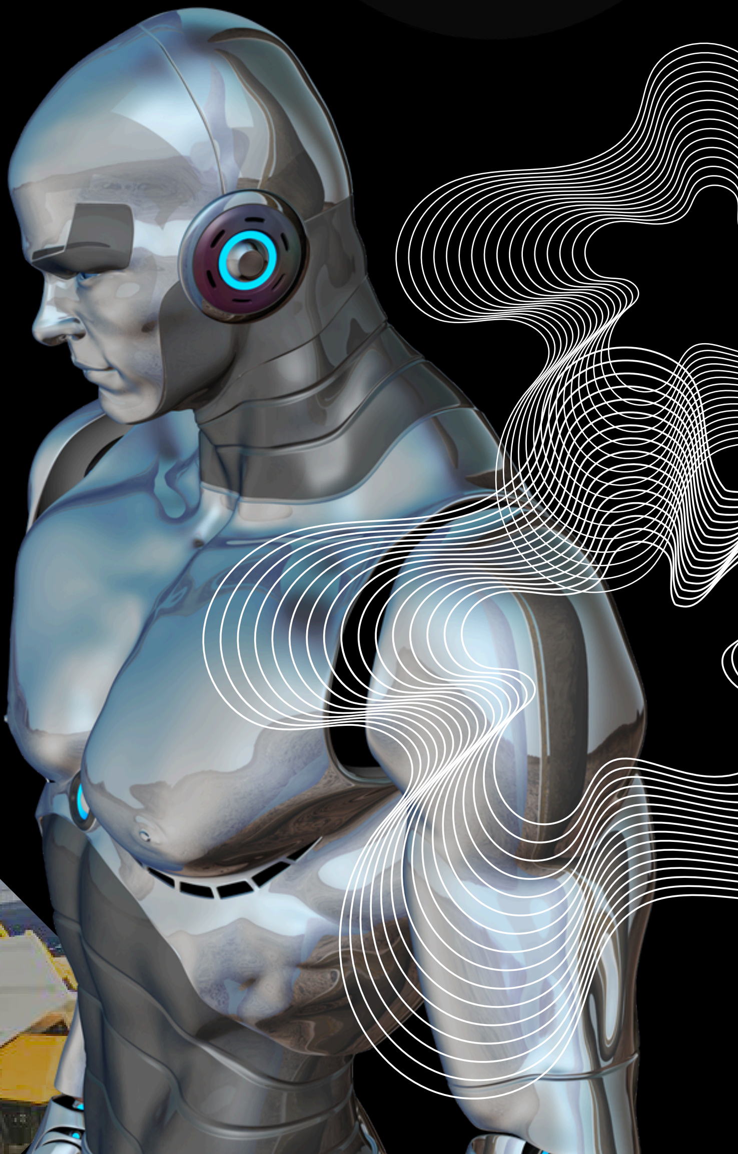

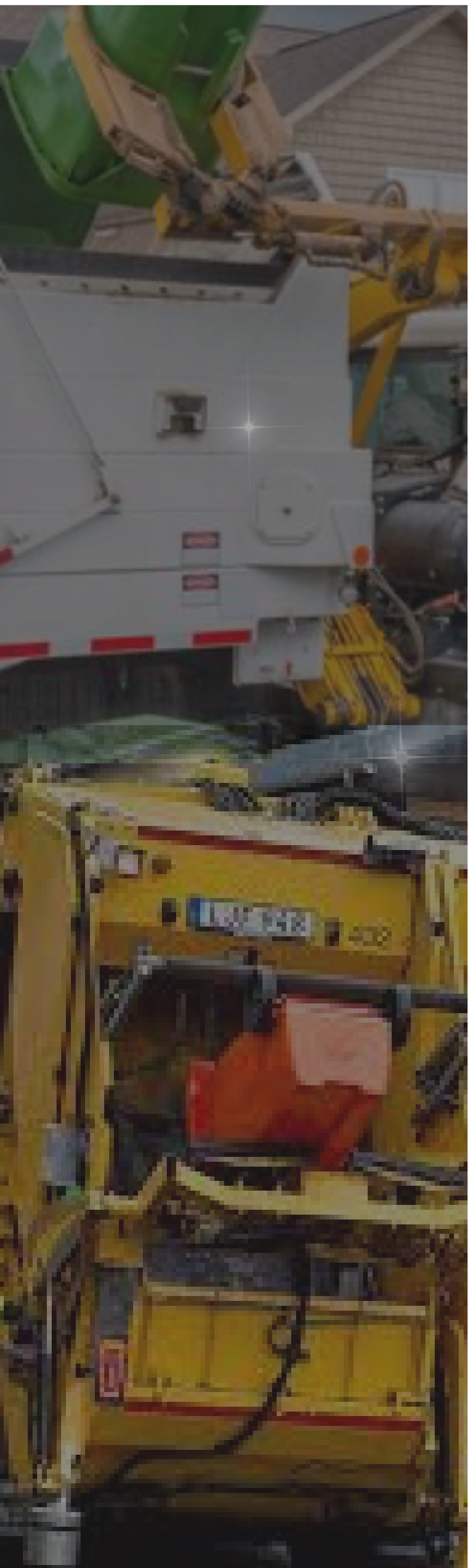

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# Introduction

" LOVELY GARBAGE TRUCK "

An automatic garbage truck is a modern waste collection vehicle equipped with advanced technology to streamline the process of waste disposal. Unlike traditional garbage trucks that rely heavily on manual labor, these vehicles use robotic arms, sensors, and automated systems to lift, empty, and replace garbage bins with minimal human intervention.

# Objectives

The objective of an automatic garbage truck project is to modernize waste management by improving efficiency, reducing environmental impact, and enhancing public health. Automation speeds up waste collection, optimizes routes, and lowers emissions, especially with electric or hybrid vehicles. It ensures cleaner environments, reduces health risks, and improves worker safety by minimizing manual handling. The project also promotes sustainability through better waste segregation and recycling, while reducing long-term costs and fostering innovation in municipal services. Ultimately, it aims to create a cleaner, safer, and more sustainable future.

# KEY COMPONETS

## Sensors

Ultrasonic Sensor : Detects the object (garbage bin)
Infrared Sensor : Detects and follow the line from the road.

## Actuators

LED : Show the process is working.
Buzzer : Alert when detects the object.
Servo : Lift and catch the object.
Motor : Moving the truck.

## Control unit

ESP32 Microcontroller : Controls and coordinates all devices, including sensors, LED, buzzer for automated vehicle.
IKB-1z : Controls motors

## Communication Module

Wi-Fi Module: Enables wireless communic ation between the microcontroller and other devices, allowing remote control and data exchange the internet.

## Display unit

Oled display : Display status how many objects detected or how many did process working.

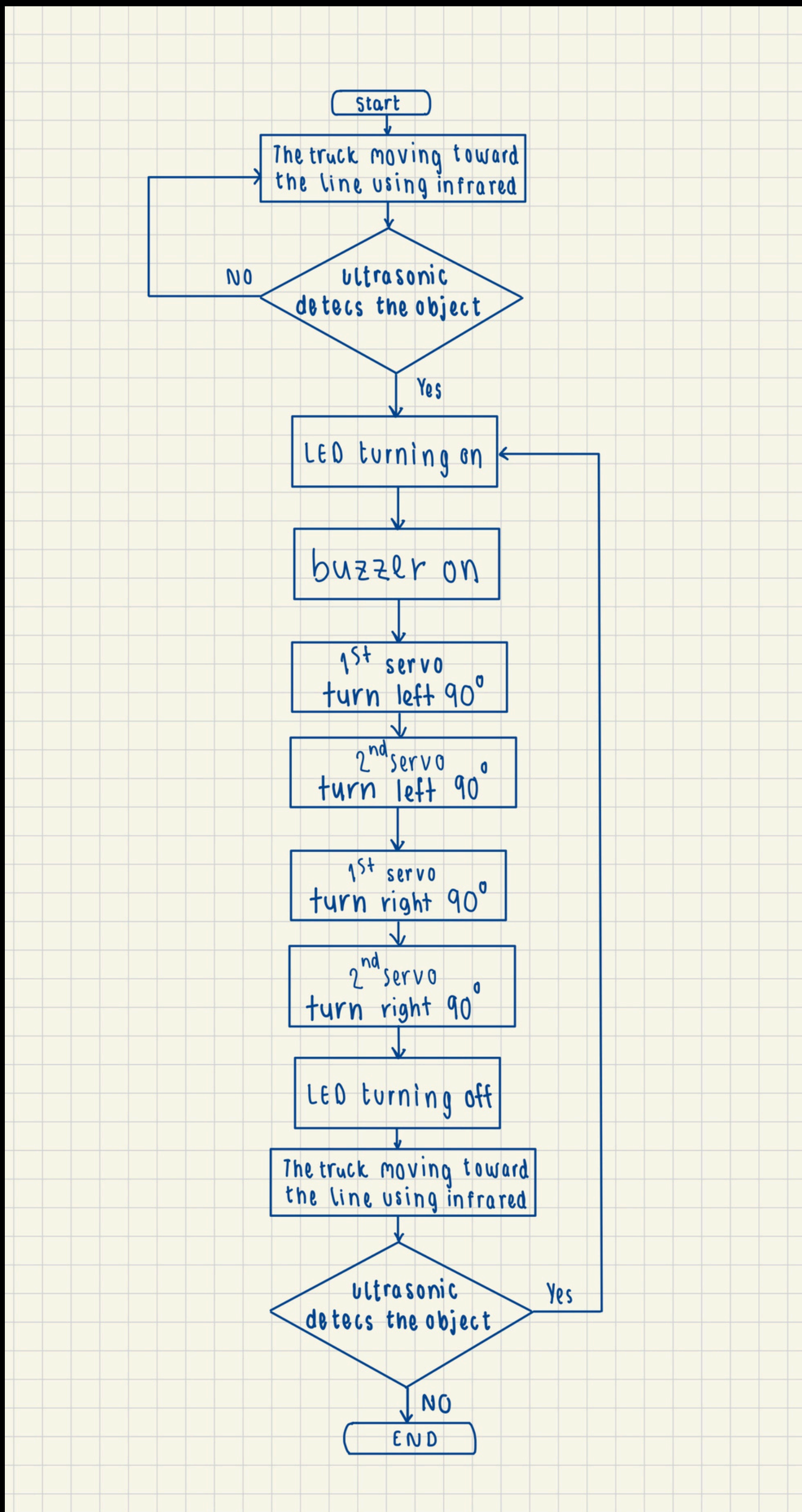
# SYSTEM ARCHITECTURE

## Description System Flow

1. INPUT
-The truck moves using an infrared sensor.
-An ultrasonic sensor detects objects.

2. PROCESS
-If no object is detected, the truck continues.
-If an object is detected:
-LED and buzzer activate.
-Servos turn left 90Â°, then return.
-LED turns off, and the truck resumes.

3. OUTPUT
-If no object is detected, the process ends.
-If an object is detected again, the cycle repeats.



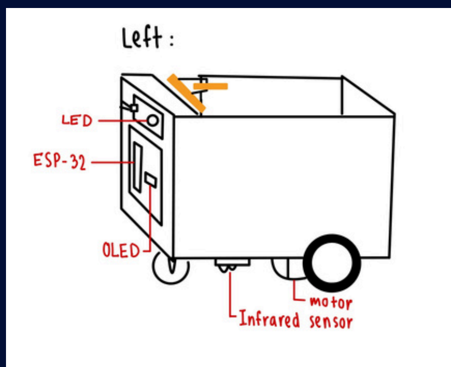
# METHODOLOGY

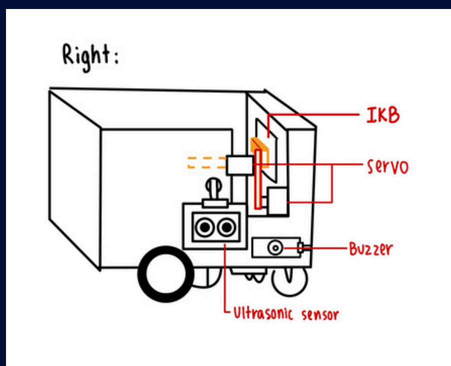
## Collecting the Components

The team gathered all the necessary components required for the prototype. The ESP32 microcontroller was selected as the central processing unit for its versatility and ability to integrate with sensors and actuators.

## Planning the Layout

The team carefully planned the layout to ensure functionality, efficiency, amd clarity. The ESP32 microcontroller was placed centrally on the breadboard to simplify wiring and maintain neat connections. Sensors were positioned along the edges for optimal detection: the ultrasonic sensor on the right,the infrared sensor under the board, and the servo on the top. The OLED display was placed at the front for clear visibility, while the buzzer and LED were positioned at the top to provide the process is working.

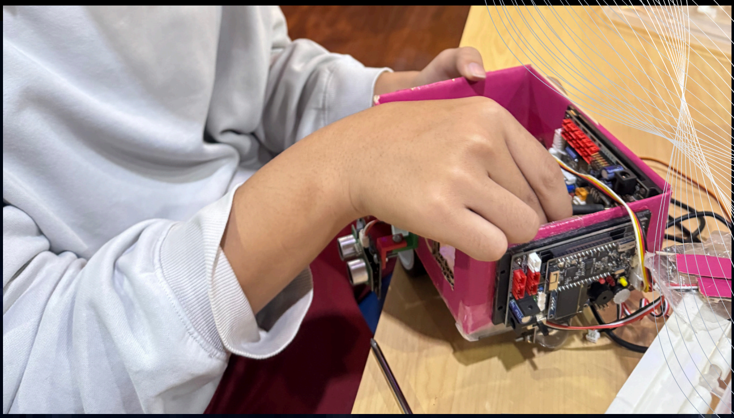


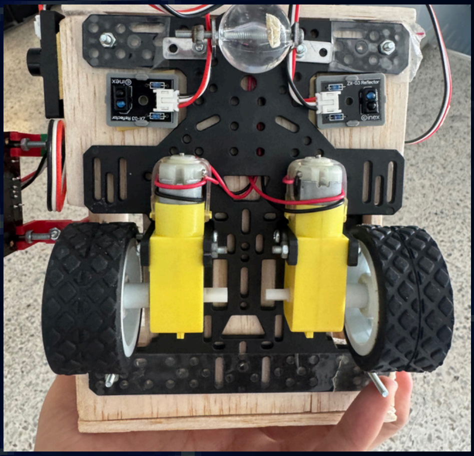
# METHODOLOGY

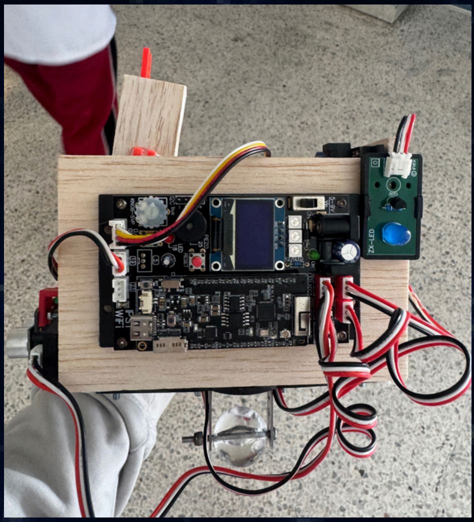
## Placing all the components

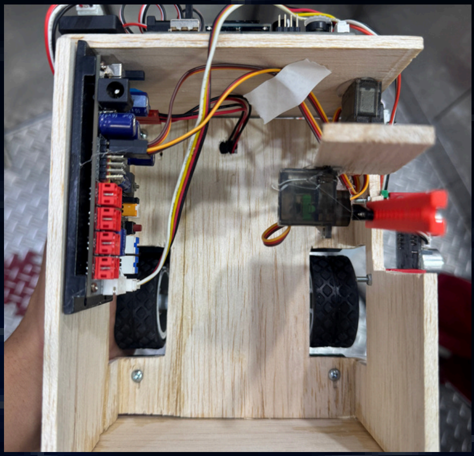
Start building the car frame by assembling the prepared wooden boards and attaching the sensors to the wooden frame according to the plan. Start planning the commands for using the sensors and testing if there are any errors and where the frame needs to be fixed.



By the end of week 7, Our prototype and car structure have been completed. The decoration is almost complete. Ready to program (write code) for commands. There will be as many strength and stability tests as possible to be certain. Then it will be considered a complete prototype project for use.





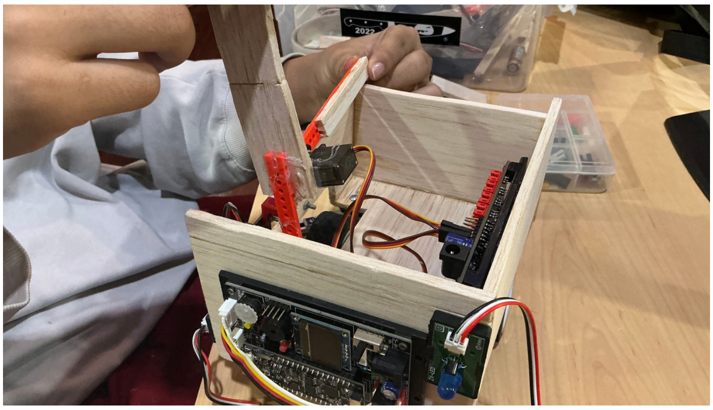


## PROGRAMMING AND INITIAL TESTING

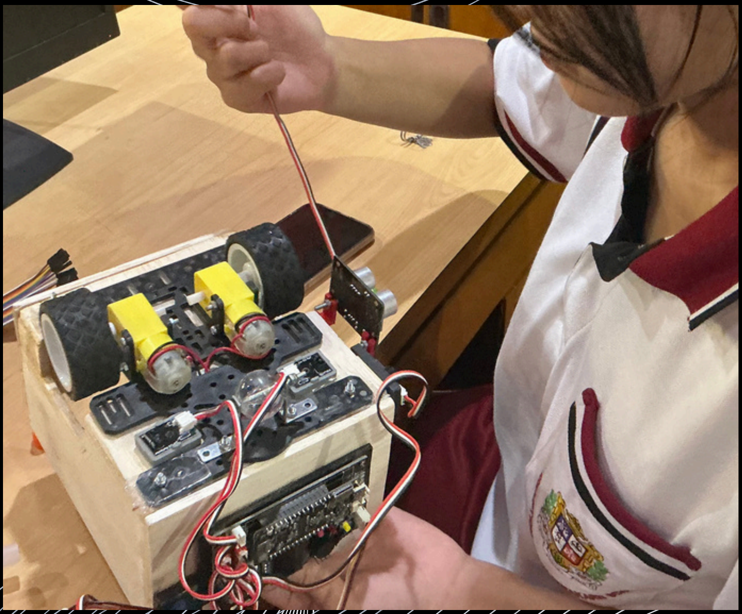
During Week 10, our main task was to write the initial code for the components of our project. We started by reviewing the system requirements and identifying the code needed to control the sensors.

Each , component required specific programming to ensure proper functionality. For instance, the ultrasonic sensor was programmed to detect obstacles and measure distance, Set the distance along the specified lines on the road surface which would allow the robot to navigate efficiently. We also wrote control code for the servol 1 and 2 used together mechanism used to pick up the garbage at these points.

Week 10



By the end of the week, we had successfully uploaded working code for each component and tested them individually to confirm they were functioning as expected.



Week 11

## SYSTEM INTEGRATION AND TROUBLESHOOTING

In week 11, we focused on developing the components of the autonomous waste collection robot, ultrasonic sensors, motor drivers, servos, and other parts to ensure the system works as a single unit and works together seamlessly.

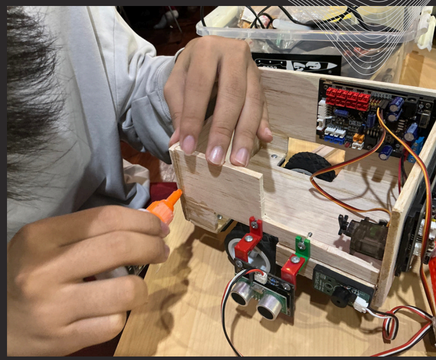
We also faced problems due to the motor installation location.

After fixing these problems, we tested the ultrasonic sensor system to detect obstacles and the servos worked properly to collect the trash.

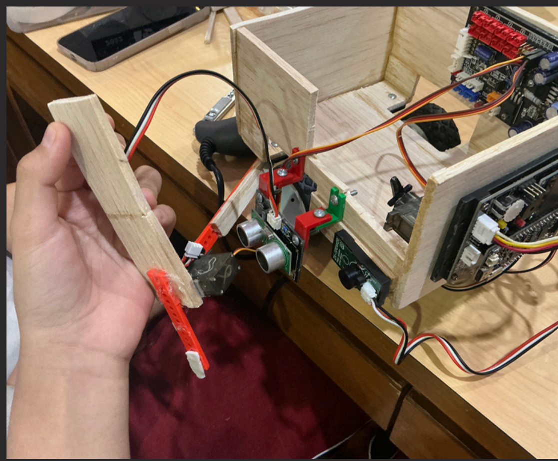
At the end of week 11, the stability system was developed and the operation of the motors installed in week 10 was focused on checking.

# PROGRAMMING INITIAL TESTING SYSTEM INTEGRATION

In Week 12, we tested to make sure the robot was performing the commands correctly. Each sensor and actuator was tested for consistency.



During testing, we identified security issues with The instability of the vehicle has led to the need to solve the problem of installing a new clamp to make it more convenient and easier to use. The clamp used to clamp the trash to be put in the vehicle increases stability and safety.

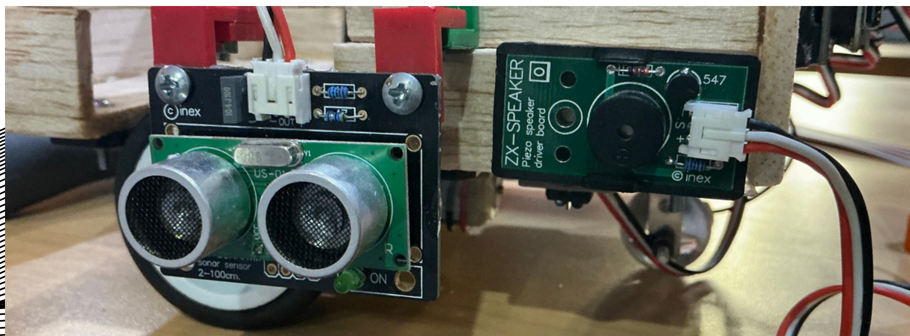


By the end of the week, our system demonstrated increased stability and security, preparing us for additional system checks in Week 13.

In week 13, we focused on improving our garbage collection robot to improve its stability and usability. The sensors were repositioned to increase accuracy, and in particular, the ultrasonic sensors were adjusted to prevent false readings from nearby obstacles.

In addition, we improved the safety and stability performance and checked whether the visual feedback was clear and whether all the wires were securely fastened.

We tested our garbage collection robot and the results showed increased stability, making the robot more reliable and usable.

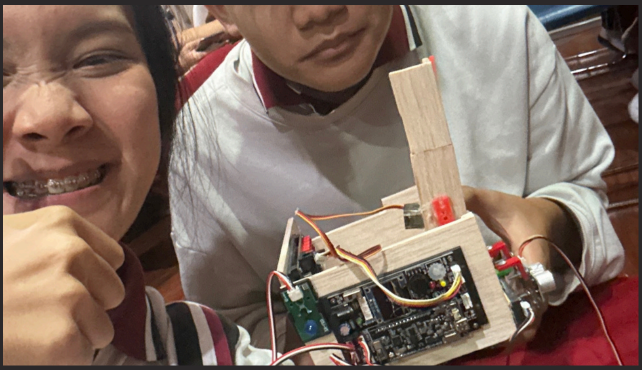


# Conclusion

We have developed our project from planning to testing. In Phase 1, we focused on planning, defining objectives, and building an initial prototype. The design is the same as the initial plan, but it is modified to suit the situation.

In Phase 2, we focused on programming, testing the system together, and getting an efficient and stable prototype. Through advanced testing and troubleshooting, we have addressed key challenges, such as sensor accuracy. We have improved the structure for safety and usability to achieve the prototype we planned in Phase 1.

After Phase 2, the project has successfully demonstrated its performance as planned. From now on, it only needs to improve the efficiency, usability, and operability to create this demonstration project perfectly and without any further problems.



## Further Development

While the project has met its primary objectives, there are several areas where further improvements can be made to enhance the system's functionality and efficiency.

| | |
|---|---|
| **Power Optimization** | Explore alternative energy solutions, such as rechargeable batteries, like today's electric vehicles, to improve energy efficiency and ensure continuous operation. |
| **User Interface Development** | Create a mobile interface that allows users to remotely check and control the system, such as checking the car battery and alerting the car when there is a problem and locating the car, which will increase accessibility and convenience. |
| **Additional Sensors** | Additional sensors, such as humidity or light sensors, can be added to expand the system's capabilities and adaptability to different environments. |
| **Prototype Design** | Improved the physical design of the prototype to be more compact, durable and easier to maintain. Improved the control storage structure to be more flexible. |
| **Real-World Testing** | Long-term testing in real environment is conducted to evaluate system performance for further improvement. |
| **Error Handling and Alerts** | Implement advanced error detection and alerting systems, such as alerts when sensors malfunction or are caught by external environments, when deployed. |