INTERNET OF THINGS LAB

(CASE STUDY)

"AUTOMATIC CAR PARKING TOLL GATE SYSTEM"

BACHELOR OF TECHNOLOGY IN INFORMATION TECHNOLOGY

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With great pleasure we want to take this opportunity to express our heartfelt gratitude to all the people who helped in learning this course**.**

On successful completion of our **Internet of Things (IOT) LAB**, we are bound to convey our sincere thanks to **"Mrs. A. Surekha"** for giving support and guidance with valuable during learning days

Submitted To

Mrs.A. Surekha

Date: 15/04/2024 (InformationTechnology)

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CERTIFICATE

This is to certify that the project report entitles "**AUTOMATIC CAR PARKING TOLL GATE SYSTEM"** submitted by in partial fulfillment of the requirements for the award of the degree of bachelor of Technology in Information Technology of Anil Neerukonda Institute of technology and sciences, Visakhapatnam is a record of bonafide work carried out under my guidance and supervision.

Project Guide	**Head of the department**
Mrs. A.Surekha	**Dr. M. Rekha Sundari**
Assistant Professor	Professor
Department of IT	Department of IT
ANITS	ANITS

DECLARATION

We hereby declare that the project work entitled "**SMART DUSTBIN"** submitted to Anil Neerukonda Institute of Technology and Sciences is a record of an original work done by **G. Ojaswini Sree(A21126511087), B. Tharun Gupta (A21126511072), Ch. Durga Prasad (A21126511081), B. Rasagnya (A21126511076), G. Umesh Krishna Vamsi (A21126511090)** under the esteemed guidance of **Mrs. A. Surekha** Assistant Professor of Information Technology , Anil Neerukonda Institute of Technology and Sciences and this project work is submitted in partial fulfillment of the requirements for the award of degree bachelor of technology in information technology . This entire project is done to the best of our knowledge and not submitted for the award of other degree in any other universities.

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AUTOMATIC CAR PARKING TOLL GATE SYSTEM

ABSTRACT

An IoT project on a smart dustbin involves integrating sensors, microcontrollers, and communication modules to create an intelligent waste management system. The hardware setup includes sensors like ultrasonic sensors for garbage level detection. These sensors are connected to a microcontroller board such as Arduino UNO, which processes the sensor data and controls the system.

A crucial aspect of this project is the communication module, which enables the smart dustbin to connect to the internet or other devices. This connectivity allows the dustbin to send data, such as garbage level status and environmental conditions, to a central server or a mobile app in real time.

The data collected from the sensors is processed and analyzed using software algorithms. This analysis helps in understanding garbage level trends, temperature variations, and other relevant metrics, providing valuable insights into waste management.

Smart functionalities enhance the dustbin's capabilities, such as automatic lid opening/closing based on proximity or gestures.

Integration with cloud services further enhances the system by enabling remote monitoring and control, data storage, and advanced analytics.

Overall, this abstraction encapsulates the key components and functionalities of an IoT project on a smart dustbin, highlighting its potential to revolutionize waste management through technology-driven solutions.

1. INTRODUCTION

The advent of Internet of Things (IoT) technology has brought about transformative changes in various domains, including waste management. One compelling application of IoT in this context is the development of smart dustbins. These innovative bins are equipped with a range of sensors and communication capabilities, enabling them to collect real-time data about garbage levels, environmental conditions, and operational status.

At the heart of a smart dustbin lies a sophisticated hardware setup. This includes sensors like ultrasonic sensors for precise garbage level detection,serve motor to run the application. These sensors are integrated with microcontroller boards such as Arduino UNO, which serve as the brains of the system, processing sensor data and orchestrating the dustbin's functionalities.

One of the key benefits of smart dustbins is their ability to provide actionable insights into waste management. By analyzing data collected from sensors, algorithms can identify usage patterns, predict garbage accumulation trends, and optimize waste collection schedules. Moreover, smart dustbins can enhance user experience through features like automated lid operations based on proximity sensors, real-time status updates via mobile apps or web interfaces, and intelligent notifications when bins reach capacity.

In essence, smart dustbins represent a convergence of hardware innovation, data analytics, and connectivity solutions, offering a promising avenue for addressing modern challenges in waste management with efficiency and intelligence.

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1.1 OBJECTIVE:

The integration of communication modules is another pivotal aspect of smart dustbins. These modules, which can be based on technologies like Wi-Fi, Bluetooth, or GSM, establish connectivity with external networks or devices. This connectivity empowers the dustbins to transmit data to centralized servers or user interfaces, facilitating remote monitoring, data analysis, and operational control.

1.2 IOT Definition:

IoT stands for the Internet of Things. It refers to a network of physical devices, vehicles, appliances, and other objects embedded with sensors, software, and connectivity capabilities that enable them to connect and exchange data over the internet. In simple terms, IoT is the concept of connecting everyday objects and enabling them to communicate and interact with each other, as well as with users, through the internet.

The fundamental idea behind IoT is to bridge the gap between the physical and digital worlds, allowing objects to collect and share data, perform tasks autonomously, and provide enhanced functionality and convenience to users. These objects, often referred to as "smart" devices, can range from small sensors and wearable devices to larger systems like smart homes, industrial machinery, and even entire cities

2. SYSTEM SPECIFICATIONS

2.1 Functional Requirements:

Functional requirements for a smart dustbin IOT Project

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1. Gate Control:

- Based on the measured distance, the system should determine whether to open or keep the gate closed.
- It should have the ability to open the gate automatically when a vehicle approaches within a specified distance threshold.

2. Distance Measurement:

- The system must accurately measure the distance between the vehicle and the toll gate.
- It should utilize sensors or other appropriate technology for distance measurement.

2.2 Non-Functional Requirements:

Non-functional requirements for a smart dustbin

1. **Security:**

   - The system should prevent unauthorized access to the parking area by ensuring that the gate only opens for authorized vehicles.
   - Data communication between components should be encrypted to prevent tampering or interception.

2. **Performance:**

   - The gate opening/closing mechanism should operate swiftly to minimize waiting time for vehicles.
   - The system should have low latency in distance measurement and gate response.

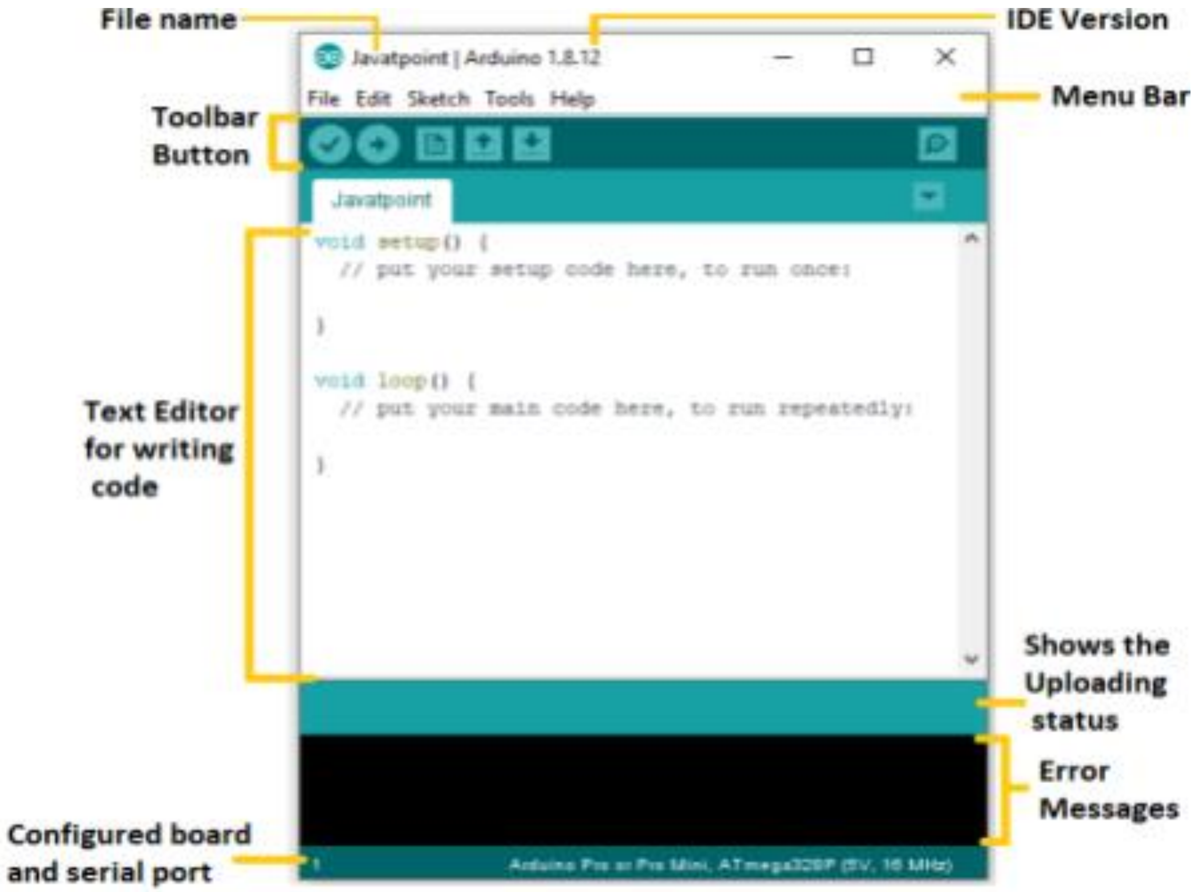
3. **Reliability:**

   - The system should operate reliably under various weather conditions (rain, snow, etc.) and lighting conditions (day, night).
   - It should be resistant to false triggers or disturbances, such as nearby objects or noise..

3. SYSTEM SOFTWARE

3.1 Arduino IDE:

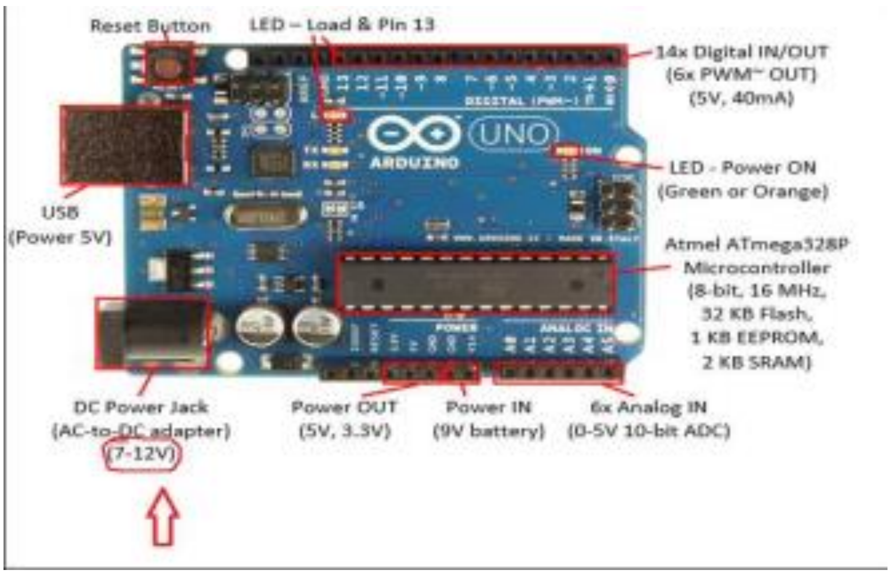
The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino hardware to upload programs and communicate with them.



4. SYSTEM HARDWARE

4.1 Arduino Board:

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



4.2 Ultrasonic Sensor:

An ultrasonic sensor is a device that uses high-frequency sound waves to detect and measure distance to objects in its vicinity. The sensor works by emitting a high-frequency sound wave, which bounces off an object and returns to the sensor. The time taken for the sound wave to travel to the object and back to the sensor is used to calculate the distance between the sensor and the object.

4.3 Jumper Cables:

Jumper wires are simply wires that have connector pins at each end, allowing them to be used to connect two points to each other without soldering. Jumper wires are typically used with breadboards and other prototyping tools in order to make it easy to change a circuit as needed

4.4 Sensor Explanation:

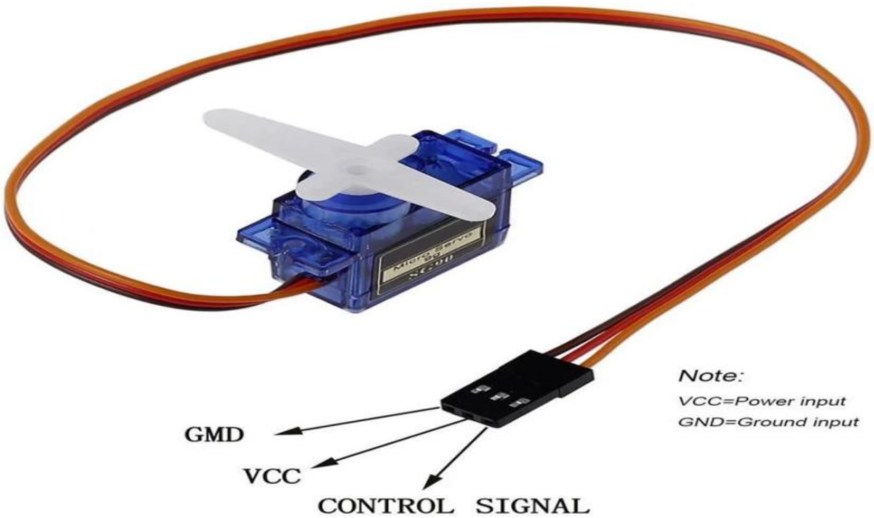
An ultrasonic sensor is a device that uses high-frequency sound waves to detect and measure distance to objects in its vicinity. The sensor works by emitting a high-frequency sound wave, which bounces off an object and returns to the sensor. The time taken for the sound wave to travel to the object and back to the sensor is used to calculate the distance between the sensor and the object.

In IoT applications, ultrasonic sensors are used as proximity sensors to detect the presence or absence of objects within a certain range. They are often used in combination with other sensors, such as infrared sensors, to provide more accurate distance measurements.

Ultrasonic sensors can be used in a wide range of applications, including security systems, robotics, industrial automation, and smart homes. For example, in a security system, an ultrasonic sensor can be used to detect the presence of an intruder by measuring the distance between the sensor and the intruder. In robotics, ultrasonic sensors can be used to detect obstacles and navigate around them.

The data collected by the ultrasonic sensor can be transmitted to other devices or systems through the IoT network, providing real-time information on the location and distance of objects in the sensor's field of view. The information collected by the ultrasonic sensor can be used to trigger actions or alerts, such as turning on lights, sounding an alarm, or sending a notification to a mobile device.

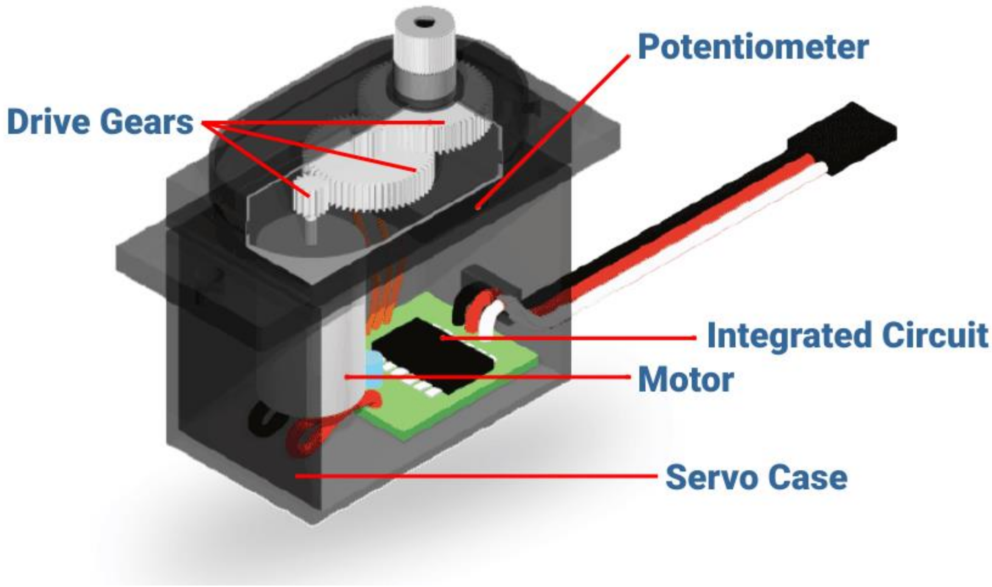
4.5 Servo Motor:



A servo motor is a precise rotary actuator commonly used in robotics and automation. It operates based on closed-loop control, accurately controlling position, velocity, and acceleration. With features like high torque, compact size, and smooth operation, servo motors are essential for tasks requiring precise motion control in various industries.

Servo motors use feedback devices like encoders or potentiometers to provide real-time position feedback to the control system, ensuring accurate positioning and motion control.

4.6 Working of Motor:

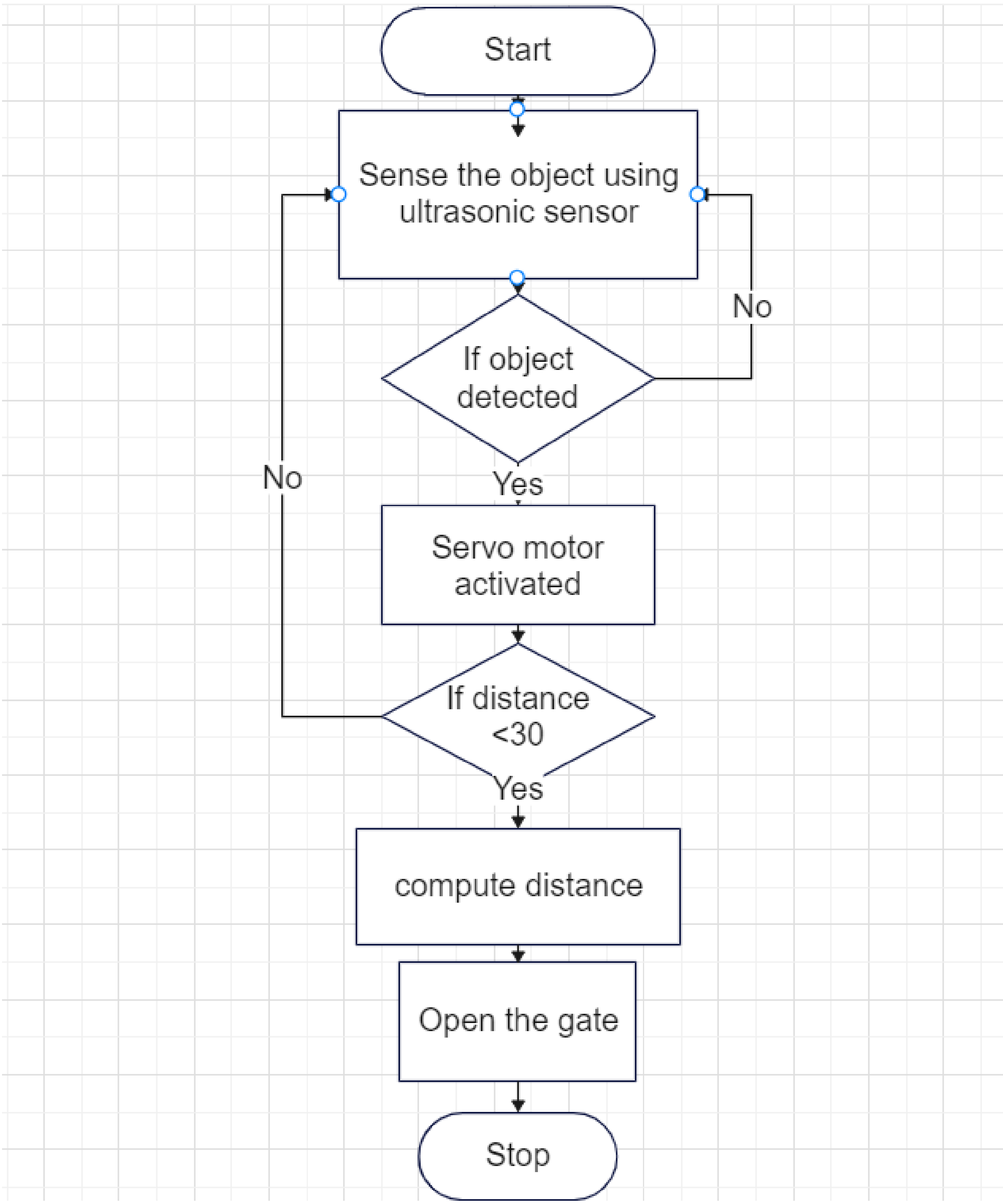


In a smart dustbin, the motor operates as the pivotal component for automated lid functionality, streamlining waste disposal processes. Integrated within the dustbin's design, the motor receives signals from the control system, triggered by sensor inputs or user commands.

This signal prompts the motor to activate and initiate rotational motion, which is then translated into linear movement through a mechanical linkage or gear system. As a result, the lid of the dustbin opens or closes smoothly and accurately, based on predefined conditions such as reaching a specific garbage level or user-initiated actions via a mobile app or interface.

Additionally, some smart dustbins incorporate feedback mechanisms using sensors or limit switches to ensure the motor stops once the lid reaches its desired position, preventing overexertion and optimizing operational efficiency. Overall, the motor's precise control and automated functionality enhance the smart dustbin's usability, promoting hands-free waste management and contributing to a more efficient garbage disposal system.

5. FLOWCHART



Start
Sense the object using ultrasonic sensor
No
If object detected
No
Yes
Servo motor activated
If distance <30
Yes
compute distance
Open the gate
Stop

6. METHODOLOGY

6.1 Description of the Methodology:

For the development of the car parking toll gate system, an Agile methodology will be employed. Agile emphasizes iterative development, collaboration, and flexibility, which are crucial for a project with evolving requirements like this.

The project will start with a comprehensive analysis phase to identify stakeholder needs, define requirements, and establish project goals. This will involve engaging with parking lot operators, technical experts, and potential users to gather input and feedback.

Next, the development team will break down the project into smaller, manageable tasks or user stories. These tasks will be prioritized based on their importance and dependencies.

Development will proceed in short iterations or sprints, typically lasting two to four weeks. Each sprint will focus on delivering a working increment of the system, starting with core functionalities like distance measurement and gate control.

Regular meetings, such as daily stand-ups and sprint reviews, will facilitate communication and collaboration within the team. Feedback from stakeholders will be incorporated at the end of each sprint to ensure alignment with their expectations.

Continuous testing and quality assurance will be integral to the development process, with automated and manual tests conducted to ensure reliability and accuracy.

Finally, the system will undergo thorough validation and verification before deployment, with user acceptance testing to confirm that it meets the requirements and satisfies user needs.

6.2 Overall flow of project:

Step-1: Gather Components:

Collect the necessary components for the project, including:

1. Arduino board (e.g., Arduino Uno)
2. Ultrasonic sensor
3. Jumper wires
   Male to Male.
   Male to female wires.
4. Servo motor
5. Battery(optional)
6. Bread Board

Step-2: Setup Arduino Environment, Write Arduino Code.

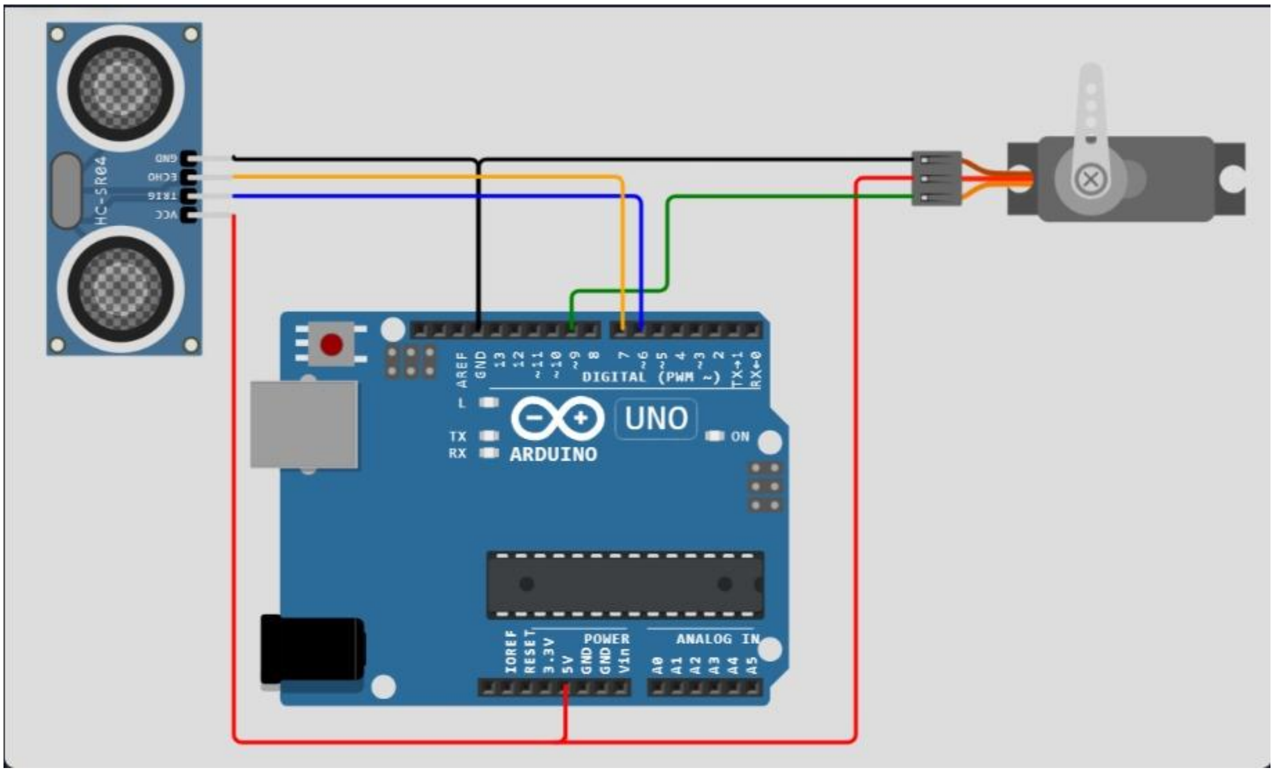
Step-3: Connect Components using environment setup.

Step-3: Power on the Arduino and observe the system's behavior.

Keep the object nearer to the ultrasonic sensor and observe the moments of the dustbin lid.

When ultrasonic sensor detects the object under specified distance then motor activates and open the lid automatically. After vehicle went it closes the gate.

6.3 Environmental Setup



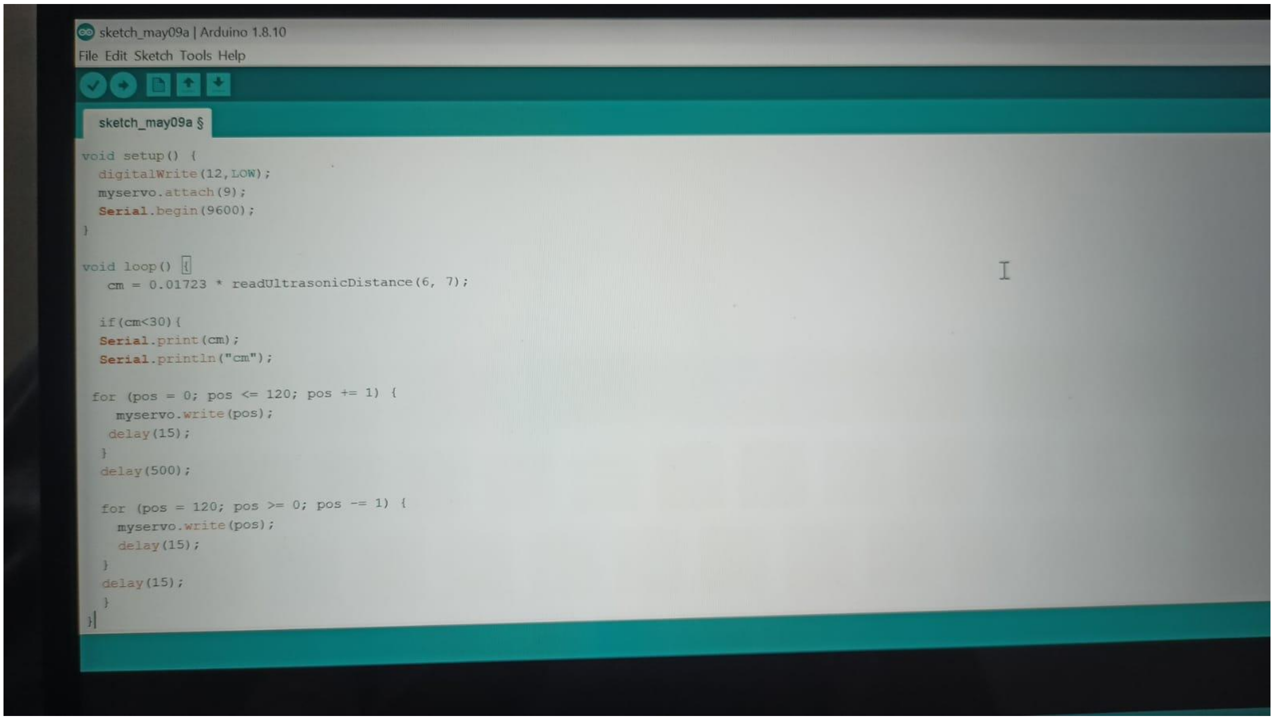
7. IMPLEMENTATION

7.1 Code:

```
#include <Servo.h>
Servo myservo;
int pos = 0;
int cm = 0;


long readUltrasonicDistance(int triggerPin, int echoPin)
{
  pinMode(triggerPin, OUTPUT);
  digitalWrite(triggerPin, LOW);
  delayMicroseconds(2);
  digitalWrite(triggerPin, HIGH);
  delayMicroseconds(10);
  digitalWrite(triggerPin, LOW);
  pinMode(echoPin, INPUT);
  return pulseIn(echoPin, HIGH);
}


void setup() {
  digitalWrite(12,LOW);
  myservo.attach(9);
  Serial.begin(9600);
}


void loop() {
   cm = 0.01723 * readUltrasonicDistance(6, 7);
  if(cm<30){
  Serial.print(cm);
  Serial.println("cm");
 for (pos = 0; pos <= 120; pos += 1) {
    myservo.write(pos);
   delay(15);
  }
  delay(500);
```

```
  for (pos = 120; pos >= 0; pos -= 1) {
    myservo.write(pos);
    delay(15);
  }
  delay(15);
  }
}
```

7.2 Compilation Step



9. CONCLUSION

In conclusion, the Agile methodology provides a robust framework for the development of the car parking toll gate system, ensuring adaptability, collaboration, and continuous improvement throughout the project lifecycle. By embracing iterative development cycles, the project team can respond swiftly to changes in requirements and stakeholder feedback, delivering a solution that aligns closely with user needs. By adhering to Agile principles and practices, the development team can navigate the complexities of the project effectively, delivering a high-quality car parking toll gate system that meets both functional requirements and user expectation

10. FUTURE SCOPE

Looking ahead, the car parking toll gate system presents several avenues for future expansion and enhancement. One potential area for improvement is the integration of advanced technologies such as machine learning and computer vision for more accurate vehicle identification and classification. This could enable the system to differentiate between various types of vehicles and automate entry/exit processes further.

Additionally, incorporating IoT (Internet of Things) devices could enhance real-time monitoring and management of parking spaces, providing insights into occupancy levels and facilitating efficient space utilization. Integration with mobile applications could offer users convenient features like remote booking and payment, enhancing the overall user experience.

Furthermore, the system could be scaled up to accommodate larger parking facilities or integrated with smart city initiatives for seamless urban mobility. Implementing sustainability features such as solar-powered gates or EV charging stations could align the system with environmental goals.

Lastly, continuous refinement based on user feedback and emerging technologies will be essential to keep the system up-to-date and competitive in a rapidly evolving landscape. By embracing these future opportunities, the car parking toll gate system can evolve into a sophisticated and indispensable component of modern transportation infrastructure.

11.REFERENCES

1) https://www.youtube.com/watch?v=PFF4DTkMsaM