THE THIRD EYE
THE SMART TRASH

20EC5203 - ELECTRONIC DESIGN PROJECT I

A PROJECT REPORT

Submitted by

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K. RAMAKRISHNAN COLLEGE OF TECHNOLOGY

(AUTONOMOUS)

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BONAFIDE CERTIFICATE

Certified that this project report titled **" THE THIRD EYE AND THE SMART TRASH " is a Bonafide work of SHANKAR SHARMA K J (811722106099) , NANDHINI G (811722106061) , THANUSH SARAN S (811722106119),** who carried out the project under my supervision. Certified further, that to the best of our knowledge the work reported here in does not from part of any other project report or dissertationon the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.

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DECLARATION

We jointly declare that the project report on "**THE THIRD EYE**" and "**THE SMART TRASH**" is the result of original work done by us and best of our knowledge, similar work has not been submitted to "**ANNA UNIVERSITY CHENNAI**" for the requirement of Degree of **BACHELOR OF ENGINEERING**. This project report is submitted on the partial fulfillment of the requirement of the award of Degree of **BACHELOR OF ENGINEERING.**

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LIST OF FIGURES

LIST OF ABBREVIATIONS

DC	-	Direct Current
LED	-	Light Emitting Diode
IC	-	Integrated Circuit
OP-AMPS	-	Operational Amplifiers
FET	-	Field Effect Transistor
V	-	Volt
I	-	Current
R	-	Resistance
Ω	-	Ohm
PCB	-	Printed Circuit Board
NTC	-	Negative Temperature Coefficient
IR	-	Infrared Sensor
UR	-	Ultrasonic Sensor
F	-	Farads
Ma	-	Milliampere
Hz	-	Hertz
5V	-	5 Volts (Voltage Supply)
AC	-	Alternating Current
PVT	-	Power, Voltage, and Temperature

CHAPTER 1
COMPONENTS

1.1 BREAD BOARD

A breadboard serves as an indispensable tool in the realm of electronics, providing a versatile platform for the assembly and testing of electronic components. Comprising a rectangular board with a grid of interconnected holes, the breadboardis designed to offer a user-friendly environment that facilitates the creation of electronic circuits without the need for soldering. The grid arrangement follows rowsand columns, and within each row, multiple holes are electrically connected. Beneath the surface of the board, metal clips establish electrical connections, allowing for thecreation of intricate circuits without the permanency associated with solderedconnections.

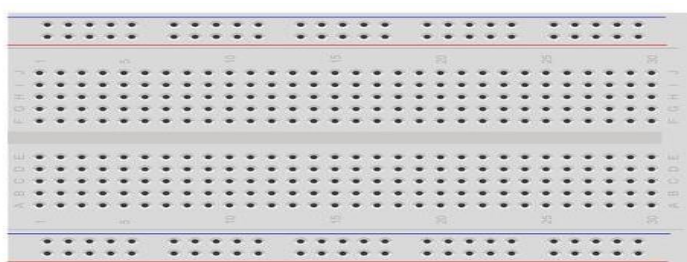

Figure 1.1 Bread board

In addition to its grid structure, breadboards typically feature power rails along the sides, commonly colored in red and blue. These power rails provide accessible pointsfor connecting power sources, whether they be batteries or external power supplies.The ease of access to power facilitates the testing and experimentation of circuits. Connecting wires play a crucial role in establishing electrical connections between various components on the breadboard. These are shown in Figure 1.1.

1.2 DIODE

A diode, a fundamental semiconductor device with two terminals known as the anode and cathode, plays a pivotal role in electronic circuits due to its unique electrical properties. The primary function of a diode is to control the flow of electriccurrent by allowing it in one direction while blocking it in the opposite direction. This property is vital in rectification processes, especially in power supply circuits, where diodes are instrumental in converting alternating current (AC) to direct current (DC). The behavior of a diode is characterized by its voltage-current relationship, described by the Shockley diode equation, which exhibits an exponential relationship between the voltage across the diode and the currentflowing through it. When the diode is forward-biased, meaning a positive voltage is applied to the anode with respect to the cathode, it conducts current, allowing the flow of electrons. In contrast, when the diode is reverse-biased (negative voltage applied to the anode), it blocks current, essentially acting as a one-way valve for electric current.

Figure 1.2 Diode

In addition to their crucial role in rectification processes, diodes exhibit a diverse array of types and applications, contributing significantly to electronic circuits and modern technology. One notable type is the Schottky diode, characterized by its rapid switching speed are represented in Figure 1.2.

1.3 IR SENSOR

An infrared (IR) sensor is a device that detects infrared radiation emitted by objects in its surroundings. Infrared radiation is a type of electromagnetic wave that falls just beyond the visible light spectrum and is commonly associated with heat energy. IR sensors are widely used for sensing and detecting objects, measuring heat, and enabling remote communication.

Infrared sensors operate in two main categories: active and passive. Active IR sensors emit their own infrared light and detect its reflection from nearby objects to measure distance or identify the presence of an obstacle. Passive IR sensors (as shown in Figure 1.3), on the other hand, do not emit any radiation but instead detect the infrared energy naturally emitted by objects, making them ideal for applications like motion detection.

Figure 1.3 Infrared Sensor

These sensors have a variety of applications across different fields. In consumer electronics, they are used in remote controls for TVs, air conditioners, and other devices. In security systems, passive IR sensors play a critical role in motion detection for alarms and surveillance. Industrial automation systems use IR sensors for flame detection, quality control, and temperature monitoring. Moreover, IR sensors are also used in robotics for navigation and object detection, as well as in healthcare for thermal imaging and non-contact temperature measurement.

1.4 ULTRASONIC SENSOR

An ultrasonic sensor is a versatile device used for measuring distances by utilizing ultrasonic sound waves. These sensors operate by emitting high-frequency sound waves, typically beyond the audible range of humans, and detecting their reflection from a target object. The core principle involves calculating the time taken for the sound waves to travel to the object and return to the sensor, which is then used to determine the distance. This non-contact method of measurement makes ultrasonic sensors highly reliable and precise in various applications.

Ultrasonic sensors (as shown in Figure 1.4) are widely employed in numerous industries due to their efficiency and adaptability. In the automotive sector, they are integral to parking assistance systems, helping drivers avoid collisions by detecting obstacles. In robotics, these sensors aid in navigation and object detection, enabling autonomous movements. Industrial applications include liquid level measurement, object counting, and quality control processes. Additionally, ultrasonic sensors are a key component in smart systems, such as IoT-based devices used for home automation and waste management.

Figure 1.4 Ultrasonic Sensor

The advantages of ultrasonic sensors are significant. They are capable of functioning in low-light environments and can detect a variety of materials, including liquids, solids, and granular substances.

1.5 POWER SUPPLY

A battery stands as a fundamental component in the realm of portable electronics, operating as a versatile electrochemical device designed to store and deliver electrical energy through a controlled chemical reaction. Typically composed of oneor more electrochemical cells, a battery (as shown in Figure 1.5) consists of positive (cathode) and negative (anode) electrodes immersed in an electrolyte solution. The chemical interaction between these components, when a circuit is closed, triggers a reaction that results in the flow of electrons, generating electrical energy. Alkaline batteries, for instance,are ubiquitous in everyday devices due to their reliability and cost-effectiveness. Lithium-ion batteries, renowned for their high energy density and rechargeable nature, are prevalent in various applications, including smartphones and electric vehicles. Nickel-cadmium batteries, also rechargeable, find their niche in portable electronics, offering a balance between efficiency and longevity. Alkaline batteries are ideal for low-drain devices, while lithium-ion batteries shine in applications demanding compactness and high energy storage.

Figure 1.5 Battery

Rechargeable batteries, a notable category, contribute significantly to sustainabilityefforts by minimizing waste and promoting resource efficiency. Particularly economical for devices with frequent usage patterns, rechargeable batteries not onlyreduce environmental impact but also prove cost-effective over time. Batteries serve as omnipresent power sources, indispensable for a broad spectrum of electronic devices.

1.6 RESISTOR

A resistor is a fundamental electronic component that opposes the flow of electric current. It is a passive two-terminal device with the primary function of controllingor limiting the amount of current passing through a circuit. Resistors are crucial in electronics for adjusting voltage levels, protecting components from excessive currents, and defining time constants in various applications. Resistors come in various types, including fixed resistors with specific resistance values and variable resistors like potentiometers and rheostats that allow manual adjustment.

The resistance of a resistor (as shown in Figure 1.6) is measured in ohms (Ω) and is governed by Ohm's Law, which relates the voltage (V), current (I), and resistance (R) in a circuit through theequation $V = I \times R$. In electronic circuits, resistors play essential roles in voltage dividers, signal conditioning, and setting bias points for the active devices like transistors.

Figure 1.6 Resistor

Moreover, in setting bias points for active devices like transistors, resistors contribute to stabilizing and controlling the operation of these components. They arealso employed in filters, oscillators, and numerous other applications where precise control of electrical parameters is necessary.

1.7 CAPACITOR

A capacitor is a fundamental electronic component that stores and releases electricalenergy in a circuit. It consists of two conductive plates separated by an insulating material called a dielectric. When a voltage is applied across the plates, an electric field is established, causing the accumulation of positive and negative charges on the respective plates. Capacitors (as shown in Figure 1.7) are versatile components with various applications in electronics. They play a crucial role in smoothing voltage fluctuations, filtering signals, and providing energy storage in circuits. The ability to store electrical energy temporarily makes capacitors valuable in timing circuits, coupling AC and DC signals, and decoupling power supplies. Capacitors come in different types, including electrolytic capacitors, ceramic capacitors, and tantalum capacitors, each with specific properties suited to different applications. The capacitance of a capacitor, measured in farads (F), indicates its ability to store charge.

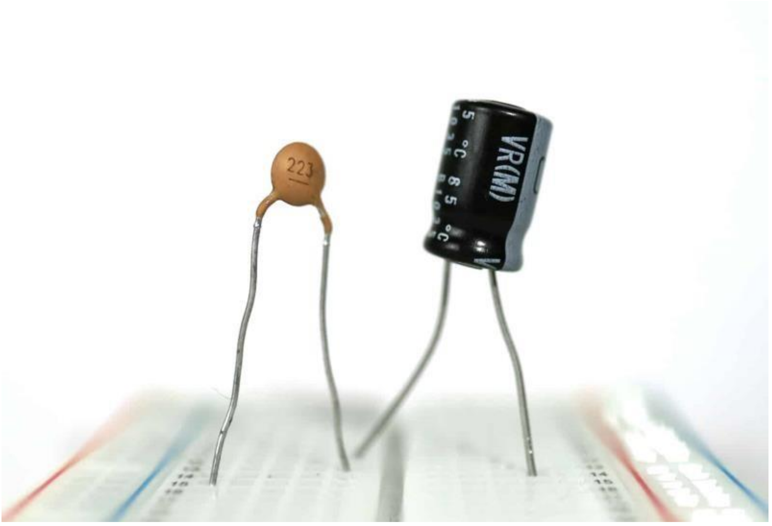

Figure 1.7 Capacitor

In electronic circuits, capacitors are essential for stabilizing power supplies, eliminating noise, and facilitating the proper functioning of various electronic components. They play integral roles in audio systems, power amplifiers, filters, and numerous other electronic devices, contributing significantly to the efficiency and performance of electrical systems.

1.8 INTEGRATED CIRCUIT

An Integrated Circuit (IC) is a compact arrangement of interconnected electronic components, such as transistors, resistors, capacitors, and diodes, fabricated on a semiconductor material. The miniaturized design of an IC (as shown in Figure 1.8) allows for the integrationof multiple functions and electronic circuits into a single chip, providing a significant advancement in electronic technology. Digital ICs, such as microprocessors and memory chips, process binary information, enabling the operation of computers anddigital devices. Analog ICs, like operational amplifiers (op-amps) and voltage regulators, are designed for continuous signal processing, common in audio amplifiers and power supplies. The 555 timer IC and the 741 op-amp are notable examples.

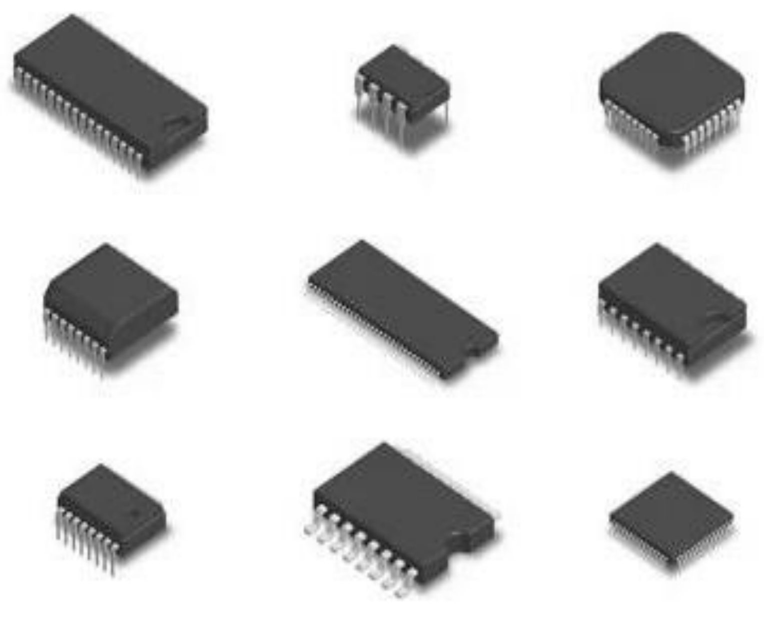

Figure 1.8 Transistor

The 555 timer is widely used for generating time delays, pulse-width modulation, and oscillations. The 741 op-amp, on the other hand, is versatile and commonly usedin amplifiers and signal processing applications. The compact nature of ICs enables the creation of complex electronic systems while minimizing space requirements, power consumption, and manufacturing costs. Integrated Circuits have revolutionized the field of electronics, contributing to the development of countlesselectronic devices, from computers.

1.9 BUZZER

A buzzer, a straightforward yet essential component in electronics, functions as an audio signaling device designed to produce sound when an electrical current is applied. Operating as a transducer, the buzzer converts electrical energy into audiblesound waves, making it a valuable component for providing alerts and notificationsin various electronic devices. The basic construction of buzzers typically involves avibrating element, which could be a diaphragm or a piezoelectric crystal, and an electromagnetic coil. When an electric current flows through the coil, it generates amagnetic field. This magnetic field interacts with the vibrating element, causing it to vibrate and produce sound waves. The vibration frequency determines the pitch or tone of the sound emitted by the buzzer. Buzzers serve a wide range of applications, finding use in alarms, timers, notification systems, and any scenario where an audible alert is necessary.

Figure 1.9 Buzzer

In electronic circuits, the operation of buzzers (as shown in Figure 1.9) is often controlled by oscillators or timer circuits. These circuits dictate the frequency at which the buzzer vibrates, resulting in distinct tones for different purposes. For instance, in an alarm system, abuzzer might be designed to emit a continuous, attention-grabbing tone, while in a timer application, it may produce intermittent sounds to indicate specific intervals or events.

1.10 VARIABLE RESISTOR

A variable resistor (as shown in Figure 1.10), exemplified by components like potentiometers, stands out as aspecialized and versatile device in electronics, offering a dynamic approach to controlling resistance within a circuit. Unlike fixed resistors, which maintain a constant resistance value, variable resistors enable users to manually adjust resistance, providing a means to control the flow of electric current. Potentiometers, a common type of variable resistor, often feature a rotary or linear mechanism that allows users to modify resistance by turning a knob or sliding a lever. This adjustability makes variable resistors highly valuable in electronic devices and systems where the fine-tuning of voltage or current levels is essential for optimal performance. One of the key applications of variable resistors is in volume controlsfor audio equipment. Tuning circuits in radios and other communication devices represent another significant application of variable resistors.

Figure 1.10 Variable Resistor

In electronic designs, variable resistors contribute to the adaptability and functionality of systems. The ability to manually adjust resistance allows for real- time customization, providing users with control over the behavior of circuits.

In summary, variable resistors, particularly exemplified by potentiometers, play a keyrole in electronic systems by offering a means for users to adjust resistance. This adjustability provides versatility and control, allowing for precise customization of electronic devices and contributing to their adaptability and functionality.

1.11 TRANSISTOR

A transistor, a pivotal semiconductor device, stands as a cornerstone in the world of electronics due to its remarkable ability to amplify signals and act as a switch. Representing a fundamental building block in electronic circuits, transistors offer versatility and are integral to a broad spectrum of applications, ranging fromamplifiers and oscillators to digital logic circuits. The two primary types of transistors (as shown in Figure 1.11) are bipolar junction transistors (BJTs) and field-effect transistors (FETs), each with its own variations. BJTs, categorized as NPN (negative-positive-negative) and PNP (positive-negative-positive), involve the movement of charge carriers between two semiconductor materials. On the other hand, FETs encompass types like MOSFETs (Metal-Oxide-Semiconductor Field-Effect Transistors) and JFETs (Junction Field-Effect Transistors), relying on the modulation of conductivity withina channel. This ability to amplify signals is harnessed in various devices, including audio amplifiers that drive speakers, radio-frequency amplifiers in communication systems, and operational amplifiers in instrumentation.

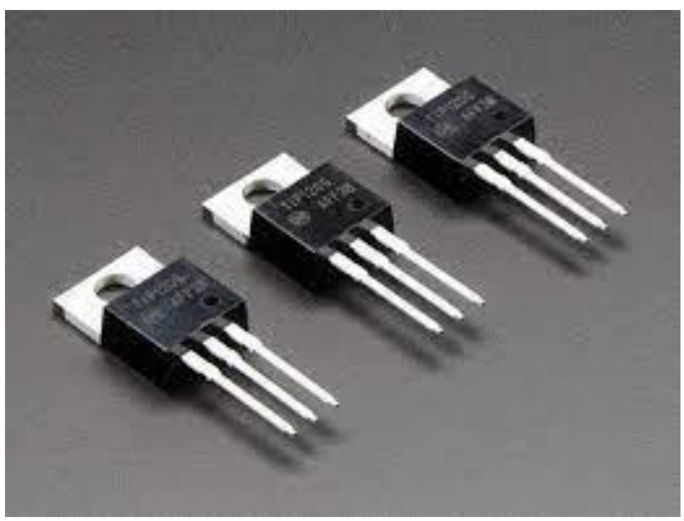

Figure 1.11 Transistor

The compact size, low power consumption, and reliability of transistors have been instrumental in the miniaturization and advancement of electronic technology.Transistors have played a transformative role in the evolution of electronic devices, contributing significantly to the development of computers and communication devices.

1.12 CONNECTING WIRES

Connecting wires form the indispensable infrastructure of electronic circuits, servingas the vital conduits that establish electrical pathways and facilitate the seamless flow of electric current. These wires, typically composed of conductive materials like copper or aluminum, play a fundamental role in ensuring the proper functioningof circuits, both on breadboards and within complex electronic systems. The primaryfunction of connecting wires is to link various components within a circuit, creatingthe necessary electrical connections for the circuit to operate as intended. Their conductivity allows for the transmission of electrical signals between different elements, forming the essential links that enable communication and cooperation among circuit components. Beyond their basic role in establishing electrical connections, connecting wires contribute significantly to the organization and structure of circuit layouts. Their flexibility allows for the creation of specific signalpaths, aiding in the systematic arrangement of components.

Figure 1.12 Connecting wires

Different lengths accommodate diverse circuit layouts, while distinct colors aid in visually distinguishing between various connections. This visual clarity becomes particularly crucial during the prototyping and experimentation stages of electronicsystem development, where designers and engineers need to troubleshoot and optimize circuit configurations. As technology advances, the importance of well-designed and well-organized connecting wires remains paramount in the pursuit of innovation andprogress in the field of electronics. These are shown in Figure 1.12.

CHAPTER 2
THE THIRD EYE

2.1 ABSTRACT

The "Third Eye" project is an assistive technology designed to help visually impaired individuals navigate their surroundings by providing non-audio cues. This device integrates a variety of components t analyze environmental information. Key elements include IC 555 timer, proximity sensors, and several resistors and capacitors to ensure circuit stability and efficient power management (Ref 1). The IC 555 timer controls certain timing functions, like the intervals for data processing updates. The sensors detect obstacles so that the user can easily come over that. Proximity sensors, such as ultrasonic sensors, detect nearby obstacles, alerting users of potential hazards via vibrations. The resistors and capacitors stabilize electronic circuits, ensuring smooth and reliable performance across various settings. Additional features like gesture recognition and voice command support enable users to interact with the device hands-free, making it user-friendly and responsive (Ref 2). Powered by machine learning algorithms, the "Third Eye" system performs real-time object and text recognition, empowering users to navigate public spaces confidently and independently. In industrial settings, machinery can pose significant risks of injuries to workers due to unintentional contact, malfunction, or human error. Preventing accidents is critical for ensuring worker safety and avoiding costly downtime. Ensuring worker safety is paramount, as industrial accidents can lead to severe injuries or fatalities (Ref 3). Effective safety mechanisms reduce the risk of accidents, improve productivity, and maintain legal compliance with safety regulations

2.2 INTRODUCTION

The Third Eye project employs a combination of fundamental electronic components including a breadboard, resistors, capacitors, an IC 555 timer, and sensors to create a simple yet effective obstacle detection system (Ref 4). It serves as the core of the circuit, functioning in astable mode to generate continuous pulses. Ultrasonic or infrared sensors detect the presence of obstacles, while resistors and capacitors regulate the circuit's timing and response. When an object is detected within a certain range, the circuit can trigger visual or audio alerts, helping users navigate around obstacles (Ref 5). This project offers a hands-on approach to understanding electronics and sensor-based obstacle detection.

2.3 COMPONENTS USED

- Bread Board
- Resister -1kΩ (2)
- BC-547 -2
- Preset -10k (1)
- Capacitor -100µf (1)
- Connecting wire -As required
- Battery -9v (1)
- IC 555 -1
- Switch -1
- Buzzer -1
- Ultrasonic Sensor -1

2.4 CIRCUIT DIAGRAM

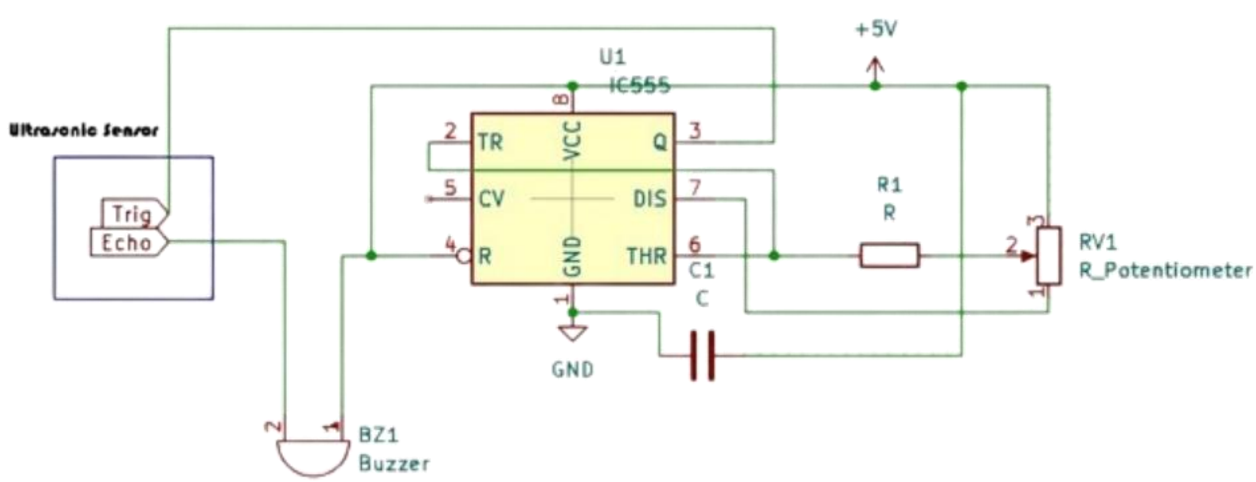

Figure 2.4.1 Circuit Diagram

This circuit is designed to detect objects within a specific range and trigger an audible alert using an ultrasonic sensor and a 555 timer IC. The ultrasonic sensor, equipped with separate trigger and echo pins, emits sound waves and detects their reflection from nearby objects. The echo signal is sent to the 555 timer IC, which processes it in either astable or monostable mode, depending on the configuration. A 10 µF capacitor stabilizes the power supply, ensuring smooth operation, while a 10 kΩ variable resistor provides the ability to fine-tune the sensitivity or timing of the detection. To further enhance circuit stability, a 100 µF capacitor suppresses voltage fluctuations. A 1 kΩ resistor is included to limit the current, protecting sensitive components from potential damage. This circuit utilizes an ultrasonic sensor and a 555 timer IC to activate a buzzer when an object is detected within a specific range. The ultrasonic sensor, with separate trigger and echo pins, sends a detection signal to the 555 timer, which is configured in either astable or monostable mode. A 10 µF capacitor stabilizes the power supply, while a 10 kΩ variable resistor allows adjustments to the circuit's sensitivity or timing. To suppress voltage fluctuations, a 100 µF capacitor is included, and a 1 kΩ resistor limits the current to protect the components. The buzzer, powered by the IC's output, alerts the user upon detection, and the entire setup operates on a 3–7V DC power supply.

2.5 WORKING MODEL

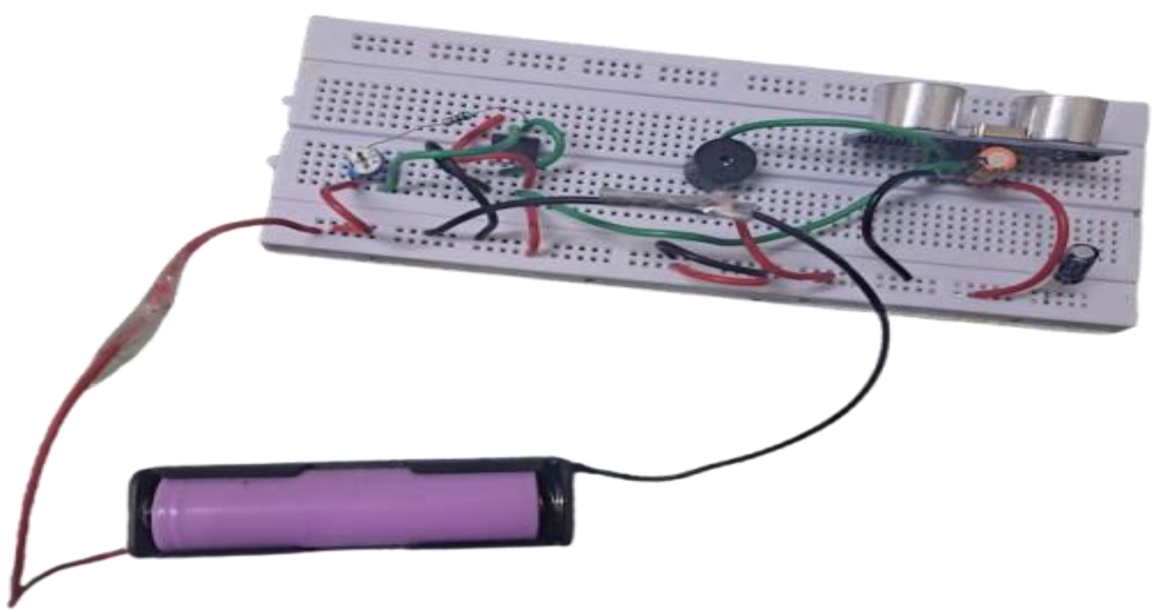

Figure 2.5.1 Circuit Diagram

An obstacle detector circuit using the IC 555 timer, resistors, capacitors, and an ultrasonic sensor operates as follows: The ultrasonic sensor emits ultrasonic waves that reflect off obstacles and return to the sensor. The sensor then measures the time delay between sending and receiving the waves, which corresponds to the distance of the obstacle. When an object is detected within a preset range, the sensor outputs a low pulse signal. This signal is fed to the trigger pin (Pin 2) of the 555 timer, configured in monostable mode. In this mode, the 555 timer generates a single output pulse (on Pin 3) each time it receives a trigger signal. The duration of this pulse depends on the values of an external resistor and capacitor connected to the 555 IC, forming an RC timing circuit. When the sensor detects an obstacle and sends a trigger pulse, the 555 timer output goes high, turning on an buzzer connected to Pin 3, signaling the presence of the obstacle. As soon as the pulse duration ends, the output returns to low, turning off the indicator until the next trigger. This cycle repeats as the ultrasonic sensor continuously monitors for obstacles, activating the buzzer each time an object is detected within the sensor's range. The RC circuit’s values determine how long the buzzer remains on for each detection, making it possible to adjust the indicator duration as needed.To operate an obstacle detector circuit built with an IC 555 timer, resistors, capacitors, and an ultrasonic sensor, begin by connecting it to a suitable power source, typically 9V DC, to supply power to both the IC and the ultrasonic sensor. Once powered, the ultrasonic sensor starts emitting high-frequency sound waves in pulses. These ultrasonic waves travel forward until they hit an obstacle and then reflect back to the sensor. The sensor calculates the time it takes for the waves to return and, if an obstacle is within a predefined distance, it generates a low pulse output signal. This signal is fed to the trigger pin (Pin 2) of the 555 timer, which has been set up in monostable mode. In this configuration, the IC 555 generates a single, stable high pulse at its output pin (Pin 3) every time it receives a low trigger signal from the ultrasonic sensor. The duration of this output pulse is set by an external resistor and capacitor, which together form an RC timing circuit. The high output pulse from the 555 timer pin 3 activates an indicator such as an a buzzer connected to this output, alerting the user that an obstacle has been detected. Once the pulse duration, defined by the RC circuit, ends, the output returns to low, switching off the indicator until the next detection cycle. This setup allows for continuous monitoring, with the ultrasonic sensor continuously scanning for objects. Every time an obstacle is detected, the sensor sends a new low pulse to the 555 timer, and the cycle repeats, causing the indicator to activate each time an obstacle is within range. Adjusting the values of the resistor and capacitor connected to the 555 timer can change the pulse duration, allowing customization of how long the buzzer stays active with each detection. In industrial settings, it can be used for automated machinery, ensuring equipment halts when an object or person enters a hazardous zone, thereby enhancing worker safety. The system’s compact and low-cost design allows for easy integration into assembly lines, where it can detect parts or components. This circuit can be modified for different detection ranges, making it suitable for tasks in inventory management, such as monitoring storage zones or conveyor belts. Furthermore, the durability of the 555 timer IC makes it ideal for harsh industrial environments, ensuring consistent and long-term operation without frequent maintenance.

This project is a simple object detection system that uses an ultrasonic sensor, a 555 timer IC, and a buzzer to alert users when an object is detected within a certain range. The ultrasonic sensor operates by emitting ultrasonic waves through its trigger pin (Trig). When these waves hit an object, they are reflected back and detected by the sensor's echo pin (Echo). The time taken for the waves to travel to and from the object is measured, which helps in determining the distance of the object. The output signal from the ultrasonic sensor is fed into the 555 timer IC, which is the central processing unit of the circuit. The 555 timer is configured in either a monostable or astable mode, depending on the design. It processes the input signal from the ultrasonic sensor and generates an output pulse. This pulse determines whether the object is within the predefined detection range, triggering the next action. A 10 kΩ variable resistor (VR) is included in the circuit to adjust the sensitivity or the detection range of the system. By tuning this resistor, the user can set the distance at which the sensor detects objects. When the 555 timer IC detects that an object is within the range, it activates the buzzer. The buzzer then emits a sound, alerting the user about the presence of an object. The circuit also incorporates capacitors for stability and noise reduction. The 100 µF capacitor helps stabilize the power supply, ensuring that any voltage fluctuations do not interfere with the circuit's operation. A 1 kΩ resistor is also used to limit the current, protecting the components from potential damage due to excessive current flow. Overall, this model demonstrates a practical and cost-effective solution for object detection. It can be adapted for various applications such as obstacle detection in robotics, parking assistance systems, or smart trash bins, showcasing the integration of basic electronics for real-world problem-solving.

2.6 BLOCK DIAGRAM

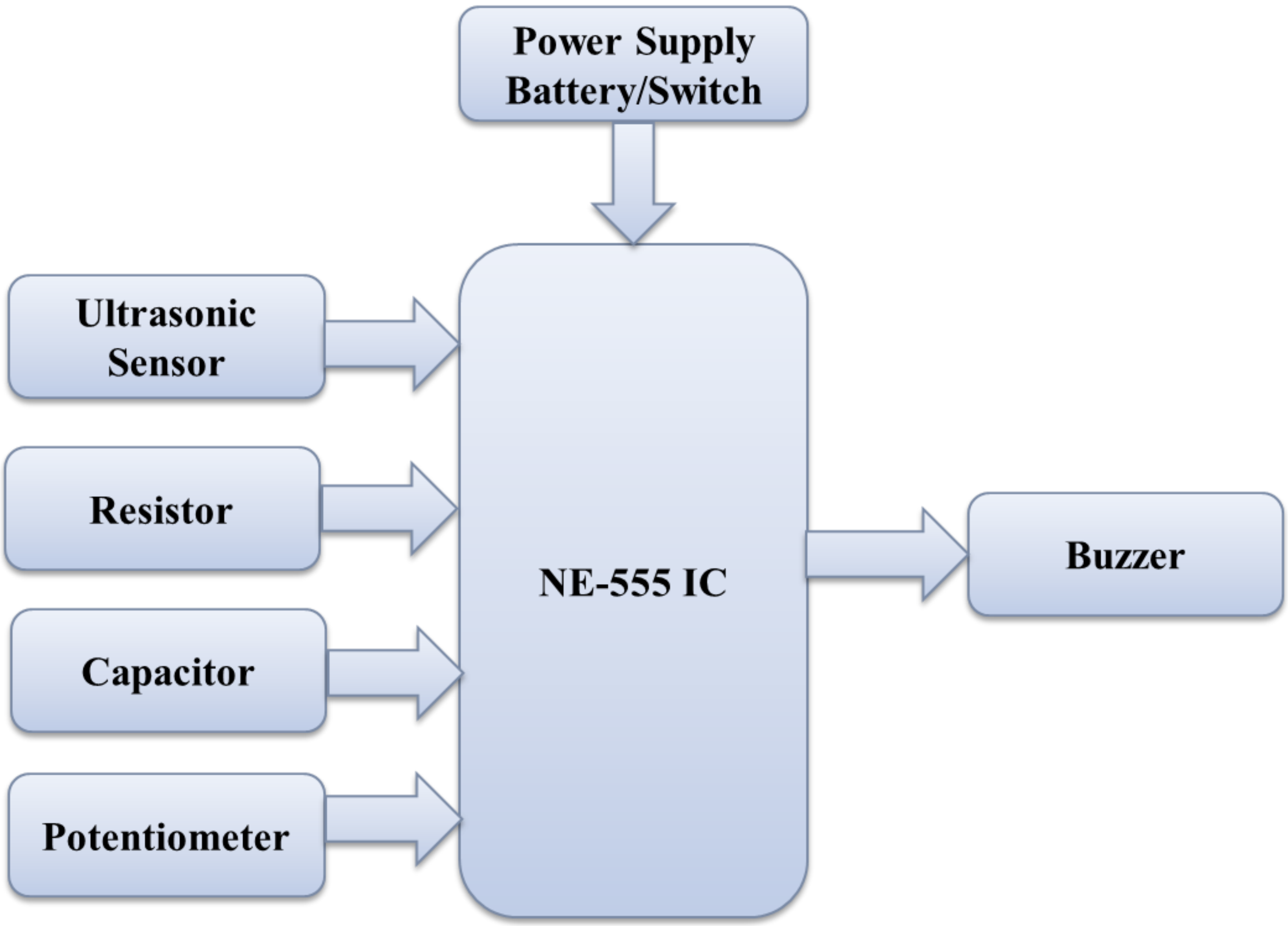

Figure 2.6.1 Block diagram

2.6.1 Power Supply: The power supply provides the necessary electrical energy to drive the entire circuit. It is a foundational component that ensures the continuous operation of the system. Without a power supply, the circuit would not function, asthe components would have no source of energy to draw from. The power supply, therefore, is a critical component of the module.

2.6.2 Ultrasonic Sensor: The integration of an ultrasonic sensor allows the module to detect distances and obstacles accurately. This feature expands the module's versatility, enabling applications where proximity detection is essential.

2.6.3 IC 555 Timer: The IC 555 timer chip serves as the timing component within the module, providing precise control over time-based operations. It plays a critical role in triggering or delaying certain actions, such as initiating alerts or powering specific circuits. The inclusion of the IC 555 adds reliability and consistency to the module's functionality, offering users a stable and well-timed response to different events.

2.6.4 Buzzer: The inclusion of a buzzer in the module provides an audible alert for various conditions, such as a short circuit event. This sound-based feedback helps users quickly identify issues without needing constant visual monitoring. As a result, the buzzer enhances the overall user experience, ensuring immediate attention when necessary, thereby improving the module's effectiveness in real-world applications.

2.6.5 Potentiometer(10kΩ): The potentiometer adjusts the detection range or timing by varying resistance. This allows fine-tuning for different applications. It enhances the circuit's adaptability, making it suitable for varying object distances.

2.6.6 Resistor (1 kΩ): The resistor limits current flow to protect sensitive components. It ensures safe operation, preventing potential damage from excessive current.

2.6.7 Capacitor(100µF): This capacitor filters out noise or rapid voltage changes in the signal, ensuring stable operation of the timer and preventing false triggers.

10 µF: Stabilizes the power supply, ensuring consistent operation.

100 µF: Filters noise and suppresses voltage fluctuations, improving signal reliability.

2.7 ADVANTAGES

- Provides continuous, reliable security monitoring.
- Enables task automation through visual detection.
- Offers real-time feedback and alerts.
- Allows remote access for convenient monitoring.
- Reduces human error in surveillance tasks.

2.8APPLICATIONS

- Home Security: Detects intruders and enhances property safety
- Industrial Automation: Monitors processes for quality control and efficiency.
- Traffic Management: Manages and monitors vehicle flow and detects violations.
- Environmental Monitoring: Tracks conditions like light, temperature, and movement.

CHAPTER 3
THE SMART TRASH

3.1 ABSTRACT

The Smart Trash Bin is a modern, automated waste management system that prioritizes hygiene and convenience. It is designed to address the common issues of physical contact with trash bins, which can lead to contamination and the spread of germs. The system utilizes a proximity sensor to detect the presence of a user's hand or object near the bin (Ref 6). Once detected, the sensor triggers a signal that activates a servo motor to open the lid automatically, ensuring a hands-free experience. This approach provides a hygienic and user-friendly solution for managing waste. At the core of the system is a transistor, which acts as a switch to control the servo motor's operation efficiently. The transistor ensures the motor is only activated when needed, optimizing energy consumption and prolonging the system's lifespan. The use of readily available and cost-effective components like proximity sensors and servo motors makes this system affordable and easy to implement in various environments, including homes, offices, and public spaces (Ref 7). The design is compact and efficient, ensuring seamless integration into existing infrastructure. This project has the potential for further enhancements, such as integrating IoT technology to monitor waste levels or adding solar-powered operation for increased sustainability (Ref 8). By reducing physical interaction and promoting cleanliness, the Smart Trash Bin contributes to improved waste management practices and supports broader efforts to create smarter, more hygienic living spaces.

3.2 INTRODUCTION

Waste management is a critical aspect of maintaining cleanliness and hygiene in both public and private spaces. Traditional trash bins require manual operation, which often leads to physical contact with the bin. This can result in the spread of germs, creating health risks and reducing user convenience. To address these challenges, automated solutions like the Smart Trash Bin are gaining popularity as they offer a hands-free and efficient alternative for waste disposal. The Smart Trash Bin integrates a proximity sensor, a servo motor, and a transistor to enable automatic lid operation. When a user's hand or an object is detected near the bin, the proximity sensor sends a signal to the transistor, which activates the servo motor to open the lid. Once the user moves away, the lid closes automatically, ensuring a touchless and hygienic experience. This simple yet effective mechanism minimizes physical contact and enhances the overall user experience. Designed for cost-efficiency and ease of implementation, the Smart Trash Bin is suitable for various settings, including homes, offices, and public spaces. Its modular design allows for customization and future upgrades, such as IoT integration for waste monitoring or solar-powered operation (Ref 9). This project demonstrates how automation and innovation can improve everyday activities while addressing pressing hygiene concerns. the Smart Trash Bin provides a sustainable and scalable solution for modern waste management. Designed for cost-efficiency and ease of implementation, it is suitable for various settings, including homes, offices, and public spaces. Its modular design allows for customization and future upgrades, such as IoT integration for waste monitoring, solar-powered operation, or smart notifications (Ref 10). By leveraging automation and technology, this project aims to promote cleanliness, reduce health risks, and contribute to smarter living spaces.

3.3 COMPONENTS USED

- Proximity/IR sensor - 1
- Transistor BC 547 - 1
- Battery 3.6 to 5V - 1
- Servo motor/slow motion rpm motor- 1
- Relay module 5V - 1
- Switch - 1
- Jumper wires – 5

3.4 CIRCUIT DIAGRAM

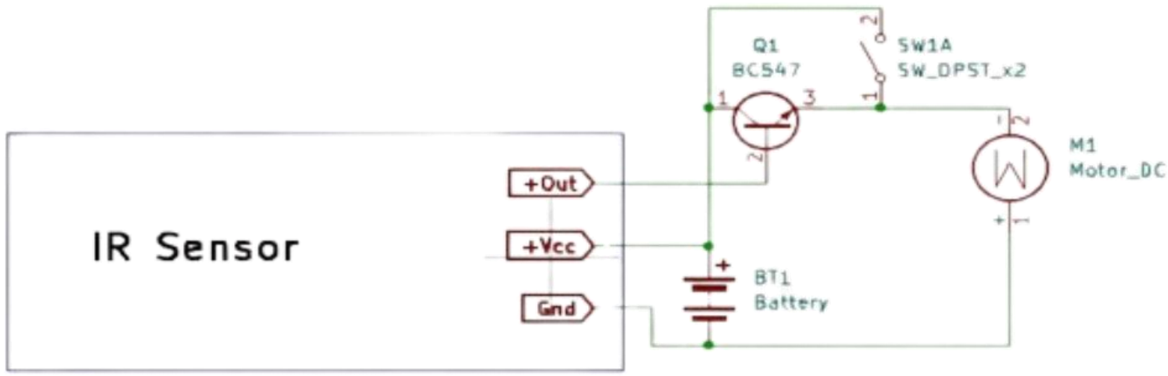

Figure 3.4.1 Circuit diagram

3.5 WORKING MODEL

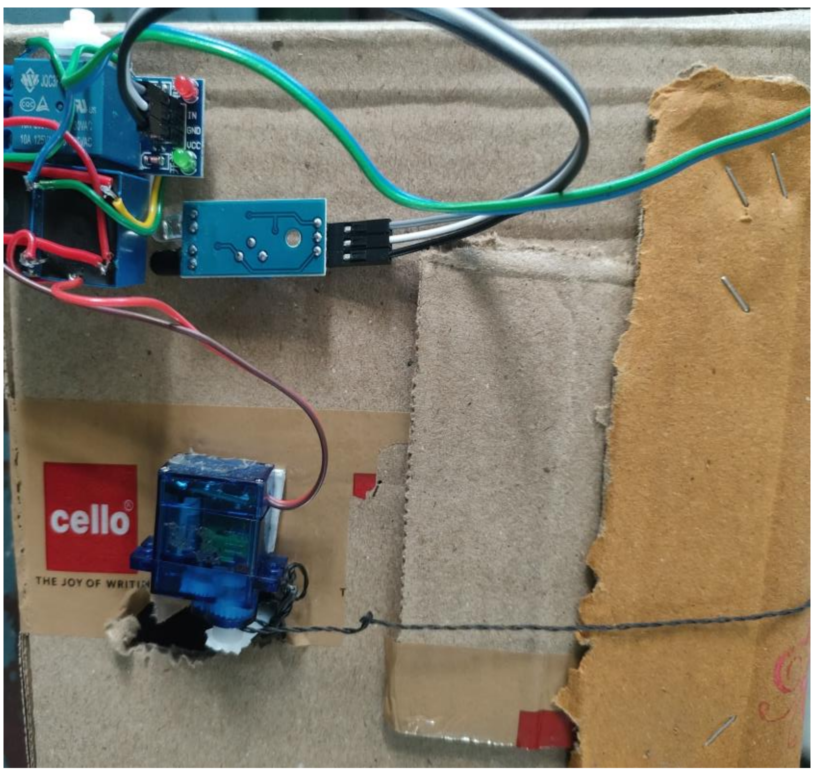

Figure.3.5.1 Working Model

This circuit demonstrates an innovative approach to waste management by integrating automation and sensor-based technology, providing an intelligent and efficient solution for trash handling. At its core is an ultrasonic sensor, which detects the presence of objects based on distance. The sensor emits ultrasonic waves and measures the time it takes for the reflected waves to return, determining if trash is approaching the bin. The ultrasonic sensor is connected to a microcontroller, which serves as the circuit's central processing unit.

When the sensor detects an object within a predefined range, it sends a signal to the microcontroller. The microcontroller processes this input and triggers a motor driver circuit connected to a servo motor. The servo motor then activates the lid of the smart trash bin, allowing it to open automatically for waste disposal. After a short delay, the lid closes to maintain hygiene and prevent odor release. To enhance functionality, the circuit includes an infrared (IR) sensor to monitor the bin's fill level. Positioned inside the bin, the IR sensor detects whether the trash has reached a critical level. When the bin is full, the IR sensor sends a signal to the microcontroller, which activates an LED indicator or a buzzer, alerting the user to empty the bin.

Voltage regulators are included to maintain consistent voltage levels for the sensors and microcontroller. The modular design allows for customization—users can adjust the ultrasonic sensor's range, modify the lid's opening duration, or integrate additional sensors to meet specific needs.

In summary, the circuit operates as follows: when an object is detected near the bin, the ultrasonic sensor signals the microcontroller to open the lid using a servo motor. Simultaneously, the IR sensor monitors the fill level, alerting the user when the bin is full. The integration of IoT features and customizable components makes this "Smart Trash Bin" a sophisticated, user-friendly, and adaptable solution for intelligent waste management.

3.6 BLOCK DIAGRAM

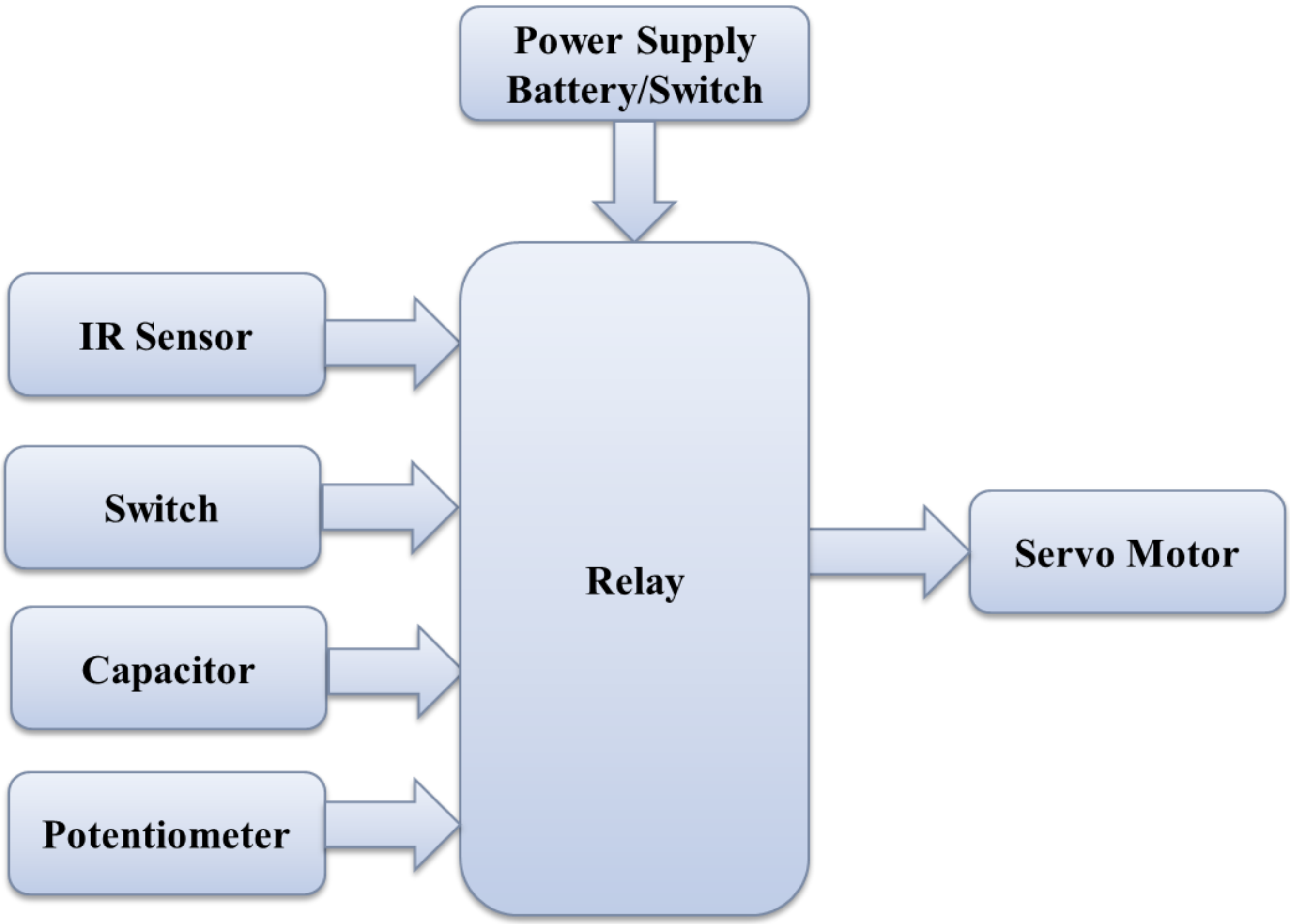

Figure 3.6.1 Block diagram

3.6.1 Proximity/IR Sensor:

The proximity/IR sensor serves as the detection component, identifying nearby objects or obstacles based on infrared light. When an object enters its detection range, the sensor emits a signal, triggering the associated circuit components. It is vital for automation and object recognition, enabling responsive actions in the circuit.

3.6.2 Transistor (BC 547):

The BC 547 transistor acts as a versatile switch and amplifier. It responds to the input signal from the proximity/IR sensor by regulating current flow in the circuit. This ensures efficient control of connected components, such as the relay module or motor.

3.6.3 Battery:

The battery provides the necessary power supply for the circuit, delivering a stable voltage to all components. Its compact design and lower voltage range make it ideal for small-scale applications. It ensures reliable operation while being energy-efficient for prolonged use.

3.6.4 Servo Motor/Slow-Motion RPM Motor:

The servo or slow-motion RPM motor serves as the output actuator. It performs mechanical actions, such as rotating or moving objects, in response to signals from the relay or transistor. The motor is designed for precise movements, making it suitable for controlled operations and applications requiring slow and steady motion.

3.6.5 Potentiometer(10kΩ):

The potentiometer adjusts the detection range or timing by varying resistance. This allows fine-tuning for different applications. It enhances the circuit's adaptability, making it suitable for varying object distances.

3.6.6 Capacitor(100µF): This capacitor filters out noise or rapid voltage changes in the signal, ensuring stable operation of the timer and preventing false triggers.

3.6.7 Switch:

The switch is a manual control device, allowing the user to toggle the circuit on or off as needed. It ensures convenience and adds a layer of safety, preventing the circuit from operating when not required. The switch is a critical interface between the user and the system, ensuring control over circuit functionality.

3.7 ADVANTAGES

- Improved hygiene by minimizing direct contact with trash.

- Energy-efficient operation with minimal power consumption.
- Convenient, hands-free operation for user comfort.
- Optimizes waste management through proper segregation.
- Enhances visual appeal with sleek and modern design.
- Promotes recycling and eco-friendly waste disposal practices.

3.8 APPLICATION

- Used in public spaces like airports, malls, and parks.
- Ideal for residential areas such as kitchens and living spaces.
- Essential in hospitals for maintaining sterile environments.
- Useful in offices to promote cleanliness and automation.
- Integral to smart cities with IoT-based waste monitoring.
- Beneficial in schools and universities for hygiene education.

CHAPTER 4
CONCLUSION

The obstacle detector and smart trash system, developed using basic components, highlight the ability of simple, cost-effective solutions to address everyday challenges effectively. By relying on fundamental technologies like ultrasonic or infrared sensors and microcontrollers, these systems provide practical and scalable solutions for enhancing safety and promoting environmental hygiene. The obstacle detector plays a critical role in navigation, detecting obstacles in real time to ensure safety and prevent accidents. Its simple design makes it accessible and versatile for a wide range of applications, including aiding visually impaired individuals, improving the navigation of robots, and enhancing automation in vehicles. By detecting objects in their path, these systems significantly reduce the risks associated with manual navigation and increase efficiency in various domains.

The smart trash system, similarly, demonstrates how basic components can contribute to better waste management practices. Features such as trash level detection and automatic lid opening improve hygiene and encourage responsible disposal habits. These systems can be integrated into public spaces, homes, and offices, reducing manual intervention and ensuring cleaner environments. Moreover, their simplicity allows for cost-effective deployment, making them a practical solution for communities and institutions aiming to promote sustainable practices. Together, these systems exemplify how fundamental technologies can address real-world problems without the need for complex or expensive components. The combination of obstacle detection and smart waste management in a single project illustrates the potential of merging safety, convenience, and sustainability into one coherent solution. This approach not only enhances user experience but also fosters innovation in resource-constrained environments. In conclusion, the obstacle detector and smart trash system prove that basic components, when thoughtfully applied, can lead to impactful outcomes.

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