Department of Electronic and Telecommunication Engineering

University of Moratuwa

EN2160 – Electronic Design Realization

Conceptual Design Report – Smart Dustbin

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Contents

1. Introduction

This report presents the conceptual design of a smart dustbin, an innovative solution that incorporates advanced technology for automatic opening and closing. The aim of this design is to provide users with a convenient and hygienic waste disposal experience. By eliminating the need for manual operation, the smart dustbin enhances efficiency and user convenience. This brief introduction provides an overview of the report, which explores the enclosure design and block diagrams, highlighting the importance of user feedback and customization options. The report serves as a foundation for further development, showcasing the potential of the smart dustbin to revolutionize waste management.

2. List of members who contributed to the Design Driven Innovation

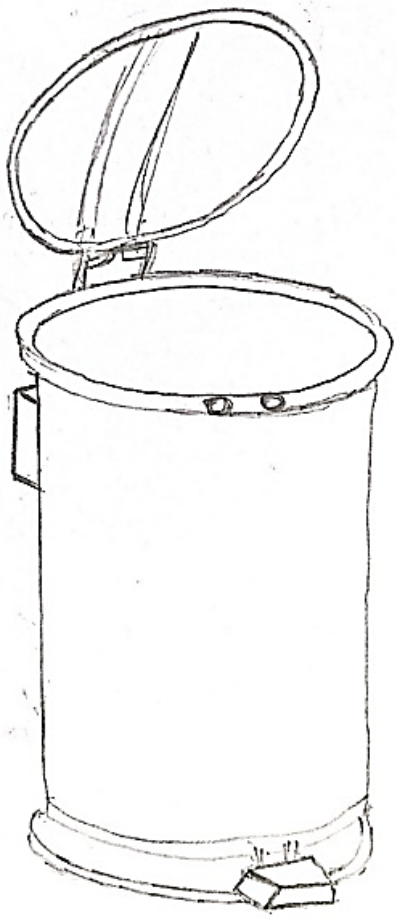
1. Anuki Pasqual	200445V
2. Tharusha Pathirana	200449L
3. Navindu Gunawardena	200201V
4. Peshala Gunathilaka	200439G
5. Lasitha Jananjaya	200650U
6. Chehal Jayasuriya	200262G
7. Malanban Kuganenthiran	200373X

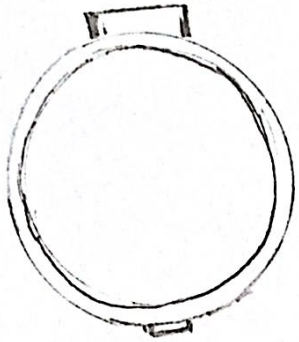
3. Hand Sketches for Enclosure Designs

After considering team members' ideas, three specific enclosure designs were chosen for evaluation in the design process. Each design aims to provide an optimal solution for the smart dustbin.

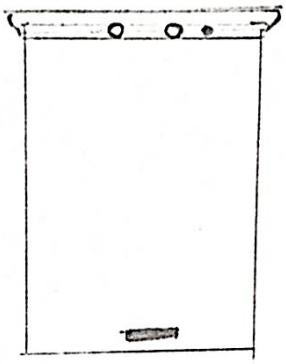
3.1 Design 1

- Round peddled dustbin design with a metal case.
- For PCB there is a box behind the dustbin.

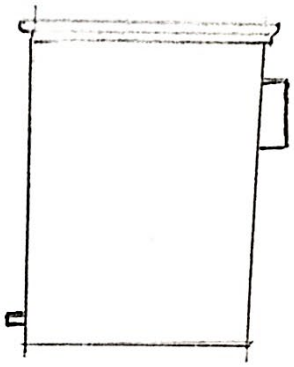




Top view



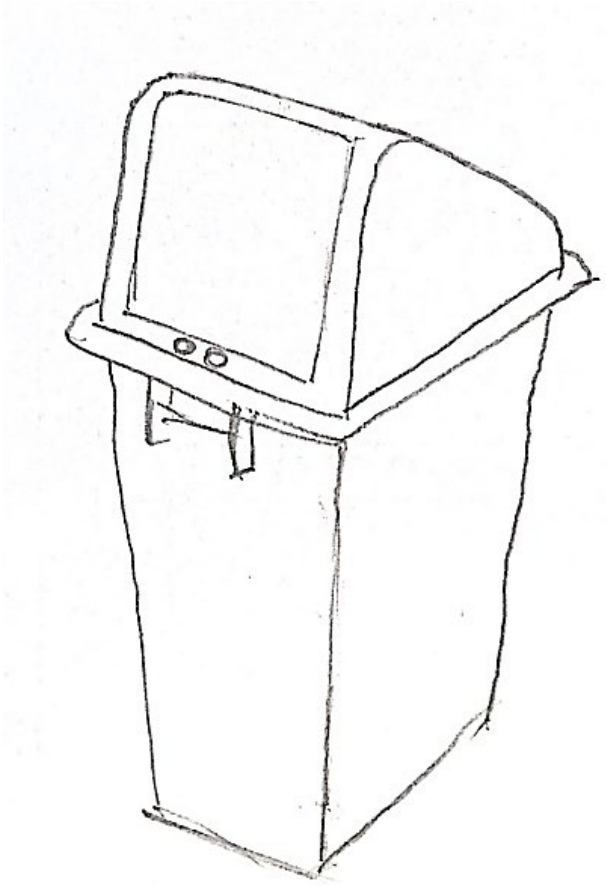
Front view

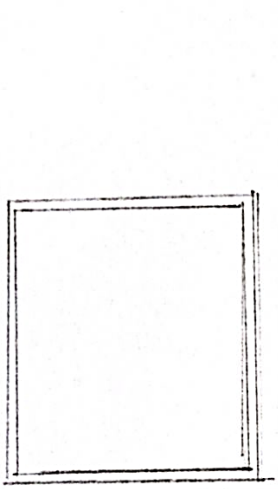


Side view

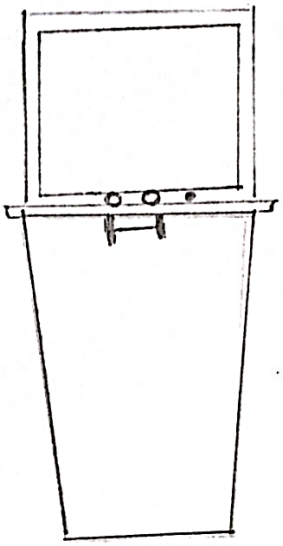
3.2 Design 2

- Box type dustbin design with plastic material.
- For PCB there is an internal box in the above part of the dustbin

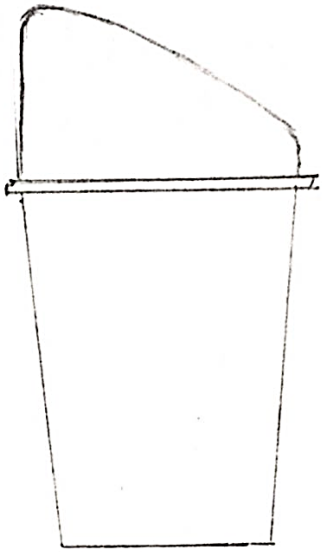




Top view



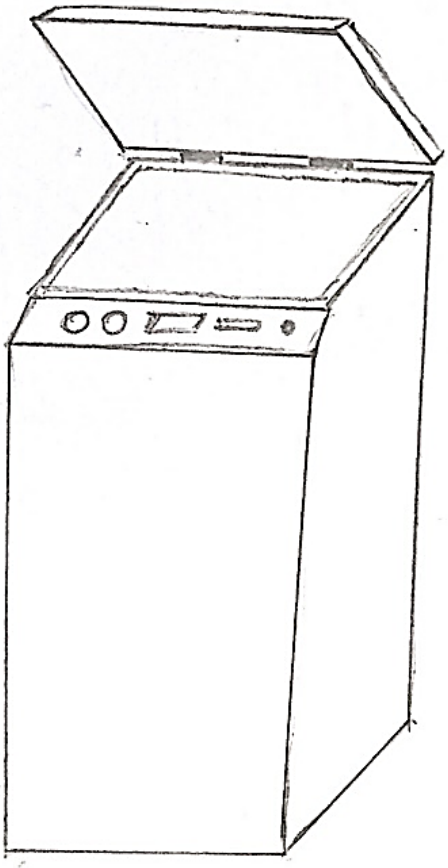
Front view

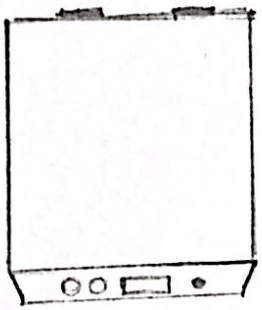


Side view

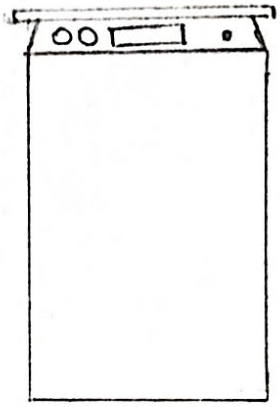
3.3 Design 3

- Box type dustbin with plastic.
- There is a seperate location in the dustbin base for the pcb and other sensors

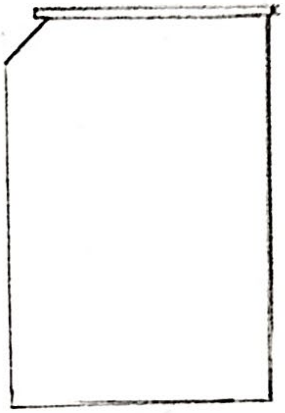




Top view



Front view

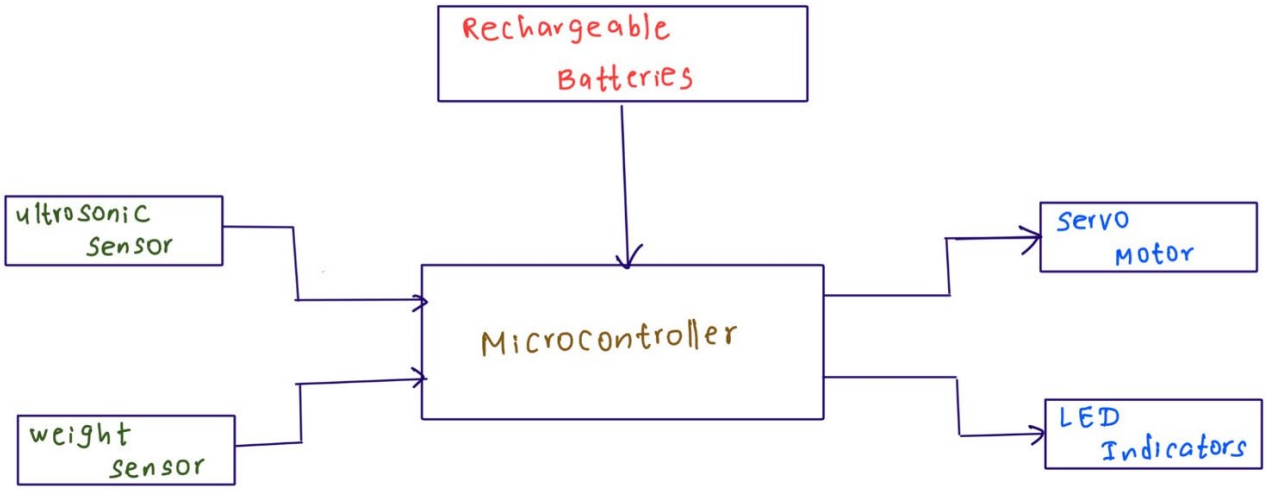


Side view.

4. Block Diagrams for Circuit Designs

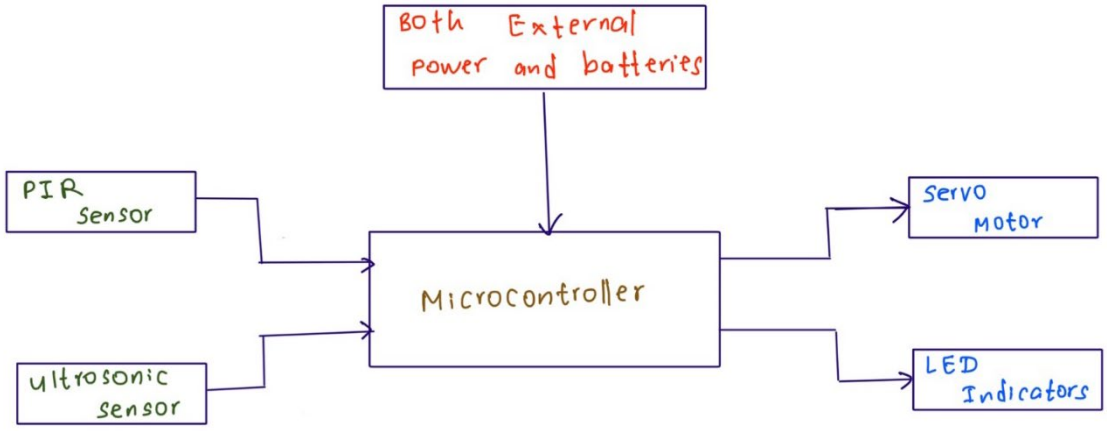
In the smart dustbin project context, there are options to consider for the circuit design: power supply, sensor technologies, and lid opening mechanisms. These options were thoroughly reviewed and evaluated with the group, considering the specific components required and the desired functionality of the smart dustbin. The group's careful assessment allowed for the selection of the most suitable options that align with the project's design goals and objectives.

4.1 Design 1



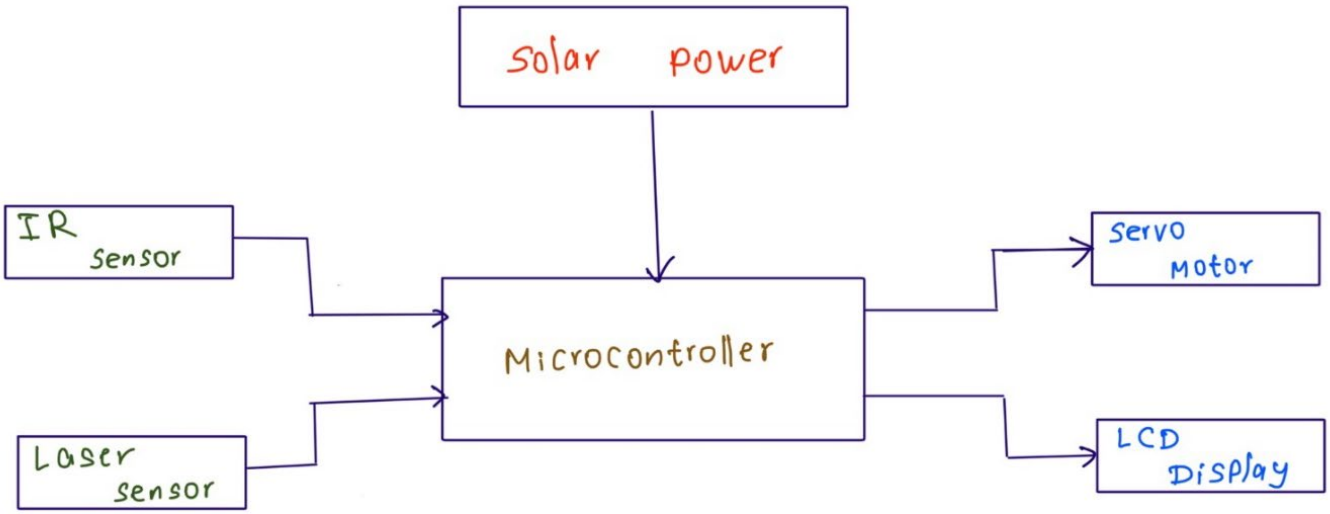
- Newly added: Rechargeable batteries as a power source.
  Weight sensor for measuring the content of the bin.
- Removed: One ultrasonic sensor

4.2 Design 2



- Newly added: Batteries as a power source.
  PIR sensor for motion detection.
- Removed: One ultrasonic sensor

4.3 Design 3



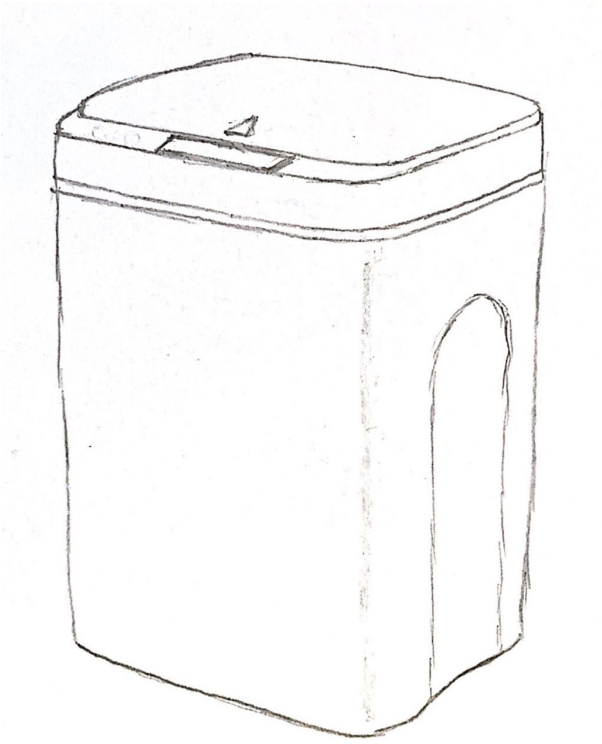
- Newly added: Solar power as the primary power source.
  IR sensor for motion detection.
  Laser sensor for measuring the content of the bin.
- Removed: Two ultrasonic sensors
  External power source
  LED indicators

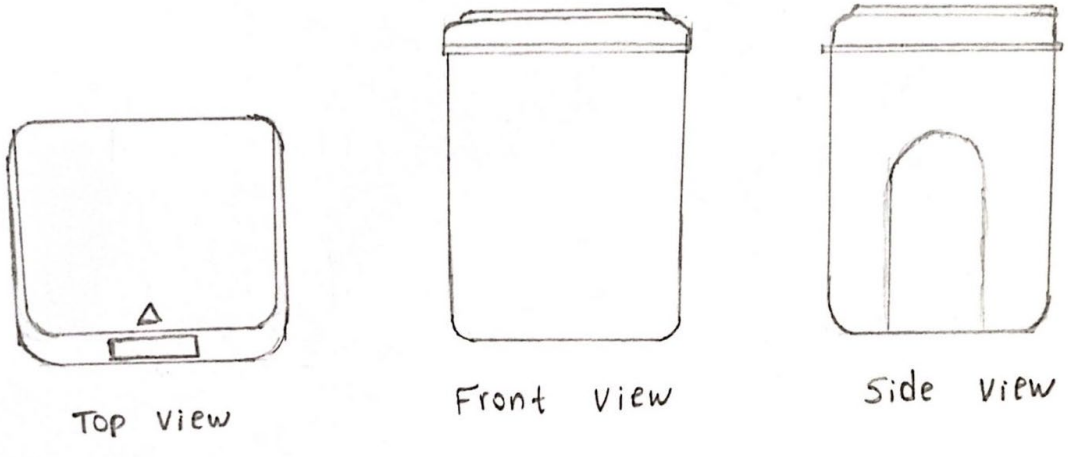
5. User Centered Deign

To gather input on user preferences for the smart dustbin design, a user survey was conducted. The survey covered various aspects, including usability, functionality, and design aesthetics. Based on the feedback received, the enclosure and circuit diagram of the smart dustbin were modified to better align with user preferences and requirements. The adjustments made aim to enhance the overall user experience and ensure that the smart dustbin meets the needs and expectations of its intended users.

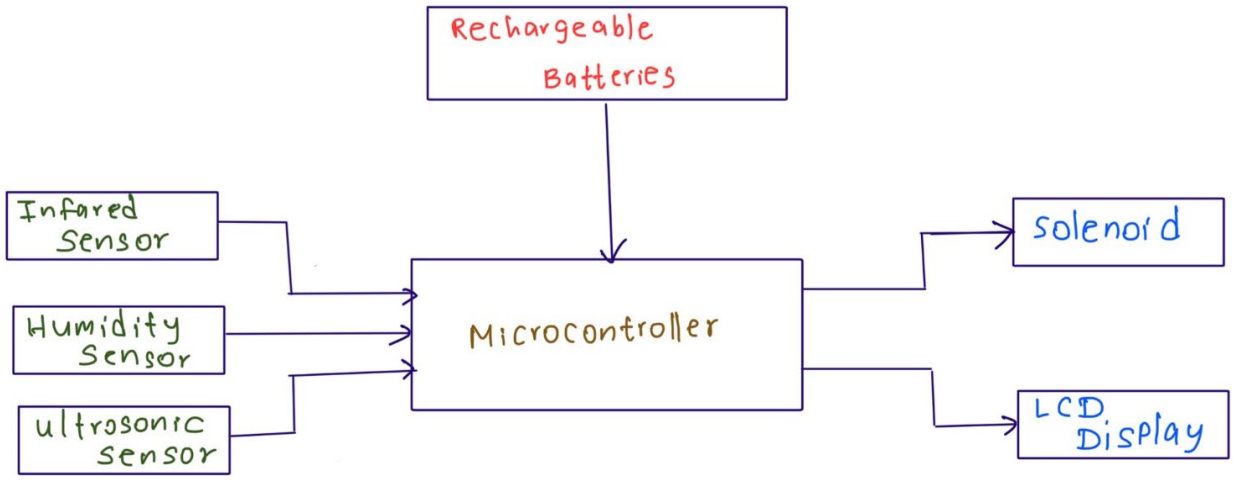
5.1 Hand Sketches for Enclosure Design

- Box type modern dustbin
- Metal case
- Portable





5.2 Block Diagram for Circuit Design



- Newly added: Rechargeable batteries.
  IR sensor for motion detection.
  Ultrasonic sensor for measuring the content of the bin.
  Solenoid for lid open mechanism
- Removed: Two ultrasonic sensors
  External power source
  LED indicators
  Servo motor

6. Selection Matrix

6.1 Evaluation Criteria for Enclosures

1. **Aesthetics**: Assess the visual appeal and overall design harmony of the enclosure.
2. **Functionality**: Evaluate how well the enclosure accommodates the waste disposal process and ease of use.
3. **Durability**: Examine the materials and construction of the enclosure for long-lasting performance and resistance to wear and tear.
4. **Weather Resistance**: Consider the enclosure's ability to withstand outdoor conditions, such as rain, sunlight, and temperature fluctuations.
5. **Accessibility**: Evaluate how easily users can interact with the smart dustbin, including opening and closing mechanisms, sensor placement, and user interface.
6. **Size and Space Efficiency**: Assess the enclosure's dimensions in relation to the available space for placement and storage efficiency.
7. **Safety**: Consider any safety features incorporated into the enclosure design, such as childproof mechanisms or sensor-based obstacle detection.
8. **Integration**: Evaluate how well the enclosure design integrates with the surrounding environment, whether it is a residential, commercial, or public setting.

The following Table depicts the marks given for each point (out of 10)

Criteria	Design 1	Design 2	Design 3	User Centered Design
Aesthetics	8	7	6	9
Functionality	7	6	7	8
Durability	7	8	9	7
Weather Resistance	7	8	7	7
Accessibility	6	8	8	9
Size and Space Efficiency	9	6	7	9
Safety	5	6	7	8
Integration	6	7	9	8
Total Marks	**55**	**56**	**60**	**65**

Based on the aforementioned criteria, it is evident that the user centered design received the highest score, making it the selected choice to proceed.

6.2 Evaluation Criteria for Circuit Design

1. **Functionality**: Assess the overall functionality and performance of the circuit design, ensuring that it accurately detects and responds to the waste disposal requirements.
2. **Power Efficiency**: Evaluate the circuit design's power consumption and efficiency to ensure optimal energy usage and battery life.
3. **Sensor Integration**: Assess how well the circuit design integrates and interfaces with the various sensors used in the smart dustbin, such as ultrasonic sensors, weight sensors, or proximity sensors.
4. **Communication**: Evaluate the communication protocols and interfaces used in the circuit design, ensuring seamless data transmission between the sensors, microcontroller, and other components.
5. **Safety**: Consider any safety features implemented in the circuit design, such as overcurrent protection, voltage regulation, or short-circuit prevention mechanisms.
6. **Reliability**: Evaluate the reliability and robustness of the circuit design to ensure consistent and accurate performance under different operating conditions.
7. **Scalability**: Assess the circuit design's ability to accommodate future upgrades or additions, allowing for potential expansion or integration of additional features.
8. **Cost-effectiveness**: Consider the overall cost of the circuit design, including component selection and manufacturing considerations, to ensure a balance between functionality and affordability.

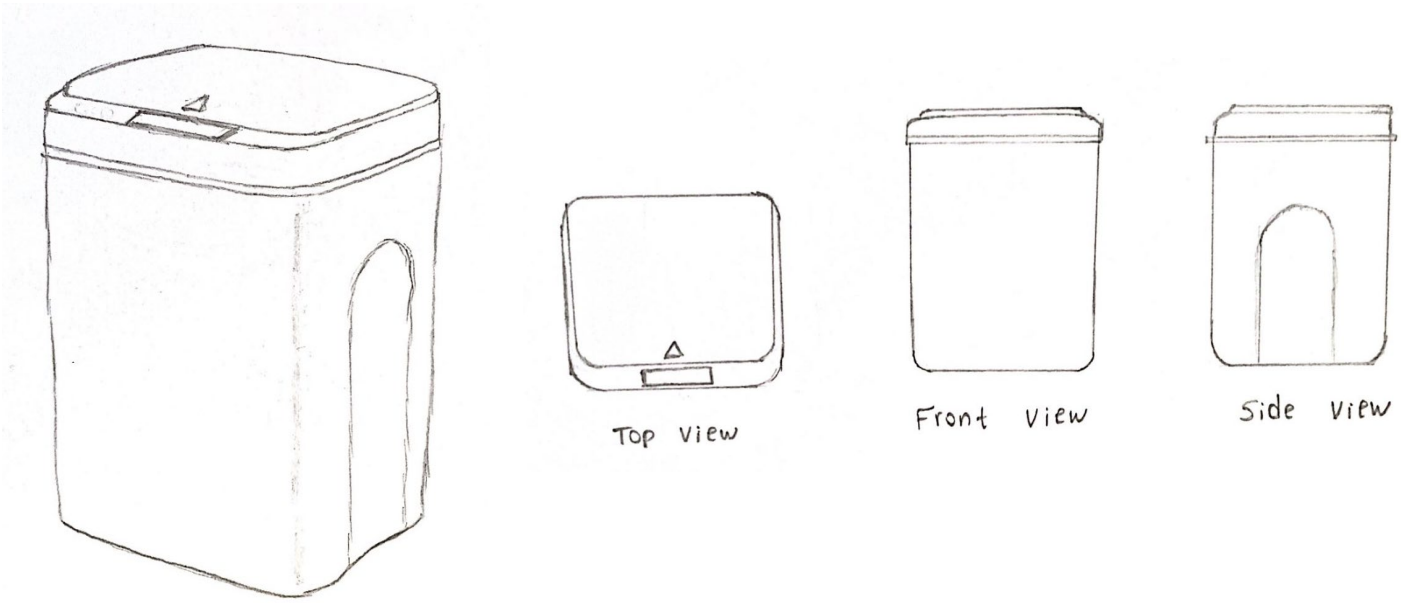
The following Table depicts the marks given for each point (out of 10)

Criteria	Design 1	Design 2	Design 3	User Centered Design
Functionality	8	7	8	9
Power Efficiency	7	9	5	7
Sensor Integration	6	7	8	9
Communication	8	8	8	8
Safety	8	8	6	9
Reliability	6	6	8	9
Scalability	9	9	9	8
Cost-effectiveness	7	8	6	5
Total Marks	**59**	**62**	**58**	**64**

Based on the aforementioned criteria, it is evident that the user centered design received the highest score, making it the selected choice to proceed.

7. Selected Design

7.1 Enclosure Design



7.2 Circuit Design