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Design and Development of the Compact Garbage Bin with a Sorting System.

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Abstract: Waste management has emerged as a significant global concern, posing various social, environmental, and health challenges due to the lack of proper garbage sorting when disposed of the garbage. Appropriate waste sorting at the source offers numerous advantages. Modernized garbage bins equipped with technology encourage individuals to segregate their waste, deviating from traditional approaches. With a sorting system, the compact garbage bin serves as a garbage collection container, aiding indoor occupants in sorting trash into four distinct sections within a single unit. This overview delves into the compact bin's objectives, advantages, and prospects with a sorting system. It illustrates its role in promoting effective waste management to pave the way for a sustainable future.

 Index Terms: IOT, Smart-bin, Sensors, Waste Management, Waste Segregation

1 INTRODUCTION

The management of waste generated in the environment has become a global challenge. Correct decisions and approaches are required to face those challenges [1]. Daily waste generation from various sources like offices, homes, and businesses poses significant challenges for many countries regarding monitoring and proper disposal of solid waste [2]. Timely and proper waste disposal is vital for maintaining a safe and eco-friendly environment. Garbage bins, especially those equipped with lids, are pivotal in mitigating unpleasant sights, odors, and environmental pollution [3]. In conventional waste management, cleaners handle waste collection without a structured categorization system. However, smart bins with innovative technologies have emerged as viable solutions, encouraging systematic waste disposal [4]. Effective waste management is a crucial aspect of sustainable development, necessitating a multi-faceted approach encompassing primary and secondary segregation. Primary segregation at the source involves conscientious sorting of recyclable materials from non-biodegradable waste. In contrast, secondary segregation at central facilities refines the process further, enhancing efficiency and recyclable output quality. Control over the quality of low-output products and efficient processing of wet waste further amplify the efficacy of waste management systems. Incorporating these practices into waste management strategies is imperative to minimize environmental impact and maximize resource recovery, aligning with sustainability objectives. Segregating waste at the source offers several advantages, including reduced need for pre-treatment during recycling, decreased potential for waste contamination, lower capital investment in secondary segregation units, reduced transportation footprint, minimized greenhouse gas generation, extended landfill lifespan, and the promotion of decentralized treatment facilities [5,6]. In this research, we will delve into identifying problems with current waste bins, outline objectives, explore the operation of compact bins with sorting systems, discuss their benefits, and highlight future prospects for waste management.
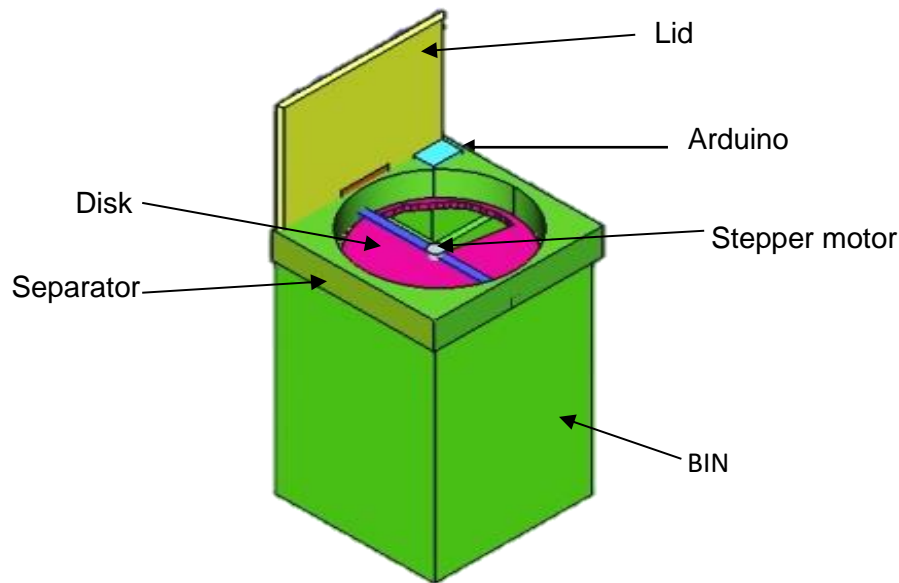
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Fig. 1. 3D Design of The Proposed System

2 PROBLEM IDENTIFICATION

In many offices and institutions, a prevalent practice involves disposing of all types of waste in a single bin, usually due to limited space. Regrettably, this leads to unpleasant odors and insect infestations, often exacerbated by open-lid garbage bins. The staff may need more awareness regarding the importance of waste classification, making it difficult for cleaners to maintain cleanliness and impeding effective waste management. Even with color-coded garbage bins available for waste sorting, identifying and utilizing them at night or in poorly lit areas poses a challenge. To address this problem, a proposed solution could involve a compact garbage bin with a sorting system, shown in the 3D design in Fig. 1, providing a comprehensive resolution. The aims of designing and developing a compact bin with a sorting system are to reduce the space that takes for several bins, to make the community aware of how to classify trash, to make it easy for cleaning staff, and to refer the trash for the recycling process. Also, classifying trash in a place that generates a small amount of trash, to support the waste management process and reducing the occupation of space in indoor premises that take several trash bins are the objectives of developing this bin.

3 METHODOLOGY

The first square-shaped bin was divided into four sections using dividing plates. Then, eco-friendly biodegradable trash bags were placed in each section. Next, the separator cover, which is a box shape, was made and removed a circle up and downside of it. After that, a strip was placed along the diameter of the side circular hole. Then, the stepper motor is placed on the middle of the strip so that a disk that is quarter removed can be mounted. Then, the servo motor is mounted on the back of the separator, and the lid is set to it; the ultrasonic sensor and the four push buttons are installed on the head of the separator, and the Arduino board, battery, motor control, LED bulbs are placed inside the separator,

connected with connecting wires and installing the code on the Arduino board. Finally, the separator was placed in the bin. It's possible to get a proper idea about all the components of the compact bin with a sorting system by referring to Fig. 2.
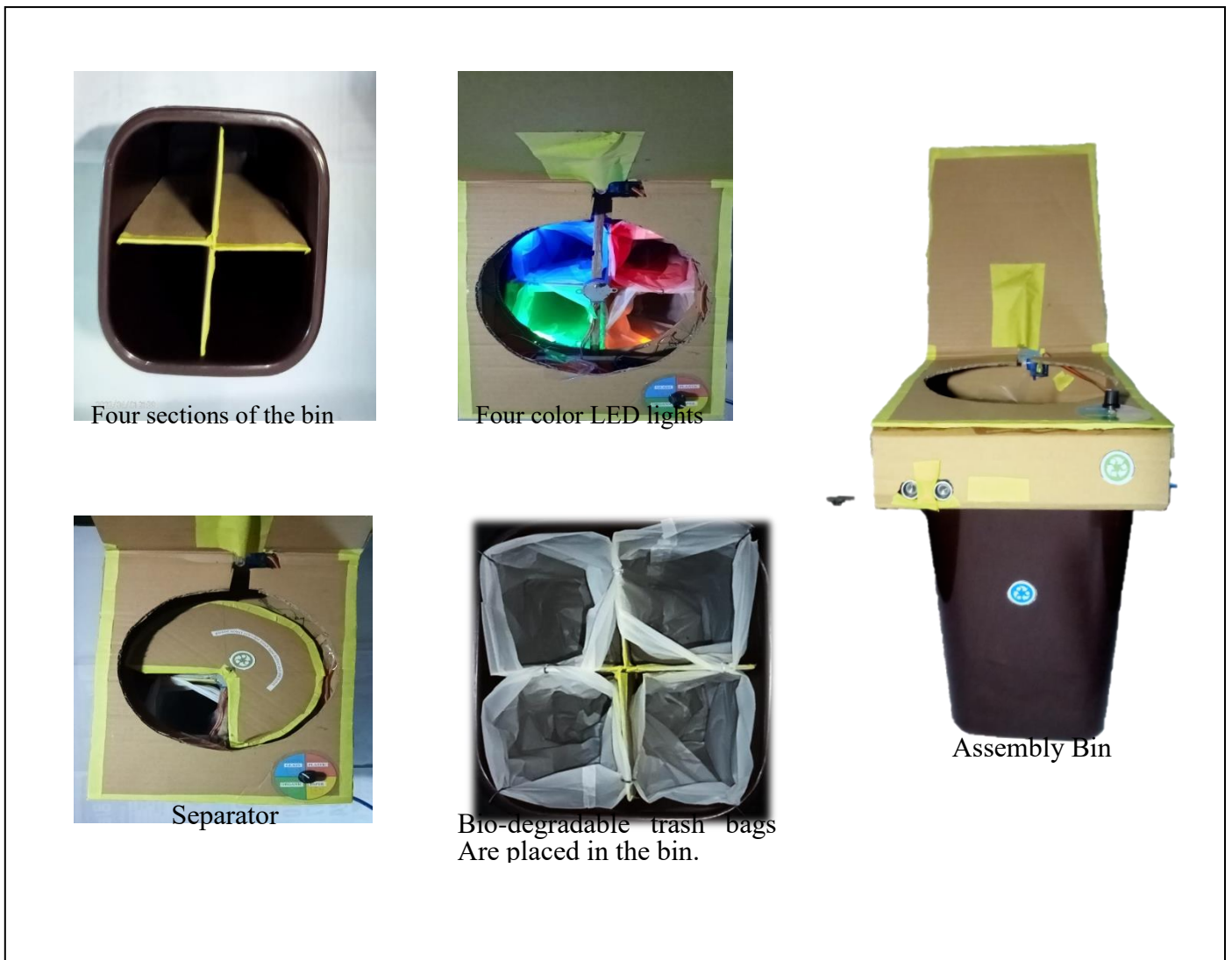

Four sections of the bin

Four color LED lights

Separator

Bio-degradable trash bags Are placed in the bin.

Assembly Bin

Fig. 2. Fabrication of The Compact Bin

5   OPERATIONS OF THE SYSTEM

When a person approaches the bin about 0.5 meters away, the ultrasonic sensor detects it, rotating the servo motor 90^0 degrees. Then, the lid that was attached to the servo motor opened automatically. At the same time, turn on the four-colour LEDs and light the four sections of the bin. Below the lid, a disk with a quarter removed was mounted on the stepper motor. The stepper motor will be placed at the centre of the separator. When someone selects the type of trash using the push button, the disk rotates and sets the respective section. Then, the person can put the respective type of trash into the bin. The flow chart in Fig. 3. shows all the system's operations. As shown in Fig. 4, an Arduino microcontroller controls the above process.
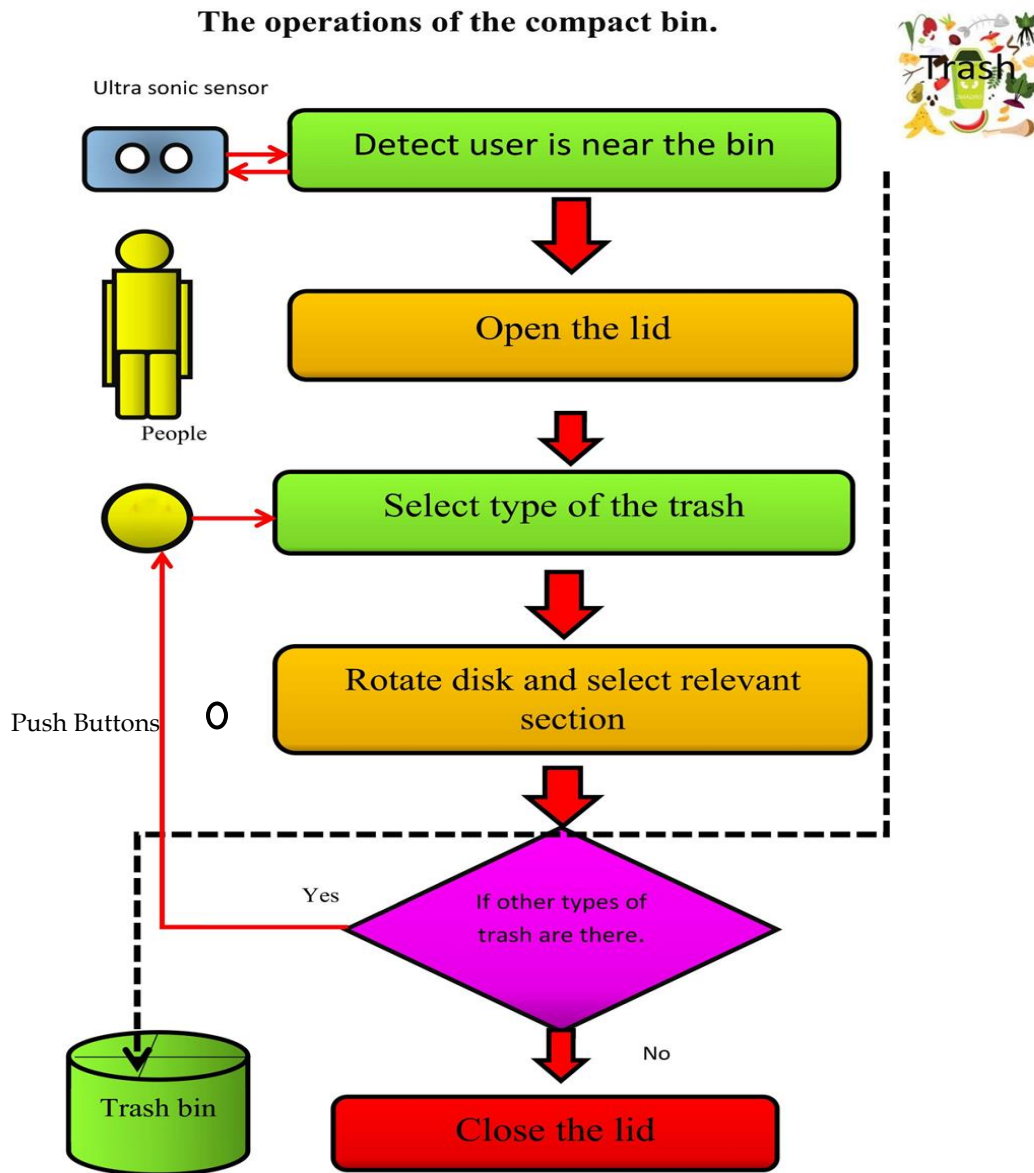
The operations of the compact bin.

Ultra sonic sensor

Detect user is near the bin

People

Open the lid

Select type of the trash

Push Buttons   O

Rotate disk and select relevant section

If other types of trash are there.

Yes

No

Trash bin

Close the lid
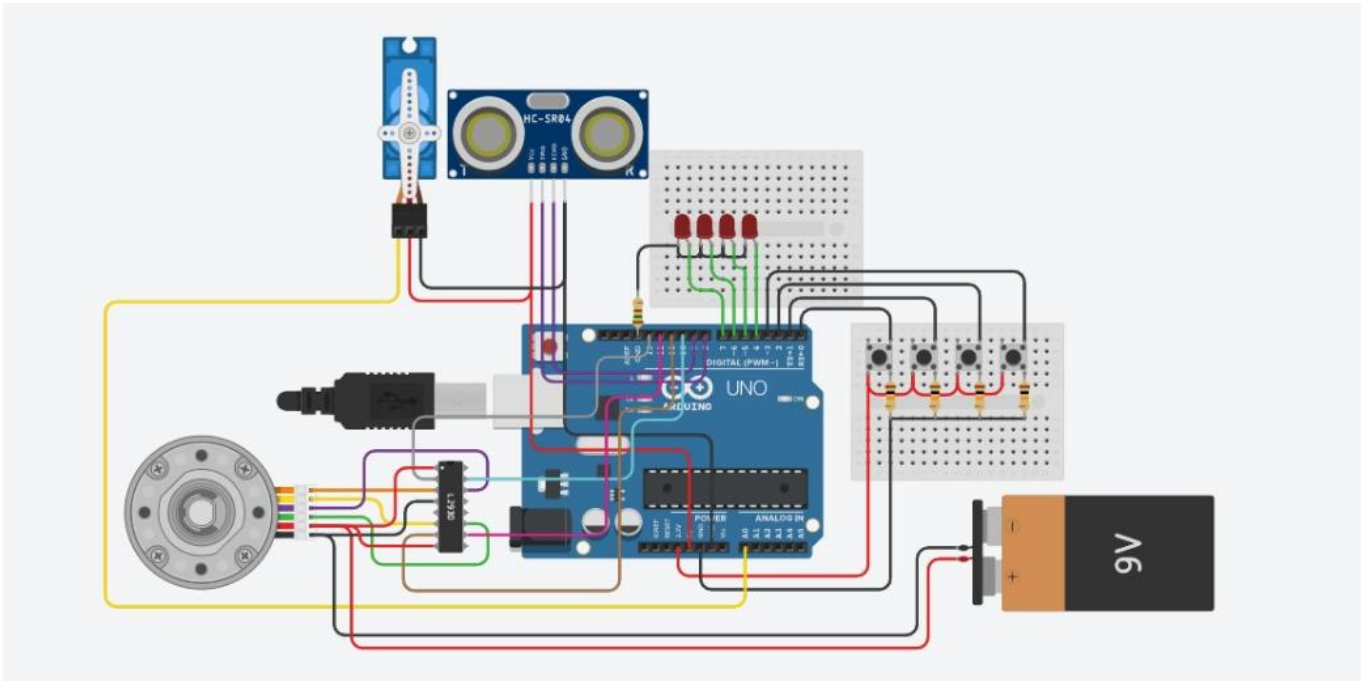
Trash

Fig. 3. Flowchart of the Operations

Fig. 4. Arduino Circuit Diagram.

6   BENEFITS OF THE PROPOSED SYSTEM

- It will help reduce the space that takes for the several bins.

- It will help people get an idea about how to classify trash.

- It will be easy for cleaners, and it is easy to refer the trash for the recycling process.

7 FUTURE PROSPECTS

The future holds great promise for waste management with the advent of compact trash bins equipped with advanced sorting systems, bolstered by IoT technologies, and powered by microcontrollers. These innovations pave the way for efficient recycling efforts. The crucial element lies in segregating waste at its source, a task made significantly effective by integrating cutting-edge sensors. This approach yields numerous advantages for waste management strategies, impacting the efficiency of recycling processes and fostering greater public awareness regarding appropriate waste disposal practices. By incorporating these technological advancements and promoting the separation of waste at its origin, we stand to decrease the volume of waste destined for landfills substantially. Concurrently, this aids in cultivating environmental consciousness on a broader scale. Thus, embracing segregation at the source emerges as a paramount, environmentally friendly strategy within the waste management landscape, promising a more sustainable and eco-conscious future for communities and the planet.

8 CONCLUSION

In conclusion, implementing a compact garbage bin equipped with a sorting system addresses the prevailing drawbacks of traditional trash bins. While modern sorting systems have been developed, their effectiveness is compromised if people don't shift their mindset towards proper waste segregation. The implications of this initiative offer a clear understanding of the importance of segregating garbage at its source, paving the way for a more sustainable future. Such innovative waste management solutions can optimize resource recovery and recycling processes. This minimizes the burden on landfills and promotes a circular economy. A critical aspect of this approach is educating and raising community awareness about the benefits of segregating waste. Encouraging responsible waste disposal habits will ensure that the sorting systems can function fully. Achieving a sustainable future necessitates a collective shift in behaviour and attitudes towards waste management. Through informed choices and widespread adoption of proper waste segregation practices, it's possible to create a cleaner, healthier environment and preserve valuable resources for future generations.

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