Smart Garbage Segregation and Dustbin Level Indicator

Manali Bhalerao[1], Sayali Rane[2], Shruti Londhe[3], Arti Tekade[4], Maithili Andhare[5], Vijayalaxmi Kumbar[6]
[1,2,3]*Department of E&TC, PCCOER, Ravet, Pune, India*
E-mail: [1]mmpbhalerao@gmail.com, [2]sayalirane850@gmail.com, [3]shrutil13042000@gmail.com

Abstract- ***Cities, and towns, home to over half of humanity are generating 80% of the world's GDP, and are in the front of the global waste challenge. In India, 0.1 million tonnes of garbage is generated every day, and 62 million tonnes of garbage every year and this is municipal solid waste. According to the report, only 33% of the municipal waste is managed which is environmentally safe. Developing nations of Asia and Africa have the major issue of waste management and most of the waste ends up in dumping and landfills. According to the 2018 project report rapid urbanization, population growth, and economic development are the reasons for the rapid growth in the garbage, and this can increase 70% of the total garbage in the next 30 years.***

***Keywords*—RaspberryPi, Bluetooth model HC05, Smartphone, motor driver IC LM293D, Stepper motor, ultrasonic sensor**

I. INTRODUCTION

The goal is to reduce the human force required for waste collection and segregation. Thus, avoiding maximum contact or touch between dustbin and person so, prevention from germs and diseases. The waste segregator categorizes the waste as recyclable, electronic waste, and other. The waste collection process is observed by the monitoring section. The system we are using in this process makes use of sensors, motors, and image processing to separate the waste. In this system, we are making use of Bluetooth technology through which we can send an SMS to the concerned authority. Ultrasonic sensors are used to detect the level in the bins. This system is fully automatic and reduces manpower

II. BACKGROUND

Due to high population density in urban areas, growing population, and inadequate garbage collection and transportation methods, the Indian government is encountering a problem managing waste or upgrading garbage collection methods across the country, from small towns to metro cities [7]. A proper waste management system is needed for the increasing population. Due to increasing population and waste different fatal diseases are caused. The system is connected to Internet.[5]. The use of this smart dustbin would prevent the garbage from being clumped together for extended periods, reducing the spread of illnesses and ensuring a clean atmosphere in the city [4]. Prof. R. M. Sahu, Akshay Godse, Pramod Shinde, and Reshma Shinde published their first work, "Garbage and Street Light Monitoring System Using Internet of Things," in the International Journal of Innovative Research. Set the public place for this paper bin, then the camera for the garbage bin position. The camera caught a picture of a waste can. Radio Frequency Identification (RFID), GPS, and GIS are all used to convey images to the workstation. The system is used to manage

the hut. SMS technology is used to regulate the hut. The position data is analyzed by the GPS and GPRS mapping server [3] Twinkle Sinha, K. Mukesh Kumar, and P. Saisharan published "SMART DUSTBIN." in an international journal. The leaf switch
is hung upside down via a side hole in the compression plate. Piston, switch, microcontroller, single directional cylinder, and smart dustbin are all examples of technology. They're only for smart dustbins; they don't gather waste. Smart Dustbins may significantly reduce the build-up of waste by the roadside, consequently limiting the spread of numerous illnesses [4]. The third article, "Efficient Garbage Disposal Management in Metropolitan," was written by Narendra Kumar G., Chandrika Swami, and K. N. Nagadarshini and published by Narendra Kumar G., Chandrika Swami, and K. N. Nagadarshini. Journal of Clean Energy Technologies, In Cities Using VANETs. The IR transmitter in this study is made up of LEDs that put out an IR beam. Infrared sensors, microcontrollers, Global System for Mobile, and graphical user interface (GUI) were all utilized in this technology (GSM). They only have access to the GSM network. Smart waste management system with IR sensor, microcontroller, and GSM module continues to get power and internet. When the rubbish level reaches its limit, this mechanism ensures that the dustbins are cleaned as quickly as possible [13].

III. PROBLEM STATEMENT

Waste management is a process that consists of many steps like collecting the garbage, separating the garbage, and transporting and disposal of the garbage in suitable locations. A lot of efforts have been taken till now to solve this problem but there is no proper system. There are different types of garbage and separating them is a crucial issue, due to this problem labor is required. In the past 17 years, 9 billion tonnes of plastic waste are generated and out of which 25,940 tons are generated by India, daily. Another issue faced is that garbage that can be recycled is found in the dump yards due to no proper garbage segregation. Considering the above issues/problems, this project suggests a cost-effective," Smart garbage Segregation and Dustbin level Indicator" for properly separating and managing the waste.

IV. OBJECTIVE

Although there have been various systems and solutions available for waste segregation still it's not feasible to use such technology in developing or underdeveloped countries. So, we are trying to build a system that will be pocket friendly and easily maintainable.

We are mainly planning to separate the different types of recyclable waste, electronic waste, and others. To reduce human labour required to segregate waste. To reduce the amount of recyclable waste in landfills.

V. BLOCK SCHEMATIC AND WORKING

The proposed system is divided into two sections:

The segregation section.

The monitoring section.

The segregation section consists of Raspberry Pi 3 as its main microprocessor, a capacitive proximity sensor, and three stepper motors. The capacitive sensor is used at the very start position to detect that some garbage is put in. The feedback from this sensor is given to the processor and the system turns on. Now, the camera module in the Raspberry Pi plays a major role in the segregation process using image processing (using python Open CV). Using the flap, the small portion enters the hold section where it is held by the flap here the image processing takes place. The flap is controlled by a stepper motor. Using image processing, garbage is classified as either one of the following by comparing data from the database: recyclable, electronic waste, and others. Once the processor identifies the type of garbage, the stepper motor below the dustbin is sent a response and the motor rotates at a certain angle so that the desired section appears below the flap. As we are sorting garbage into three categories, the stepper motor rotates into three steps. The movement of the stepper motor is controlled by the motor driver IC. As the desired section appears below the flap, the flap gets opened using another stepper motor for a few seconds and is closed again. Fig 1 gives the block representation of the segregation system.

The monitoring section consists of Raspberry Pi 3 as the main processor along with three ultrasonic sensors for measuring the level of garbage in each section. It also consists of Bluetooth model HC05 which is used to connect the system to mobile to send notifications to the mobile application.

Refer to fig 2 for block representation of the monitoring system.

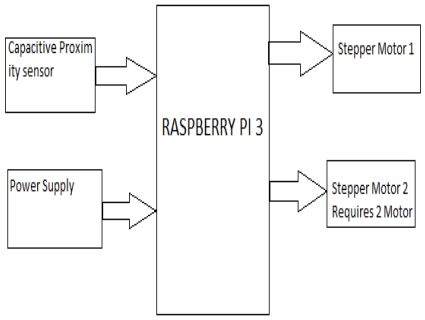

Fig 1: Segregation Section

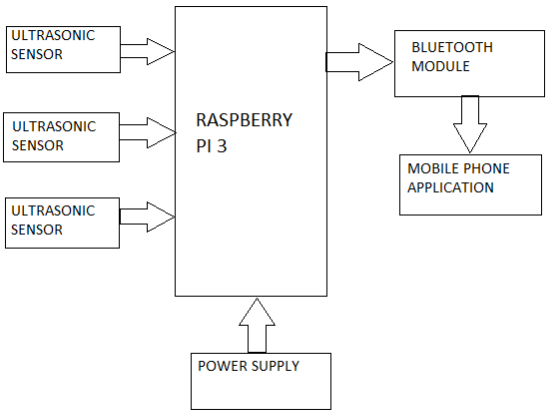

Fig 2: Monitoring Section

V. CIRCUIT DIAGRAM

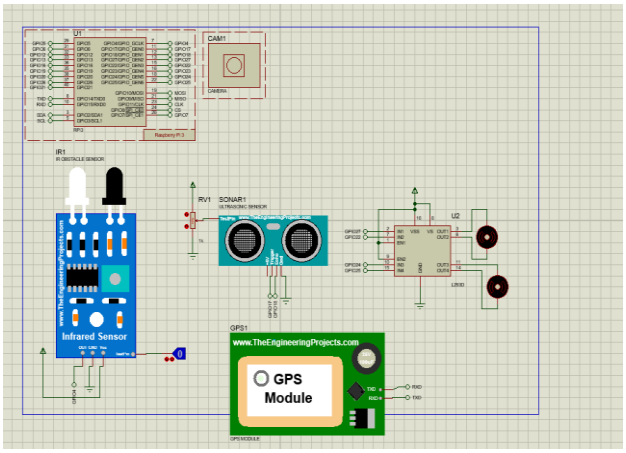

Fig 3: Circuit Diagram of the system

VI. FLOWCHART

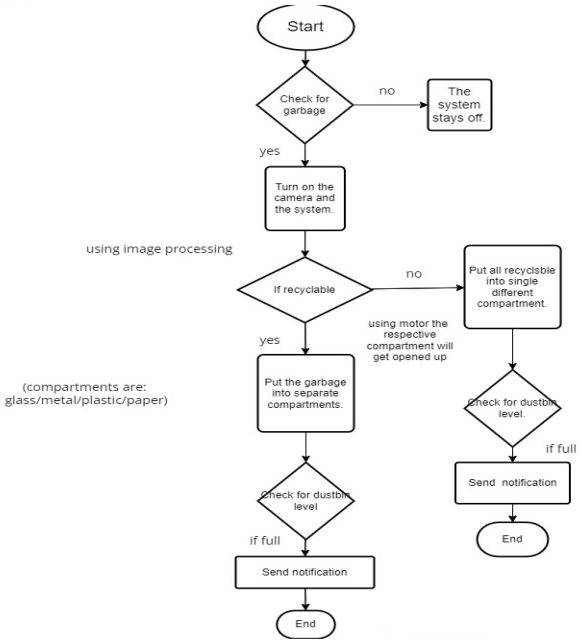

Fig. 4: Flowchart

VII. SPECIFICATION

Sensor Module Features

- It is a electronic device that responds to the input from the environment.
- It has range up to 20 cm.
- It has adjustable sensing range.
- Supply current of 20mA.
- Operating voltage of 5VDC.

Servo Motor Features

- It is programmable servomotor.
- It has plastic gears.
- It is a brushed DC motor type.
- Operating Voltage of 4.8 – 6 VDC

Ultrasonic Sensor Features

- It has a operating current of 8mA
- It has a working frequency of 40Hz with resolution of 1cm.
- It has a measuring angle of 15 degrees.
- Dimension: 50mm x 25mm x 16mm

Raspberry Pi Features

- It is a main controller in our research work.
- Raspberry Pi is a high-performance 64-bit quad-core processor.
- Bluetooth 5.0 / Gigabit Ethernet / USB 3.0 / POE features.

VIII. RESULT

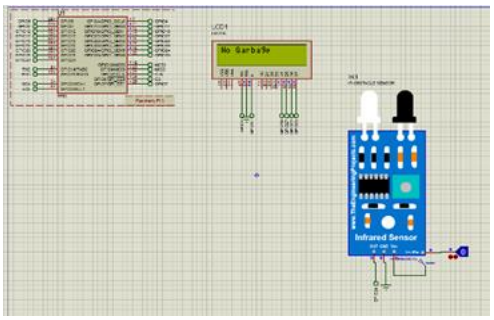

Fig 5: Simulation output when no garbage is detected.

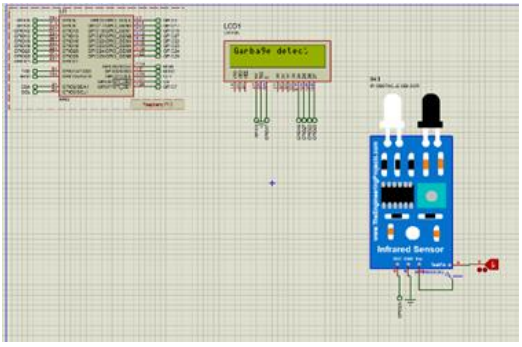

Fig 6: Simulation output when garbage is detected.

The fig.5 and fig.6 above show simulations of the research work. The research we are doing is mostly hardware-based. We had designed separate waste into mainly three sections recyclable, electronic waste, and others. The system also monitors the levels of garbage in each section and sends notifications on mobile.

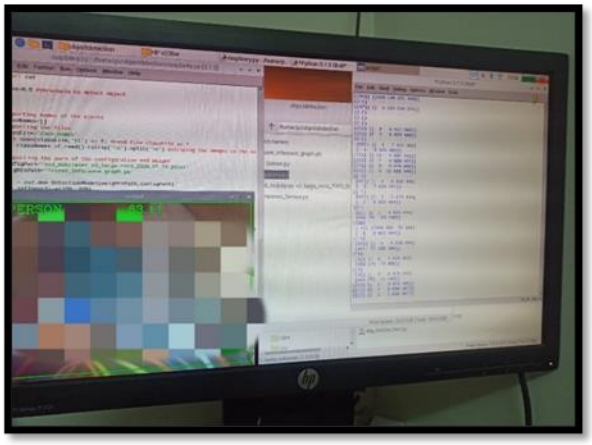

Fig 7: The actual testing of the hardware of our research work.

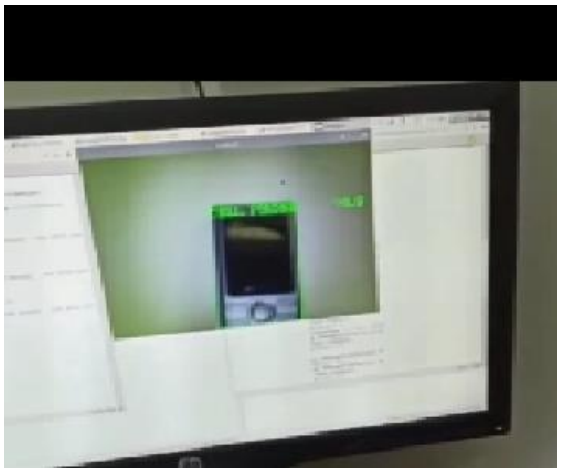

Fig 8: The Electronic waste Cell Phone is detected.

Fig 9: The Dustbin when the flip is closed.

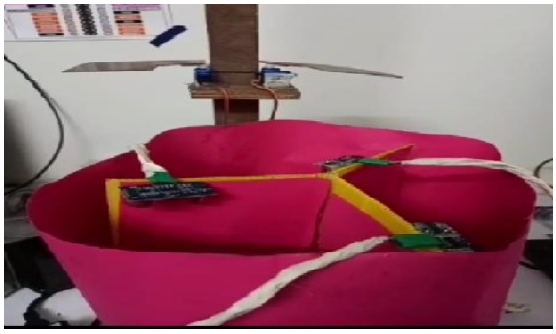

Fig 10: When the garbage gets detected and the flip gets open and the garbage falls in the following section.

IX. CONCLUSION

In this research work, we have built a smart dustbin that will separate the garbage into three different sections (recyclable, electronic waste, and others.) Also, a warning message will be received when the dustbin gets full.

X. REFERENCES

[1] Priya, C., Agasthya D. RamyaC, V. Pavithra, S. Shobika, and M. Dharini. "Garbage Bin Management System." *Annals of the Romanian Society for Cell Biology* (2021): 3593-3600.

[2] Thakker, Shubham, and Rajamanickam Narayanamoorthi. "Smart and wireless waste management." *2015 International Conference on Innovations in Information, Embedded and Communication Systems (ICIIECS)* (2015): 1-4.

[3] P. Arjun, S. Stephenraj, N. N. Kumar and K. N. Kumar, "A Study on IoT based Smart Street Light Systems," 2019 IEEE International Conference on System, Computation, Automation and Networking (ICSCAN), 2019, pp. 1-7, DOI: 10.1109/ICSCAN.2019.8878770.

[4] C. Kolhatkar, B. Joshi, P. Choudhari and D. Bhuva, "Smart E-dustbin," 2018 International Conference on Smart City and Emerging Technology (ICSCET), 2018, pp. 1-3, DOI: 10.1109/ICSCET.2018.8537245.

[5] Nanasaheb, Adhav Kishori, Kadam Gauri Santosh, Gore Komal Uttam, and Share Madhuri Dattatray. "IOT based Garbage Monitoring And Waste Management system for Smart Cities." (2019).

[6] Ghorpade-Aher, Jayshree, Anagha Wadkar, Janhavi Kamble, Utkarsha Bagade, and Vijayendra Pagare. "Smart dustbin: An efficient garbage management approach for a healthy society." In *2018 International Conference on Information, Communication, Engineering, and Technology (ICICET)*, pp. 1-4. IEEE, 2018.

[7] Malapur, B. S., and Vani R. Pattanshetti. "IoT-based waste management: An application to the smart city." In *2017 International Conference on Energy, Communication, Data Analytics and Soft Computing (ICECDS)*, pp. 2476-2486. IEEE, 2017.

[8] Viau S, Majeau-Bettez G, Spreutels L, Legros R, Margni M, Samson R. Substitution modelling in life cycle assessment of municipal solid waste management. Waste Manag. 2020 Feb 1;102:795-803. DOI: 10.1016/j.wasman.2019.11.042. Epub 2019 Dec 5. PMID: 31812832.

[9] Arshad, Rushan, Saman Zahoor, Muna Ali Shah, Abdul Wahid, and Hongnian Yu. "Green IoT: An investigation on energy-saving practices for 2020 and beyond." *Ieee Access* 5 (2017): 15667-15681.

[10] Kanade, Prakash, Prajna Alva, Jai Prakash Prasad, and Sunay Kanade. "Smart garbage monitoring system using Internet of Things (IoT)." In *2021 5th International Conference on Computing Methodologies and Communication (ICCMC)*, pp. 330-335. IEEE, 2021.

[11] Kanade, Prakash, Prajna Alva, Jai Prakash Prasad, and Sunay Kanade. "Smart garbage monitoring system

using Internet of Things (IoT)." In *2021 5th International Conference on Computing Methodologies and Communication (ICCMC)*, pp. 330-335. IEEE, 2021.

[12] Cruz N, Cota N, Tremoceiro J. LoRaWAN and Urban Waste Management-A Trial. *Sensors (Basel)*. 2021;21(6):2142. Published 2021 Mar 18. doi:10.3390/s21062142

[13] Narendra Kumar G., Chandrika Swamy, and K. N. Nagadarshini, "Efficient Garbage Disposal Management in Metropolitan Cities Using VANETs," *Journal of Clean Energy Technologies* vol. 2, no. 3, pp. 258-262, 2014.