IJRAR.ORG E-ISSN: 2348-1269, P-ISSN: 2349-5138

INTERNATIONAL JOURNAL OF RESEARCH AND ANALYTICAL REVIEWS (IJRAR) | IJRAR.ORG

An International Open Access, Peer-reviewed, Refereed Journal

AUTOMATED WASTE GARBAGE SEPARATION USING ARDUINO AND SENSORS

[1]Ms. Punam P. Warke, [2]Mrs. Swati Shelar, [3]Soham Pethkar, [4]Parth Suryawanshi

[1, 2]Assistant Professor, [3, 4]Student

[1]Department of Electronics

[1]Dr. D. Y. Patil Arts, Commerce and Science College Pimpri, Pune, India

Abstract: Nowadays technologies are getting smarter day-by day, so to clean the environment we have designed an automated dustbin using Arduino. This dustbin management system is built on a microcontroller-based system having ultrasonic &metal detectors inside the dustbin. If dustbin is not maintained, these can cause an unhealthy environment, hurts waste handling peoples and also pollution affects our health when it's destroyed. In this proposed project, when someone comes near the range of dustbin, its lid will open and wait for the user to put the garbage then closes it. The main objective of the proposed system is to design an automated dustbin which will help to keep hazardous and non-hazardous waste product separately so that they can be destroyed or separated for recycling accordingly without any injury to garbage handling person. It can be used for domestic and medical waste separations at primary levels.

Index Terms **- Arduino, Dry Battery, metal detector, Servo Motor, Ultrasonic sensor, etc.**

I. INTRODUCTION

In today's world even if we are living in the automation still some works are done by the human helps. In India, the waste garbage materials are still separated by human hands; many people's get injured during this process due to hazardous materials like metal edges etc. The prototype proposed here is a automated system to separate hazardous material from the other garbage materials. The major injuries caused due to metal cuttings or same type of sharp edge metal pieces. It is better if we separate such type of materials in the primary evels of garbage collection. The proposed system uses sensors to automate the garbage bin at primary level and separate the metal from the other waste material. This type of system is very useful in hospitals, domestic garbage collections and other garbage collection centers.

II. LITURATURE REVIEW

Aakash Sharma *et. al*, had developed a smart dustbin for smart buildings, houses and colleges. They used here ultrasonic and PIR sensor with servo motor for smooth and smart working of dustbin. They also used Aduino to control the working of used devices. The lid of dustbin will open automatically when someone comes near to the dustbin and closes after some duration of time. [1]

Nilesh Damakal *et al*. in 2019 developed a IoT based Smart dustbin project was designed to make garbage collection easy and efficient. They implemented the project using ultrasonic, PIR and GAS sensors in addition with PIC18 module. When the garbage level reaches up to a specific level the system sends alert to the garbage collecting vehicle for garbage collection. [2]

Anubhav Gandhi *et al*. in 2021 proposed a model of AI based Smart Dustbin. They have developed an AI based waste management system. The system will check the waste garbage level in a particular area and if its above the 90% then the garbage will be collected by movement of the garbage container towards collection point. Thus the garbage collection required less manpower and helps in cleaning the city effortlessly [3].

Srinivasan P *et al*. in 2021 has introduced a smart dustbin using IoT. They proposed a smart dust bin which can tell us whether the dustbin is filled or not by checking a waste level of smart dustbin. They used here NodeMCU with ultrasonic sensor. The IFTTE webhook was used as a server to send notification from the dustbin. [4]

III. MODEL DESIGN AND MATERIAL USED

3.1 Model Design

The proposed model is built for the primary waste collection in this automated garbage collection dustbin is innovated and its prototype is developed in laboratory. The whole design of automated dust bin is developed around Arduino microcontroller. Here Arduino uno is used as a controller to provide decisions and control signals to the whole system.

The fig. 1 shows the block diagram of the automated system. It includes Arduino microcontroller, two servo motors, and sensors. To open and close the dustbin ultrasonic sensor is used [5,6] whereas to separate the metal contents from garbage metal detector is used. The metal detector sensor is designed and built for the particular dust bin size. Two Light sensors are used for detection of garbage level in dustbin. Two servo motors are used to control the open-close operation and to select the material section of the dustbin.

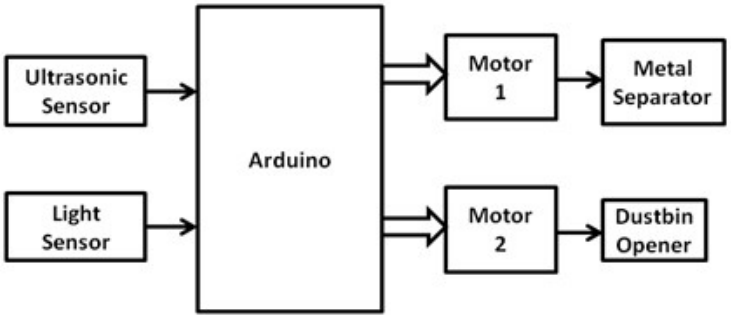

Figure 1: Block Diagram of Automated garbage bin.

The diagrammatic representation of the automated dustbin system is shown in the fig. 2. The metal detector was developed on the funnel like structure placed on the above side of the dustbin.

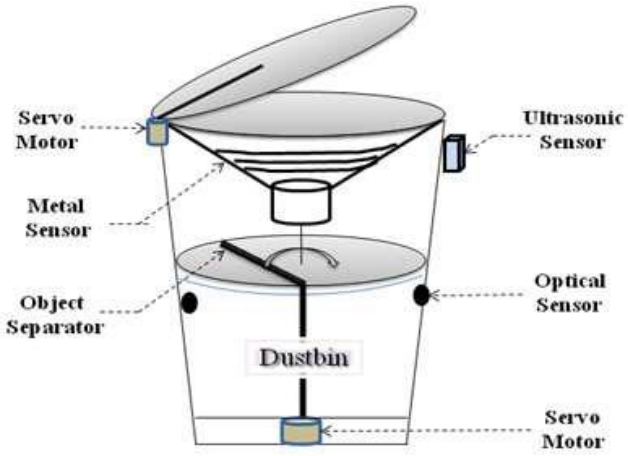

Figure 2: Representation of Automated garbage bin.

3.2 Hardware Components

The proposed system uses

- Arduino Uno
- Ultasonic Sensor
- Servo Motor
- Metal Sensor
- Optical Sensor (LED and LDR)
- DC Battery

The whole system works on 9V to 12V DC power supply

3.2.1 Arduino Uno

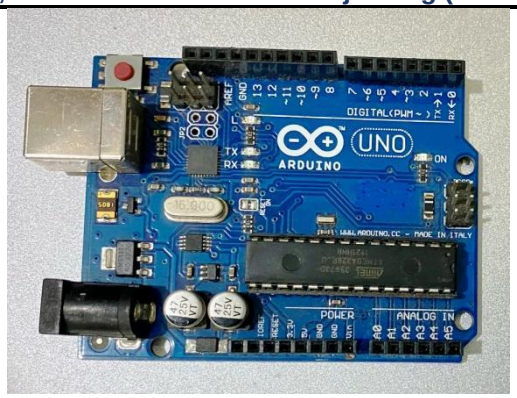

Figure 3: Arduino Uno Board

It is a Microchip ATmega328P based microcontroller board. It is programmable with Arduino IDE platform through USB cable [8]. It is powered by 9V battery or USB cable.

3.2.2 Ultrasonic Sensor

It is used to measure the distance of the object from the sensor. The ultrasonic sensor transmits ultrasonic sound waves and receives back as a echo signal which is reflected back from the object. It operates on 5v poer supply having maximum detection range about 400cm. [8]

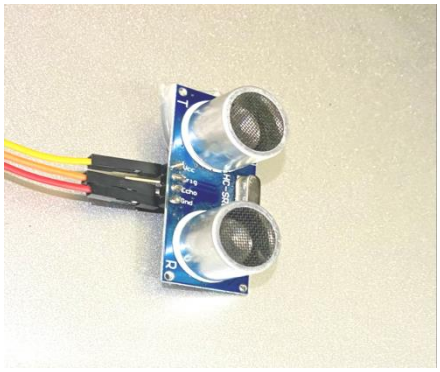

Figure 4: Ultrasonic Sensor

The distance can be calculated by using formula:

$$Distance = Time \times Speed\ of\ sound \div 2 Distance = Time \times Speed\ of\ sound \div 2$$

3.2.3 Servo Motor

Servo motor is used for precision rotation. There are two types of servo motors: AC servo motor and DC servo motor. The servo motor converts electrical energy into mechanical energy [9]. Here it is used in nonlinear output.

Figure 5: Servo Motor

3.2.4 Metal Sensor

The metal sensor used here is specially designed by using copper wire on a funnel like structure. Two wires are wound on a non-conducting material. One wire is connected with positive supply and other wire with ground. When any metallic objects fall on it the circuit is completed due to metal object which tends to create control signal to the servo motor.

IV. SOFTWARE MODEL

4.1 Flow Chart

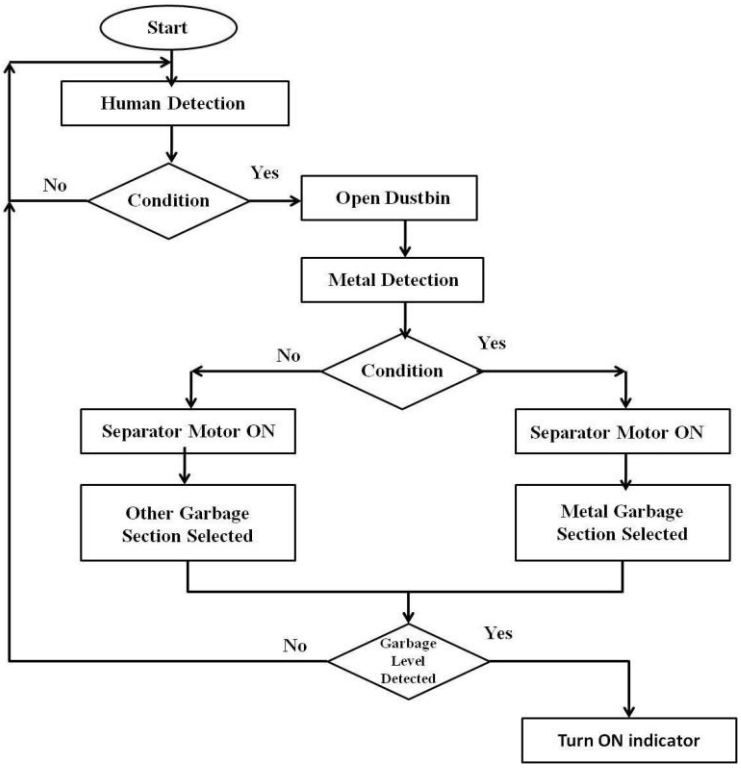

Figure 6: Flowchart of system

Software model is developed on Arduino IDE platform. Figure 6 shows Flowchart of the system software developed on Arduino IDE platform.

V. RESULTS AND DISCUSSION

Though we are moving towards automation it is very difficult to provide it at every step. Our proposed model is a small step towards making it easy to distinguish the hazardous and non hazardous materials from the waste collection at the basic or primary level. As a result, when ultrasonic detects human in its range, the first servo motor moves at 90 degree and open the cover of dust bin. Also, when metal object is detected the second servo motor moves towards right side and open the metal collecting part for waste collection and when there is no metal the second servo moves towards the left side collecting non metallic garbage in dustbin. This makes easy to the person who is collecting garbage and recycles it at recycling centers.

V. ACKNOWLEDGMENT

We would like to thank our Principal, Dr. Ranjit Patil and Head of Department , Department of Electronics, Dr. J. S. Sonawane for their continuous support and motivation.

REFERENCES

[1] Aakash Sharma *et al*, 2021. Smart Dustbin, International Journal of Innovative Research in Engineering & Multidisciplinary Physical Sciences 9(5): 16-19.

[2] Nilesh Damakal *et al*. in 2019. IoT Based Smart Dustbin, National Conference on Information, Communication and Energy Systems and Technologies, nternational Journal of Scientific Research in Science, Engineering and Technology,5(7): 513-517.

[3] Anubhav Gandh *et al*. 2021. Artificial Intelligent (AI) Based Smart Dustbin, 2nd National Level Students' Research Conference on "Innovative Ideas and Invention with Sustainability in Computer Science and IT-2021", International Journal of Scientific Research in Computer Science, Engineering and Information Technology, 8(2): 23-26

[4] Srinivasan P *et al.* 2021. Iot Based Smart Dustbin, Annals of R.S.C.B, 25(3) : 7834-7840.

[5] Nabaneeta Banerjee *et al*. 2022. Smart Dustbin, International Journal of Innovative Research in Technology, 9(2): 169-171.

[6] Mr.Varun Chaudhary *et al*. 2019. Smart Dustbin, International Research Journal of Engineering and Technology, 6(5): 7647-7651

[7] Dr. Sudha L K *et al.* 2023. Smart Dustbin Monitoring System using Arduino UNO, International Journal of Engineering Research & Technology, 12(2): 76-80.

[8] Janhavi Shelke *et al.* 2022. Smart Bin for Smart Waste Management, International Journal of Scientific & Engineering Research, 13(4): 133-138.

[9] Dhaval Padsala *et al.* 2021. A New Approach for Biomedical Waste Management, International Journal of Engineering Research and Applications, 11(3): 33-35.

[10] Anilkumar C.S., Suhas G, and Sushma S. 2019. A Smart Dustbin using Mobile Application, International Journal of Innovative Technology and Exploring Engineering, 8(11): 3964-3967.

[11] Jun-Ho Huh, Jae-Hyeon Choi and Kyungryong Seo 2021. Smart Trash Bin Model Design and Future for Smart City, Applied Scince, MDPI, 11, 4810