Design And Fabrication of Smart-Waste Segregation System Using IoT

Mr. Janardhana K [1], Shanta [2], Prajwal K [3]
[1]*Associate Professor, Department of Mechanical Engineering, Sir MVIT, Bangalore, India*
[2, 3] *U G Students, Department of Mechanical Engineering, Sir MVIT, Bangalore, India*

Abstract: With the increase in human population and the expansion of urban areas, the amount of waste generated also increases, leading to environmental pollution, disease, and unsanitary living conditions. Waste management includes the management of all types of waste, including raw material extraction, manufacture, consumption, and other activities such as health care. However, current practices of managing waste are not effective. To solve this problem, an automatic waste sorting system was introduced, separating pieces of waste into dry, wet and metallic categories. An IoT system is developed which uses sensors installed in bins to monitor the waste level and alert collection service providers to empty bins. In addition to this, methane gas detection is used to detect the methane gas in the bins which alert the users through IOT system. The goal of this work is to create an easy-to-use, affordable household waste sorting system that separates waste and tracks disposal information on a server.

Keywords: **Waste Segregation, sensors, IOT**

1.INTRODUCTION

The method of disposing of hazardous waste can produce liquid leachate contaminating surface and groundwater can transmit diseases that spread harmful diseases and can reduce the aesthetic value of the natural environment and is inefficient use of land resources, paints, wires, glasses, unwanted food, etc. come under municipal waste. This waste comes from schools and factories, but primarily comes from our homes. The composition of municipal waste differs in each municipality and keeps changing with time. Municipal waste divides further into: Materials like unused food, clothes, unwanted paper, damaged batteries, etc. come under household wastes. Agricultural waste also comes under household waste. Waste coming from any kind of businesses, trading factories, schools, etc. comes under commercial waste. Any dissolved liquid-based waste or sludge coming from wastewater plants, households, etc. come under wet waste. The softwares used are Arduino IDE, SQL, IoT, Blynk App. This system can be made use in different shopping malls, in various public places to maintain cleanliness, in schools thereby motivating the students to systematic maintenance of waste smartly, in offices and in households.

2.LITERATURE REVIEW

Michael E., Otaru C. O., Liman A. D., Bomoi M. I., Awotoye B. Design and Development of a Smart Waste Bin" - Detecting the presence of a person at a 1m distance is the goal. B. Chowdhury and M. U. Chowdhury, "RFID-based real-time smart waste management system," - "Pay as you throw"' thereby motivating the residents to minimize the waste. Dr. K. R. Nataraj and Meghana K. C, "IOT Based Intelligent Bin for Smart Cities"- Concentrates on reducing the issue of ignoring cleanliness that is spoiling the environment. V.Sowndharya, P.Savitha , S.Hebziba Jeba Rani " Smart Waste Segregation and Monitoring System using IoT" - Presents the amount of waste increasing with respect to human population and urbanization. Eunice David Likotiko, Devotha Nyambo, Joseph Mwangoka "MULTI-AGENT BASED IOT SMART WASTE MONITORING AND COLLECTION ARCHITECTURE" – real time waste monitoring and collection using IoT is preferred. Sagar Kumar Pandey, Shivam Kumar Yadav, Sharmistha Su Ajeet Tyagi, Sagar Mishra, Harpreet Kaur Channi. "Designing and Fabrication of Smart – Edustbin" - Enhancing trivial and vital component of the urban waste management system.

3.OBJECTIVE

The main purpose of this project is to separate the waste smartly using the Internet by designing it to sort the waste into metallic waste, wet waste, and dry waste. To design a compact, low-cost, and user-friendly segregation system for households to streamline the waste management process using sensors. To detect methane gas using gas sensor that indicates the presence of gas and notifies the data. To program the conditions for microcontroller using Arduino IDE software and implement it.

4.METHODOLOGY

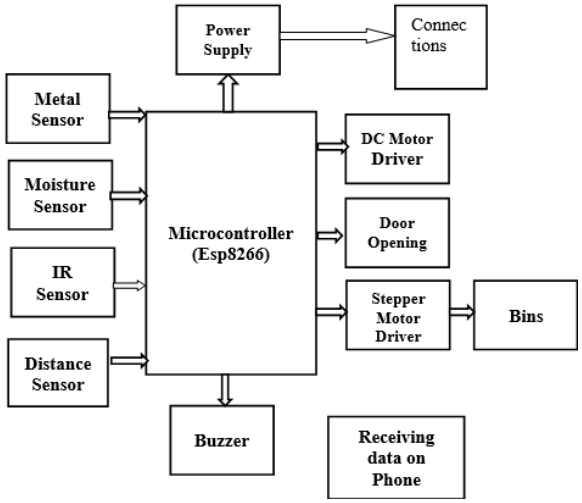

Fig 1(a): Basic Block diagram

Working: If a person approaches the container, the door opens automatically via an ultrasonic sensor. When trash is thrown into the smart trash can, an infrared sensor detects the trash thereby activating the microcontroller. The microcontroller then starts the DC motor used to spin the drum. All data is received via IOT on your smartphone. Garbage thrown into the Smart Bin falls onto a drum that has various sensors attached to detect the waste type. The first sensor is a metal sensor that emits an electromagnetic field. The sensor coil receives the returned field and alerts the user by generating a targeted response. Another connected sensor is a moisture sensor that capacitively measures the dielectric constant of the surrounding medium. This tells us if the waste is wet or dry. Based on the detected waste, the bin is selected via a stepping motor. When the rotor magnet is aligned with the stator winding, the other winding is energized. The two windings are switched on and off alternately. This locks the motor in the desired position. The buzzer signals the detection of waste by one of the sensors. Separate drivers are used for the DC motor and the stepper motor to increase the voltage level since the output of the microcontroller is 5V and the motors need 12V. Initializing all modules ensures that dynamic changes in the environment do not affect detection**.**

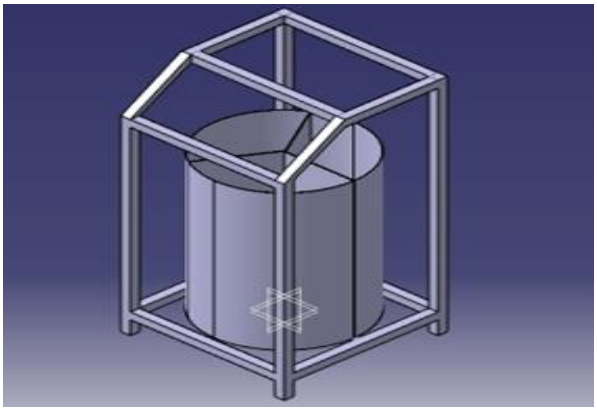

Fig 1(b) :3D CAD Model by using catia

Fig 1(c) : Fabricated working model

5.COMPONENTS USED

ESP8266 microcontroller: This module permits microcontrollers to connect to 2.4 GHz Wi-Fi, using IEEE. It has many applications when it comes to the IoT such as Networking: The module's Wi-Fi antenna enables embedded devices to connect. Equipped with a robust processor and generous memory capacity,

thereby accommodating multiple forms of connections including SPI, IC and UART.

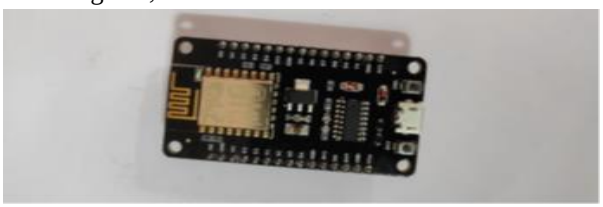

Fig 2. ESP8266 Microcontroller

Servo motor: Robotics, model making, and other hobbyist projects. Relatively low-cost, making it an attractive choice for many applications. Gram weight and a size of 22.8 x 11.8 x 22.7 mm, making it small to be used in compact and lightweight robotic designs. It has a torque rating of 1.8 kg/cm, which is sufficient for most hobbyist applications and small robotic projects. Features a dead-band width of only 1 µs, which provides precise control and positioning of ● Stall torque: 1.8 kgf·cm ● Operating speed: 0.1 s/60 degree ● Operating voltage: 4.8 V (~5V) ● Deabandwidth:10µs

Fig 3: Micro servo SG90

DC motor: Almost all types of DC motors have internal mechanism. A stepper motor (or step motor) is a brushless DC electric motor that divides a full rotation make the motor shaft turn, first, one electromagnet is given power, which magnetically When the gear's teeth are aligned to the first electromagnet, they are turned on and the first is turned off, the gear rotates slightly to align with the next one. Number of steps making a full rotation.

Fig 4: DC geared motor

Relay module: A power relay module is an electrical switch that is operated by an electromagnet. activated, the electromagnet pulls to either open or close an electrical circuit yoke. Magnetic circuit when the relay is de-energized. of contacts is closed while the other set remains open. When the relay is de-energized, the sets of contacts that When switching off the current to the coil, the armature is returned, by force, to relaxed.

Fig 5: Relay Module

Metal sensor: The sensors provide excellent results even with difficult-to-detect objects, e.g. small or thin parts, wires or bright metals. A variety of types cover a wide range of individual Thus, devices are available with N.C. or N.O. functions, with NPN or PNP switching outputs, and cable or plug connection. enclosure rating is IP66.

Fig 6: Metal Sensor

Moisture sensor: Moisture sensor module is utilized to detect the moisture of the soil. Module has both digital and analog outputs and a potentiometer to adjust the threshold.

Its specifications can be of utmost importance. This operates at a range of 3.3V to 5V DC and current of 15mA is operated. The Output Digital is of 0V to 5V. This component is easy to use with Microcontrollers or even with normal Digital/Analog IC.

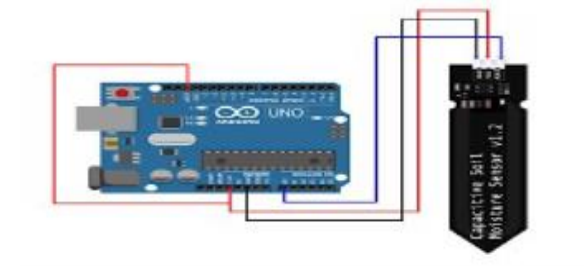

Fig 7: Moisture Sensor

6.RESULTS AND DISCUSSIONS

The system proposed successfully segregates the dry, wet, and metallic waste with the help of sensors. The type of waste detected is displayed in the software named Blynk App. The detection of gas is also possible in this work thereby sensing the methane gas for safety purpose. The programming done using various conditions for microcontroller operation is successfully working.

7.CONCLUSION

Waste separation is successfully implemented using intelligent waste bins i.e., dry, wet and metal waste at source. Meeting people's luxury needs, saving time for a busy world, providing adequate service without delay. Smart- Ewaste is proposed that can be used in public places, educational institutions, companies, offices etc., mainly because the user serves in a friendly way and helps to keep the world clean and green. This device precisely separates three types of waste, not only to increase the economic value of waste, but also to create a healthy and beautiful environment.

REFERENCE

[1] Eunice David Likotiko, Devotha Nyambo, Joseph Mwangoka, "MULTI-AGENT BASED IOT SMART WASTE MONITORING AND COLLECTION ARCHITECTURE", International Journal of Computer Science, Engineering and Information Technology (IJCSEIT), Vol.7, No.5, October 2017

[2] Arindam Ghosh, Debajyoti Sarkar, Aditya Kumar Jha, Saikat Banerjee, Sujay Barui, Biswanil Ghosh,Tapas Kumar Nandi, "Design and Fabrication of IOT based Smart Dustbin", International Journal for Research in Applied Science & Engineering Technology (IJRASET),Volume 10 Issue VII, July 2022S. Zhang, C. Zhu, J. K. O. Sin, and P. K. T. Mok, "A novel ultrathin elevated channel low-temperature poly-Si TFT," *IEEE Electron Device Lett.,* vol. 20, pp. 569–571, Nov. 1999.

[3] Mohan Kumar.V, Vigneshwar. K, Sasikumar. M, Regin. R. C, Vishnuvineeth. K, "Design and Fabrication of Smart Bin", International Journal of Engineering Science and Computing (IJESC), Volume 9 Issue No.3, March 2019

[4] Sagar Kumar Pandey,Shivam Kumar Yadav, Sharmistha Sur, Ajeet Tyagi, Sagar Mishra, Harpreet Kaur Channi, "Designing and Fabrication of Smart -EDustbin", International Journal of Innovative Science, Engineering & Technology(IJISET),Vol. 6 Issue 10,October 2019

[5] Sagar Kumar Pandey,Shivam Kumar Yadav, Sharmistha Sur, Ajeet Tyagi, Sagar Mishra,Harpreet Kaur Channi, "Designing and Fabrication of Smart -EDustbin", International Journal of Innovative Science, Engineering & Technology(IJISET),Vol. 6 Issue10, October2019 M. Shell. (2002) IEEEtran homepage on CTAN. [Online]. Available: http://www.ctan.org/tex-archive/macros/latex/contrib/supported/IEEE tran/

[6] S.S.Navghane, M.S.Killedar and Dr.V.M.Rohokale," IOT Based Garbage and Waste Collection Bin" International Journal of Advanced Research in Electronics and Communication Engineering, ISSN: 2278-909X, Volume 5, Issue 5, May 2016. "PDCA12-70 data sheet," Opto Speed SA, Mezzovico, Switzerland.

[7] Gaikwad Prajakta Jadhav Kalyani and Machale Snehal, "SMART GARBAGE COLLECTION SYSTEM IN RESIDENTIAL AREA" International journal;l of Research in Engineering and Technology, ISSN: 2319-1163 | ISSN: 2321-7308.

[8] Vishesh Kumar Kurre, "Smart Garbage Collection Bin Overflow Indicator using IOT", International Research Journal of Engineering and Technology e ISSN:2395-0056 |p-ISSN 2395-0072, Volume: 03 Issue: 05-May-2016.

[9] P V Prasad Reddy, N Vijayarami Reddy, Dr. K Sudhakar Reddy, Dr. S Madhava Reddy, "Design and Fabrication of Smart Waste Management System", International Journal of Latest Engineering and Management Research (IJLEMR), Volume 03 - Issue 05, May 2018

[10] Prof. S.A. Mahajan, Akshay Kokane, Apoorva Shewale, Mrunaya Shinde, Shivani Ingale, "Smart Waste Management System using IoT", International Journal of Advanced Engineering Research and Science (IJAERS), Vol-4, Issue-4, Apr- 2017

[11] Eunice David Likotiko, Devotha Nyambo, Joseph Mwangoka, "MULTI-AGENT BASED IOT SMART WASTE MONITORING AND

COLLECTION ARCHITECTURE",International Journal of Computer Science, Engineering and Information Technology (IJCSEIT),Vol.7, No.5, October 2017

[12] Arindam Ghosh, Debajyoti Sarkar, Aditya Kumar Jha, Saikat Banerjee, Sujay Barui, Biswanil Ghosh,Tapas Kumar Nandi, "Design and Fabrication of IOT based Smart Dustbin",International Journal for Research in Applied Science & Engineering Technology (IJRASET),Volume 10 Issue VII,July 2022

[13]].Mohan Kumar.V, Vigneshwar. K, Sasikumar. M, Regin. R. C, Vishnuvineeth. K, "Design and Fabrication of Smart Bin",International Journal of Engineering Science and Computing(IJESC),Volume 9 Issue No.3,March 2019

[14] Sagar Kumar Pandey,Shivam Kumar Yadav, Sharmistha Sur, Ajeet Tyagi, Sagar Mishra, Harpreet Kaur Channi, "Designing and Fabrication of Smart -EDustbin", International Journal of Innovative Science, Engineering & Technology(IJISET),Vol. 6 Issue 10,October 2019

[15] Sagar Kumar Pandey,Shivam Kumar Yadav, Sharmistha Sur, Ajeet Tyagi, Sagar Mishra,Harpreet Kaur Channi, "Designing and Fabrication of Smart -EDustbin", International Journal of Innovative Science, Engineering & Technology(IJISET),Vol. 6 Issue10,October2019.