iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 12 **Issue:** IV **Month of publication:** April 2024

DOI: https://doi.org/10.22214/ijraset.2024.61200

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 12 Issue IV Apr 2024- Available at www.ijraset.com

Smart Wet and Dry Waste Management System Using IoT

G.Krishna Kishore[1], P.Sonali[2], K.Divya[3], Vidhisha Reddy[4], P.Pravalika[5]
[1]*Assistant Professor,* [2, 3, 4, 5]*Student, Department of Electronics and Communication Engineering G. Narayanamma Institute of Technology and Science (For Women), Hyderabad, India*

Abstract: ***Waste management is one of the important aspects when it comes to avoiding diseases caused by unsegregated waste. Many people have lesser knowledge about what is wet and dry waste. The escalating global waste generation hasled to a pressing need for innovative waste management solutions that are efficient, sustainable, and technologically advanced. This abstract introduces a "Smart Dry and Wet Waste Management System" that leverages the Internet of Things (IoT) to revolutionize waste management practices.***

Traditional waste management systems often lack real-time monitoring and optimization capabilities, resultingin inefficiencies, environmental concerns, and increased operational costs. The proposed system aims to address these challenges by integrating IoT technologies, sensor networks, and data analytics into waste collection and disposal processes.The main objective is to automate the segregation system thereby removing the human intervention. The hardware components such as Arduino, sensors, LCD are used to build the system.

The integration of IoT in waste management contributes to a cleaner environment, reduced operational costs, and increased overall efficiency. By preventing overflows, minimizing unnecessary collection trips, and promoting recycling practices, the system aligns with sustainable waste management goals. Moreover, the collected data can be analyzed over time to identify long-term trends, enabling continuous optimization of waste management strategies..

I. INTRODUCTION

Most of cities in India are facing problem due to inefficient management of waste due to which there is serious health problem among municipal workers which even has resulted in several deaths. The number of workers working for the garbage cleaning are large due to large amount of waste being produced compared to that few years ago. It is estimatedby Centre Pollution Control Board (CPCB) that India produces around 26,000 tons of plastic garbage per day, out of which 10,000 tons remain uncollected. Currently, 4.6% of diseases in India is due to improper waste management increased to 3.40 billion tons. Across the globe, garbage created by everyone according to the day averages 0.74 kg; nevertheless, the variation is wide, ranging from 0.11 kg to 4.54 kg. By 2050, it is expected that the total amount of garbage created in low-income nations would have increased by more than thrice.

In the proposed work, we have used three type of sensor to sense wet and dry garbage and dispose it in separatedustbin. One sensor is metal detector, second is infra-red sensor module and third is moisture sensor. The sensors are attached with Arduino board and two motor's. Also a mechanism is used at the bottom side of wet waste bin to connect it to compost pit whenever IR Sensor generates a signal indicating wet waste bin is full. The compost which will be produced can further be used in organic farming and urban agriculture for better health and environment of human being. One more feature has been proposed in the paper to intimate the IoT based waste collection system to collect the garbagewhen metallic waste and/ or dry waste dustbin are full.

Therefore, we decided to create a Smart Dustbin System using IoT in order to appropriately separate (segregate)waste based on its nature. Our system uses a variety of sensors to identify the different sorts of waste and divides it into three different bins for wet and dry.

II. LITERATURE SURVEY

The garbage management in cities should be effectively and efficiently implemented. Most smart dustbin techniques so far only used IR sensors, Ultrasonic sensors and RFID tags and only concentrated on waste management. This section discusses about the existing approaches in the field of smart waste management. Insung Hong et.al [5] has suggested that replacing SGS(Smart Garbage Sensor) instead of RFID garbage collecting system helps to improve their energy efficiency up to 16% and can reduce the food waste reduction .Inside the SGS they have installed SGBs (Smart Garbage Bins) to control the energy efficiency of the system.

©IJRASET: All Rights are Reserved

In another framework, the paper proposed to design an electronic machine, which allows you to offer a way to abnormal waste disposal gadget. The designed gadget uses biosensor sensor, weight sensor and height sensor to locate overflow of the waste within the dust bin and the quantity of pollution caused by unwanted toxic gases from the bin. It included a GSM module to alert municipality about the overflow of the waste [6].

Fachmin Folianto et.al [7] has suggested that it uses mesh network. It is used to produce data and deliver it to the mesh network. Whenever the bins are filled they need to be cleaned. The bin collector gives the route to collect the bins.

Vikrant Bhor et.al [9] has suggested that when the system ensures that the garbage bins are fully filled up to theirmaximum it must be cleaned using IR sensor, GSM mode and microcontroller. When it is not filled it must be reported to the higher authority of a particular contractor. It concludes that it has a clean environment and it decreases the total number of trips the garbage collector vehicle rounds.

As per the statistics and study, garbage bins needs separate sections and various indication facility so that respective authorities can monitor the bins effectively. Solid waste management facility in India is very poor. There is noorganized efforts and processing plan to segregation. It leads to a lot of human efforts. This concept reduces the problemsof current waste management problems to a lot extent.

III. BLOCK DIAGRAM AND WORKING

The proposed block diagram of smart waste segregation system. Arduino Uno ATmega328P is used as controller. The garbage level inside the garbage bin is continuously monitored by an ultrasonic sensor set up inside the garbage bin. The ultrasonic sensor transmits ultrasonic sound, and the sound waves get reflected by the waste inside the garbage bin. There is a time gap between transmitting ultrasonic sound and receiving the reflected sound waves. With thehelp of this time gap, the percentage filled up inside the garbage bin is known. If the percentage of garbage is greater than 85%, then Ultrasonic sensor sends the alert signal to the Arduino Uno. Arduino sends the alert message to computer. Until garbage is emptied, process terminates. An ultrasonic sensor is attached to the front side of the garbage bin. IR sensor detects the object when placed on the plank. Based on the moisture content present in the object, moisture sensorwill detect the type of waste. The waste is segregated accordingly in to the bins. Servo motor helps in the process of placing the waste in respective bins by rotating the plank.

Most of the times, the garbage bins are overflowing with excess waste and are scattered out in the street. Thesescattered wastes get either decayed or burnt in that place or overflows all over which leads to serious health issues to humans. The wastes which are dumped are segregated by Humans which leads to health problems to them.

To overcome this problem a well organised waste segregation and monitoring system has been designed. It is an IoT based Waste Segregation and Monitoring system which is an innovative way to keep the cities clean and healthy. Since the population of our world is increasing rapidly, the environment should be clean and hygienic in order to lead a better life. This is a model for Waste Segregation for Smart cities.

The foremost goal of this project is to automatically segregate the wastes and to perceive the level of the dustbinswhich is delivered through wireless mesh network. With such information, litter bin providers and cleaning contractors are able to make better decision for the efficient disposal . IR sensor identifies the objects, Moisture and metal sensors detects the wet and metal waste.

Ultrasonic sensor observes the levels of bin. The waste is dropped inside the bin where the sensor identifies thetype of the waste. The Bin consists of three partitions inside were each bin collects each waste respectively.

When the object is placed on the plank one by one, servo motor will turn on and IR sensor detects the object. Depending upon the type of object placed on the plank, moisture sensor detects whether the object is wet or dry. Depending upon this result, servo motor sends the waste into corresponding bins. Later ultrasonic sensor measures the distance from the surface of the bin to garbage. When the bin is full, sensor sends a message to Arduino Uno and this signal is passed to user. The process terminates here until bin is empty.

The motor then rotates and respective partitions gets opened and respective wastes are collected. The status of the bin is displayed in Thing speak server.

The Block diagram below gives an overview of how the Waste is segregated. Various boxes in Block diagram are explained below. Block diagram is as shown in below Fig.1.1.

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 12 Issue IV Apr 2024- Available at www.ijraset.com

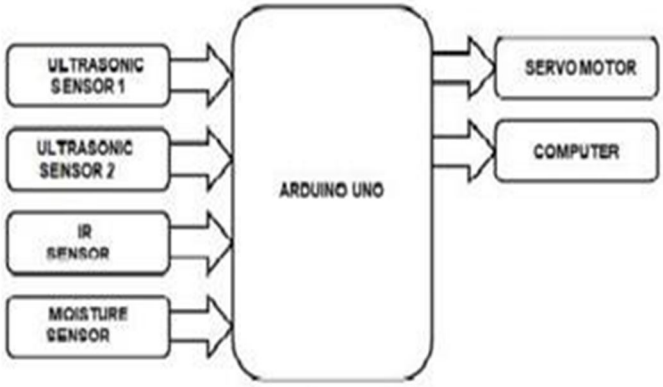


Fig. 1.1 Block Diagram of dustbin which segregate waste based on its type

Working

1) *Sensors for Waste Segregation:* The system is equipped with sensors capable of distinguishing between dry and wet waste. These sensors could be based on various technologies like infrared, ultrasonic, or weight sensors. When waste is disposed of into the system, these sensors detect the type of waste it is (dry or wet).
2) *Arduino Microcontroller:* The Arduino microcontroller acts as the brain of the system. It receives inputs from the sensors regarding the type and quantity of waste being deposited. Based on this input, it processes the data and triggersappropriate actions.
3) *IoT Connectivity:* The Arduino is connected to the internet via IoT technologies such as Wi-Fi, GSM, or Bluetooth. This enables the system to transmit data to a central server or cloud platform for further analysis and management.
4) *Data Analytics:* The collected data is analyzed using data analytics techniques to derive insights and optimize waste management strategies. This analysis can include identifying patterns in waste generation, predicting future waste generation trends, optimizing collection routes, and identifying opportunities for recycling and waste reduction.
5) *Automation and Optimization:* One of the key objectives of the system is to automate waste segregation and management processes, reducing the need for human intervention. By continuously monitoring waste levels, the system can optimize collection schedules, prevent overflows, and minimize unnecessary collection trips, thereby reducing operational costs and environmental impact.
6) *Feedback Loop:* The system operates in a feedback loop where data analysis results are used to improve system performance continuously. For example, if certain bins consistently overflow at specific times, adjustments can be made to collection schedules or bin capacities to address the issue.

IV. HARDWARE

1) *Arduino Uno Microcontroller:* A simple Arduino Uno microcontroller forms the heart of the system . The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet) . It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, anICSP header, and a reset button.
2) *IR Sensor:* This is used to detect whether there is any kind of waste present in the dustbin. IR Sensor works using a particular light sensor to detect a single light wavelength in the InfraRed (IR) spectrum. By using an LED whichproduces light at the same wavelength as what the sensor is expects, the intensity of the received light is recorded. When waste is put near the IR sensor, it means waste is present and it is ready for segregation. The light from the LED reflectsfrom the object and into the light sensor. A huge change in the intensity is created, which denotes that an object is present.This sensor gives a logical 1 output which denotes that there is a presence of an object and logical 0 output in the absenceof the object. This is fed as input to the microcontroller.
3) *Moisture Sensor:* The Moisture Sensor uses capacitance to measure dielectric permittivity of the surrounding medium. In wet waste, dielectric permittivity is a function of the water content. The sensor creates a voltage corresponding to the dielectric permittivity, and hence the water content of the waste . Thus it helps to differentiate between wet waste and dry waste. IR sensor for level detection- An IR sensor will detect the presence of waste and detects the level of waste. This detects the level and communicates to the microcontroller if the level crosses a particular threshold.

©IJRASET: All Rights are Reserved | SJ Impact Factor 7.538 | ISRA Journal Impact Factor 7.894 |

4) *Dc Motor:* An electric motor is an electrical machine that converts electrical energy into mechanical energy. Most electric motors operate through the interaction between the motor's magnetic field and winding currents to generate force in the form of rotation. Electric motors can be powered by direct current (DC) sources, such as from batteries, motorvehicles or rectifiers, or by alternating current (AC) sources, such as a power grid, inverters or electrical generators. An electric generator is mechanically identical to an electric motor, but operates in the reverse direction, accepting mechanical energy (such as from flowing water) and converting this mechanical energy into electrical energy. DC motors are renowned for their versatility, adaptability, and controllability, finding applications across various industries. Their simplicity allows for easy speed and direction control, making them suitable for a wide array of devices and systems. Brushed DC motors, with brushes and a commutator, offer straightforward construction and are commonly found in appliances, toys, and automotive applications. Meanwhile, brushless DC motors, relying on electronic commutation for more efficient and maintenance-free 6 operation, are prevalent in industries requiring higher precision and reliability, such as robotics, industrial automation, and aerospace. These motors play a pivotal role in countless electromechanical systems, underpinning the functionality of devices ranging from household appliances to advanced machinery, showcasing their indispensability in modern technology.

5) *Ultrasonic Sensor:* The Ultrasonic sensor used in the prototype. This HC-SR04 sensor is used for measuring distance. It uses sound waves to calculate the same. There are 4 pins – Echo, Ground, Trigger and VCC. External controller is triggered by Trigger pin that sends ultrasonic waves whereas echo pin sends ultrasonic waves and duration it takes to travel decides the distance available in the bin. VCC will take up to 5V and gives the voltage so that the sensorcan run.

6) *GSM:* GSM stands for Global System for Mobile Communications. A GSM Modem is a device that modulatesand demodulates the GSM signals. The modem used is SIMCOM 7 SIM300.As soon as the IR sensor for level detects that the dust bin is full, it sends a message to the local waste management department or municipality indicating that thebin is full and the garbage needs to be collected. As we have explained earlier, the proposed system is divided into two categories. The figure 2 as shown below represents the flowchart of waste management process. We have declared a variable ir which represents IR sensor output. If ir variable is found to be high, it indicates that the dustbin is full and initiates the GSM to send a message to the municipal groups. If it is low, then no action is taken.

V. CONCLUSION

Automated Waste Segregator has been successfully implemented for the segregation of waste into metallic, dry and wet waste at a domestic level. However, it cannot segregate ceramic into dry waste because of its higher relative dielectric constant as compared to other dry wastes. Noise can be eliminated in the sensing module to increase accuracy and overall efficiency. This system has its own limitations. It can segregate only one type of waste at a time with an assigned priority for metal, wet and dry waste. Thus, improvements can be made to segregate mixed type of waste by the use of buffer spaces. Since, the time for sensing metal objects is low the entire sensing module can be placed along a single platform where the object is stable to ensure better results.

VI. FUTURE SCOPE

The Automatic Waste Segregator has been implemented for the segregation of waste into dry, wet and metallic waste. Smart dustbin is an innovative step in the direction of bringing a change in the current garbage disposal system. Further the self-changing technology can be implemented so that the battery of the smart bin is low on power then using solar tracker the smart bin.

REFERENCES

[1] Álvaro Lozano Murciego, Gabriel Villarrubia González, lberto LópezBarriuso, Daniel Hernández de La Iglesia, Jorge Revuelta Herrero and Juan Francisco De Paz Santana, “Smart Waste Collection Platform Basedon WSN and Route Optimization “ – 2016.

[2] M.K.Pushpa , Aayushi Gupta , Shariq Mohammed Shaikh , StutiJha, Suchitra V,“Microcontroller BasedAutomatic Waste Segregator”, International Journal Of Innovative Research In Electrical, Electronics, Instrumentation And Control Engineering Vol. 3, Issue 5, May 2015

[3] Jose M. Gutierreza, Michael Jensenb, Morten Heniusa and Tahir Riazc, “Smart Waste Collection SystemBased on Location Intelligence” - 2015.

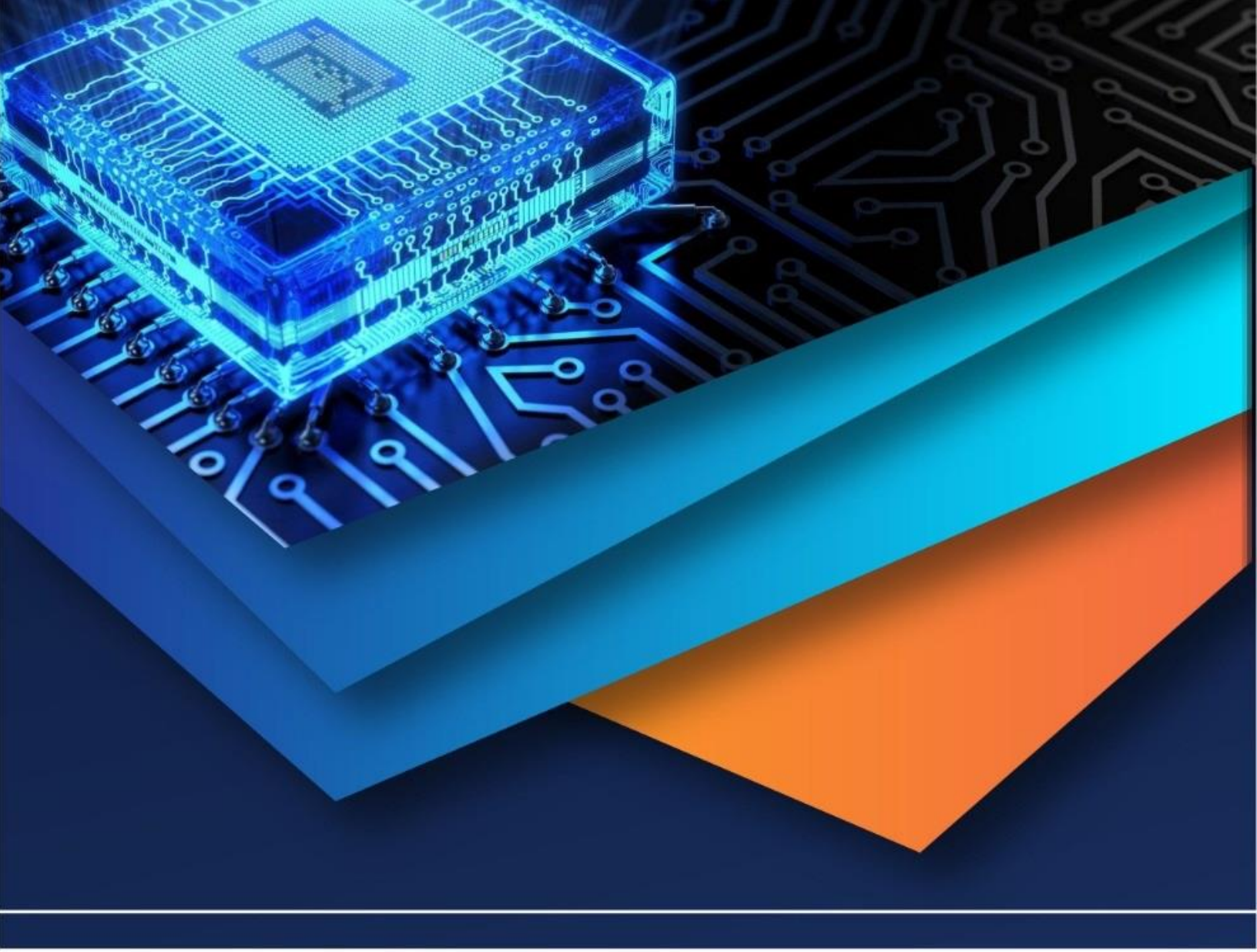
[4] WoikomReshmi, RamkumarSundaram, M Rajeev Kumar, “Sensor Unit for Waste Management: a Better Methodfor Frequent Data Updating System”, Nov 2014.

[5] InsungHong, SunghoiPark, BeomseokLee, JaekeunLee, Da ebeomJeong, and SehyunPark, “IoT-Based Smart Garbage System for Efficient Food Waste management” - Scientific World Journal-Aug 2014.

[6] Nishigandha Kothari,”Waste to Wealth”, NSWAI, New Delhi, Jul. 2013

[7] Daniel Hoornweg et al., “WHAT A WASTE A Global Review of Solid Waste Management”, Urban Development & Local Government Unit World Bank, Washington, DC, No.15, Mar. 2012.

©IJRASET: All Rights are Reserved | SJ Impact Factor 7.538 | ISRA Journal Impact Factor 7.894 |



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089 (24*7 Support on Whatsapp)