



# INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

## SOLID WASTE MANAGEMENT USING IOT

<sup>1</sup>Poornima M.Popali, <sup>2</sup>Divya D.Borase, <sup>3</sup>Saurabh P.Deore, <sup>4</sup>Harsh M.Choadhary, <sup>5</sup>Ashish Awate

<sup>1</sup>Final Year Student, <sup>2</sup>Final Year Student, <sup>3</sup>Final Year Student, <sup>4</sup>Final Year Student, <sup>5</sup>Assistant Professor Computer Engineering Department, Shri Vile Parle Kelavani Mandal's, Institute Of Technology, Dhule, India

**Abstract:** Solid waste management has been a leading concern for all the developing countries. The exponentially growing population, urbanization, and economic development have led to the rising generation of municipal solid waste. For the municipalities, especially in smart cities, this becomes a major problem in nature, and it leads to many socio-economic and environmental problems. So in this paper an alternative route can be proposed to collect waste when waste generated is below a certain threshold thus reducing the distance travelled and time taken for waste collection and a review on technologies for segregation and management of solid waste.

**Index Terms - smart dustbin, solid waste management, optimized route, IOT & ML, smart cities**

### I. INTRODUCTION

Smart waste control is a concept where we will manage masses of issues which disturbs the society in pollutants and diseases. The waste control must be achieved instantly else it ends in abnormal control so that you can have negative impact on nature. The Smart waste control is like minded specifically with idea of clever cities.

The amount of waste produced ordinary by the industries and the families is growing at an appalling rate, and the predominant cause for that is hovering use of packaged items, textiles, paper, food, plastics, metals, glass etc, thus management of this refuse becomes a crucial part in our ordinary life in maximum of the advanced nations there are many green strategies which can be used for the right management of this waste, however in a few nations especially the developing ones the careless mind-set of human beings towards preserving clean surroundings, in conjunction with this many problems such as no stringent legal guidelines for the usage of the biodegradable materials, no right environ policies, no legal guidelines for sustainable development are the seed for the deadly consequences of waste management.

Due to the growing waste, the general public containers which can be used for amassing this waste are overflowing, the locality is jumbled of trash, inflicting not handiest malodorous streets however additionally a negative effect at the health and environment. The waste series system is an essential component for the service providers.

The conventional manner of manually tracking the wastes in waste boxes is a complex and makes use of extra human attempt, time and value which isn't always well matched with the modern technologies. Irregular control of waste commonly home waste, industrial waste and environmental waste is a root motive for a few of the human issues such as pollution, sicknesses and has detrimental consequences at the hygiene of dwelling beings.

In the approach of the sensible cities mission, the target is to promote cities that offer core infrastructure and provides a decent quality of life to its citizens, a clean and property environment with the applying of sensible solutions” sensible cities don't solely mean sensible buildings and smart parking areas however “smarter waste management system” is additionally a major issue to be self-addressed in developing a wise city. The SMART WASTE MANAGEMENT SYSTEM that is proposed here in uses sensible sensors to assemble fill-level knowledge from containers associated garbage bins, and send it to an authorized variety in real time.

## II. LITERATURE SURVEY

Sr No	Title	Theme	Proposed Method	Experiment & Result
[1]	Solid Waste Management, Green Index Calculation and Route Optimization:	This paper aims to form use of a worth like green index using which one can assign scores to buildings to urge a far better idea of how well the residents are following the principles and regulations.	The propose system enforces the concept of segregation at source in peoples mind the thought is to develop a rating system (Green Index) using which a worth are often assigned to buildings which represent the reach which the buildings follow waste segregation and other waste management practices.	The proposed system considers optimal routing for solid waste collection and transport which is extremely essential for cost, distance and time reduction. For enhanced efficiency of the vehicle routing system, proposed system focuses on improving the efficiency by modifying the routes taken by trucks for waste collection and site of bins along the route.
[2]	Stock Solid Waste Collection as a Service using IOT-Solution for Smart Cities:	During this paper, an IOT based solid waste management system which enables garbage bin monitoring, dynamic scheduling and routing of garbage man trucks during a smart city.	The proposed system involves monitoring and collection of solid waste from wet and dry garbage bins placed at different places during a particular geographic area.	The author developed an application supported android platform, during which real time information about garbage bin is shown in graphical form on map garbage collector person can go on to the place where there's got to empty bin. Also, driver can have active participation in whole system.
[3]	Research on Survey on IOT Based Smart Waste Bin:	During this paper, there's a sensible waste bin to form the smart waste collection system.	A sensible bin contains a gaggle of sensor that collects all the info from Bin for real - time status of Bin	After experimenting the result was effective waste collection, reducing pollution, reducing health threats and carbon. This current waste management are often developed by using better technology and by social forecasting.

Sr No	Title	Theme	Proposed Method	Experiment & Result
[4]	Optimization of Waste Collection in Smart Cities with the use of Evolutionary Algorithms:	During this paper, with use of evolutionary algorithm, Genetic Algorithm, best path for visiting the cans are often planned during a very short time.	It contains an optimal waste collection mechanism with the utilization of some IOT devices within garbage cans which show the extent of waste in them	With the utilization of sensors, aimed to detect which cans are needed to be visited. By using this approach, effectively using the workforce/resources of the smart cities and making less holdup on the road.
[5]	Justification of the Common Information Space Components for the Solid Waste Management:	During this paper, Information about collecting, transporting, sorting, processing, dumping and consumption of municipal solid waste is typically stored at the enterprise	Distribution of solid waste by organizations, engaged in sorting, processing, dumping and consumption of the solid waste and therefore the results of solid waste processing.	The result were almost 70-80% and the person, who manages solid waste-makes a choice to enhance the activities of organizations. And also will ensure "transparency" of data on SWM.
[6]	Technologies for Segregation and Management of Solid Waste: A review	The paper mainly deals with how Geographical Information System and other technologies like RFID, GPS etc. can be used as a decision support tool for proper planning of solid waste management.	The paper mainly deals with how Geographical Information System and other technologies like RFID, GPS etc. can be used as a decision support tool for proper planning of solid waste management.	Incorporating technologies like RFIDs, GPS has provided real time tracking and monitoring of the system. Also using the web based solutions has helped the citizens to interact with the municipal authorities and also provided bi- directional communication which is very important for a good and efficient system to work.
[7]	A Review of Solid Waste Management Techniques using GIS and Other Technologies:	This paper presents a review on technologies for segregation and management of solid waste, by using GIS(Geographical Information System).	It collects the waste from the point of generation as well as with the transportation of waste, waste treatment, segregation of the waste and finally disposing of the waste .It successfully does this by GIS technology as well as with other technologies too.	By getting the results from proposed system and applying algorithms, the proper collection of waste from where it was generated, transmitted through the shortest route to the waste treatment plant. And it required minimum amount of time to avoid the effects caused by the waste.

### III. PROPOSED SYSTEM

Segregation of solid waste is one of the important building blocks in SWM system. Solid waste includes many things like metal pieces; plastics etc., many of them can be reusable and acts as input to other systems. For example, organic waste can be used to generate biogas and the residue can be used as bio fertilizers and metal pieces can be used for recycling. Plastic wastes are non-bio-degradable it cannot be simply dumped on the landfill or it cannot be dispose by incineration because during incineration plastics are decomposed into the fluorocarbon gases they affect the ozone layer. It is required to treat and segregate solid waste for proper SWM.

In IoT, based waste management system, we display the live updates of garbage bin. Each garbage bin consists of two slots, one for wet another for dry. The level of waste is measured in both slots with the help of level sensors.

Smart waste bin contains many sensor, these are collecting real time data. The cloud server stored the data and the administrator can see the data through data display which is connected from the website through internet.

- The **ultrasonic sensor** measures distance using ultrasonic waves. Its head radiates an ultrasonic wave and receives a reflected wave from a target, further it measures the time between emission and reception and calculates distance.
- An **ultrasonic sensor HC-SR04** has widest range of 2 cm – 4 m and operated on 5V.
- **NEO-6M GPS** module is used to find current location of bin in form of Longitude and Latitude through satellite. It is operated on 3.3 V
- **Arduino UNO R3** is the interface between Cloud & Sensors. Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button and turn it into an output , turning on an LED.

- All the sensors are operated on a single arduino board. It has 14 input-output pins. 2cm-4cm
- **GSM SIM 800L** is a miniature cellular module which allows for GPRS transmission, sending and receiving SMS and making and receiving voice calls.
- **GSM** sends the Short Message Service(SMS) including status whether empty or full and location of bin.It operates on 4.4V power supply.

All these sensors are usually assembled on Dustbin-each one for dry and wet. We have used wires for connecting, batteries for power supply, brackets to assemble sensors. And for coding the sensors Arduino IDE is used. After every 12 hours GSM checks the status of bin .

The proposed system uses an internet based platform for management and monitoring of waste collection

- We have developed an Android App named “Smart Bin System” The system aims at providing proper allocation and relocation of waste bins, checks for unsuitability and proximity convenience to users.
- Registration module includes Personal Details(Name , Email,Driving License etc).
- Truck Driver can see the location
- It is cost effective and also provides a real time platform for citizen and municipal authority communication to deal with grievances, feedback etc.

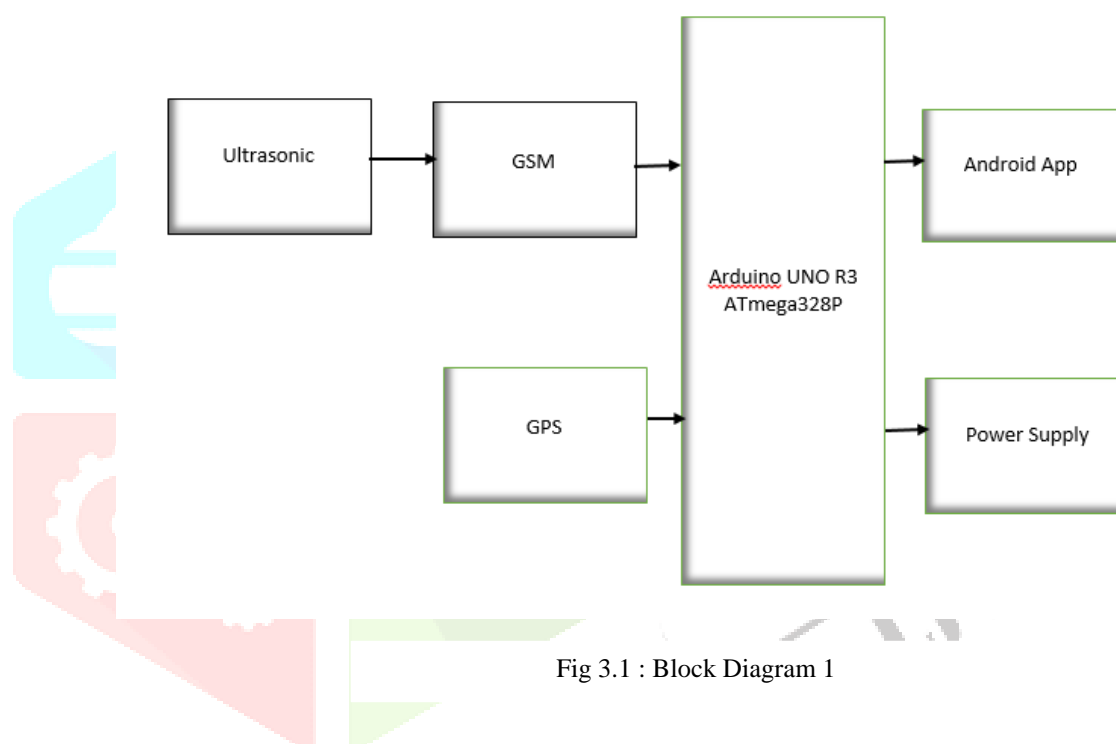


Fig 3.1 : Block Diagram 1

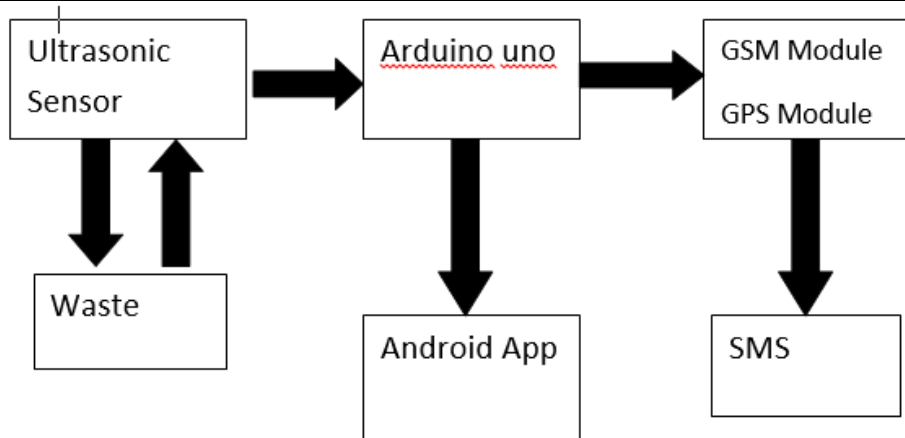


Fig 3.2 : Block Diagram 2

**IV. MAJOR CONSTRAINTS**

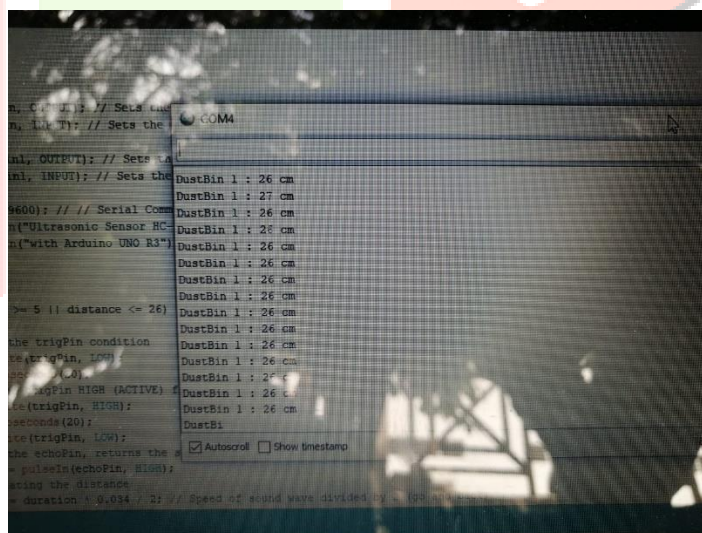
- To select the appropriate sensors for status of bins like Ultrasonic sensor, hc-sr04 , Neo-6m gps module , Sim8001 GSM module,Arduino UNO R3
- To create interface between dustbin and app.
- Exact location and exact status of dustbin.

**V. FUTURE SCOPE**

Due to less time available and pandemic situation we could create the project only for one dustbin.Later we are planning to create multiple smart dustbins so that the waste can be managed appropriately saving the time.

**VI. EXPERIMENTAL RESULTS**

Case1) When Empty 0 percent - Dustbin Empty



Case2) When Partial 40-90 percent- Dustbin Half

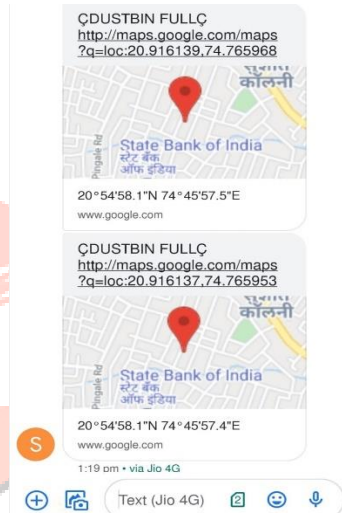
```
void setup() {
  pinMode(trigPin, OUTPUT); // Sets the trigPin as an OUTPUT
  pinMode(echoPin, INPUT); // Sets the echoPin as an INPUT
  pinMode(trigPin, OUTPUT); // Sets the trigPin as an OUTPUT
  pinMode(echoPin, INPUT); // Sets the echoPin as an INPUT
  Serial.begin(9600); // // Serial Communication
  Serial.println("Ultrasonic Sensor HC-SR04");
  Serial.println("with Arduino UNO R3");
}

void loop() {
  // Clears the trigPin condition
  digitalWrite(trigPin, LOW);
  delayMicroseconds(500);
  // Sets the trigPin HIGH (ACTIVE)
  digitalWrite(trigPin, HIGH);
  delayMicroseconds(20);
  digitalWrite(trigPin, LOW);
  // Reads the echoPin, returns the duration of the pulse
  duration = pulseIn(echoPin, HIGH);
  // Calculating the distance
  distance = duration * 0.034 / 2; // Speed of sound wave divided by 2 (go and back)
}
```

Case3) When 90 percent (threshold) - Dustbin Full

```
void setup() {
  pinMode(trigPin, OUTPUT); // Sets the trigPin as an OUTPUT
  pinMode(echoPin, INPUT); // Sets the echoPin as an INPUT
  pinMode(trigPin, OUTPUT); // Sets the trigPin as an OUTPUT
  pinMode(echoPin, INPUT); // Sets the echoPin as an INPUT
  Serial.begin(9600); // // Serial Communication
  Serial.println("Ultrasonic Sensor HC-SR04");
  Serial.println("with Arduino UNO R3");
}

void loop() {
  // Clears the trigPin condition
  digitalWrite(trigPin, LOW);
  delayMicroseconds(200);
  // Sets the trigPin HIGH (ACTIVE)
  digitalWrite(trigPin, HIGH);
  delayMicroseconds(20);
  digitalWrite(trigPin, LOW);
  // Reads the echoPin, returns the duration of the pulse
  duration = pulseIn(echoPin, HIGH);
  // Calculating the distance
  distance = duration * 0.034 / 2; // Speed of sound wave divided by 2 (go and back)
}
```



Outputs:-



Fig:6.1-Output 1



Fig:6.2-Output 2



Fig:6.3-Output 3



Fig:6.4-Output 4

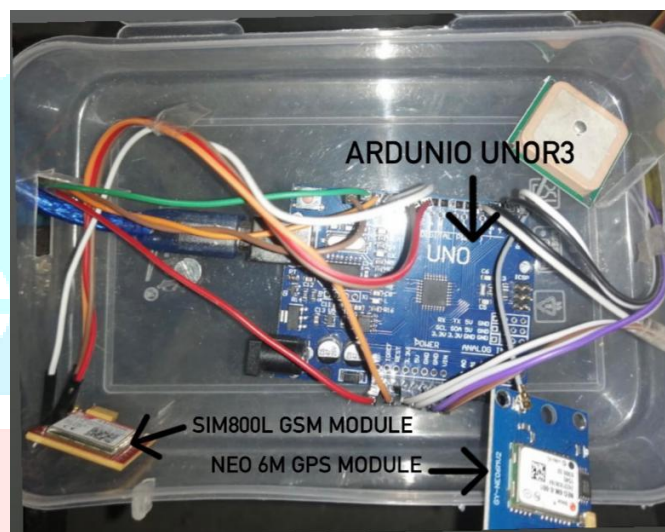


Fig:6.5-Output 5

Note that the equation is centered using a center tab stop. Be sure that the symbols in your equation have been defined before or immediately following the equation. Use "Eq.1" or "Equation1", not "(1)", especially at the beginning of a sentence: "Equation 1 is..."

## VII. CONCLUSION

The proposed concept may be applied for clever towns in which the citizens could be busy sufficient with their demanding time table and wouldn't have sufficient time for handling waste. The boxes may be applied in a metropolis if preferred in which there could be a huge bin that can have the capability to build up the waste of stable kind for a single apartment. The value could be allotted many of the citizens main to inexpensive provider provision.

We implemented a real-time waste management system by using a smart garbage can to check the level of the smart garbage can, whether the garbage cans are full or not. In this system, the interested person can access the information of all intelligent trash cans from anywhere and at any time and make an appropriate decision. By implementing this proposed system, cost reduction, optimization of resources and effective use of smart trash cans can be achieved.

Monitoring the fullness of dustbins through using sensors, it's far feasible to gain a extra green device than the modern existing. Our concept of "Smart waste management device", specially concentrates on Monitoring the waste management, supplying a clever era for waste device, averting human intervention, decreasing human time and effort and which ends up in healthful and waste ridden environment.

This method makes collecting waste in the city easier. It helps reduce air pollution, traffic flow, work, and time. With the right technology, we can help trucks choose the shortest route to collect garbage. This project can give cities an edge with the goal of becoming intelligent and human-friendly.

## REFERENCES

- [1] David Varghese, Priyanka Puranik, Sherin Palamattam and Sana Shaikh, "Solid Waste Management: Green Index Calculation and Route Optimization," 3rd International Conference on Communication System, Computing and IT Applications (CSCITA), April 2020
- [2] Sangita S. Chaudhari & Varsha Y. Bhole, "Solid Waste Collection Service using IoT- Solution for Smart Cities," International Conference on Smart City and Emerging Technology (ICSCET), Jan 2018
- [3] Dharmendra Kumar Tripathi, Sandeep Dubey, Sandeep Kumar Agrawal, "Survey on IOT Based Smart Waste Bin," IEEE 9th International Conference on Communication Systems and Network Technologies (CSNT), April 2020.
- [4] Ilknur Aktemur, Kubra Erensoy, Emre Kocyigit, "Optimization of Waste Collection in Smart Cities with the use of Evolutionary Algorithms," International Congress on Human-Computer Interaction, Optimization and Robotic Applications (HORA), June 2020.
- [5] A.A Popov, A.O. Kuzmina, "Justification of the Common Information Space Components for the Solid Waste Management," IEEE International Conference Management of Municipal Waste as an Important Factor of Sustainable Urban Development (WASTE), Oct 2018.
- [6] Siddappaji, Radha R C, K Sujatha, "Technologies for Segregation and Management of Solid Waste: A review," International Conference on Emerging Trends in Engineering, Technology and Science (ICETETS), Feb 2016
- [7] Priyanka Shrivastava, Shivangi Mishra, S.K Katiyar "A Review of Solid Waste Management Techniques using GIS and Other Technologies," International Conference on Computational Intelligence and Communication Networks (CICN), Dec 2015.

