

# COLLECTING WASTES FROM TRASHCAN USING LoRa

R.KHOWSHALYA<sup>#1</sup> and E.VANI<sup>\*2</sup>

<sup>#</sup> KSR COLLEGE OF ENGINEERING, TIRUCHENGODE, INDIA

<sup>\*</sup> ASSOCIATE PROFESSOR, KSR COLLEGE OF ENGINEERING, TIRUCHENGODE, INDIA

**Abstract**— Waste management is a major challenging issue in populated countries. The solutions for managing waste have emerged due to the rise of Smart Cities. They require the deployment of a low cost and low consumption sensor network which can be used by different applications. This system introduces a waste monitoring and management platform used in rural environments. A prototype of a low consumption wireless node is developed to obtain measurements of the filling volume and current location of a waste container. This monitoring allows the progressive filling data of every town container to be gathered and analyzed as well as creating alerts in case of incidence. The platform features a high end RF module called LoRa, for optimizing waste collection. This LoRa module dynamically generates message obtained through the deployed nodes to save energy, time and costs. LoRa has been used for long distance communication at very low power consumption. It also features a new feature for the collection fleet which guides every collection truck during their journey. Waste collection in towns is usually delegated to municipality groupings or is directly managed by the regional administration.

**Index Terms**—Waste, Waste management, LoRa

## I. INTRODUCTION

Irregular increase in population has ensued in generating more waste than what the earth can ingest. Waste management is a challenge that is faced by cities across the world. There are existing systems to tackle this menace but are not effective enough as these needs to be employed at large. At present waste collection is conventional in nature which requires abundance of labour and is a time devastating process.

Smart cities are in the need of labour, wherein the vision is to consolidate information technology with internet of things to employ effective management of assets. An IOT framework consists of representing things and their presence on the internet. IOT aims to integrate the real and virtual worlds by bridging devices and applications through cloud. In this IOT system the sensors like ultrasonic sensor connected to Arduino UNO, a slave processor and again connected to Raspberry Pi, a master processor to collect and transfer the data to cloud. However, there are two slave processors for each of the biodegradable and non-biodegradable cans are used. The trash can is designed in such a way that, threat perception method for threat detection like ignition or flames from scent bottles, battery discharges

and e-wastes by employing temperature sensor, smoke sensor and a metal detector. To segregate trash at the point of generation two different cans are used. Each resident is provided with a specific identity through RFID (Radio Frequency Identification). The RFID system is used to store the data of waste generated at any particular time. A load cell is used which is placed at the base of the can to determine weightage of the garbage. Though there are efficient systems and algorithms for automatic waste management, it lacks remote status can monitoring. Therefore, in this paper an application is used to monitor the cans remotely. The status of the cans is observed through an application interface.

The acquired data from the sensors is transferred to a devoted system for monitoring the status of the can. This data is subsequently used to analyze for future use. To classify the locations of the bin, to predict the status of the bin and also to optimize the route that truck can use to collect the trash. Further analysis increases the efficiency of the system by reducing fuel consumption and also helps in mitigating the future waste generated by households.

The Chennai corporation alone is with the population of about 7.9[13] million produces 4500MT [13] for which 11184[13] labour force is employed. All this trash is collected through the door to door system and transported through route schedules for each and every vehicle and for each trip with two dumping sites. This creates a lot of miscommunication as there is no coordination between the government, residents and workers for processing trash.

## II. LITERATURE SURVEY

The literature survey is done from different papers to get an idea of how this proposed system is implemented. Krishna Nirde, Prashant S. Mulay, Uttam M.Chaskar [2] paper provides us with insights into the practicality of the waste management system. The sensing of trash filling in the can is through time of flight by ultrasonic sensor. Signals are transferred over RF transmitter and received by Rf receiver connected to the arduino modem. The limitation is that there were differences in status by two sensors when trash was unloaded from waste bin.

Sauro Longhi, Davide Marzoni, Emanuele Alidor, Gianluca Di Bu`o, Mario Prist, Massimo Grisostomi and Matteo Pirro [3] proposed a garbage collector with sensors that provide status and information. The data retrieved is sent through DTN (Data Transfer Nodes). The system heterogeneous integration of multiple sensor nodes of different types. Here the data is not directly transferred to the

nodes instead transferred through nodes

C.K.M. Lee and Trevor Wu [4] have attempted to introduce a waste management system in Hongkong. They are very supportive of use of RFID in system. The use of GPRS to transfer the data to an app over cloud doesn't seem plausible as fitting GSM modules to all the dustbins of a city and guaranteeing that GPRS information is accessible to each of the containers is illogical.

Big data analytics for waste management by Parag Kedia[5] gives insights into how the large scale data generated and gathered is to be stored in cloud. Then analytics are performed on the data using different algorithms- Linear regression. KNN algorithm is used depending on the necessity to prune fuel consumption and time.

Dr.N.Sathishkumar,B.Vijayalakshmi,R.Jeniferprarth ana, A.Shankar [6] projects a system with a leaf switch that is suspended from lid on the top. This switch compresses the trash to a definite degree. The limitation here is that leaf switch needs to be placed in angle so that trash doesn't damage or chunk leaf functionality even in exceptional conditions.

After the thorough exploration of all these works, we are proposing an "SMART RECYCLE TRASH IN AN IOT MANAGEMENT SYSTEMS FOR SMART CITY" with an architectural exposition giving a comprehensive outline of block- level architecture, which can be administered and scaled on a large level without much complication.

### III. PROPOSED SYSTEM

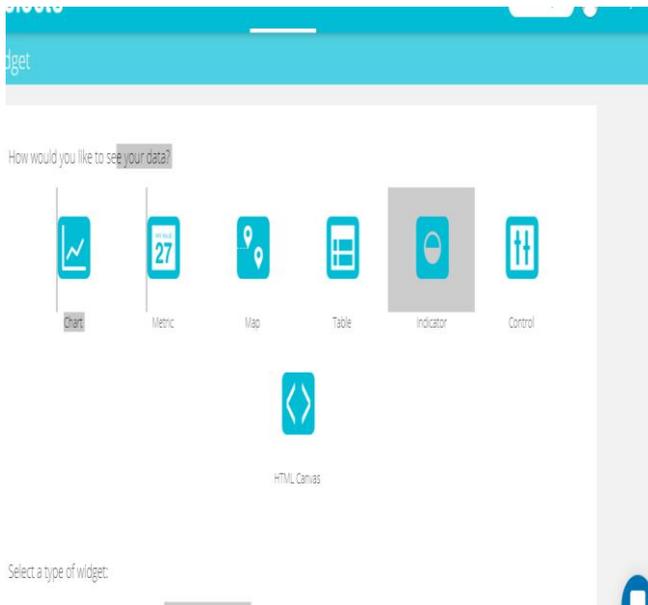
The routes currently performed in the large majority of the regions are static so that the collection trucks cover predefined routes whether the containers are filled or not. Efficiently managing routes and trucks required for collecting all waste in a region allows savings in fuel, workforce and maintenance of the vehicle fleet. Journeys from one collection unit in a region to another may sometimes be several kilometers long and skipping some waste collection unit may mean important savings on fuel and time. This system presents an intelligent platform to manage waste. It consists of a network of low-cost, low energy consumption and wireless intelligent sensors, a platform with a fleet management system and a system to optimize collection routes. The Trashcan units consist of sensors and a GPS device support for location identification . If the trashcan fills, it automatically generates a message to the municipal unit using LoRa module and a LoRa module in Municipal unit receive the message and the information is transferred to the specified waste collection truck of that area to collect the waste from the filled trashcan.

Our proposed work is made to detect the status of waste in the trash can. In common the waste generated is collected, transported to a designated dumping site and then processed for recyclable materials. Here are we are trying to separate distinct waste at the point of generation. RFID system is introduced to track the trash generated by each individual. The Radio Frequency Identifier utilizes radio waves to discover and recognize an object. A radio tag with encoded serial no in a chip is brought near to RFID reader, radio

waves what are considered to be electromagnetic waves are translated into digital codes to be read by reader which then specifies the code to the object.

An ultrasonic sensor is placed in the head of the can. It is fixed onto one part of the lid. We placed this sensor at 90% height from bottom. By fixing at that height we can notify the status level at earliest before the can overflows. At the base of the can is placed load cell. Through this load cell is to determine the mass of the trash in can. The dual sensors are fixed in both the bins. In biodegradable is equipped with smoke sensor and in non-biodegradable with temperature sensor. This is the part of the threat perception method to warn about any fire, harmful gases due to decomposition of waste or due to leakage of any acid from bottles or through cells. So that nobody uses that bin till problem is looked after. Metal Detector helps in identifying any metal pieces that may get mixed up with decomposable waste. When smoke sensor identifies a harmful gas a bulb on the exterior of the can is placed that glows up to indicate the can is a threat. Likewise the metal detector beeps sounding a beep blare to wary the user that he is putting the trash in wrong can. All the sensors are carefully picked after their usability is studied. Before putting the waste in the bin the resident user needs to scan their id by placing on the RFID reader. Every resident or user is provided with a RFID tag that contains the details regarding their identity and location. The trash produced by that user is stored against his details.

Arduino Uno is coded with embedded C. When users put the trash in sensors read the data in analog and sent to slave processor. The slave processor after receiving analog signals improves their readability by converting them into digital signals. So this can simply be called ADC(Analog to Digital converter) .In the same the controller in the other bin also functions in same way by receiving signals at origin in analog and sending these signal to sub controller to transfer them to main controller. In the process these signal are converted into digital for enhancing their readability for further processing. Power supply to these controllers can be supplied either directly from live connection by connecting with a power plug or through a USB cable connected to laptop or even through battery. It requires 5v power supply. The controller has I/O pins out of which 6 are input and 6 are pulse with modulation outputs. The sensors assembled with male to male jumper wires and rooted onto bread board. On the bread board one side is chosen as positive and the other is ground. All the connections are made depending on the analysis of the requirements.



#### IV. CONCLUSION

This paper exhibits how trash can is managed by incorporating internet of things with information technology. Here, we discussed about using hazard detection methods to identify and avert any accident. The organization responsible for recycling waste can segregate non-biodegradable trash easily, which on selling can directly fund setting up more of these systems and also biodegradable waste can be composted and sold to farmers which helps environment. Proper utilization of huge data collected through this smart trash cans will eventually bring down trash produced per each individual. This smart trash can system in IOT can be a best suit for smart city as well as Swach Bharath mission. There can be future enhancements can be made for any project.

#### REFERENCES

- [1] Theodoras Anagnostopoulos, Member, IEEE, Arkay Zaslavsky, Senior Member, IEEE, Kostas Kolomvatsos, Alexey Medvedev, Pouria Amirian, Jeremy Morley, and Stathes Hadjiefthymiades "Challenges and Opportunities of Waste Management in IOT-Enabled Smart Cities: A Survey", Vol 2, No 3, July-September 2017.h
- [2] IoT based solid waste management system for smart city ,Krishna Nirde , Prashant S. Mulay , Uttam M.Chaskar ;International Conference on Intelligent Computing and Control Systems ICICCS 2017.
- [3] Solid Waste Management Architecture using Wireless Sensor Network technology Sauro Longhi, Davide Marzioni† , Emanuele Alidori† , Gianluca Di Buo`, Mario Prist , Massimo Grisostomi and Matteo Pirro, Universita Politecnica delle Marche, Dipartimento di Ingegneria dell'Informazione ` Via Breccie Bianche. snc, 60131 Ancona, Italy
- [4] C. K. M. Lee and T. Wu, "Design and development waste management system in Hong Kong," 2014 IEEE International Conference on Industrial Engineering and Engineering Management, Bandar Sunway, 2014, pp. 798-802. doi: 10.1109/IEEM.2014.7058748
- [5] Big Data Analytics For Efficient Waste Management Parag Kedia; IJRET: International Journal of Research in Engineering and Technology, Volume: 05 Issue: 10 | Oct-2016
- [6] IOT Based Smart Garbage alert system using Arduino UNO ;Dr.N.sathish kumar, B.vijayalakshmi, R.jeniferprarthana, A.shankar 2016 IEEE Region 10 Conference (TENCON) — Proceedings of the International Conference
- [7] Smart Bin- An "Internet of Things" Approach to Clean and safe Public Space by Neetha, Sanjana Sharma, Vaishnavi V,Vandana Bedhi,; Department of Information Science and Engineering ;International conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud) (I-SMAC 2017)

- [8] Gaikwad Prajakta, JadhavKalyani, MachaleSnehal, "SMART GARBAGE COLLECTION SYSTEM IN RESIDENTIAL AREA" International Journal of Research in Engineering and Technology March-2015
- [9] "WIRELESS DUST BIN MONITORING AND ALERT SYSTEM USING ARDUINO" P.Siva Nagendra Reddy , A.Amareshwar Kumar, R.Naresh Naik,S.Nanda Kishor S.Nanda Kishor :2017IEEE
- [10] Andrea Zanella, Nicola But, Angelo Castellani, Lorenzo Vangelista, Michele Zorzi, "Internet of Things for Smart Cities", IEEE Internet of Things Journal ( Volume: 1, Issue: 1, Feb. 2014 )