Automation of smart waste management using IoT

Prof. S.I. Shirke[1], Shubhangi Ithape[2], Sandhya Lungase[3], Madhuri Mohare[4]

[1,2,3,4]*Electronics & Telecommunication Engineering, Pimpri Chinchwad College* of *Engineering, Pune*

Abstract - *"Swachh Bharat Abhiyaan" is a national campaign by the Government of India, covering 4,041 statutory cities and towns, to clean the streets, roads and infrastructure of the country. The aim of the mission is to cover all the rural and urban areas of the country to present this country as an ideal country before the world with the proliferation of Internet of Things (IoT) devices such as Smartphone & sensors. One of the main concerns with our environment has been solid waste management which in addition to disturbing the balance of the environment also has adverse effects on the health of the society. The detection, monitoring and management of waste is one of the primary problems of the present era. The process of making the things automatic is being exploited in almost all the major fields of life. Solid waste which is one of the sources and causes of environmental pollution has been defined under Resource Conservation and Recovery Act as any solid, semi-solid liquid or contained gaseous materials discarded from industrial, commercial, mining or agricultural operations and from community activities.*

Many times, in our city we see that the garbage bins or dustbins placed at public places are overloaded It creates unhygienic conditions for people as well as ugliness to that place leaving bad smell. To avoid all such situations we are going to implement a project called IoT Based Smart Garbage and Waste Collection bins.

These dustbins are interfaced with microcontroller based system having ultrasonic sensor systems along with central system showing current status of garbage, on mobile web browser with html page by Wi-Fi. Hence the status will be updated on to the html page. Major part of our project depends upon the working of the Wi-Fi module; essential for its implementation. The main aim of this project is to reduce human resources and efforts along with the enhancement of a smart city vision.

Key Words: detection, monitoring and management, **WiFi**

1. INTRODUCTION

The rising popula□on of India poses serious threats with regard to the availability of living space, u□lization of natural resources and raw materials, education and employment. But another serious peril that follows is the escalating amount of waste generated each minute by an individual. Every city is grappling with the menace of ever increasing waste. An astounding 0.1 Million tons of waste is generated each day in our country. Sadly, only 5% of this colossal amount of waste is recycled. In India, the collection, transportation and disposal of MSW are unscientific and chaotic. Uncontrolled dumping of waste on outskirts of towns and cities has created overflowing landfills which are not only impossible to reclaim because of the haphazard manner of dumping but also has serious environmental implications. When viewed on a larger scale, the poor recovery rate has impeded the growth of the country as well as the economy of the nation. One possible solution for this problem could be segregating the waste at the disposal level itself. We have thus come up with an Automatic waste segregator that categorizes the waste as wet, dry.

This project IOT Garbage Monitoring system is a very innovative system which will help to keep the cities clean. This system monitors the garbage bins and informs about the level of garbage collected in the garbage bins via android app. Admin should monitor the dustbin. There should be send message to worker when garbage is reached to certain threshold. In existing garbage monitoring system, local governments manage garbage by deploying garbage bins and employing multiple pickup businesses for garbage collection. However, the existing garbage monitoring method is based on a flat rate, that is, a price structure that charges a single fixed fee, which causes environmental problems and increases waste discharge because there are no restrictions on heavy producers of food waste and no incentives for lighter producers. To deal with these problems in existing garbage monitoring, IOT based garbage monitoring system has been introduced. The Internet of Things (IoT) is a concept in which surrounding objects are connected through wired and wireless networks without user intervention.

1.1 Motivation

Swatchh Bharat Abhiyan is a national campaign by the Government of India, covering cities and towns, to clean the streets, roads and infrastructure of the country. The aim of choosing this topic is to contribute to this mission by our engineering knowledge for the benefits of our society.

A trend of significant increase in municipal solid waste generation has been recorded worldwide. This has been found due

to over population growth rate, industrialization, urbanization and economic growth which have ultimately resulted in increased solid waste generation. Final destination of solid waste in India is disposal. Most urban solid waste in Indian cities and towns is landfilled and dumped.

Our Project deals with the most blistering topic i.e. waste segregation. An efficacious management needs to be materialized for better planet to live in. Hence, with our cost effective project proposal, we try to bring in the change. It deals with the minimization of blue- collar method utilization for exclusion of waste into an automated panache. An automation of this style not only saves the manual segregators of the numerous health issues, but also proves to be economical to the nation. Besides, this system utilizes low cost components for the successful segregation of most types of waste. When installed in apartments or small colonies, it proves to be beneficial in sorting the waste at the site of disposal itself. This is the objective of our project. Owing to the characteristics and merits of IoT services, waste management has also become a significant issue in academia, industry, and government as major IoT application fields.

1.2 Literature Survey

"Smart garbage collection system in residential area"- In this project mainly Solid waste management is a big challenge in urban areas for most of the countries throughout the world. An efficient waste management is a pre requisition for maintain a safe and green environment as there are increasing all kinds of waste disposal. The main concept is that a Camera will be placed at every garbage collection point along with load cell sensor at bottom of the garbage can. The camera will take continuous snapshots of the garbage can. A threshold level is set which compares the output of camera and load sensor.

There are many technologies are used for waste collection as well as for well managed recycling. The Information gathering is big and cumbersome. The concurrent effects of a fast national growth rate, of a large and dense residential area and a pressing demand for urban environmental protection create a challenging framework for waste management. The complexity of context and procedures is indeed a primary concern of local municipal authorities due to problems related to the collection, transportation and processing of residential solid waste today the garbage collection is manual which takes a lot of efforts and is time consuming. In this project humans and vehicles were used to do that work and here we are using automatic technique to detect garbage level in Garbage.

"Intelligent Waste Separator"-This paper proposes a prototype of the Intelligent Waste Separator (IWS) that consists of a common trash can, with more containers inside it, using multimedia technology. People can throw their waste, no matter what kind, into the system. The latter is able to decide what kind of waste it belongs to and to deposit it in the correct container. Garbage is a global problem that affects all living beings. A study from Grow NYC shows that 80% of the world's solid waste is produced in the United States of America. Also, 70% of its trash is used once and 45% is buried or burnt, such waste is paper, plastic, etc.

A lot of places like universities, downtowns, subways, and malls have different containers for specific kinds of waste. Unfortunately, there are people who do not place waste in the correct containers. For this reason, it is more difficult to recycle waste which has to go through a separation process of a high economic cost. Most of garbage is buried or burnt or even kept in places to which it does not belong. Big volumes of garbage thrown away and the methods used to store it cause air, water, and soil pollution.

"Waste segregation using smart dustbin"-Thus, aim

of our project is to make a municipal waste management system useful at domestic level. Dry, wet, metallic are the categories in which waste is compartmentalized. Continuous increase in populace is increasing waste generation. Waste generated in India is in the range of 200-870 grams per day and its rate is rising by about 1.3% per capita per year in India. In addition to this, some portion of waste is burnt openly on dumpsites or streets. As the production and consumption is proliferating, extensive amount of solid materials are generated as well as rejected by people on regular basis. Garbage Mountains are a commonly seen today. The waste dumped is ubiquity in the form of rotting mound that dot our terrains and make our rivers, wells, lakes abhorrent. 68.8 million tons municipal solid waste is generated per year in India. Unsorted waste, when collected, is dumped openly that leads to generation of leachate and gaseous emissions contaminating the nearby environment. As this system is aimed deliver results at household level, municipal solid waste (msw) is its target. The waste is sorted out in three categories dry, wet and metallic. Wet waste at household level may be vegetable peel, garden leaves, weeds, dried fruits etc.

2. PROPOSED SYSTEM 2.1 Methodology

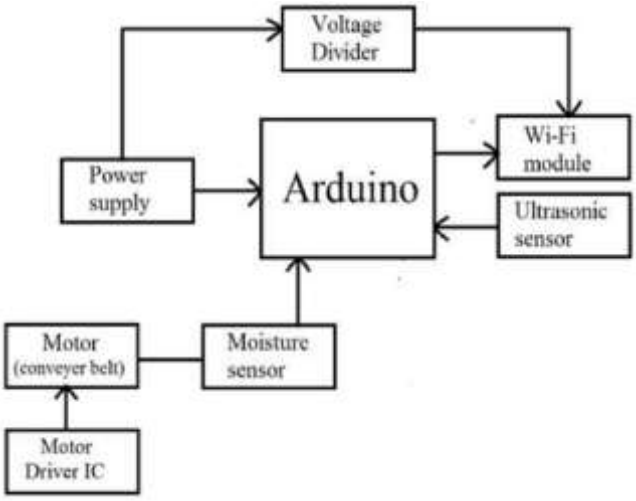

Fig.1 Block diagram

- ESP8266 Wi-Fi module is used to update status of dustbins on the mobile app.

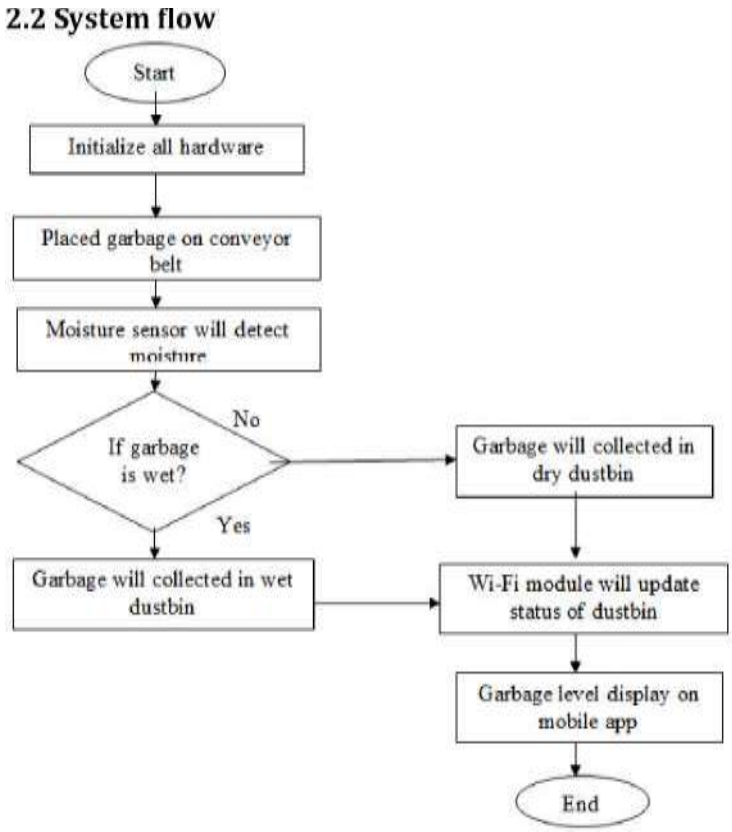

Fig.2 flow diagram

- Block diagram consist of components are Arduino Uno, Moisture sensor fC-28, Ultrasonic sensor HC- SR04, DC motor, relay and ESP8266 Wi-Fi module etc.
- Moisture sensor is used to detect garbage is either dry or wet.

- Two DC motors are used; one is for moving conveyor belt and second is for rotating dustbin position to collect garbage in separate dustbin.
- Relays are used for driving DC motors.
- Ultrasonic sensors are used to detect garbage level in dustbins, to determine the dustbin is full or empty. One is used to detect garbage level of dry dustbin and second is to detect garbage level of wet dustbin.
- First power supply to Arduino is given through USB from laptop & external 12V power supply is given to both DC motors.
- In our project first garbage is placed on conveyor belt, then conveyor belt will move through DC motor then moisture sensor will detect garbage is dry or wet, if garbage is dry then it is collected in dry side of dustbin and if garbage is wet then dustbin will move 180 degree & collect garbage in wet side of dustbin.
- After this ultrasonic sensor will detect level of garbage in dustbins and send information to Arduino, then Arduino send this information to wifi module & wifi module update this information on mobile app.
- In the circuit diagram A0 pin of moisture sensor is connected to port C A0 pin of the Arduino. VCC & GND pins of moisture sensor are connected to 5v & GND of the Arduino.
- Trigger & echo pins of ultrasonic sensor 1 are connected to port D pin 4 & pin 5 of the Arduino respectively. Similarly trigger & echo pins of Ultrasonic sensor 2 are connected to port D pin 6& pin 7 of the Arduino respectively.
- Then VCC & GND of both ultrasonic sensors are connected to 5v & GND of the Arduino.
- DC motor 1 & DC motor 2 are connected to port B pin 0 & port B pin 1of the Arduino through Relay. Then VCC & GND of both relays are connected to VCC & GND of the Arduino.
- One end of the voltage divider network is connected to 5v & other end connected to port B pin 4 of the Arduino.
- VCC pin of ESP Wi-Fi module is connected to voltage divider network & GND is connected to GND of the Arduino. Reset pin of Wi-Fi module connected to the reset pin of Arduino.

3. Result

- Here we are using a one variable voltage source & we set -250V as a threshold value. By varying voltage below threshold value we got output on virtual terminal that is dustbin is not full.
- In proteus we connect this variable voltage source to the analog pin of ultrasonic sensor, connect trigger & echo to Arduino and potentiometer is using as moisture sensor and connecting to A0 pin of Arduino.

• Now upload the Arduino hex file ,after uploading the hex file, hit RUN button .then virtual terminal will display distance measurement i.e. dustbin is either full or empty.

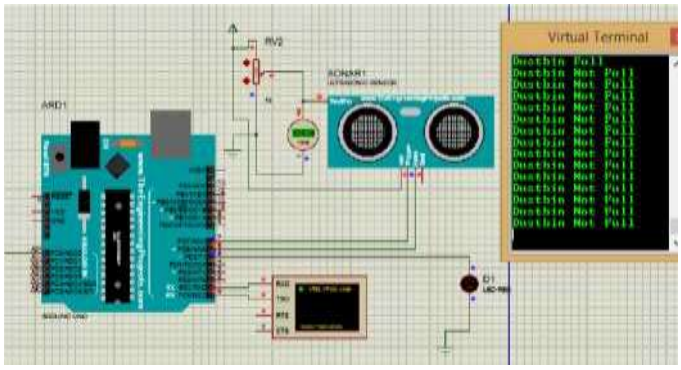

Fig.3 Simulation when dustbin is not full

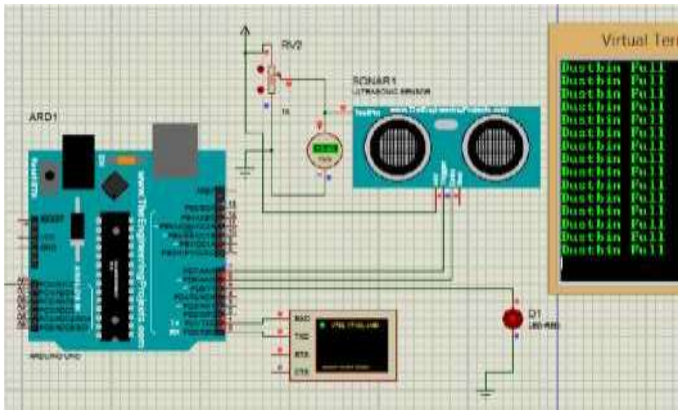

Fig 4 Simulation when dustbin is full

Following pictures show the mobile app status and real time dustbin for 50% full dry & 100% full wet dustbin as well as database also.

Fig 5 Mobile Application status

Fig 6 Dustbin Status

REFERENCES

1. Tarandeep Singh , Rita Mahajan , Deepak Bagai, "Smart Waste Management using Wireless Sensor Network", in IJRCCE Volume 4 , Issue 6 , June 2016.

2. Collection Bin" ، IJARECE) Volume 5, Issue 5, May 2016.

3. Prakash, Prabu," IoT Based Waste Management for Smart City", published in IJRCCE Volume 4, Issue 2, February 2016.

4. Narayan Sharma, "Smart Bin Implemented for Smart City",I nternational Journal of Scientific & Engineering Research, Volume 6, Issue 9, September-2015

5. KanchanMahajan, "Waste Bin Monitoring System UsingIntegrated T echnologies", International Journal of Innovative Research in Science, Engineering and Technology, Issue 3, Issue 7, July 2014.

6. Issac, R;Akshai,M. "An effective solid waste management system for Thiruvalla Municipality in Android OS" IEEE Conference Publications , 2013.

7. M. Al-Maaded, N. K. Madi, RamazanKahraman, A. Hodzic, N. G. Ozerkan , An Overview of Solid Waste Management and PlasticRecycling in Qatar, Springer Journal of Polymers and the Environment, March 2012, Volume 20, Issue 1, pp 186-194.

8. Islam, M.S. Arebey, M. ;Hannan, M.A. ; Basri, H,"Overview for solid waste bin monitoring and collection system" Innovation Management and Technology Research (ICIMTR), 2012 International Conference , Malacca, 258 - 262

9. Longhi,S ; Marzioni,D ; Alidori, E ; Di Buo,G.; Pris,M. ; Grisostomi, M. ; Pirro,M. "Solid Waste Management Architecture Using Wireless Sensor Network Technology", New Technology, Mobility and Security (NTMS), 2012 5th International Conference.

10. Raghumani Singh, C. Dey, M. Solid waste management of Thoubal Municipality, Manipur- a case study Green Technology and Environmental Conservation (GTEC 2011), 2011 International Conference Chennai 21 - 24

11. S.Navghane, M.S.Killedar, Dr.V.M.Rohokale, "IoT Based Smart Garbage and Waste