Smart Trash Management using ARDUINO UNO

P. Kusuma Vani [1], S. Chandra sai [2], D. Venkatesh [3], N. Hephzibah [4], K. Raja Bhushan [5]
Department of Electronics and Communication Engineering[1, 2,3,4,5]
Raghu Institute of Technology, Visakhapatnam, India.

Abstract— The main idea of this project is the fact that dustbins require frequent cleaning to maintain hygienic conditions for the people and to create good surroundings. Garbage in the garage bins are not collected at proper time. Due to this people are affected with many diseases like dengue, malaria and many. So, to avoid all such situations we develop a project to control the over filling of the waste in dustbin. In this project we use ultrasonic sensor to detect the level of waste. Whenever the garbage is full it sends a message to the approved person by informing that the garbage bin is full [6]. It is done with the help of Arduino Uno and GSM/GPS module. An acknowledgment is sent through message which contains the location of the bin so it will be helpful for the municipal office to find the location of the garbage bin. An LCD display is also attached to the device to show the status of the bin.

Keywords— *Arduino Uno, Ultrasonic sensor, GSM/GPS module*

I.   INTRODUCTION

India is heading towards the development of smart cities. Our project intends to improve the management of waste in a smarter way. The main challenge is the clearance of trash in Metropolitan cities. Along with this health is an important issue which is affected due to improper garbage collection. Air pollution is the main outcome due to overflow of garbage which causes various respiratory diseases and other adverse health issues. To overcome this and to develop a healthy environment proper garbage management is required. The collection of waste is conventional and requires a lot of labour and is immense process. Our focus is to reduce the overflow of trash in dustbins and to reduce the effort and time taken to collect the garbage every day. It is done with the help of Arduino Uno and global positioning system and global system for mobile communication.

II.   LITERATURE SURVEY

The literature survey was done on some different papers to get idea about our project in different views. The first literature survey has been done is Sagnik Kanta, Srinjoy Jash and Himadri Nath Saha, Department of Computer Science and Engineering [3]. This project uses camera to monitor the level of the garbage with the help of the camera it captures images continuously and these are sent to the work station with the help of RFID, GPS and GIS. The limitation in this project is that they are using complex components and cost is very high.
The next literature survey is "IoT based Waste Collection System using Infrared Sensors" Abhimanyu Singh, Pankhuri

Agarwal and Rahul Arora Student, Computer Science and Engineering, Electronics and Communication Engineering [1]. The infrared sensors are placed at the top of the garbage bin. This system consists of IR sensor, GSM module; Python based web framework and Raspberry pi. With the help of the framework it collects all the data from bins and marks the location on a map. The limitation of this project is that they have used many components which will in turn Increase the cost of the device.

III.   MOTIVATION

One of the challenges we are facing today is waste management. This is controlled by the municipal corporation but sadly it is not given enough importance and attention resulting in several problems. There are no enough resources to control waste management. As we all know that technology is all about making work smarter and easier. Keeping it in mind we have developed a new device in which we use less components when compared to other similar technologies. This helps in reduction of cost and work can be done more efficient than other systems. Nearly one lakh tones of municipal solid waste are generated in India per day and most of the developed cities like Mumbai generate waste in which 83% is collected and 30% is treated.

IV.   EXISTING SOLUTIONS

A.   Garbage management using only GPS

This system is adopted by foreign countries like US to provide shortest paths to collect garbage.

B.   GIS based garbage management

Geographic information system-based waste management is another way of reducing waste collection. The placement of bin is planned on a geographical map of the city.

C.   RFID based waste management

This is a new concept where the waste item is having RFID tags and bins are provided with RFID readers [3]. With the help of this reader the location of the bin is notified and helps in segregation of the waste at final level.
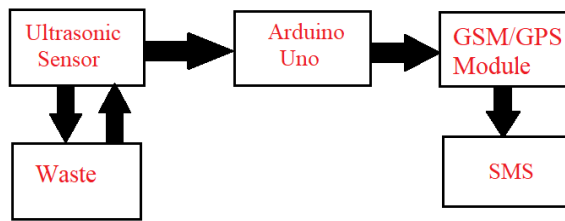
V.　　PROPOSED METHODOLOGY

Fig.1 Block Diagram

This system features an optimized garbage collection using sensors and GPS and GSM module with an Arduino interface as shown in *Fig.1*. Here an ultrasonic sensor is placed at the top of the garbage bin [4] which is used to get the garbage level of the bin. Initially, the GSM and GPS are initialized, and mobile number should be registered (which is written in the code) to whom the message will be sent. After mobile number is stored the ultrasonic sensor will measure the time interval and thus distance is calculated. According to the distance values (full/empty) code is written and when the requirement is matched (whenever it is filled or collected) then the Arduino will interface with the SIM 808 to send the message indicating trash is Full/Empty along with that Location of the bin is also sent with latitude and longitude [2] This sensor is programmed with ATmega microcontroller (Arduino Uno R3) which is further interfaced with sim808 GSM and GPS module. We have used sim808 instead of different GSM and GPS modules to reduce the cost and to make the system to work more effectively.

VI.　　HARDWARE DESCRIPTION

A.　Arduino Uno

In 2003 David Cuartielles and Massimo Banz started Arduino project to provide a cheap and flexible way to people for controlling devices. Arduino Uno is mostly used board in Arduino family. When compared to other boards it is cheap and very easy to work with. The Arduino UNO R3 was released in 2011.

Specifications

- The Arduino board contains ATmega 328P microcontroller as shown in *Fig.2*.
- It operates at a voltage of 5V
- The Arduino board is given an input voltage of 7 to 12V
- It contains 14 Digital I/O pins in which 6 of them are for PWM output and 6 Analog pins.
- It has Flash memory of 32KB and 1KB EEPROM.
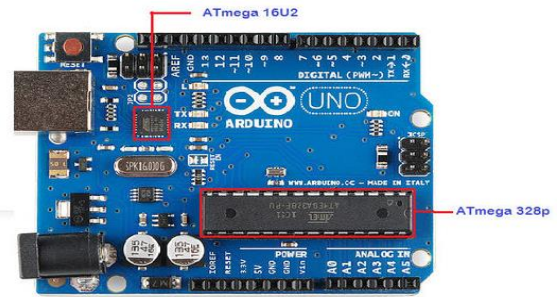- Clock speed is 16MHZ.

Fig.2 Arduino Uno R3

B.　Ultrasonic Sensor

Ultrasonic sensor HCSR04 offers non-contact measurement system within the range of 2cm-400cm with accuracy up to 3mm [5].
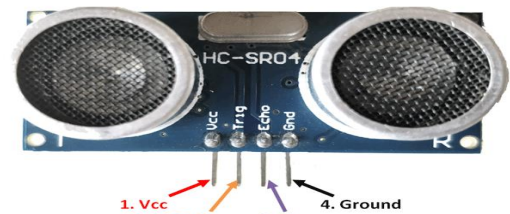

Fig.3 Ultrasonic sensor

HC-SR04 Sensor Features

- It operates at a voltage of 5V
- It can measure practically from 2cm to 80cm with an accuracy of 3mm.
- It operates at a frequency of 40Hz

(Refer the datasheet for other features and specifications)

Ultrasonic sensor consists of one transmitter and one receiver as in *Fig.3* it uses ultrasonic sound waves to detect nearby objects. The transmitter operates at 40 KHz of frequency and the receiver accepts 40 KHz sound waves. Whenever obstacle is found it calculates the time by sending signals and receiving them. It has high sensitivity and can tolerate high or low temperatures.

C.　SIM 808 GSM/GPS Module

It is a Quad band (850/900/1800/1900MHz) GSM/GPS module with frequencies GSM 850MHz and GPS offers best tracking sensitivity and acquisition and accuracy. It has 68 pins as shown in *Fig.4* which provides hardware interfaces between the boards and the module. It has UART interface. The current consumption is low as 1.2mA with GPS engine down. It

supports both 2G and 3G SIM networks with speeds of 236Kbps and 5.7Mbps.

Fig.4 SIM 808 Module

Specifications

- It operates at voltage of 5V
- The board is provided with an input power of 7-23V
- It supports low power consumption with 100mA at a voltage of 7V.
- It supports AT commands.
- It supports GPS navigation technology [7].
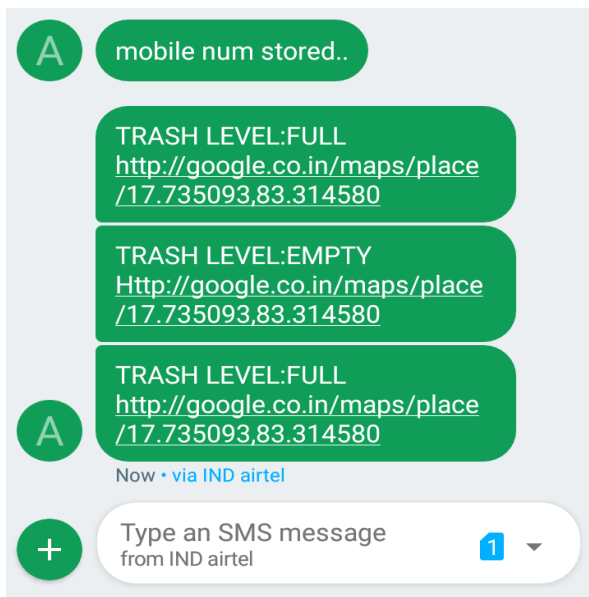
VII.   RESULTS

Fig.5 Message sent to Mobile with Location

Whenever the trash is full or empty the allotted person will receive a message along with the location as shown in the above *Fig.5*
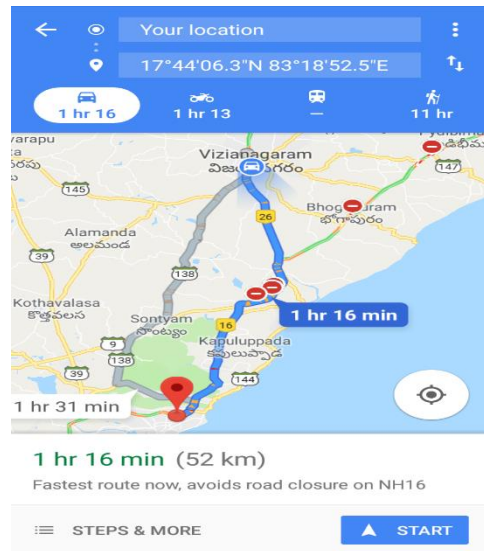

Fig.6 Optimized Route Map

After clicking the link, you can get optimized route map [8] as shown above *Fig.6*

VIII.   CONCLUSION

This paper proposes a method to detect the waste level in the garbage bin and sends the message if the bin is full and later another message is sent indicating garbage is collected with the help of sensor, microcontroller and GSM/GPS SIM 808 module. This is a cost-effective method that reduces the effort of labor.

IX.   ACKNOWLEDGMENT

X.   REFERENCES

[1] Abhimanyu Singh, Pankhuri, Aggarwal, Rahul Arora, "IOT based waste collection System using Infrared se sensors" IEEE, pp.505-509, Proc 2016.

[2] Gopal Krishna Shyam, Sunil Kumar S. Manvi, Priyanka Bharti, school of Computing and Information technology, "Smart Waste Management using (IOT)", Second International Conference on computing and Communications Technologies (ICCCT17)), pp.199-203, Proc 2017.

[3] Sagnik Kanta, Srinjoy Jash, Himadri Nath Saha, Department of Computer Science and Engineering, "Internet of Things Based Garbage Monitoring System", IEEE, pp.127-130, Prop 2017.

[4] S. Vinoth Kumar, T. Senthil Kumaran, A. Krishna Kumar and Mahantesh Mathapati, Department of Computer

Science and Engineering, "Smart Garbage Monitoring and Clearance System using Internet of Things",2017 IEEE International Conference on Smart Technologies and Management for Computing, Communication, Controls, Energy and Materials (ICSTM), pp.184-189, August 2017.

[5] N. Sathish Kumar, B. Vijaya Lakshmi, R. Jenifer Prarthana, A. Shankar, "IOT Based Smart Garbage alert system using Arduino UNO", IEEE Region 10 Conference (TENCON) — Proceedings of the International Conference, pp.1028-1034, 2017.

[6] Fachmin Folianto, Yong Sheng Low, Wai Leong Yeow, "Smartbin: Smart Waste Management System", 2015 IEEE Tenth International Conference on Intelligent Sensors, Sensor Networks and Information Processing (ISSNIP), pp1-2, April 2015.

[7] Md. Abdulla Al Mamun, M. A. Hannan, Aini Hussain Dept. of Electrical, Electronic and Systems Engineering, "Real Time Solid Waste Bin Monitoring System Framework Using
Wireless Sensor Network".

[8] Jetendra Joshi, Joshitha Reddy, Praneeth Reddy, Akshay Agarwal, Rahul Agarwal, Amrit Bagga, and Abhinandan Bhargava Department of Computer Science, "Cloud Computing Based Smart Garbage Monitoring System",978-1-5090-2160-4/16/$31.00 ©2016 IEEE 2016 3rd International Conference on Electronic Design (ICED), pp.70-75, August 2016.

[9] I. Hong, S. Park, B. Lee, J. Lee, D. Jeeong, "IOT based smart garbage system for efficient food waste management" , The scientific world journal volume(2014), Article Id 646953.

Chandra sai Suru is currently pursuing B.tech in Electronics and Communication Engineering in Raghu institute of technology, Visakhapatnam, India.

Venkatesh is currently pursuing B.tech in Electronics and Communication Engineering in Raghu institute of technology, Visakhapatnam, India.

Hephzibah Nagothi is currently pursuing B.tech in Electronics and Communication Engineering in Raghu institute of technology, Visakhapatnam, India.

Raja Bhusan Kattamuri is currently pursuing B.tech in Electronics and Communication Engineering in Raghu institute of technology, Visakhapatnam, India

Kusuma Vani Parepalli received B. tech degree in ECE in the year 2005 from MVGR Engineering College and He received M. tech degree from Nishita college of Engineering with specialization in VLSI system design in the year 2010. She has 10 years of teaching experience. She is currently working as an Assistant Professor in Raghu Institute of Technology, Visakhapatnam.