SMS based Intelligent Dustbin for Garbage Flooding Protection

Ajay Suri a , Hritik Sharma b , Mamta Karakoti c, Rachit Mishra d

a Dept. of ECE, ABES Engineering College, Ghaziabad, India,

b, c, d Dept. of ECE, ABES Engineering College, Ghaziabad, India,

Abstract— **This research work us dedicated to design and develop a low cost, fast responding garbage bin level alarming system to assist garbage collection department about the level change of tank and notification when bin become full. In this system SMS based technology is implemented to immediate transmission of level and there is no need of WiFi connectivity and other additional equipment to operate it. An ultrasonic sensor module having transmitter and receiver module aid to get the level of bin according the concept of sound echo theory. So main objective of this project to avoid the overflow of garbage bin and support swachh bharat abhiyaan and promote concept of developing smart city. This is low cost project and low maintenance is required.**

Keywords*— *Smart Garbage Level Indicator, Microcontroller, Height Sensing, GSM Module, Object detection and AT command Algorithm.

I. INTRODUCTION

Now a days, automation of existing systems are going on for last decade worldwide, there is one smelling issue worldwide, it is first priority to handle thrash. Many social media news and complaint are being updated regarding flooding of garbage and poured out from bin. Due to such problem infections related diseases expand in that particular area and loss of money and lives happen.

As we know that population of India is on top most amongst 206 countries and it is typical to manage thrash in India. This undertaking gives us perhaps the most effective method for keeping our current circumstance clean furthermore, green [1]. The savvy city idea is still new in India, despite that need and demand of automation of things in smart cities are necessary to provide a healthy life and protect from infections.

In India, now a day lot of urban areas are needed urgent maintenance throughout the country and individuals need such type of garbage bin which have capability to inform about level of bin and also needed to extract the gases generated inside so that managed immediately. Most of the population in India dispatch their waste either on roadside or any open space. Many dumping zones are available near NCR (national central region) in India but most of the garbage dumping locations are near residential area. This leads big problem for those residents and ultimately become prime region of diseases and infections.

In this project a solution is implemented for the above discussed all problems. An information share system is proposed to be implemented for small garbage bins as well as for large garbage bins. A height measuring sensor is used which is able to sense from 2 centimeter height to 200 centimeter. So this device can be installed to small and large dustbin both [2].

In our urban communities, it can be observed that public spots are used to dump the garbage and they are spilling over and they suffer from bad smell and unhygienic circumstances. Likewise it makes offensiveness to that spot. Simultaneously terrible smell is additionally spread. To stay away from all such circumstances we have executed a venture called GSM based brilliant dustbins for shrewd urban areas. In many types of dust bin IR sensor based sensing technology has been implanted which is not a suitable sensor as it could not detect black garbage so ultrasonic sensor is much better as compared to IR sensor [1]. Assuming the dustbin is stacked with trash, the status will be shown on the screen. In the event that the trash isn't gathered in unambiguous time then SMS will be shipped off the individual illuminating that dustbin isn't cleaned at this point. Simultaneously, status report will be refreshed so that the sweeper for worker for hire liable for the tidiness can be question for the deferral. Consequently a programmed framework can be intended to keep up with the city Clean with the assistance of gadgets. Anyway we see that in the event that there is some celebration or some capacity, heaps of trash material is produced by individuals in that specific region. In such cases the trash dustbin gets promptly full and afterward it floods which makes numerous issues. So in circumstances, with assistance of our task the public authority individual can get SMS right away. So they will get SMS before their occasional span visit of getting the dustbin. Then, at that point, they can proceed to get the dustbins. After each get stretch the dustbins will under support, while each dustbin's singular battery will be charged under the direction of municipal corporation.

Execution of this savvy dustbin can forestall lumping of the trash for a significant stretch of time, accordingly forestalling the far and wide of sicknesses by and large and a motive to make the city neat and clean [2]. The main idea behind the proposed concept is to keep our current circumstance clean by staying away from the inappropriate assortment and isolation, ill-advised removal of squanders and spilling over of dustbin in open regions. This proposed hardware is implemented in a readymade dustbin and edited for deploying the manufactured model and fixing the ultrasonic sensor. This implemented project is just a prototype of the concept and to construct a ready to install model, an enclosed sensor should be used and water proof

packaging of circuit board is mandatory.

The organization of the proposed research paper is as follows:
A brief description of related literatures are presented in the section II while section III concludes methodology of proposed project. Section IV shows the results and analytical performance. Conclusions and future scope is described in section V and section VI respectively.

II. LITERATURE REVIEW

There are past investigates on unpleasantness in shrewd dustbin framework that has utilizing the different circuit and application. It additionally has utilized the different strategy, material and investigation plan to get the issue of waste. Furthermore, in this audit it will incorporate about Solid Waste Management System existing in various piece of the savvy urban areas.

Ngosa Willie [3] this undertaking proposes GSM and GPS based hybrid model having hardware as well as software installed in the controller unit which is known as GSM and GPS based overflow management for protecting overflow of garbage as an innovative project modeling with a feature of continuous updating of the location of dustbin and its level data. The framework advises the individual responsible for trash assortment by an informative system like SMS based sharing scheme and letting them know where the full receptacle is by and large found. Again after at some point the framework tells the cluster head which is known as admin and ultimately transferred to the driver related to that particular zone. This improvement will at last save a ton of time particularly when the board doesn't need to proceed to really take a look at the degree of trash in the container. Furthermore, it will convenient forestall the flood of trash because of the way that trash will be gathered on schedule. That is, the gathering will gather trash just when the time has come to do so instead of routine where even half-full containers are gathered.

Prasad Kulkarni [4] had proposed hardware model that can be installed throughout the different cities at different location and configured with ultrasonic sensor module to detect the presence of the waste inside so to differentiate the full and empty bin is not typical job as an indicator is placed on the top of the bin to show the level inside. A GSM modem is connected to the controller to get the information of waste bin.

Kanchan [5] had depicted that significant test in metropolitan regions all through the world with strong waste. In that System, they presented an incorporated framework joined of RFID, GPS, GPRS, web camera and GIS. The RFID per user is implicit truck would naturally recover a wide range of client data and container data from some tag that has information in form of fourteen digit numbers, implanted in individual bin. The location of area where has to truck driver need to approaches is shared on his mobile number. The information is saved to server and timely updated to the users. This data up gradation is performed with help of GPRS service available with the advanced GPS module SIM900. But this system is quite costly as internet data regular recharge of the SIM fixed with module is an essential requirement. In this framework, receptacle as well as data set has created in the manner that data of canister as well as truck ID, information and season of waste assortment, container and truck GPS organizes data. Receptacle status and measure of waste are ordered in an information parcel. The framework is showed that ongoing picture handling and other container data have been shown in the GUI.

Priya [6] had depicted a framework which is grown predominantly to focus on annihilating grotesqueness as well as problem. They utilized a brilliant garbage which has gas sensor and one IR sensor module. Gas sensor is used to check the gases generated inside and IR sensor has responsibility to monitor the level of bin. When the waste is filled, the RFID put inside the rubbish will give data about spilling over of garbage to the enterprise office. Their framework comprising of a transmitter unit and collector unit which are worked by PIC microcontroller.

Pavithra [7] had proposed the original model of strong waste container checking framework utilizing remote sensor organization. The framework design involves GSM module and wireless device Zigbee for sharing information as well as a bunch of painstakingly picked sensors to screen the situation with strong burn through receptacles progressively. In that framework comprise of three level construction like lower, center and upper level. Gauge based sensing module is inserted to the bin and information is sent to nearby zigbee enabled local node and ultimately to the cluster head that may be admin of sub-admin.

Subho [8] planned a framework for developing smart city concept in Dhaka city. This is contraction based dustbin which compress the existing dust available in dustbin and acknowledge the administrator and information shares to the central room with help of wireless network mechanism share information from one node to other node to send final point.

Tripathi [9] presented an RFID based dustbin monitoring system with GSM based communication module. RFID helps to identify to the location and identity of particular dustbin and GSM module helps to send instant level of dustbin and send alert when garbage bin became full and hence provide automatic information.

Hong [10] proposed a framework to diminish how much food squander. In a brilliant trash container, battery-based savvy trash receptacles that is first crush the garbage when goes to higher level above a threshold value.

Gayanthika [11] invented the a native method of monitor garbage bin using radio frequency based RFID receiver module and with special sensors which observe the bin and immediately transfer information to user identified with RFID module.

Sahu [12] presented a framework that has fabricated camera based dustbin that was a smart dustbin and also configured with a load cell based weight monitoring of garbage bin. At each time garbage inserted to dustbin camera captured image and send to user.

III. METHODOLOGY

In the proposed project a contactless garbage level

monitoring is implemented using ultrasonic radar sensor and an 8-bit controller board popular as arduino uno board has been used to interface with sensor and wireless communication modem. GSM module SIM 900 is used here to transmit the information. Block diagram of proposed system is shown below in figure 1.

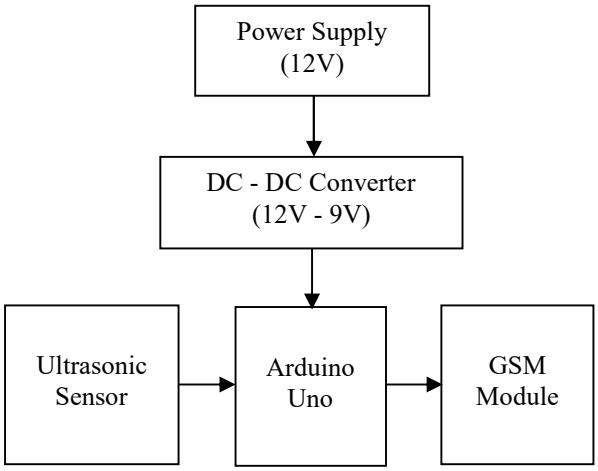

Fig 1: Block Diagram of Proposed System

According to block diagram it can be depicted that there are four main parts of this project, power supply, microcontroller, ultrasonic sensor and GSM module.

A. Hardware Implementation

The main part of this project is arduino uno board which is used to monitor the events and control actuators. Circuit diagram of proposed project is shown in figure 2.

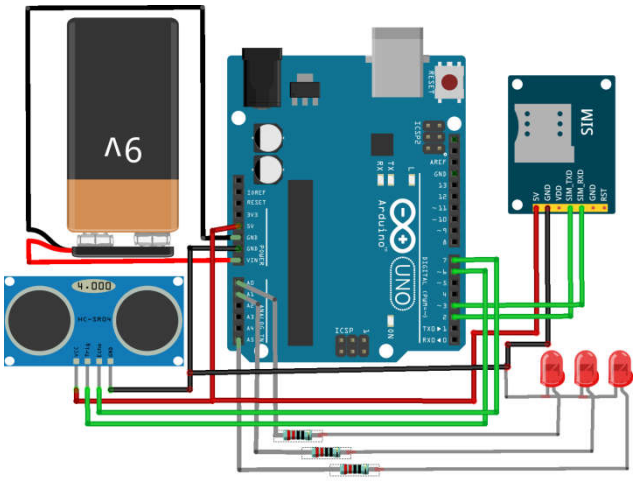

Fig 2: Circuit Diagram of Proposed Project

As per the project circuit diagram, ultrasonic sensor digital pin of uno is used for triggering sound with trigger pin of sensor and pin7 of uno is used to read the received signal from sensor that is echo pin. GSM module is connected to arduino serial communication pins GSM Tx pin is connected to arduino pin 2 and Rx pin of GSM module is connected to pin 3 arduino. Three LEDs are connected to arduino pins A0, A1 and A5 for Empty, Medium and Full level of dustbin respectively.

1) Arduino Uno

Arduino Uno is a kind of development board used to develop embedded based project applications. Embedded system is basically includes hardware components and programming in controller placed on board. Arduino provides an IDE (integrated development environment) that is used to compile program and debug. Arduino boards have its own boot loader, so don't need any program burning device. Using A-B USB cable Arduino board can be program with it IDE which is an open source tool.

Arduino is compatible to C programmable as well as C++ programming language. Arduino Uno has thirteen number of digital pins and six number of analog pins. It has separate serial communication pin.

Arduino based development boards are currently used in different automation applications. One of the most important arduino board controller is ATMEGA328P which is known as automotive controller. Arduino Uno has inbuilt timer and controller. There are two eight bit timer and one sixteen bit timer, six PWM pins used to generate pulses for power electronics circuitry as well motor speed control and switching devices controlling.

Arduino Uno is capable of handling fast processing applications as it works with 16MHz external frequency source and inbuilt internal 8MHz RC oscillator. Pin diagram of arduino uno is shown in figure 3.

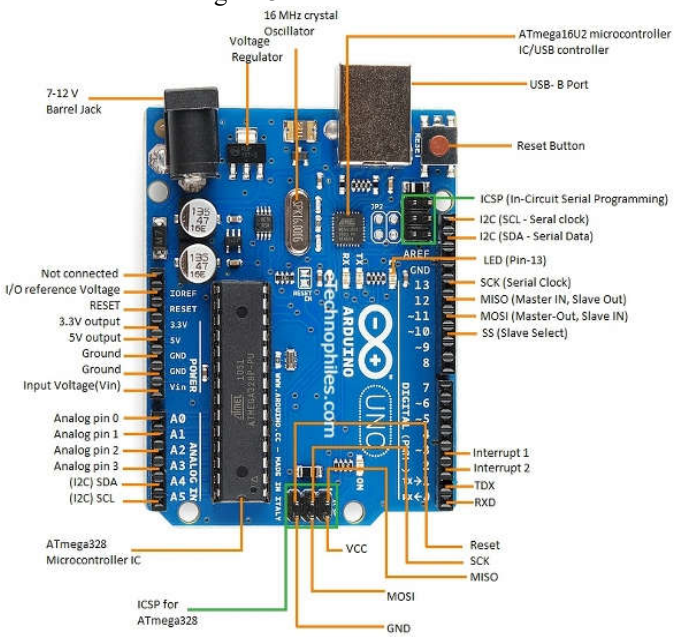

Fig 3: Arduino Uno Pinout

Thirteen digital pins have multi functions like PWM, SPI communication and six analog pins are also equipped with multiple functions like I2C communication.

2) Ultrasonic Sensor

Ultrasonic sensor is mainly used for distance measuring applications using a very low cost sensor module named as HC-SR04 which has total four number of pins. Pin one is basically positive power supply pin works from 3.3V to 5V and pin 4 is negative pin works with ground pin that is 0V. Pin 2 is trigger pin which is used to start ultrasonic transmission and pin 3 is echo pin which generates signal when reflected echo is received to receiver of module. Distance using ultrasonic sensor is calculated as

$$distance = velocity\ of\ sound * travel\ time \quad (1)$$

Distance of any object in front of ultrasonic sensor is calculated with the help of equation 1. According to this equation time period and velocity of speed should be known. Speed of sound is 332 m/s and time period can be calculated as half of travel time of ultrasound. Pin diagram of ultrasonic sensor is shown in figure 4.

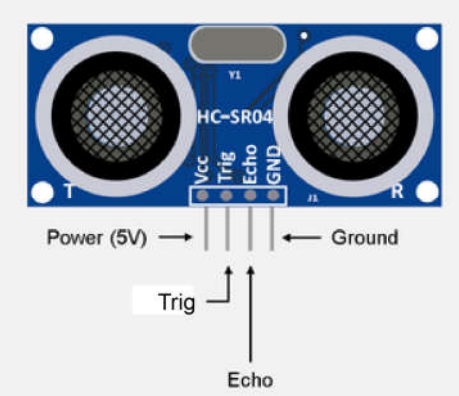

Fig. 4: Ultrasonic Sensor Pinout

Working of ultrasonic sensor can be described as shown in figure 5. In this module one part is ultrasound transmitter and second part is sound receiver. Reflected signal is received on receiver module and after being processed transmitted to controller.

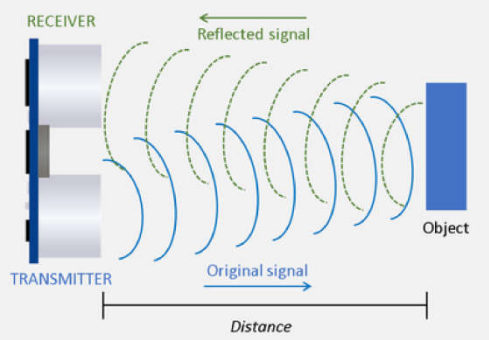

Fig. 5: Ultrasonic Sensor Signalling

3) GSM Module

Digital cell innovation like GSM (Global System for Mobile Communication) is utilized to send portable information as well as voice administrations. This idea was executed at Bell Laboratories involving a portable radio framework in 1970. As the name recommends, it is the normalization bunch name that was laid out in the year1982 to make an overall European cell phone standard. This innovation claims above 70% of the portion of the overall industry of the computerized cell supporter all over the planet. This innovation was created by utilizing computerized innovation. As of now, GSM innovation upholds over 1 billion versatile endorsers all over the planet in the over 210 nations. This innovation gives voice and information administrations from central to complex. This article talks about an outline of GSM innovation.

Pinout and view of GSM module used in this project is GSM SIM900 mini shown in figure 6.

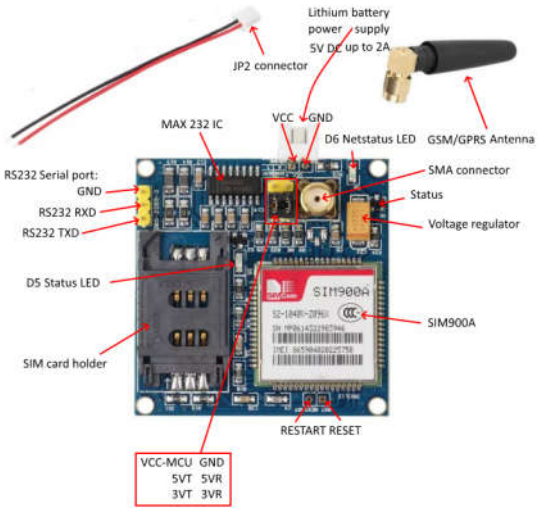

Fig. 6: GSM Module SIM 900 Mini

B. Software Implementation

Arduino IDE tool has been used in this project to compile the program for proposed project. Arduino IDE is shown in figure 7 below.

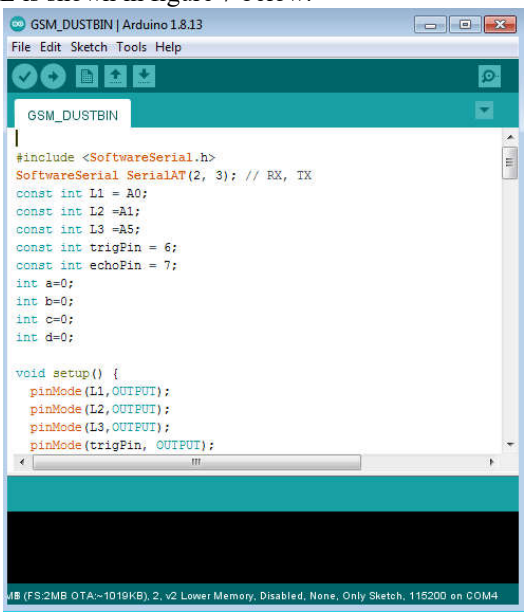

Fig. 7 Arduino IDE

A virutal serial communication library "SoftwareSerial.h" is used to communicate with GSM module. Arduino serial communication virtual pins 2 & 3 are used. AT commands used to send SMS are as follows:

AT- to test AT command
ATE0 - to turn of echo
AT+CMGF=1 - to open write test box
AT+CMGS= "Mobile number" to fill mobile number
Send text on serial port
Press ctrl+z to send SMS.
Now, SMS will be sent to mobile number filled with date and time with that text.

To measure the level of garbage in dustbin calculation of distance is done. Processing of signal is shown below in figure 8.

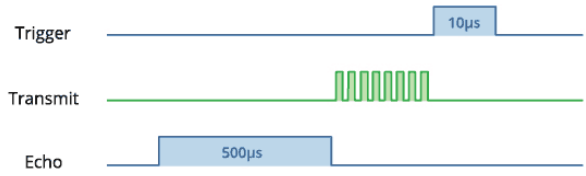

Fig. 8 Ultrasonic Signal Processing

A trigger pulse of 10us is generated by arduino which is converted into pulses by ultrasonic processing unit and transmitted after reflecting from the object in front of sensor an echo signal of 500us is received at echo terminal.

IV. PERFORMANCE ANALYSIS

Hardware implemented is shown below in figure 9. Output of hardware is presented in form of received SMS and level of garbage in dustbin.

Fig. 9: Hardware Model

When dustbin is empty all LEDs are turned off which shows empty dustbin, Level 1 indicator turned on when garbage level reaches to 30% dustbin is fill, Level 2 & 1 LEDs are turned on when level reaches to 60% and all three LEDs are turned on when garbage level reaches its maximum point that is full.
When dustbin is at its lower level a message "Dustbin is empty is send to user's mobile.
When level1 is achieved a message "Dustbin is 30% Occupied" is transmitted to user mobile.
When level2 is achieved a message "Dustbin is 60% Occupied" is transmitted to user mobile.
When level3 is achieved a message "Dustbin is Full" is transmitted to user mobile.

V. CONCLUSION

A system for protecting the overflow of garbage from dustbin is successfully implemented and tested. This project is useful for different application areas like municipal corporation garbage collection project, industrial garbage collection and garbage collection in school and colleges. Specialty of this project is that it does need additional wiring for providing internet service or WiFi connectivity so can be used in cities as well as in rural areas.

VI. FUTURE SCOPE

This project is extended to a product form for ready use model and an additional feature to compress the garbage can be implemented so that garbage crushed and converted to block form so that its recovery and collection become easy. Such type of development will lead protect form garbage overflow and also prevent from many dangerous diseases spread.

REFERENCES

[1] Neha Singh, Pooja Siriya, Pooja Pandey, Priya Sevlani, "GSM Based Smart Dustbins for Smart Cities", International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, Vol. 6, Issue 4, April 2017.

[2] A K. Suresh, S. Bhuvanesh and B. Krishna Devan, "Arduino Microcontroller Based Smart Dustbins for Smart Cities", ICTACT Journal on Microelectronics, Volume: 05, Issue: 03, October 2019.

[3] Ngosa Willie, Kapata Lucy, KatawaShadrick, Phiri David Victor and Sinonge John, ―GSM and GPS Based Garbage and Waste Collection Bin Overflow Management System for Kitwe City Council‖, International Journal of Engineering Research & Technology, vol.7, Issue 4, April 2018.

[4] Prasad Kulkarni, VivekPatil, AmeyChavan, RajaramPowar and Vishal Dhaygude, ―GSM based Garbage Management System‖, International Journal of Electrical and Electronics Engineers‖, vol.9, Issue 9, June 2017.

[5] Kanchan Mahajan, Prof.J.S.Chitode ―Waste Bin monitoring system using Integrated Technology‖, International Journal of Innovative Research in Science engineering and Technology‖,vol 3,Issue 7,july 2014

[6] Priya B.K., T.Lavanya, V.Samyakta Reddy ―Bin That Think's ,‖ The international journal of science and technology(ISSN 2321919x) vol 3 Issue 6,June 2015.

[7] Pavithra, ―Smart trash system: An application using Zigbee,‖ International Journal of Innovative Science, Engineering and Technology, vol. 1, Issue 8 October 2014.

[8] M.T.H. Shubho, M.T. Hassan, M.R. Hossain and M.N. Neema, "Quantitative Analysis of Spatial Pattern of Dustbins and Its Pollution in Dhaka City-A GIS based Approach", Asian Transactions on Engineering, Vol. 3, No. 4, pp. 1-7, 2013.

[9] A. Tripathi, C. Pandey, A. Narwal and D. Negi, "Cloud Based Smart Dustbin System for Metro Station", Proceedings of 3rd IEEE International Conference on Internet of Things: Smart Innovation and Usages, pp. 1-8, 2018.

[10] Insung Hong, Sunghoi Park, Beomseok Lee, Jaekeun Lee, Daebeom Jeong and Sehyun Park, "IOT-based Smart Garbage System for Efficient Food Waste Management", The Scientific World Journal, Vol. 3, No. 4, pp. 137-150, 2014.

[11] W.A.L. Gayanthika, G.K.C.D. Maduranga, A.I.S. Silva, S.D.H.S. Wikramarathne, R.M.I.S. Ranasinghe, "Smart Dustbin for Waste Management", International Journal of Environmental Science and Development, Vol. 10, No. 4, pp. 118-121, 2019.

[12] R.M. Sahu, Akshay Godase, Pramod Shinde and Reshma Shinde, "Garbage and Street Light Monitoring System using Internet of Things", International Journal of Innovative Research in Electrical, Electronics, Instrumentation and Control Engineering, Vol. 4, No. 4, pp. 107-109, 2016.