Smart Garbage Monitoring System

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Abstract- 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 the garbage collected in the garbage bins via a web page. For this the system uses ultrasonic sensors placed over the bins to detect the garbage level and compare it with the garbage bins depth. The system puts on the buzzer when the level of garbage collected crosses the set limit . The web page gives a graphical view of the garbage bins in order to show the level of garbage collected. We are using cloud services for storage of Sensor information and display meaningful information on graphs. There are many services are available which provide the cloud storage with graphical data representation.The detection, monitoring and management of wastes is one of the primary problems of the present era. The traditional way of manually monitoring the wastes in waste bins is a complex, cumbersome process and utilizes more human effort, time and cost which is not compatible with the present day technologies in any way.

Keywords- Solid Waste, Zigbee, Arduino, GSM,.

I. INTRODUCTION

In our daily life, we see the pictures of garbage bins being overfull and all the garbage spills out resulting in pollution. This also increases number of diseases as large number of insects and mosquitoes breed on it. Hence our problem statement is to design a System Based on Arduino - for collecting the garbage from a particular area – the area whose public Garbage Bins are overflowing with prior concern. A big Challenge in the urban cities is Solid waste management .Not only in India but for most of the countries in the world. The project gives us one of the most efficient ways to keep our environment clean and green. Zigbee and Global System for Mobile Communication (GSM) are the latest trends and are one of the best combinations to be used in the project.

Hence, a combination of both of these technologies is used in the project. To give a brief description of the project, the sensors are placed in the common garbage bins placed at the public places. When the garbage reaches the level of the sensor, then that indication will be given to Arduino. The controller will give indication to the driver of garbage collection truck as to which garbage bin is completely filled and needs urgent attention. Arduino will give indication by sending SMS using GSM technology

II. RELATED WORK

In [1], Prof.Dr.Sandeep , for the implementation of smart dustbins ; the idea has existed for many years, after the IoT field finding its grip in our lives. This is, however an original plan for designing a smart garbage bin with Ultrasonic sensor ,Aurdino, Wifi Modem MAX232 for transmission of data to the server.

In [2], Ronit Chaudhuri explains garbage monitoring using arduino board connected to an ultrasonic sensor and a Wi-Fi module and this entire system is connected to every single bin inside the campus area. The ultrasonic sensor is directed towards the face of the bin and whenever the bin is less than 5 cm empty the status of the bin will be shown as full, otherwise it will be shown as empty.

In this paper [3], they explains with the age old system of hiring people to regularly check and empty filled dustbins, the process has been prone to human error and neglect. Additionally, due to different frequency of usage of dustbins in different areas, routine checks which are based on time crevices is inefficient because a dustbin might get filled early and may need immediate attention or there might not be any need of a routine check for a long period of time.
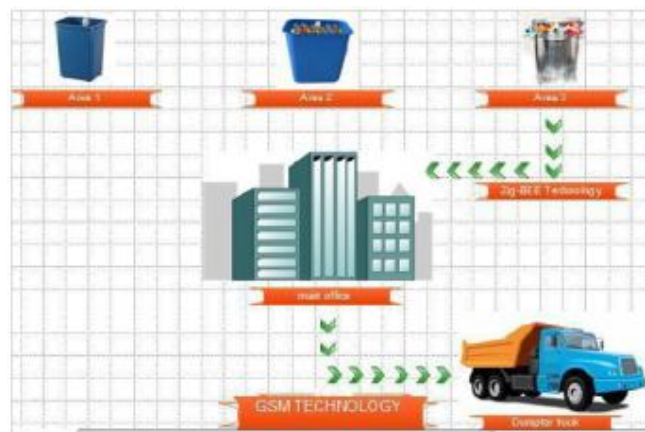
Fig1. Implementation of Solid waste management

III. SYSTEM REPRESENTATION

In this project,we are going to make an**"IOT BASED GARBAGE MONITORING SYSTEM"**which will tell us that whether the trash can is empty or full through the webserver and you can know the status of your Trash Can or Dumpster from anywhere in the world over the internet.It will be very useful and can be installed in the Trash Cans at public places as well as at home.

The Ultrasonic sensors is used to measure the distance with high accuracy and stable readings.It can measure distance from 2cm-400cm or from 1 inch-13 feet.It emits an ultrasound wave at the frequency of 40KHz in the air and if the object will come in its way then it will bounce back to the sensor.By using that time which it takes to strike the object and come back,you can calculate the distance.The ultrasonic sensors has four pins.Two are VCC and GND which will be connected to the 5V and the GND of the Raspberry Pi while the other two pins are Trig and Echo pins which will be connected to any digital pins of the Raspberry Pi.The Trig pin will send the signal and the Echo pin will be used to receive the signal.To generate an ultrasound signal,you will have to make the Trig pin high for about 10us which will send a 8 cycle sonic burst at the speed of sound and after striking the object,it will received by the Echo pin.

In this **IOT** an **Ultrasonic Sensor** is used for detecting whether the trash can is filled with garbage and not.Here,Ultrasonic Sensor is installed at the top of the Trash Can and will measure the distance of garbage from the top of Trash Can and we can set a threshold value according to the size of the Trash Can.If the distance will be less than the threshold value,means that the Trash Can is full of garbage and we will print the message "Garbage is Full" on the webpage and the distance is more than its threshold value,then we will print the message "Garbage is Empty".Here,we have set the threshold value of 5cm in the program code. We will use ESP8266 wi-fi module for connecting the Arduino to the webserver to demonstrate the working of this Garbage Monitoring System.
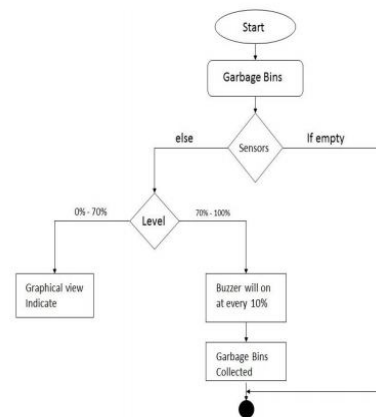

Fig 2: Flowchart

IV. MATERIALS AND METHODS

A. *GSM Module:*

Global System for Mobile Communications, originally Groupe Spécial Mobile commonly known as GSM, is a standard set developed by the (ETSI) to describe protocols for second generation digital cellular networks used by mobile phones. It became the fact of global standard for mobile communications with over 80% market share.The GSM modem is interfaced with the Arduino microcontroller. If the garbage Box is full and if SMS alert has to be sent to the driver through the GSM .Mobile is in the hand of user which receives SMS. TheGSM Module is interfaced with the a Arduino. GSM Module has a SIM card, itsends an SMS to user, when an error introduced. They are used for sending and receiving SMS and MMS alerts.

Fig 3: GSM Module

B. *Ultrasonic Sensor:*

Fig 4. Ultrasonic Sensor

The Ultrasonic Sensor sends out a high-frequency sound pulse and then times how long it takes for the echo of the sound to reflect back. The sensor has 2 openings on its front. One opening transmits ultrasonic waves, (like a tiny speaker), the other receives them, (like a tiny microphone). The speed of sound is approximately 341 meters (1100 feet) per second in air. The ultrasonic sensor uses this information along with the time difference between sending and receiving the sound pulse to determine the distance to an object.

C. *Arduino IDE:*

Fig 5. Arduino

The Arduino Software (IDE) is an open source software and it makes easy to the code and upload it to the board. I t runs on the different plant from Windows, MAC OS, Linux. The environment is written in Java and before running the IDE Java software to be installed on the machine this software can be used with any Arduino board.

D. *Zigbee*

Fig 6. Zigbee

Zigbee is an IEEE 802.15.4-based specification for a suite of high-level communication protocols used to create personal area networks with small, low-power digital radios, such as for home automation, medical device data collection, and other low-power low-bandwidth needs, designed for small scale projects which need wireless connection. Hence, Zigbee is a low-power, low data rate, and close proximity (i.e., personal area) wireless ad hoc network.

F. *SQL*

SQL is a domain-specific language used in programming and designed for managing data held in a relational database management system (RDBMS), or for stream processing in a relational data stream management system (RDSMS). In comparison to older read/write APIs like ISAM or VSAM, SQL offers two main advantages: first, it introduced the concept of accessing many records with one single command; and second, it eliminates the need to specify how to reach a record, e.g. with or without an index.

SQL was one of the first commercial languages for Edgar F. Codd's relational model, as described in his influential 1970 paper, "A Relational Model of Data for Large Shared Data Banks".Despite not entirely adhering to the relational model as described by Codd, it became the most widely used database language.

V. WORKING PRINCIPLE

A. *Algorithm*

- Connect the ultrasonic sensors to Arduino.
  Board to the PC through the USB as well as to the dustbin.
- The values are acquired and are stored in the form of an array
- Received values are read by MATLAB at the patient side and the values are compared with threshold values to indicate the garbage level.
- These vital parameters are also displayed on the front panel.
- The values are also stored in a file in the cloud storage using IOT for further assistance in the garbage management.
- The nearest driver will get an alert as soon as the garbage level will reach 70% of the dustbin.

B. *Working*

The input to the sensor module would come from the waste bin which are placed at different localities in the public area . The sensor is placed in the garbage bin at a max level , if that level is crossed by the garbage in the bin, then sensor will sense that and will communicate to Arduino through Zig Bee technology. When the garbage box 1 becomes full, the ultrasonic sensor attached to its lid will detect the level and send a command through zigbee. The zigbee receiver will always receive the command and show the condition of garbage box on Liquid Crystal Display and on the computer .The Message would be that the garbage bin 1 in particular area is filled completely, please collect it". At the same time a same message will be sent to a driver's mobile that particular garbage bin is completely full through Short Message Service. Same thing will happen when the garbage box 2 becomes full; the ultrasonic sensor will detect the level and send a command through zigbee. The receiver attached to Zig bee will receive that command and will display that on Liquid Crystal Display (LCD) and computer that garbage bin 2 in another area is filled completely , please collect it. At the same time a same message will be sent to a driver's mobile to collect the garbage bins through Short Message Service. By Instance even if both the garbage bin are full at the same time, then also both messages will be displayed on Liquid Crystal Display and computer of base station one by one. Also Short Message Service will be sent to driver's mobile one by one.

VI. EXPERIMENTATION AND RESULTS

Various studies reveal that about 90% of MSW is disposed of unscientifically in open dumps and landfills, which are effectively creating problems to public health and the environment. In the study recently , a sincere attempt has been made to provide a comprehensive and sincere review of the generation , characteristics, , collection and transportation. This project solid waste monitoring and management system has been successfully implemented with the integration of communication technologies such as Zigbee, GSM and for truck monitoring system The proposed system would be able to monitor the solid waste collection process and management the overall collection process. This technique would provide solid waste collection in time and also overcome all the disadvantages which are as use of minimum route, low fuel use, clean and green environment and available vehicle . The technologies which are used in the proposed system are good enough to ensure the practical and perfect for solid waste collection process monitoring and management for green environment .

Fig 7:Garbage Box

Fig 8: Garbage Box

Fig.7 Garbage box 1 Fig.8 Garbage box 2 Fig 7 and Fig 8 shows the different garbage boxes located at different places. They all communicate with central node as shown in fig .

Fig 9:Central Controlling uni

VII. CONCLUSION

An integrated system of Wi-Fi modem, IOT, Ultrasonic Sensor will be introducing for efficient and economic garbage collection. The system will provide improved database for garbage collection time and waste

amount at each location. The solutions currently available for the implementation of IoT.this project we will avoid over flowing of garbage from the container in residential area which is previously either loaded manually or with the help of loaders in traditional trucks. It can automatically monitor the garbage level & send the information to collection truck. The technologies which will be used in this project are good enough to ensure the practical and perfect for solid garbage collection process monitoring and management for green environment.

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