

Smart Garbage Monitoring System

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Abstract- Efficient waste collection is the need of the hour as increase in population has led to an increase in the amount of waste generated every year. Through waste collection the workers are prone to various diseases and infections. Proper segregation and management of the waste is important to curb the spreading of diseases. In metropolitan cities, like Mumbai, large amount of waste is neither collected efficiently nor properly segregated. Therefore, a smart monitoring system would help in increasing the efficiency and contributing to some extent in Swachh Survekshan as well. Garbage monitoring helps in detecting the state of the garbage bins and send trucks to only those areas where the bins are full, ensuring that the truck's fuel is not wasted and the garbage is collected on time. The location of the bin that is fully loaded is taken using Global Positioning System (GPS) modem.

Keywords – Arduino UNO; NodeMCU; GPS modem; GSM module

I. INTRODUCTION

Waste management are the activities and actions required to manage waste from the time it is created to its final disposal. It is collection, transportation, treatment and disposal of waste, together with monitoring of the process. Waste can be of any form (solid, liquid or gaseous) and each has a different treatment procedure. Domestic waste disposal is an issue that is important to the management of any urban area. Cities without a functioning waste-disposal plan face risks of disease running rampant and economic activity grinding to a halt.

Globally, millions of tons of municipal solid waste are generated every day. Urban waste management is drawing increasing attention, as it can easily be observed that too much garbage is lying uncollected in the streets, causing inconvenience, environmental pollution, and posing a public health risk. The poor waste management situation in recent years has led to a high incidence of sanitation related illness, such as cholera, intestinal worms and typhoid. These are among the top ten diseases that have been recorded, which raises the alarm of a public health crisis.

Thus, developing an efficient system for waste monitoring has become a necessity.

II. MOTIVATION

The health of all organisms depends on their surrounding or their environment. Therefore, public cleanliness is important for individual health, which makes collecting and clearing the garbage regularly an important factor. Developed countries make more waste than the developing countries but they have efficient methods for treatment and disposal. A garbage monitoring system is the need of the hour for an improved waste management and a healthy environment. A system that monitors the garbage/garbage bins in all localities and clears it once the bin is filled will save the time and fuel of the traditional garbage collecting trucks.

III. LITERATURE REVIEW

A study of different garbage monitoring systems over the years was done.

A. Garbage monitoring using microcontroller AT89S52

In [3], AT89S52 Microcontroller is used to interface sensor system with Global System for Mobile Communication (GSM) system, it has 128 bytes of RAM, 4K bytes of on chip ROM, two timers, one serial port and four ports - all on a single port. Sensors are used to monitor level of dustbin. Fig. 1 shows the flow of the system. After acquiring desire information, output is given to microcontroller to send message via GSM module.

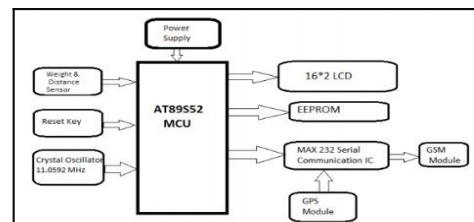


Fig.1 Flow of the System [1]

B. Garbage monitoring using Arduino

In [4], Ultrasonic sensor is placed on top of the bin and triggered by Arduino Mega 2560. Fig 2 shows that after reaching threshold value, the sensor sends the signal to Arduino mega, which in turn activates GSM Module & Global Positioning System (GPS) Modem.

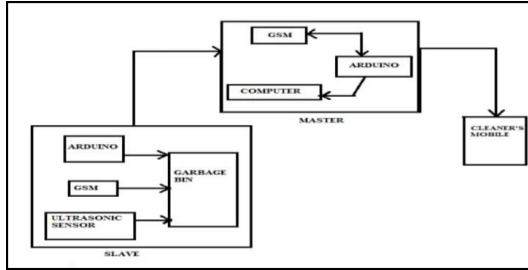


Fig. 2 Block diagram of smart garbage system [2]

C. Statistical Data

According to [2], India generates 62 million tons of waste every year, of which less than 60% is collected and around 15% processed. With megacities spurting a growth of 30.47% (Census 2011), India's basic necessities have sometimes been ignored. Also, there has been an increase in the focus towards services such as water, electricity and food for the growing population, the Indian administration has unfortunately ignored another major public service: waste management.

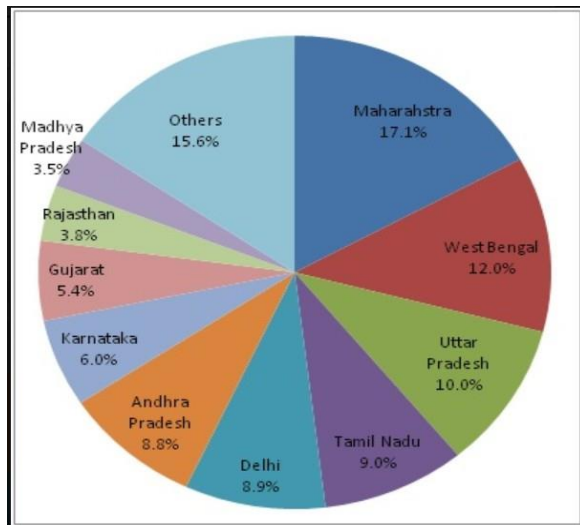


Fig.3 Share of states and UT in Urban MSW generated [1]

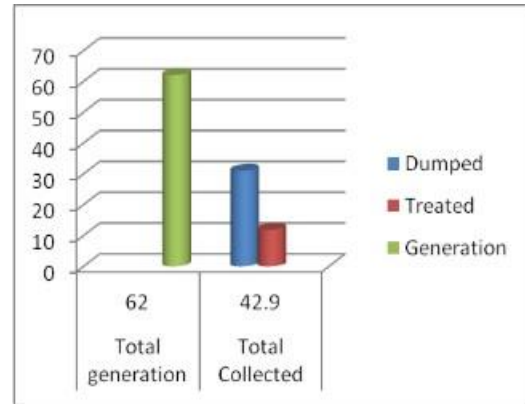


Fig. 4 Collection vs Dumped Statistics (numbers in million MT per annum) [2]

IV. SYSTEM DESCRIPTION

The flow of the system and block diagram is as shown and explained below.

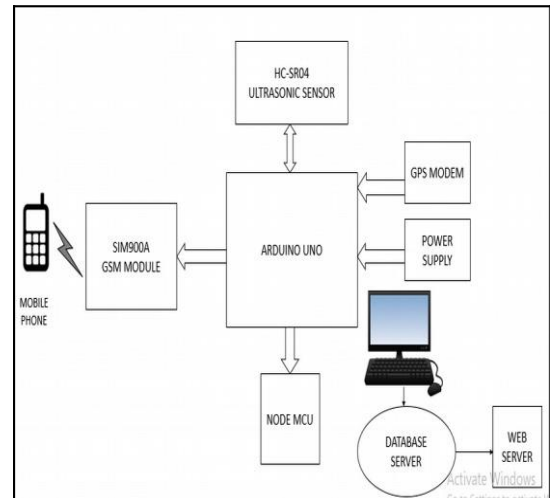


Fig 5. Block diagram of the system

Ultrasonic sensor, placed at the top of the bin, is used to determine the level of garbage in the dustbins. Once filled up to the threshold level, it sends a message to the driver via GSM module stating the same, plus uses GPS modem to send the location. The data is sent to the webpage via database server for central monitoring of the dustbins.

The heart of the system is Arduino UNO which controls the other components of the system. Ultrasonic sensing is one of the best ways to sense proximity and detect levels with high reliability. It measures the distance using

ultrasonic sound waves. An ultrasonic sensor uses a transducer to send and receive ultrasonic pulses that relay back information about an object's proximity. High frequency sound waves reflect from boundaries to produce distinct echo patterns. The time required for the waves to reflect back is utilized to calculate the distance. If this distance becomes lesser than the given threshold (10 cm), a message is sent to the driver stating that the dustbin of that particular location is about to be full. The same message is passed onto the webpage for the central monitoring of the dustbins.

V. RESULTS

The results of the ultrasonic sensor, GPS modem and GSM module under different test conditions were studied. The experimental tests involve testing of sensor and output analysis of various stages.

The ultrasonic sensor was tested to find out if it was giving the right measurements. The height of the dustbin used was 30 cm. Following are the test results:

Table 1

Results of the distance of ultrasonic sensor

Level of the garbage (in cm)	Distance from the sensor (in cm)	Distance measured by the sensor (in cm)
0	30	30
5	25	25
20	10	10

The distances calculated using ultrasonic sensor were same as the actual levels of the garbage. Thus, ultrasonic sensor gave the proper results.

The GSM module was tested to see the correct reception of the message on the mobile phone. The module did not send message when the garbage bin was filled only up to a few centimeters, i.e. when the bin had garbage level lesser than the threshold (10 cm), but it successfully sent the message when the bin had garbage level greater than the threshold (10 cm), i.e. when the bin was about to be full.

The GPS modem was used to send the location of the garbage bin. Whether the location sent by the GPS modem was correct or not was verified using the Google Maps app. The GPS modem gave the proper

results but it does not work properly during the rains or at certain locations where the network is not easily available.

The webpage shows the garbage bins that are full and needs the waste to be collected. Once the waste is collected, the status of that bin will be updated and won't be displayed on the website. This will ensure that there is a central monitoring system to keep a tab on the states of the garbage bins.

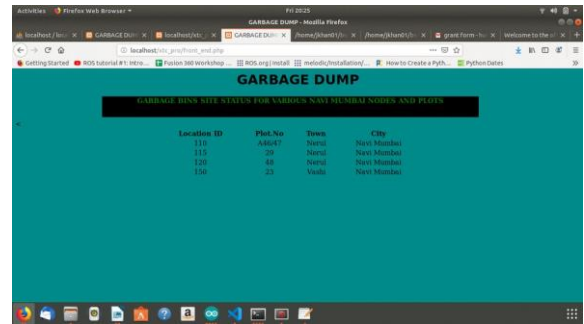


Fig 6. Website for Central Monitoring

VI. CONCLUSION

The system is made for monitoring the waste which is useful for saving the fuel of the trucks and also helps in efficient collection of the garbage. The monitoring system sends a message regarding the status of the dustbin via the GSM module.

The bins that are full will be printed onto the website to enable central monitoring and to increase the efficiency of the system.

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