Smart City Waste Management System Using GSM

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ABSTRACT

The idea is simple and is driven by the fact that dustbins require very frequent cleaning, which is not always possible. This leads to unhealthy environment and spread of diseases. The aim is to accommodate more and get the dustbin cleaned timely using alert services. In many places, the Municipal garbage bins are overflowing and they are not cleaned at proper time. As a result of which the consequences are severe. It includes overflow of garbage which results in land pollution, spread of diseases, also it creates unhygienic conditions for people, and ugliness to that place. The term waste management usually relates to all kinds of waste, whether generated during the extraction of raw materials, the processing of raw materials into final products, the consumption of final products, or other human activities, including municipal, agricultural, and social like health care etc. There needs to be system that gives prior information of the filling of the bin that alerts the municipality so that they can clean the bin on time and safeguard the environment. To avoid all such situations we intend to propose a solution for this problem Smart Garbage Bin, which will inform the authorized person when the garbage bin is about to fill and will send the location of bin by using GSM.

Keywords: Global System for Mobile; Microcontroller; Ultrasonic sensor; Smart Bin

I. INTRODUCTION

These trends support the development of Smart City concepts, which are intended to improve living in urban areas by using innovative technologies. The “Internet of Things” provides new opportunities for making cities smarter. By introducing the Smart Waste Management System, we are taking key step towards becoming a Smart City.

We have few garbage bins placed in cities which is overflowing and it checked by local authorities there are all types of garbage all disposed in bins and it all dumped together. So we designed the new concept of waste management disposal using automatic garbage level detecting from ultrasonic sensors and it will provide real time information about dustbins which is situated city. we classified waste in following categories:

The garbage dustbins is filled these information can be send to the concerned authority person to clean the dustbin. For real time information we use GSM. GSM is now back bone of communication system which is low cost and high performance device and easy to implement. And another application are used in these system is GPS. GPS will show the location of the dustbin. The working of GSM module is give message signal when the dustbin is 90% filled. The targeted waste. Collection saves time, money, and fuel and also reduces exhaust Gas emissions and noise levels for local residents. Garbage truck tours can be reduced by 30 %. There might be more cities benefitting from this system in future—twenty other countries

II. LITERATURE SURVEY

R.Narayanmooorthi, Shubham Thakker: Smart and wireless waste management System. System that gives prior information of the filling of the bin that alerts the municipality and propose a “Smart Garbage Bin”, which will alarm and inform the authorized person when the garbage bin is about to fill. NIR spectroscopy is used for separation of biodegradable waste.

Ahmed Imteaj, Mahfuzulhoq Chowdhury, Md. Arafain Mahamud: Dissipation of Wastusing Dynamic Perception and Alarming System: A Smart City Application. The system is an android based application where the user himself can contribute to clean his city, notify volunteer to come forward or can inform city corporation.

Jose M. Gutierrez, Michael Jensen, Morten Henius, Tahir Riaz: Smart Waste Collection System Based on Location Intelligence. Waste collection solution based on providing intelligence to trashcans, by using an IoT prototype embedded with sensors, which can read, collect, and transmit trash volume data over the Internet.

Pervasive computing technology has taken place to improve waste management by providing electronic system which utilizing radio frequency identification at bin level.


New framework that enables the remote monitoring of solid waste bin in real time, via ZigBee-PRO and GPRS, to assist the solid waste management process.


The system architecture is based on sensor nodes and makes use of Data Transfer Nodes (DTN) in order to provide to a remote server the retrieved data measurements from the garbage bins filling. A remote monitoring solution has been implemented, providing user the possibility to interact with the system by using a web browser.


Modern traceability devices, like volumetric sensors, identification RFID (Radio Frequency Identification) systems, GPRS (General Packet Radio Service) and GPS (Global Positioning System) technology, permit to obtain data in real time, which is fundamental to implement an efficient and innovative waste collection routing model.

M. Arebey, M. Hannan, H. Basri, and H. Abdullah: Solid waste monitoring and management using RFID, GIS and GSM.

The system consists of RFID system, mobile communication like GSM and geographical information system (GIS) for tracking vehicle position.

III. SYSTEM LEVEL DESCRIPTION

A. Web Application

The Web applications that are designed, called “Waste Management” and is used on the client’s side as well as sever side. Vehicle driver can registered to server through web application, User can update his information when needed through Server.

B. GSM Module

A GSM module is used to communicate with authorized person when the bin is about to fill. Communication is done via text massage that contain bin ID and location address. Thus person can collect waste from informed address. GSM module can also be used for two way communication. It is used as a complaint number for people. If cleaning of waste bin is not properly done then people can raise the complaint on these number to municipal office.

C. Node MCU Controller

Advanced API for hardware IO, which can dramatically reduce the redundant work for configuring and manipulating hardware.

Use of Node MCU module simplifies the number of hardware and software required to build the system. It has already power and circuitry setup to program and communicate with microcontroller via USB. On software side, it has number of libraries to program the microcontroller easily. It is high performance, low power microcontroller clocked at 16 MHz. It has 14 digital input/output pins out of which 6 can be used as PWM outputs, 6 analog inputs, one UART for serial communication. In our application, reception of data i.e. waste level in bin is not too much sensitive therefore it is programmed in such a way that it would control the power being wasted. Initially it first calculate depth of bin and set multiple distinct threshold level for it say 25, 50, 75, 90 percent. Microcontroller allows the sensor to sense waste level after certain period of time. Monitoring the bin at every interval will cause unnecessary waste of energy through sensors. Thus, the sensors will be activated only after certain intervals of time. If sensed level is greater than pre-determined threshold level, then the data will be send to control station through GSM network.
D. Ultrasonic Sensor

Ultrasonic sensors are used to detect the garbage level of bin. It is accurate to detect small objects. It is cheap, robust and can work in critical condition like dust and dirt. Further response of sensor is not depend on surface structure of object, colour of object etc. Considering all the parameters and requirement, ultrasonic sensors can be implemented for level detection. HC–SR04 is popular ultrasonic sensor module that can be detect level ranging from 2cm to 4m. It operate at frequency of 40 kHz. The number of sensor and range vary according to bin size. One or more ultrasonic sensor can be used in a bin for more accurate level estimation Sensors will be placed at the top of the bin in protecting box such that it cover entire area of bin.

The ultrasonic sensor is worked on property of sound and frequency there are two terminals of sensor which is Echo and Trigger. Echo which transmit the waves and these reflected waves are captured by the trigger. The trigger this captured signal gives to the micro controller and micro controller sense the signal and immediate take action.

![Fig 2: HC-SR04 Ultrasonic Sensor](image)

IV. APPLICATIONS

- Lowers waste and recycling costs by reducing the number of times compactor(s) are emptied.
- Reducing the environmental hazards to the residents.
- Saving tax payers money to pay less on the garbage collection fees.
- New products such as advertisement on smart can may be included.
- Local event signage can be posted electronically.
- This can be best used by municipal corporation for their betterment of management regarding collection of wastes.
- With the help of proper technology (GSM & SOFTWARE APPLICATIONS) we can guide the trucks to choose the shortest path.
- It also favours the “SMART CITY” project and “DIGITAL INDIA”.

V. ALGORITHMS

A. At Garbage Bin

a. Start.
b. Initialize setup. Calculate depth(X) of bin and set multiple threshold level.
c. Set flag f = 0
d. Check real time level i.e. fulfilment of garbage in bin and flag status.
e. If level > 50% of X and f = 0 then send notification to control station, increase flag by 1 and go to step d.
f. If level > 70% of X and f = 1 then send notification to control station, increase flag by 1 and go to step d.
g. If level > 90% of X and f = 2 then send notification to control station else go to step c.
h. Stop.

B. At Control Station

a. Start.
b. Initialize setup.
c. Receive available data, send it to computer.
d. Sort data coming from different bins.
e. Display level corresponding to each bin on graphic user interface.
f. Check bin status.
g. If bin is full then Alarm and send details of respective bin via SMS. Go to c.
h. Stop.

VI. WORKING

The garbage containers transmit signals to indicate that they are over 80% or 90% full and
should be emptied. Via the mobile communications network, the signals are sent to a web based software application used by the waste management company.

A set of sensors is installed in the garbage bin to detect level of a bin. As soon as the garbage bin is 90% full it will send a notification to the authorized person and also to the garbage collecting vehicle. By using GSM technology it will assign a unique ID to every Bin and it will send its location through GSM only to the vehicle. As soon as the vehicle is notified about the condition of the garbage bin it will collect the garbage. After the collection it will send message about the empty bin.

In the software, the capacity of the container is indicated, which is taken as a basis to plan the best route for waste collection garbage trucks travel only to those containers that actually need to be emptied.

A robust ultrasonic sensor is installed in the garbage container and detects the fill level regardless of what has been deposited inside. The whole system contains Ultrasonic Sensor, GSM module, Power supply. The sensor is fixed on to the bread board. The connection between the Node MCU board and sensor is made with the help of connecting wires. The working program is fed into the arduino board. The gsm module is also connected to the same controller board with the help of wires.

**VII. RESULT**

The garbage collection is mostly prepared in the urban part of India. More than 65% waste is collected from urban cities. Many time we see the garbage bins are place in public places are overflow. Due to this unhygienic condition occurs and causes deadly diseases. For avoid these condition we implement real time waste management system using GSM system. In these proposed system using automation technique we reduce human efforts. Ultrasonic sensor is provided for detection of garbage levels and passes signal to the microcontroller and micro controller provide signal to the GSM system and GSM module send the message to the authorized person and he collect the garbage from located bins. So it reduces transportation cost and less time consuming system. The fig.7 Shows the message of dustbin levels full/empty and also location of garbage bins for authorized person. Another application added in this system is Light Emitting Diode which works on the intensity of light.

**VIII. CONCLUSION**

A sincere attempt has been made to provide a comprehensive and sincere review of the
generation, characteristics, collection and transportation. 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.

IX. FUTURE SCOPE

The management of solid waste is an important aspect in which everyone needs to put responsive and immediate action without any delay. For a future prospective web server can also build for effective graphic user interface of a system and controlling action[1]. All bins are equipped with GPRS enabled embedded system. Central servers receive information from bins. It can store all necessary information such as bin level history, number of dispatched waste collecting vehicles etc. Thus based on prediction of collected data on bin level, it enables optimization of number of vehicles used. An application for smartphone will be developed, through which citizens can report to municipal office (fill level, photo, comment, etc.). When all such a technology integrated together a new way of waste management system emerges. This will led to reduction in amount of garbage in city and cost of transportation and realized clean and convenient environment.

ACKNOWLEDGEMENT

As our country has started a new project of Smart city. We have taken the initiative to add some features and innovations into that project up to our knowledge and abilities. It provides digital and smart way to reduce and control the waste and provide our contribution in Smart cities Development Project.

REFERENCES


