

## Smart Waste Management Using Vehicle Tracking System

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### ABSTRACT

Solid waste management is one among the basic essential services provided by municipal authorities in the country to keep a city clean. However, it is among the most poorly rendered services. The systems applied are unscientific, outdated and inefficient; population coverage is low; and the poor are marginalized. Municipal laws governing the urban local bodies do not have adequate provisions to deal effectively with the ever-growing problem of solid waste. The aim of this article is to provide an efficient and cost-effective method to get information about Garbage Collector Truck and hence providing clean, healthy and green environment. This study proposes a new framework that enables remote monitoring of Garbage Truck in real-time via Wi-Fi connection, to assist the waste management activity.

Date of Submission: 01-06-2020

Date of Acceptance: 16-06-2020

### I. INTRODUCTION

'Solid Waste is defined as the organic and inorganic waste materials produced by households, commercial, institutional and industrial activities that have lost their value in the eyes of the first owner.' (Huysmand Baud 1994) [1].

Municipal Solid waste Management (MSW) is a mandatory service of Urban Local Bodies in India. The Union Ministry of Environment, Forests and Climate Change (MoEF&CC) recently notified the new Solid Waste Management Rules (SWM), 2016 [2]. These rules will replace the Municipal Solid Wastes (Management and Handling) Rules, 2000, which have been in place for the past 16 years. To honour these guidelines, various cities introduced the Door to Door Garbage Collection (DDGC) system. Therefore, it is the responsibility on the part of the DDGC program to ensure proper collection, segregation, transportation, processing and disposal of municipal wastes. Table 1, represents the data on door-to-door collection and segregation at source for selected cities and towns as reported by the cities and towns themselves [3].

MSW COLLECTION & SEGREGATION AT SOURCE  
LARGE CITIES: SELF-REPORTED

City	State	Population (million)	Door-to-door Collection from Households (%)	Segregation at Source (%)
Mumbai	Maharashtra	20.0	80	nil
Delhi	-	19.1	39	2
Bengaluru	Karnataka	10.4	71	50
Chennai	Tamil Nadu	10.0	80	nil
Hyderabad	Telangana	9.1	73	nil
Ahmedabad	Gujarat	7.5	95	nil
Surat	Gujarat	5.8	60	12
Pune	Maharashtra	5.8	50	52

Table 1

### II. MOTIVATION

Various cities have failed to conduct door-to-door garbage collection service. As a result, heaps of waste got litter on the street. Roads are not swept on a daily basis in various cities. Solid waste causes bacterial and infections to develop, accordingly influencing the general health of people [4].

In an informal study of the punctuality of Garbage Truck, we found that on an average Garbage Truck was never on time, people kept waiting and have to check out for garbage truck leaving their work in between, and worst of all, sometimes they never showed up at all. For the people with tight time schedules, the Door to Door

Garbage Collection (DDGC) system unreliability can greatly affect them. Customers complaints began to pile up on daily basis. But there is no system to register complaints about each zone.

People would think, "I wish I knew when the Garbage Truck was coming." Our device is engineered to address this question. It will allow anyone with an Internet connection to track the Garbage Truck and know if it is early, on time, late, or even if it is skipping their stop. With this information people can adapt their schedule to meet the projected arrival time and help to register user complaints.

### III. TECHNOLOGY USED

#### A. GPS Module

Global position system (GPS) is used in vehicles for both navigation and tracking [5]. GPS is a space-based satellite navigation system. It provides location and time information in all weather conditions, anywhere on or near the Earth. The GPS consists of satellites that orbit the earth. These satellites are geosynchronous with an orbital period that is the same as the Earth's rotation period. So, they maintain exactly the same position with respect to the earth below them. All the GPS satellites transmit radio signals, which are then captured by a GPS receiver and used to calculate its geographical position. GPS receiver converts the received signals into position and estimates time. Architectural diagram of Vehicle Tracking System is shown in fig.1.

#### B. GSM/GPRS Module

General Packet Radio Service (GPRS) is an enhancement of GSM networks to support packet switched data services such as email and web browser in addition to existing GSM data services such as Short Message Service (SMS) and Circuit Switched Data (CSD) for fax transmission. GPRS operates on the existing GSM network transmission. Thus, it does not overload the existing GSM network traffic and can efficiently provide data services [6].

Global system for mobile communication (GSM) and Global Packet Radio Service (GPRS) is used to establish the communication between computer and GSM/GPRS module. A GSM/GPRS MODEM can perform the following operations:

- Receive, send or delete SMS messages in a SIM.
- Read, add, search phonebook entries of the SIM.
- Make, Receive, or reject a voice call.

#### C. Microcontroller

It is responsible for acting as an interface between GSM module and GSM receiver. A microcontroller is a small computer on a single integrated circuit containing a processor core, data memory, A/D converter and programmable input/output peripherals. In this device the microcontroller is programmed in such a way that it stimulates the GSM modem in message forwarding when a request is sent by the user [7].

#### D. Google Earth and Google Map

Google Earth is a very popular free software that provides maps by satellite images around the world [8]. Google Map is a version of Google Earth that shows the maps on-line using with a web server and a web browser. The program provides plug-ins for community to show objects in the program. Such objects are, for example, 3D objects of skyscrapers using Sketch Up software, pin objects to indicate a point of interest (POI), and line objects to show a track. To show such objects, Google Earth utilizes its own programming language called KML (Keyhole Markup Language) which is an Extensible Markup Language (XML) that is written to describe how the objects are rendered.

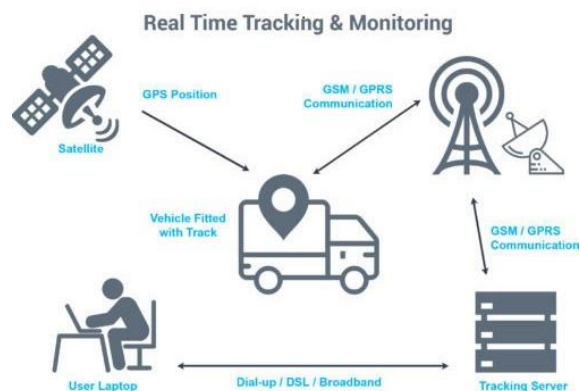


Figure 1: Architectural Diagram of Vehicle Tracking System

### IV. WORK DONE : VEHICLE TRACKING SYSTEM

This system helps to track and determine the position of Garbage Truck of each zone adopting the GPS technology as well as the GSM technology.

Android Studio provides a platform to develop applications for smart phones. Android Studio is selected because it is easy to use and provides user friendly environment. Fig. 2, shows the graphical user interface (GUI) of the android based Smart Waste Management System using Vehicle Tracking System. The login screen is used

to protect the data from unauthorized users and attackers. An authorized user must register itself before accessing the application. If the user is already registered, he / she enters the email and the password in order to login into the application. Once the user is login to the application, the main screen appears as shown in Fig 3. When the user clicks on the Vehicle Button the current location of the vehicle will be plotted on a google map as shown in Fig. 4. Complaint section shown in Fig. 5, is used to further improve the application by taking the feedback of the residents and is also used to raise the complaints.

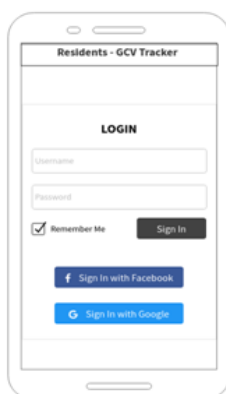


Fig 2. Resident Login Screen



Fig 3. Side menu and sub sections

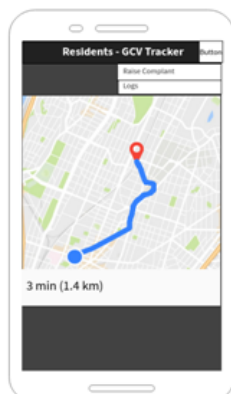


Fig 4. Live location of driver



Fig 5. The Complaint Section

## V. CONCLUSION AND FUTURE WORK

This paper presents a way of locating the Garbage Truck, so that not only the whole process of Door to Door Garbage Collection become efficient. The user can easily monitor the current location of the vehicle at any time. This model can

be used for effective management of solid waste collection and disposal, and help in reducing time taken to collect and dispose solid waste.

Future work will focus on finding the shortest path for each zone and finding an efficient solid waste collection method so as to make our city clean and make our Prime Minister dream come true of "Swachh Bharat".

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Mr. Saurabh Chauhan, et. al. "Smart Waste Management Using Vehicle Tracking System." International Journal of Engineering Research and Applications (IJERA), vol.10 (06), 2020, pp 10-12.