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Smart City Waste Management System for Swachh Bharat with IOT

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Abstract: ***To make cities smarter the cities must be clean, green, Internet of Things (IoT) can play an important role. We present a waste collection management solution based on making waste bin smart using an IoT prototype with sensors. It can read, collect, and transmit huge volume of data over the Internet. Such system is based on the android mobile application and the sensor. We are using the different sensor for obtaining the real time status of the dustbins and then update the information by sending it to the server or mobile application via Wi-Fi module. This paper represents the smart system for the smart cities which makes the peoples responsible to keep the city clean and healthy. This project will definitely make the waste management more reliable and smart for the big cities as well as for small towns to make their city a smart city. We use NodeMCU microcontroller and sensor for making the hardware system working and an android application for displaying and tracking the data which is send by the dustbin module.***
Keywords: IoT, smart dustbin, NodeMCU, IoT enabled dustbin etc.

I. INTRODUCTION

As the population is increasing the solid waste is also increasing in urban and rural areas and waste management has become a global concern. We need to take right decision in order to manage this overflowing garbage. Mainly there are three types of sources where garbage is generated viz. residential, commercial and industrial. The garbage produced in the residential area can be collected directly from home or by making an arrangement for mass collection in that area and can be lifted using vehicles. In case of restaurants, malls and other commercial establishment garbage can be collected directly from the unit using vehicles. The data has been received, analyzed and processed in the database, which displays the status of the Garbage in the dustbin on the application of authorized person mobile.

The concerned authority get alert about dustbin is full and informs person whoever is responsible for collecting garbage from the particular areas. The garbage trucks collect the garbage from the completely full dustbin and dispose it. The authority will check the garbage for every two hours and it will give the alert message the garbage is not cleaned. After cleaning the trash can the ultrasonic sensor checks the trash can whether it is empty or full and if the trash can is empty then it sends the information to the NodeMCU, then it initiates the cleaning process by switching on centrifugal pump, it flows the at public places gets overflowed in advance before the commencement of the next cleaning process. This, in turn, leads to various hazards such as bad odor & ugliness to that place which may be the root cause for the spread of various diseases. To tackle this problem, we propose the Smart dustbins. IoT module is used to control and monitor the waste and the information will be sent to the particular organization and the common man.

Operates to ensure the efficient measurement of its status while consuming minimum energy. At present, most of the cities around the world require challenging solutions for solid waste management, as there is rapid growth in residential areas and the economy. Solid waste management is a costly urban service that consumes around 30% of Municipal Corporation's annual budget in many developing nations.

After various surveys and study done by numerous organizations it has been seen that factors affecting effective solid waste management are due to improper management and lack of cutting edge technology infrastructure. Municipal authorities have inadequate resources for waste management institutions to effectively collect the waste generated. It becomes an excessive wastage of resources when bins are collected that are filled up partially. By optimizing the quantity and deployment of smarter technology for waste collection and management activities can be carried out very efficiently to reduce operational cost.

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II. LITERATURE SURVEY

Solid waste management is one of major aspect which has to be considered in terms of making urban area environment healthier. The common dustbins placed by the municipal corporation are leading no. of health, environmental and social issues. Various causes are there like improper dustbin placement in city, improper system of collecting waste by City Corporation, and more specifically people are not aware enough to use dustbins in proper way. [1]

These various major causes are leading serious problems like, an unhygienic condition, air pollution, and unhealthy environment creating health disease. Up till now, research has been carried out by developing a Software Applications for indicating dustbin status, another by Shortest path method for garbage collecting vehicles by integrating RFID, GSM, GIS system; but no any active efforts has been taken paying attention towards managing such waste in atomized way. Considering all these major factors, a smart solid waste management system is designed that will check status and give alert of dustbin fullness and more significantly system has a feature to literate people to use dustbin properly and to automatically sense and clean garbage present outside the dustbin. Thus presented solution achieves smart solid waste management satisfying goal of making Indian cities clean, healthy and hygienic.[2]

"Swachh Bharat Abhiyaan" is a national campaign initiated by the Government of India, which covers 4,041 cities and towns, to clean the streets, roads and infrastructure of the country. The main motto of the mission is to cover all the rural and urban areas of the country. With proliferation of Internet of Things (IoT) devices such as Smartphone & sensors, this paper describes the effective dry and wet dirt collection using Embedded System. The main motto of the application is collection of dry and wet waste separately which is placed in a conveyor belt on which the dry waste collected dust bins are placed left side and wet waste collected bins on right side.

The system will get the input through the dust collecting person through switches and sends signal to the Micro controller unit using RF technology and that makes the H-bridge to rotate conveyor belt. When the belt starts rotating clockwise the dust bin's lid is automatically closed, simultaneously the waste is dumped into the underground garbage container placed at the ground floor. Here IoT module is used to control and monitor the waste and the information will be sent to the particular organization and the common man. The mobile app shows the collection of waste. [3]

The ultimate need of the hour for developing nation is the key for "Smart City". The influential ecological factor that poses to be a threat to this may include: hazardous pollution and its subsequent effects on health of humanity, alarming global warming and depletion of ozone layer etc. Mostly Environmental pollution may be owing to the Municipal Solid Left- over (MSL).In this paper, we discuss a smart mechanism for improving the management of wastes in cities. The proposed system is based on the foundation of geographic information systems (GIS), and optimization algorithms. It consists of an IoT based prototype with sensors to measure the waste volume in containers or waste bins, with facility to transmit information over the Internet. [4]

III. RELATED WORK

A. Problem Definition

Nowadays, waste management is one of the problems on which millions of dollars are spent worldwide. The key issue in waste management is waste collection and sorting. Also, one of the issues in the waste management is that the garbage bin

At public places gets overflowed in advance before the commencement of the next cleaning process. This, in turn, leads to various hazards such as bad odor & ugliness to that place which may be the root cause for the spread of various diseases. To tackle this problem, we propose the Smart dustbins.

B. Motivation

Issues in the waste management, Waste truck drivers need navigation system and reporting problem system. Citizens want to have better service, lower cost and having easy accessible reports. Citizens as well as the government have a feasible and flexible system for waste management so that the citizens will be healthy and city clean and the government will avail this services at low cost and on time.

The motivation to Empowered Swachh Bharat mission and E- governance based on digital India. It also Reduce environmental pollution. The main goal of this project is to develop system a target two crucial problems, cost efficiency and timely waste collection processes.

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IV. PROPOSED SYSTEM

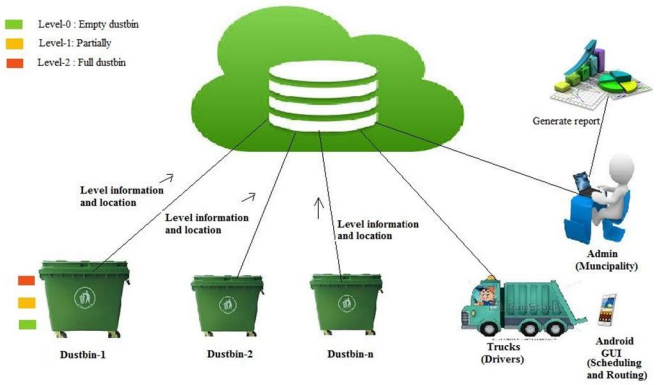


Fig 4.1: Proposed System Architecture

Fig System Architecture Shows the architecture of our proposed system in which the IoT enabled dustbin are sending their status like level and location to the server of the system. The status information from the server can be accessed by the administrator, public and truck driver to monitor the dustbin status.
The truck driver is get known about the dustbin status with the help of an Android application so that he knows the level and location of the dustbin which is full now. Administrator can take the decision and action against the truck driver.
The proposed system is divided into three module

A. Administrator
B. Truck Driver
C. Public

This system that we have proposed improves the current scenario, by bringing all the data on the internet so that systems operate more efficiently.

Primarily, there is level sensor and toxicity sensor that will be sending the data collected at intervals of 15 minutes each. With the following data, we have a decision taking system that will decide whether to include the dustbin in the list of collection and mark it on the map of the municipal application. This will in fact save a lot of efforts and fuel wasted in collection process as real-time monitoring of bins is done. As well as the parameters of the dustbin is used to notify the user about the status of the dustbin so that user can dump their waste accordingly. All the municipal waste collection trucks would be registered with some more information like their capacities and registration numbers, etc. If a citizen or user wants to add the waste to the dustbin, they can scan their RFID which will trigger the lid of the bin to open, and user can then add waste. The amount of waste added is monitored using weight sensors integrated in the dustbin, according to the amount of waste our system will calculate points which will be rewarded to the user in an Android application consisting of a virtual wallet.

1) Mathematical Model

S= {I, P, O, R}
S=System I=Input P=Process O=Output
I = {I0, I1, I2}
I0=Bin details I1=Admin details I2=Driver details
P= {p0, p1, p2, p3}
P0= Receive message from bin to admin. P1= Schedule and Route
P2= Send message to the driver P3= Receive message from admin
O= {O1, O1, O2}
O0= Schedule which first bin clean
O1= Route to which bin is close to garbage collector truck
O2= Clean bin

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V. EXPERIMENTAL MODEL

The experimental set up of the Smart Waste Management system in which the three dustbin contain the ultrasonic sensor.



Fig 5.1: Implemented Model Based Design of Smart Waste management System

When there is some waste in any of the dustbin shown in figure 5.8. The value on the web admin page changes with respect to that dustbin and when this system is connected to the network via Wi-Fi module.



Fig5.2: Garbage in dustbin

Once the admin Sign In to the web page he would be able to see the information regarding the bin around him on the Main Screen.

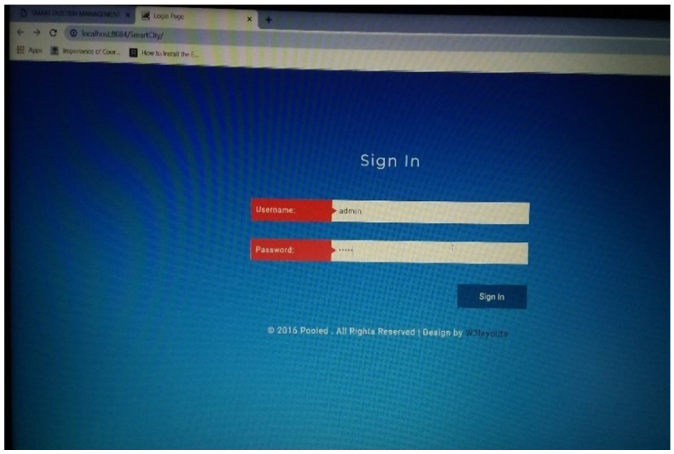


Fig 5.3: Web page Sign In

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As shown in above figures the system will display information Bins, driver, vehicle, assign vehicle and Google map of admin web home page.

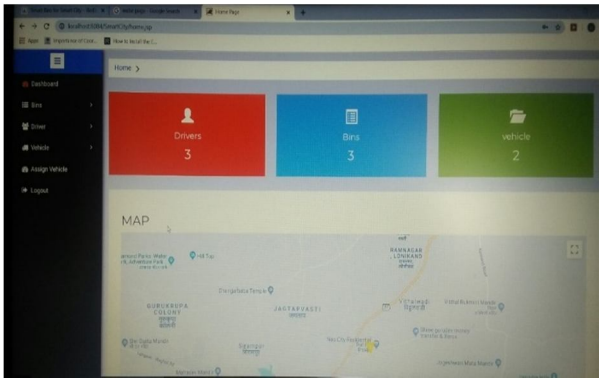


Fig.5.4 Admin web home page

As shown in above figures the system will display the status value of dustbin in numerical digits. Initially the dustbin is empty the status value is 0, dustbin is partially full the status value is 1 and dustbin is full the status value is 2.

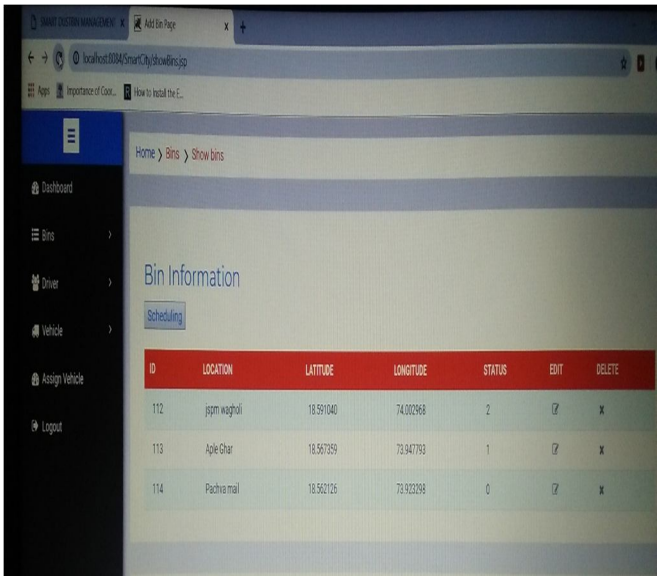


Fig.5.5 Value of dustbin on web page

The admin can register driver and can assign each dustbin to an individual driver and the driver gets notification from the dustbin about cleaning the dustbin when he/she login there account.

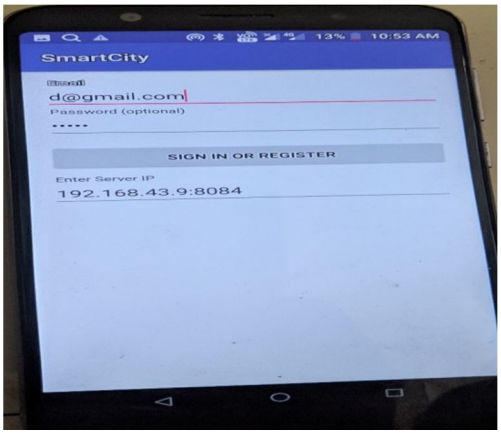


Fig.5.6 Android application Sign In

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When the user Sign In to the android application he will be taken to the Google Maps where the location of the bin is displayed.

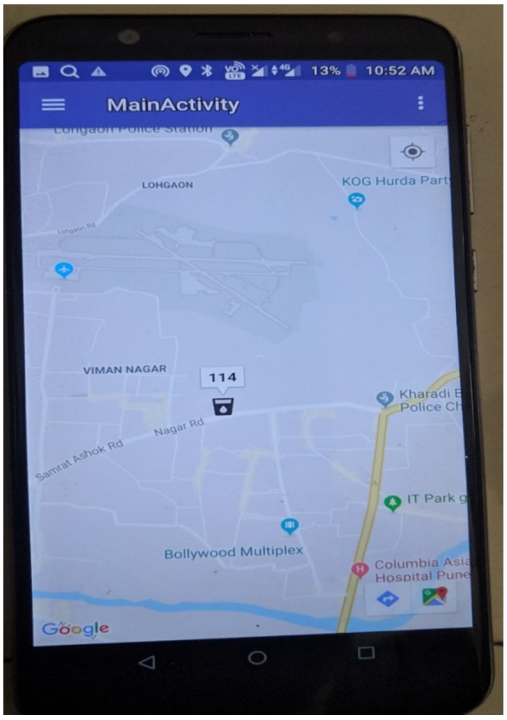


Fig.5.7 Location of the bin displayed on Google maps

VI. OTHER SPECIFIACTION

A. Advantages

1) Waste collection is done on timely basis which also avoid the fuel wastage and give notification about overflowing of the wastes from the bins.
2) Ecological pollution decreases.
3) Inefficiency of the waste collection and sorting processes increases.
4) It reduces environmental pollution.
5) It provides Real time solution for cleaning our cities.

B. Applications

1) Empowered swachh bharat mission.
2) E-governance based on digital India.
3) Reduce environmental pollution.
4) Real time based cleaning of our cities.
5) It makes our system transparent between Municipal Corporation, workers and public.

VII. CONCLUSION

We have implemented garbage management system by using smart dustbins to check the level of smart dustbins whether the dustbin are full or not. In this system when garbage is full the information is send to the authorized person. By implementing this proposed system we can develop the smart city concept and cost is reduced. By the effective usage of smart dustbins can the resource is optimized. This system reduces the traffic in the smart city, so that environment will be cleaned. The existed system will inform the status of the garbage in each and every dust bin, so that the concerned authority send the garbage collection vehicle only when the dustbin is full. By implementing this proposed system we can develop the smart city concept and cost is reduced. The existed system will inform the status of the garbage in each and every dust bin, so that the concerned authority can send the garbage collection vehicle only when the dustbin is full. We have implemented garbage management system by using smart dustbins to check the level of smart dustbins whether the dustbin are full or not.

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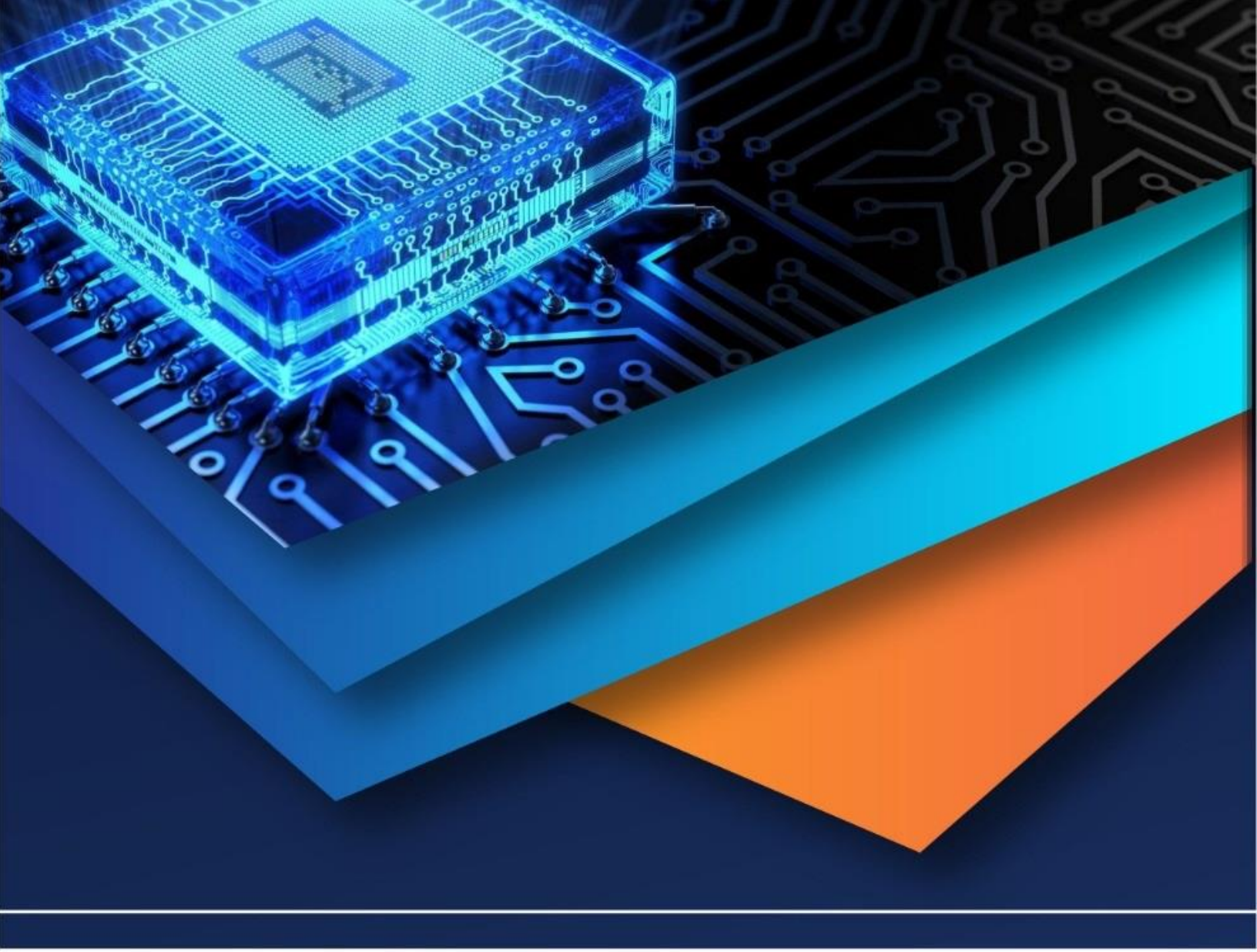
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