Top-k Query based Dynamic Scheduling for IoT-Enabled Smart City Waste Collection

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Abstract - *Waste is an important issue, which needs to be tackled smartly. The main purpose of this paper is to develop the system which uses the information collected from sensors to manage the waste collection. In proposed system, Smart waste Dustbins are located in several areas of city are connected to Internet wirelessly, they equipped with sensors which collects the data about level of collected waste in Smart waste Dustbin. Then Smart waste Dustbin sends this information to central web portal using WIFI module. If the Smart waste Dustbin is filled up to its threshold value then the message is displayed on web portal and the responsible authority take proper action and it will shows the all information on to the Smart waste Dustbin Application on the users mobile phone.*

Key Words: **Ultrasonic sensors, Android application, Arduino, GUI, IOT, Internet etc.**

1. INTRODUCTION

District administrations are interested in controlling the process of waste collection, checking quality of service, quick and legal ways for solving disputes and problems. Waste truck drivers need navigation system and reporting problem system. Citizens want to have better service, lower cost and having easy accessible reports. The major advantage of this proposed system is it will stop the dustbin overflowing around the road side and localities as smart bins are used in real time.

1.1 Problem Defination

Waste management is one of the major environmental problems of Indian cities. The problem is over flowing of wastages on the roads. Several efforts have been invested in tackling.

1.2 Goals and Objectives

- Sensor based smart waste dustbin will judge the level of waste in it and send the message directly to the municipal corporation.
- It can sense all the type of waste material either it is in the form of solid or liquid.
- According to the filled level of the smart waste dustbin, the vehicles from the municipal corporation will choose the shortest path with the help of the "Transportation Software", which will save their time.
- It emphasizes on "Digital India".

- The system is simple. If there is any problem with any equipment in the future, that part is easily replaceable with new one without any difficulty and delay.

2. LITERATURE SURVEY

P. Haribabu, Sankit R. Kassa, J. Nagaraju, R. Karthik, N. Shirisha, M. Anila, "Implementation of a Smart Waste Management system using IOT", IEEE Proceedings of the International Conference on Intelligent Sustainable Systems, 2017.

[1]Waste collection services, today, are exhausted and unable to bear the burden of rising cities. It is one of the biggest ongoing challenges, being faced by developing economies, where a large variety of goods ranging from cars to metal and hardware end up in inadequately managed and uncontrolled dumpsites, spreading diseases and increasing pollution. However, most of these plans have been able to manage waste once it has already been created. We, therefore, propose a system through a mobile application associated with a Smart Trash Bin .The main aim of this application is to reduce human resources and efforts along with the enhancements of a smart city vision. At regular intervals dustbin will be squashed. Once these smart bins are implemented on a large scale, by replacing our traditional bins present today, waste can be managed efficiently as it avoids unnecessary lumping of wastes on roadside.

Ujwala Ravale Anindita Khade Namrata Patel Suvarna Chaure, "SMART TRASH: An Efficient Way for Monitoring Solid Waste Management", IEEE International Conference on Current Trends in Computer, Electrical, Electronics and Communication, 2017.

[2]Solid waste management is primary issue in modern cities due to increase population, change in our lifestyle and increased in number of industries. As we have seen number of times the dustbins get overflowed and the concerned people don't get the information within a time and due to which filthy condition formed around the surroundings, at the same time bad smell spread out due to waste, bad look of the city which paves the way for air pollution and to some harmful diseases around the locality which is easily spreadable. It creates unhygienic condition for the people and creates bad ugliness around the surroundings. This leads in spreading some deadly diseases & human illness, to avoid such a situation we are planning to design Solid Waste Management using Smart Bin. This will

help to provide a better standard of living for people. Also the waste generated can be forwarded to recycling centers as well as biodegradation centers according to the type of waste. The major advantage of this proposed system is it will stop the dustbin overflowing around the road side and localities as smart bins are used in real time.

Saurabh Dugdhe1 , Pooja Shelar, Sajuli Jire and Anuja Apte, "Efficient Waste Collection System", IEEE International Conference on Internet of Things and Applications, 2016.

[3]Waste is an important issue, which needs to be tackled smartly. Wisely, we segregate the waste at our homes for ease at processing and recycling. We observed trash vans/trucks come irregular to homes creating a havoc of households. Due to this many civilians empty their overloaded dustbins in open spaces. This in turn increases environmental pollution. We got inspired from "Swatch Bharat Abhiyan" which is a national campaign by the Government of India, to clean the streets, roads and infrastructure of the country. The citizens want to have better service, lower cost and having easy accessible reports on what has been done and how much it cost. The proposed system aims to schedule trucks by finding shortest path between the almost filled waste bins and bins which have produced harmful gases and gives a route for collection. The system will consist of setting up smart waste bins/ trash cans per society, which will be IOT enabled. These smart bins will transmit information about its fill status and harmful gas levels. Proposed system provides efficient and optimized routes to collect maximum waste with less cost and fuel. The system provides estimated dates for collection of waste, real time bin status, expected fill up dates for the bins, and optimized shortest path for waste collection. The system will summarize the collected information and generate reports.

Sahil Mirchandani, Sagar Wadhwa, Preeti Wadhwa, Richard Joseph, "IoT Enabled Dustbins", IEEE International Conference on Big Data, IoT and Data Science, 2017.

[4]Nowadays, waste management is one of the problems on which million 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 IOT enabled dustbins in this paper. These bins use RFID tags for tracking of the wastes linked with a web-based online system and according to the weight of waste added, host server calculates the points and updates in the database of virtual wallet. Also, it measures the fullness of the dustbins and updates the status of each dustbin on the municipal server. It notifies them when the dustbin is full and provides the shortest route to empty all the dustbins based on the capacity of the municipal waste loading vehicles. Our system, target two crucial problems, cost efficiency in waste sorting and waste collection processes.

2. PROPOSED SYSTEM

In proposed system, Smart waste Dustbins are located in several areas of city are connected to Internet wirelessly, they equipped with sensors which collects the data about level of collected waste in Smart waste Dustbin. Then Smart waste Dustbin sends this information to central web portal using WIFI module. If the Smart waste Dustbin is filled up to its threshold value then the message is displayed on web portal and the responsible authority take proper action and it will shows the all information on to the Smart waste Dustbin Application on the users mobile phone.
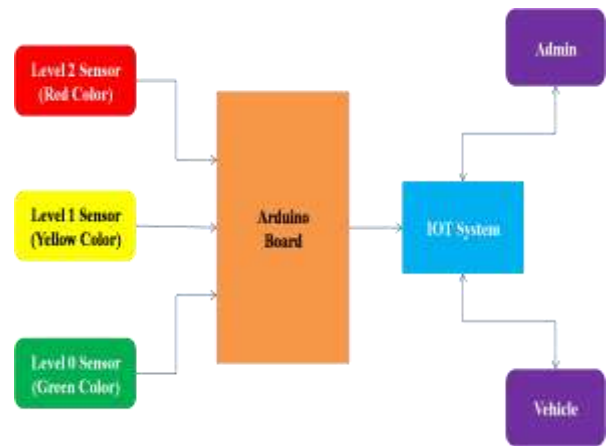

Fig 1: Block diagram

3. SYSTEM DESIGN

To design system for waste collector which will show the information about level of waste in waste collector to user and on android application and also show the all available waste collector in nearby area and path to nearest waste collector.

Fig 2: System Architecture

4. MODULES

1. Smart bin module

- Level detector consists of infrared sensor which is used to detect the level of the garbage in the smart waste dustbin.
- The output of level detector is given to Arduino.
- When the smart waste dustbin is filled up to the highest level, the output of infrared sensor receiver becomes active low.

2. IOT Module-

This output is given to Arduino to send the message to the admin module via IOT module.

3. Admin module

- Admin module is present where all the activities are manage.
- Scheduling
- Routing
- Update status
- Send Notification

4. Driver module

- Receive notification
- Clean bin
- Send notification

5. APPLICATIONS

There are many applications that help users to monitor their running activities.

- Empowered 'Swatch Bharat Mission'.
- E-governance based on digital India.
- Reduce environmental pollution.
- Real time based cleaning of our cities.
- It makes our system transparent between Municipal Corporation, workers and public.

6. CONCLUSION

This proposed approach can be used to keep our city clean. We started from smart waste Dustbin. By using network environment, the real time accurate data from the implemented system could be used for the efficient solid waste management system. The system can collect accurate data on real time which can be used further as an input to a management system. With load cell calibration approach, it simplifies the calibration process so it can be attached to commonly used waste-bin without changed or modification. The level sensors also can be attached to common waste-bin. So the prototype is suitable for using in conventional waste management infrastructure.

7. FUTURE WORK

- For future, instead of person in the vehicle we can make use of a line follower robot which does not require a man power to move the vehicle.
- This path follower robot is able to follow line marked on contrasting background usually black line on a white surface or white line on a black surface.
- So using line follower robot technology vehicle moves to the particular trash bin area based on the information sent from the LoRa Gateway. So this makes the system more reliable.
- In future, some additional features will add to this project to crush and recycling plastics and other materials automatically.

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