



Smart Garbage Monitoring System Using IoT

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Abstract:

Waste management is one of the primary problems faced in India irrespective of the case of developed or developing regions. The key issue in the waste management is that the garbage bins at public places gets overflowed well in advance before the commencement of the next cleaning process. It in turn leads to various hazards such as bad odor and ugliness to that place which may be the root cause for the spread of various diseases. Healthy environment is imperative to a healthy and a happy community so this problem needs to be tackled smartly. As the Internet of things (IoT) is giving us unique solutions to everyday problems, we propose a smart garbage alert system for efficient waste monitoring. The proposed system will consist of waste bins that are equipped with ultrasonic sensors which are interfaced with Arduino Uno and a Wi-Fi module. The system will collect the waste fill level status and upload the data to database. This data will be used to represent the fill levels of all the bins on the android application. Once a bin gets filled, notification will be sent to the appropriate client based on their location. Based on the number of filled bins an optimized pickup path will be displayed to cover all the filled bins. This system will thus eventually reduce the manual process of verification of the garbage fill levels.

Keywords: Smart Devices; Internet of Things ; Wireless Sensor Network ; Front End ; Android ; Garbage Monitoring System.

I. INTRODUCTION

A healthy environment is necessary if you want to stay healthy. Though the world is in the stage of upgradation there is yet another problem that has to be dealt with which is “Garbage”. In most of the places overflowing of garbage bins takes place. This gives rise to various diseases as large number of insects and mosquitoes breed on it. In India the absence of efficient waste management has led to some serious issues, it is a big challenge faced by most of the regions of India. Hence smart garbage monitoring system is a system which can eradicate the problem or can reduce it to the minimum level. Our present prime minister of India Shri Narendra Modiji has introduced the concept of implementing 100 smart cities in India. “Swachh Bharat Abhiyan” was initiated to ensure a clean environment, and the smart garbage monitoring system is going to play a big role in this. We are living in the age where the task and systems are fusing together with the power of IoT to have more efficient system of working and to execute jobs quickly. With all the power at our fingertips that is what we have come up with.

The Internet of Things (IoT) shall be able to incorporate transparently and seamlessly a large number of different systems, while providing data for millions of people to use and capitalize. One of the main problem with our environment has been solid waste management which impacts the health and environment of our society.

The detection, monitoring and management of wastes are one of the primary problems of the present era. The traditional way of monitoring the waste bins is a difficult process and utilizes more human effort, time and cost which can easily be avoided. with our present technologies. So we have proposed a method in

which waste monitoring is automated. The proposed system is an innovative way that will help to keep the cities clean and healthy.

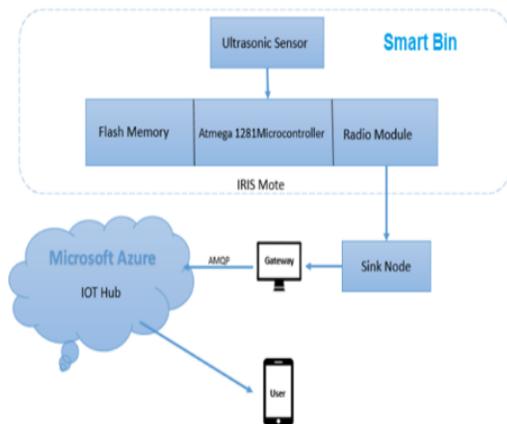
II. LITERATURE SURVEY

Maher arebey [1] proposed an integrated system Solid waste management is a big challenge in urban areas for most of the countries throughout the world. An efficient waste management is a prerequisite for maintaining a safe and green environment as there are increasing all kinds of waste disposal. In this paper an integrated system is introduced which comprises of Radio Frequency Identification (RFID), Global Position System (GPS), General Packet Radio Service (GPRS), Geographic Information System (GIS) and web camera. The RFID is used for the purpose of verification, the GSM module is used for the purpose of communication. This system uses web cameras for taking the snapshots of the garbage bins at regular intervals of time. Waikhom reshmi [2] proposed an electronic system, in order to provide a solution to irregular waste disposal system. The designed system makes use of biosensor sensor, weight sensor and height sensor to detect overflow of the waste in the dust bin. The technology which are suggested in this paper, achieved effective waste management system where sensors unit are used for sensing, microcontroller for controlling and for communication they have used GSM module. The LCD display is used to display the current condition of the waste. B. Vijayalaxmi [3] proposed a smart alert system for garbage clearance by giving an alert signal to the municipal web server for instant cleaning of dustbin with proper verification based on level of garbage filling. This process is aided by the ultrasonic sensor which is interfaced with Arduino UNO to check the level of garbage filled in the dustbin and sends the alert to the

municipal web server once the bin is filled. After cleaning the dustbin, the driver confirms the task of emptying the garbage with the aid of RFID Tag. RFID is a computing technology that is used for verification process and in addition, it also enhances the smart garbage alert system by providing automatic identification of garbage filled in the dustbin and sends the status of cleanup to the server affirming that the work is done. The whole process is upheld by an embedded module integrated with RFID and IOT Facilitation. Andrei Borozdukhin [4] proposed a solution of the optimization garbage removal problem in the large cities is suggested. In this paper, system architecture is defined to find time-optimal dynamic route for garbage trucks within “Smart Clean City” project. This system makes use of infrared and ultrasound sensor for inspection of fullness. It makes use of GSM module for communication. After 70% fill level, the system decides to remove garbage from it. In this system the sensor is located at the side of the container.

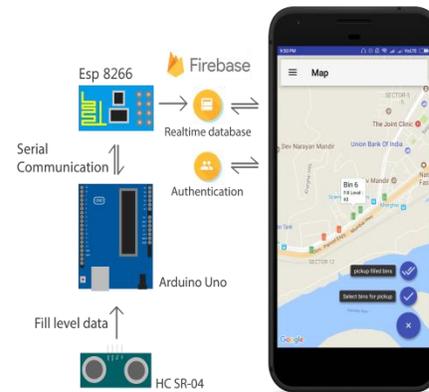
III. RELATED WORK

Jitendra Joshi [5] presents a solution to the existing waste management problem which integrates the idea of IoT with wireless sensor networks. This paper also puts forward the concept of a network of smart garbage bins based on the stack based front end approach of integrating wireless sensor network with the cloud computing and discuss how machine learning techniques like decision forest regression can be applied to the sensor data leveraged by the system to gain useful insights to improve the efficiency of the garbage monitoring. This system makes use of ultrasonic sensors. Here in this system IoT azure hub is used. Azure IoT hub is a fully managed service that enables reliable and secure bidirectional communication between millions of IoT devices and a solution backend. Bins are equipped with sensor nodes.



It measures the level of garbage using ultrasonic sensor attached to GPIO pin. Sensing interval is a variable parameter. These motes are rugged, low cost, low powered devices that can last a week on AA battery. While deploying each bin we can assign a static relocation against a device ID. So as to eliminate the use and cost of installing the GPS sensor. So we have a network of garbage bins each equipped with such a sensor node which sends all the data to the sink node. There are multiple such sink nodes which further relays the data to the gateway node which via means of web service uploads the data to the cloud. The notification for the garbage collection is sent to the respective authority informing them to collect the garbage.

IV. SYSTEM ARCHITECTURE



The arduino module is located on the top of the bin. The various components used in the proposed system are ultrasonic sensor. The advantage of using ultrasonic sensor is it is cheap and is dust free. The advantage of using the ultrasonic sensor is it is cheap and is dust free. Ultrasonic sensor is used to measure the fill level of the garbage. The existing system makes use of more than one sensor for the same, so the cost of using multiple sensors is eliminated. The wifi module is used for communication. ESP8 266 module is used that connects the appropriate wifi network without any error. Android application is developed for real time simulation of fill level of the garbage. Using the proposed system waste collection is optimized based on real time data and predictive analytics. The detailed working of the system is explained in propose system.

V. PROPOSED SYSTEM

The ultrasonic sensor will measure fill level of bin after certain interval. This data will be sent to the firebase database by the wifi module. After successfully sending the data the wifi module will go on the battery saving mode for certain interval of time using the minimum power. The firebase database will store the fill level of all the bins along with the timestamp. All necessary notifications and alerts will be sent from the server to the required dustman. The client application will show the location of the individual bins on the map. Clicking on a particular bin would present the fill level description. The dustman will get notification when a bin is filled in their vicinity. The dustman will be shown a route consisting of all the filled bins that they can pickup. The client will have options to collect or the filled bins or they can select the number of bins for pickup. After this bins will be marked for pickup. Using the location of dustman the process of verification process will be done i.e. if the user gets closed to the bin they get the option to pick up after which the ultrasonic sensor will verify the empty fill level.

The system is divided into 3 units

1. Android application
2. Arduino uno module
3. Firebase database and functionality

Android app: It is the user interface for interacting with the system. The app will perform functions like login, notifying the client about filled bins, showing the bins on the map with their fill level, showing their shortest pickup routes for all the bins.

Arduino Uno module: This unit will be interfaced with a Wi-Fi module and an ultrasonic ranging sensor. The Wi-Fi module will request for fill level after a certain interval of time. The Arduino will sense the fill level using ultrasonic sensor. If there is a change in fill level, the data will be forwarded to the Wi-Fi module. The Wi-Fi module will then connect to the firebase and update the fill level for that bin in the database.

Firestore: The firestore authentication is used for user login purpose. The firestore realtime database will be used to store the fill levels of all bins. The firestore cloud functions will define the operations to be performed on the data. Firestore notifications will be used to send fill level notification on the client application.

VI. CONCLUSION

An Arduino based smart garbage monitoring and alert system is devised which eliminates the need of manual verification process which is prone to human-error and neglect. The system averts the irregular cleaning of the bins by sending alerts to the concerned individuals. The garbage bins in public places get overflowed before the commencement of next cleaning process. This system provides real-time monitoring of fill-levels, hence the pick-ups can be organized to prevent overflowing of the bins. Thus, this system helps to reduce human intervention in garbage monitoring and makes the entire process more efficient.

VII. REFERENCES

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