IoT Based Automatic Waste Management System

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Abstract: The key issue in the waste management is that the garbage bin 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 & ugliness to that place which may be the root cause for spread of various diseases. To avoid all such hazardous scenario and maintain public cleanliness and health this work is mounted on a smart garbage system. The main theme of the work is to develop a smart intelligent garbage alert system for a proper garbage management. This Paper proposes 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 Raspberry Pi to check the level of garbage filled in the dustbin and sends the alert to the municipal web server once if garbage is filled. Ultrasonic sensors 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 clean-up to the server affirming that the work is done. The whole process is up held by an wifi module integrated with and IOT Facilitation. The real time status of how waste collection is being done could be monitored and followed up by the municipality authority with the aid of this system. In addition to this the necessary remedial / alternate measures could be adapted. An Web based application is developed and linked to a web server to intimate the alerts from the microcontroller to the urban office and to perform the remote monitoring of the cleaning process, done by the workers, thereby reducing the manual process of monitoring and verification. The notifications are sent to the Web based application using wifi module.

Keywords: Raspberry Pi, Ultrasonic Sensor, WIFI Module.

I. INTRODUCTION

Internet and its applications have become an integral part of today’s human lifestyle. It has become an essential tool in every aspect. Due to the tremendous demand and necessity, researchers went beyond connecting just computers into the web. These researches led to the birth of a sensational gizmo, Internet of Things (IOT). Communication over the internet has grown from user - user interaction to device – device interactions these days. The IoT concepts were proposed years back but still it’s in the initial stage of commercial deployment. Home automation industry and transportation industries are seeing rapid growth with IoT. Yet not many articles have been published in this field of study. This paper aims in structuring a state of the art review on IoT. The technology, history and applications have been discussed briefly along with various statistics. Since most of the process is done through the internet we must have an active high speed internet connection.

The technology can be simply explained as a connection between human’s computers-things. All the equipment’s we use in our day to day life can be controlled and monitored using the IoT. A majority of process is done with the help of sensors in IoT. Sensors are deployed everywhere and these sensors convert raw physical data into digital signals and transmits them to its control centre.
The generation and disposal of waste in large quantities has created a greater concern over time for the world which is adversely affecting the human lives and environmental conditions. Wastes are the one which grows with the growth of the country. Segregation of waste is important for proper disposal of vast amount of garbage modern society.

By this way we can monitor environment changes remotely from any part of the world via internet. This systems architecture would be based on context of operations and Processes in real-time scenarios. Smart collection bin works in the similar manner with sensor namely ultrasonic sensor that indicates its different levels. The ultrasonic sensors will show us the various levels of garbage in the dustbins and also the weight sensor gets activated to send its output ahead when its threshold level is crossed. These details are further given of the Raspberry Pi and the controller gives the details to the transmitter module (GSM module). At the receiver section a mobile handset is needed to be connected to the GSM module so that the detail of the garbage bin is displayed onto the HTML page in web browser of our mobile.

II. LITERATUREREVIEW

Some of the following garbage type Packaging waste, Agricultural waste, Inorganic waste, Liquid waste etc.

In solid waste bin monitoring system garbage bin set the public place then for garbage bin location. The Ultrasonic Sensor detect levele for garbage bin. GPS send image for work station. The Ultrasonic Sensor sends message to the cooperation. & send all information. The System are use controlling Hut. This Controlling Hut are SMS Technology. The GPS and GPRS mapping server to analysing data of various location. The control station compiled all the information and stored in the system database. The bin status and waste truck was monitored.

The sensors are place in the common garbage bins placed at the public place when the garbage reaches the level of the sensors. Then that indicated will give in indication to the driver by raspberry Pi they sending SMS using Wifi technology. The technology use by Sensor, Raspberry Pi The range of communication of the Wifi is almost 50 meter. They use for range Wifi Module, analysing we get an idea about level of garbage. The Ultrasonic Sensor would be able to monitor the solid waste collection process. This technique overcome some disadvantages which are use of minimum route, low cost, fuel use, clean environment.

Raspberry Pi is best described as a single-board computer that has deliberately been designed to be used by people who are not experts in electronics, en-Gingering, or programming. It is inexpensive, cross-platform (the Arduino software runs on Windows, Mac OS X, and Linux), and easy to program. Both Raspberry Pi hardware and software are open source and extensible. Raspberry Pi is also powerful: despite its compact size, it has about as much computing muscle as one of the original navigation computers from the Apollo Programmers, designers, do-it-yourselfs, and artists around the world take advantage of Raspberry Pi power and simplicity to create all sorts of innovative devices, including interactive sensors, artwork, and toys.

III. RESEARCH METHODOLOGY

Problem Statement & Relevant Theory

Instead of using plenty of bins in an unordered fashion around the city, we can have minimal no. of smart bins that can be placed that are feasible and affordable. As we have seen all around us, the dustbins are getting over flown and concerned municipal authorities usually don’t get information within the stimulated time.

While considering the need of technology and innovation, this is not an original idea. The idea has been proposed. But however, we need an original plan for designing a Smart Bins with ultrasonic sensors. Already existing system involves complex circuitry and high costs and features are also limited. In India, if we have a costly garbage bin that will not be a priority experiment for people. Thus here we are deploying such kind of system that is not only cheaper but with extended features that has never been implemented. For detection of trash in the bin, many sensors can be used like weight sensors, IR sensors, etc. But here we are using ultrasonic sensors which gives us directly information about percentage of trash in the dustbins. It is advantageous over weight sensors because weight sensors only tells us about the weight of the garbage, but this does not let us know the level of garbage in the bins.
Scope

We have implemented real time waste management system by using smart dustbins to check the fill level of smart dustbins whether the dustbin are full or not. In this system the information of all smart dustbins can be accessed from anywhere and anytime by the concerned person and he/she can take a decision accordingly. By implementing this proposed system the cost reduction, resource optimization, effective usage of smart dustbins can be done. This system indirectly reducing traffic in the city. In major cities the garbage collection vehicle visit the area’s everyday twice or thrice depends on the population of the particular area and sometimes these dustbins may not be full. Our System will inform the status of each and every dustbin in real time so that the concerned authority can send the garbage collection vehicle only when the dustbin is full. The scope for the future work is this system can be implemented with time stamp in which real-time clock shown to the concerned person at what time dust bin is full and at what time the waste is collected from the smart dustbins.

Objectives

1. The proposed system would be able to automate the solid waste monitoring process and management of the overall collection process using IOT (Internet Of Things).

2. The Proposed system consist of three main subsystems namely Smart Trash System(STS), Local Base Station(LBS), and Smart Monitoring and Controlling Hut(SMCH).

3. In the proposed system, whenever the waste bin gets filled this is acknowledged by placing load (weight) sensor to the waste bin, which transmits it to the receiver at the desired place in the area or spot.

4. In the proposed system, the received signal indicates the waste bin status at the monitoring and controlling system.

IV. DATA ANALYSIS AND INTERPRETATION

Data Design

The design is the first design activity, which result in less complex, modular and efficient program structure the information domain model developed during analysis phase is transformed into data structures needed for implementing the software. The object, attributes, and relationships depicted in entity relationship diagrams and the information stored in data dictionary provide a base for data design activity. During the data design process, data types are specified along with the integrity rules required in the data.

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Fig: 3.1 Data Design
Architectural Design

![Architecture of Waste Management System](image)

**Fig: 3.2 Architecture of Waste Management System**

Procedural Design

The programming language that provide such command constructs are called imperative programming languages. The software design technique that relies on these constructs is called procedural design, or also structured design.

![Procedural Diagram For Waste Management System](image)

**Fig: 3.3 Procedural Diagram For Waste Management System**
V. CONCLUSION

The proposed method for the management of wastes is efficient and time saving process. This automation of waste also reduces the human effort and consequently the cost of the whole process. Thus a hygiene and clean environment can be provided. This project helps in identifying all possible smart garbage management methods that can be implemented to make society clean.

REFERENCES