Smart Waste Management using IOT

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***Abstract*—Waste management is simple yet effective ways of reducing the amount of waste dumped into our landfills. But there are people who are unaware or even choose to ignore the fact that waste segregation and recycling are environment friendly solutions to the problem of wastes management and disposal. There are guidelines implemented by the government with regards to recycling but these efforts have yet to touch the mindset of the people. Escalating amounts of recyclables that are not maximized and indifference in proper waste segregation has led to the group in developing a solution to this. This project Smart Waste Management system is a very innovative system which will help to keep the cities clean. This system monitors the garbage bins and informs about the level of garbage collected in the garbage bins via a desktop application. For this the system uses ultrasonic sensors placed under the lid of bins to detect the garbage level and compare it with the garbage bins depth. The system makes use of Arduino family microcontroller to control every process and Wi-Fi modem for sending data to server. Dustbins are provided with low cost embedded device which helps in tracking the level of the garbage bins and a unique ID will be provided for every dustbin so that it is easy to identify which garbage bin is full. When the level reaches the threshold limit, the device will transmit the level along with the unique ID provided. These details can be accessed by the concerned authorities from their place with the help of Internet and an immediate action can be made to clean the dustbins.**

Index Terms—Arduino, Application, Disposal, Dustbin, Environment, Garbage, Internet, Microcontroller, Segregation, Threshold, Ultrasonic, Waste Management.

I. INTRODUCTION

Waste management is effective way of reducing dumped trash. Unfortunately, these practices are not widely implemented in the country. People have been negligent when it comes to proper waste disposal, ignoring labels and throwing recyclables that can still be reused. Most are unaware or choose to ignore the fact the waste segregation and recycling can reduce cost, reduce drain in our resources, and lessen the waste being produced. Typical composition of garbage people throw in are 5.8% metals, 3.5% glass, 1.6% plastic, 12.9% papers, 1.8% textiles and 53.7% biodegradables which means only the remaining 20.7% of the wastes should really be going to our landfills. In our country, recycling centers do manual process of sorting wastes leading to a high risk of acquiring sickness. This study aims to automate waste segregation and implement a waste delivery system that would minimize human interference in the waste collecting and segregation process.

Garbage may consists of the unwanted material left over from City, Public area, Society, College, Homes etc. This project is related to the "Smart City" and based on "Internet of Things" (IOT). So for smart lifestyle, cleanliness is needed, and cleanliness is begins with Garbage Bin. This project will helps to eradicate or minimize the garbage disposal problem. The Internet of Things (IoT) is a recent communication paradigm that envisions near future, in which the objects of everyday life will be equipped with microcontrollers, transceivers for digital communication, and suitable protocol stacks that will make them able to communicate with one another and with the users, becoming an integral part of the Internet.

II. LITERATURE SURVEY

The infrared sensors are used to gather real time data from the waste bins and that of raspberry Pi Development board to communicate this information to the waste manager. The waste managers can effectively use this information to optimize the scheduling and routing of collection process [4].

The dustbins are interfaced with microcontroller based system having IR wireless systems along with central system showing current status of garbage, on mobile web browser with HTML page by WIFI. Hence the status will be updated on to the HTML page [5].

In this project level of waste inside the bin is monitored with the help of level indicator switches. Microcontroller is interfaced with the system. The sensors inside the bin constantly senses and detects the waste. There are three level indicator switches placed at different level of dustbin when the dustbin is filled 50% 1st message is sent to the driver similar process happens after 75% and 100%. When the dustbin is 100% filled the alert SMS is sent to the authority [1].

This project is IOT enabled. This system particularly aims at having bins per society. When the bin is full it will transmit its status to the respective authority and the truck which is nearest to the bin will collect the waste [2].The easiest way to prepare your document is to use this document as a template and simply type your text into it.

1) IOT based waste collection system using infrared sensors by *Abhimanyu Singh, Pankhuri Aggarwal, and Rahul Arora.*

Advantages:

- The current IoT performs sensing, actuating, data gathering, storing, and processing by connecting to internet.
- Synchronization is done between collection and transportation of waste which leads to effective and economical waste management.
- Using infrared sensors real time information of waste in gathered, which can help in devising effective scheduling and optimized routing.

Disadvantages:

- The infrared sensors can't differentiate between dry and wet waste.

- In rainy season there is a high chance of miss reading by the sensor.

2) IOT based smart garbage and waste collection bin by *S.S.Navghane, M.S.Killedar, and.V.M Rohokale*

Advantages:

- It alerts the driver after exceeding a certain threshold.
- The status gets updated onto a HTML browser that means it will be sent directly to the driver.

Disadvantages:

- When the bin is full it has to wait for the driver until it comes and collects the waste.
- The waste is not segregated.
- Also, there is no quick response if the sensors are not working

3) City garbage collection indicator using wireless technology *by Chetan patil, Ajay shimpi, Prasad Sawant, Piyusha Patil.*

Advantages:

- One of the key advantage of this project is the use of Flexi sensor used in lead so that it will be opened only after applying the pressure.
- Also security matrix is used so that the lead can only be opened by the members by entering the password this prevents overloading of waste.
- The waste is segregated.

Disadvantages:

- There is no need of sending constant alerts to the driver only one alert is sufficient that is implied in our project that is alert is sent to the driver when the bin is 80% full.
- They have not used the concept of shortest distance. That is the bin will not be emptied unless the driver comes and collects the waste.

4) Efficient waste management by *Saurabh Dugdhe, Pooja Shelar, Sajuli Jire and Anuja Apte*

Advantages:

- Because of the use of shortest distance concept.It minimizes the truck's time and fuel consumption.
- Also it focuses to collect the waste first which consist of harmful gases.
- The system provides estimated dates for the collection of the bins, expected fill up dates for the collection bins.

Disadvantages:

- The waste is not segregated
- No prior alert is given to the authority and they notified when the waste is full.
- No mechanism is used to avoid overloading of waste.

III. Overview

The model which is been used is Non-personalized recommendation model. It consists of various opinions, the opinion which are been used in our project is the aggregate opinion. It will contain values like height and width of the bin the garbage collected in the bin and the distance between the driver and the bin. When the bin is filled less than 80% no action will be performed but if the bin is filled 80% or above the microcontroller will be triggered and the notification will be generated on the server side and on the app of the nearest driver.

A. Existing System

It comprises of a GPRS module, a Central Server, a Database Server and a Web server. The figure-1, reveals the block diagram of the web centered software system.

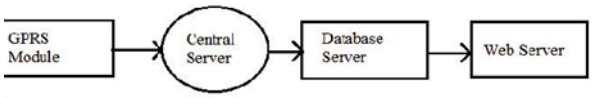

Fig. 1. Existing system architecture

The central theme of this work is to develop an intellectual monitoring system for proper management of MSL (Municipal Solid Leftovers).

With the objective in anterior a microcontroller based embedded system integrated with RFID and GPRS technology is developed in this work. Since it is a microcontroller based embedded system, it is transportable and is of low price tag too. A municipal authority can custom this type of system and monitor the waste collection status in real time based on the recorded information. In addition to this they can prepare different reports and measure the performance of the team and thereby increase their productivity. The system also has provisioning in which there are options available for the customers to lodge their complaints in case of discrepancies. This facilitation do bestows an opportunity to overcome the hindrances and maintain the solution in a seemingly sensible way. It alerts the driver after exceeding a certain threshold. The status gets updated onto a HTML browser that means it will be sent directly to the driver. But the disadvantages of this system are when the bin is full it has to wait for the driver until it comes and collects the waste. The waste is not segregated. Also, there is no quick response if the sensors are not working.

B. Proposed System

In IoT based garbage management, each garbage bin has two slots, one for wet and other for dry. Height of waste in both slots is measured with help of ultrasonic sensors and that information is transferred to server via Wi-Fi module to PC server. A four way DIP switch is used to give each dustbin an ID and that ID with location information is stored in database on server PC Dustbin forwards three type of data using Wi-Fi module to PC, 1. ID of a bin, 2. Dry waste in percentage, 3. Wet waste in percentage to PC server through Wi-Fi module via router. PC server has database which consists of, Dustbin ID, Location information, Wet waste percentage, Dry waste percentage. Server will send data about the bin to Android app. On Android app, user can view the percentage of Dry bin and

percentage of Wet bin. When any bin is about to full, user / driver will get a pop up message on app with text as well as in speech format using TTS. If a specific value is present for a lot of amount of time it will sense it and alert at server end.

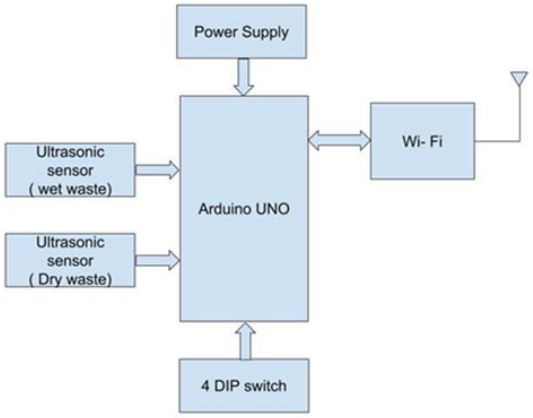

Fig. 2. Proposed system architecture

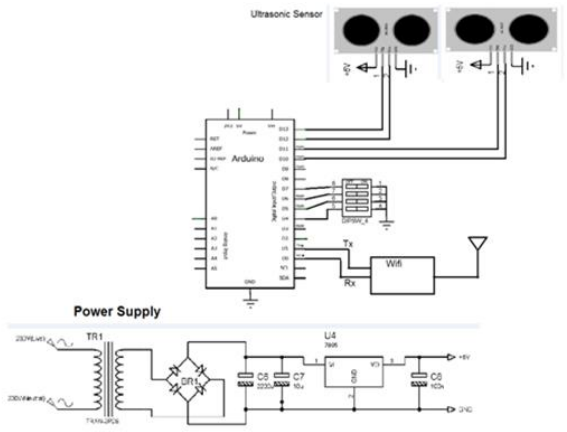

Fig. 3. Circuit Diagram

Power supply from 12V Adapter to bridge rectifier for rectification, Capacitors for filtering and 7805 for voltage regulation. Trigger and echo pin are connected to Arduino. Toggle switch for selection of location is connected to arduino. All the data is transferred via Wi-Fi connected at communication port of Arduino.

C. Implementation Details

The implementation detail is given in this section.

Algorithm:

1. Start the process.
2. Declare the array size. Array size is depend upon the DIP switch.
3. Get the number of processes to be inserted.
4. Get the value.
5. Start with the first process from it is initial position let other process to be in queue.
6. Calculate the total number of burst time.
7. If more process are in queue then go to step number 5
8. Stop the process.

Flow Chart:

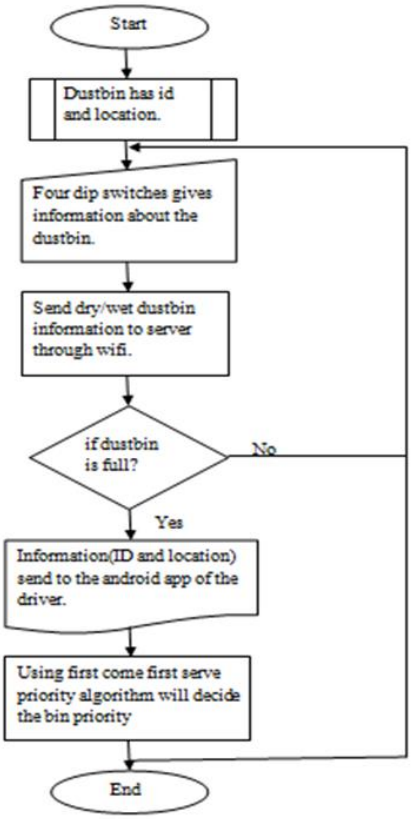

Fig. 4. Flow Chart

As shown in the figure below each dustbin has its unique id and location so as it is easy for the driver to track the the bin when the driver is notified. In our system we have DIP switches which gives different locations. To give different locations we have used 4 dip switches. Constant updates are sent to the drivers about the level of the dustbin. It then checks if the dustbin is 80% filled if yes then the location and id of that bin is sent to the driver of that particular area. Sometimes there might be a case where many dustbin at a time may be filled for that we have used FCFS priority algorithm. So when the notification is sent to the driver it will check the priority of that bin and accordingly collect the waste. If the dustbin is not 80% full then it will continue checking its status.

IV. TEST CASES

Test case ID	Test Case Name	Inputs	Expected Outputs	Actual Outputs
1	Garbage Full	Garbage level = 85%	Garbage is Full	Garbage is Full
2	Garbage Empty	Garbage level = 0%	Garbage is Empty	Garbage is Empty
3	Garbage Filling	Garbage level = 40%	No Output	Garbage filled 40%
4	Garbage Overflow	Garbage = 110%	Error	Garbage is Full

V. OUTPUTS

Fig. 5. Server Side

Fig. 6. Client Side

Fig. 7. Data Base

VI. CONCLUSION

This project is the implementation of smart garbage management system using ultrasonic sensor, microcontroller Arduino and Wi-Fi module. This system assures the clearing of dustbins soon when the garbage level reaches its maximum. In major cities the garbage collection vehicle visit the area's everyday 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 dust bin in real time so that the concerned authority can send the garbage collection vehicle only when the dustbin is full. It ultimately helps to keep cleanliness in the society. Therefore, the smart garbage management system makes the garbage collection more efficient.

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