

IOT Based Smart Bins for Smart Cities

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ABSTRACT

The burgeoning of IoT has paved the way for enhancements in many aspects of life. One issue that needs to be improved is the handling of garbage collection. This system proposes an IoT based system that can support the existing workforce to manage waste generated in the sectors of a city. The bins to be collected are selected on the basis of three criteria: a. fill percentage based on either level or weight (high, low, medium) b. day of the week (weekday or weekend) c. the period of time (morning, afternoon, evening). The system calculates the shortest possible path including the selected bins and also provides the real-time status of the bin. The aggregated outcome of the above mentioned system helps in magnifying the efficiency of work and in the reduction of time and cost to complete it. Index Terms—smart bin, IoT, path optimization, frequency optimization, smart city, waste management

Keywords— Embedded System, Smart City, Smart Bin, Wireless sensor networks, Wireless Communication

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I. INTRODUCTION

The increase in the population of India brings some concerning issues need to be addressed and proper conduct should be applied to make the changes noticeable. One such issue which comes with the increase in population is the waste generation In India, 62 million tons of waste is generated every year, out of which 43 million is collected and only 11.9 million processed. This number is likely to increase from 62 million to 165 million tons by 203. If we look at the numbers, only 69 percent of the total waste generated is collected and about 19 percent is processed . This is an alarming number considering the fact that waste directly impacts in degradation of

the environment and thus has a negative impact on climate change. By improving the collection numbers we can reduce the waste burning at the street corners and on empty/unoccupied lands. The collection of waste will also help in keeping the environment clean and disease free, surroundings fresh. The current waste collection methods use static scheduling. The static scheduling system of waste collection has various demerits Smart bins are not entirely new as an idea but continuous effort of design and implementation can make it possible to spread this idea into actual use.

II. LITERATURE SURVEY

Idea of smart garbage bins and systems have been in discussion for quite a long time. The technologies used at disposal to develop this smart system have also evolved, Internet of Things (IoT). Each idea seems to be similar but is slightly different at its core and our proposed work is no exception from the same. After the IoT field, finding its hold in our lives, this is our original plan for designing a smart garbage collection system which has provision for citizen participation and analysis of data for better decision making. At hardware level, the smart system is a garbage bin with ultrasonic sensor, a micro-controller and Wi-Fi module for transmission of data. The worldwide implementation of Internet of Things is possible with a Cloud centric vision. This work exploits the future possibilities, key technologies and application that are likely to drive IoT research. But a strong foundation to our work is provided, where the basics and applications of Arduino board is explained . It is quite interesting as it implements a GAYT (Get As You Throw) system concept as a way to encourage recycling among citizens. As we would discuss further, the citizen participation part of our system is quite influenced by their work

- 1) **Arduino Uno:** It is a micro-controller board used to read values from the sensors.
- 2) **Ultrasonic Sensor HC-SR04:** It calculates the level of waste present in the bin.
- 3) **Load Cell HX711:** It determines the weight of the waste in the bin.
- 4) **Momentary switch:** The switch is placed below the lid to determine if the bin is closed or not. Once it is closed, the data is sent through ESP8266 NodeMCU.
- 5) **WiFi Shield ESP8266 NodeMCU:** It connects the Arduino to a network thereby allowing data transmission to the server



Figure 3.2: Sensor placement in the bin

III. DESIGN

The conventional bin is transformed into a smart-bin by installing a module that consists of a microcontroller, set of sensors and a Wifi shield. Below are the details of components used :

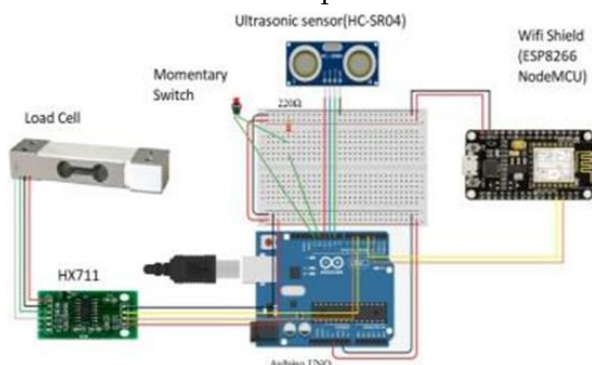


Figure 3.1: Circuit Diagram



Figure 3.3: Prototype bin

IV. ANALYTICAL / EXPERIMENTAL WORK

VI. PROS AND CONS

- 1) The real-time level and weight data are determined by the smart-bin which is then updated into the database containing a table for each bin and a master table storing the current status of the bin.
- 2) A selection algorithm identifies the bins that are to be collected based on the status of the bin.
- 3) Application is used to display the information which is collected from the bin. The garbage collectors can access current status of the bin and what bins are to be collected based on selection and shortest path algorithm. The application provides an ordered list of bins to be collected which redirects to Google maps for navigation.

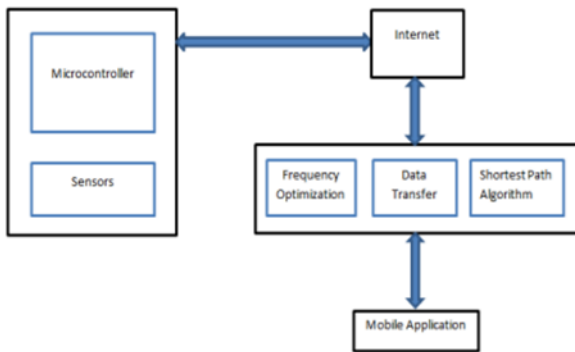


Figure 4.1: Figure 2. System Architecture

V. ALGORITHM

- Input: Current status of the bins
- $i \leftarrow 0$
- while $i \neq \text{no of bins}$ do
- if level THRESHOLD MAX OR weight THRESHOLD MAX then
- bin status $\leftarrow$ high
- else if (level i THRESHOLD MAX AND level i 50) OR (weight i THRESHOLD MAX AND weight i 50) then
- bin status $\leftarrow$ med
- else
- bin status $\leftarrow$ low
- end if
- end while

- **Pros :-**
 - Proposed system provides greater accessibility to the dustbin.
 - If position of dustbin is changed from one place to another place its position will auto- matically get changed in server with the help of GPS module.
 - It will save our fuel and time using appropriate route planning algorithm. Here we are using traveling salesman problem.
- **Cons:-**
 - In fixed scheduling if one dustbin is filled early so it will -be left unnoticed until the next interval of collection.
 - In average threshold scheduling Average is calculated so if one dustbin which is filled, will be emptied after the value exceeds the threshold value which will be late in some cases.
 - In Full capacity scheduling, unless and until all dustbin are filled no garbage collection will be done

VII. APPLICATIONS

- To collect dustbins placed at public places in city.
- Automatic open-close lid for ease of use
- There is no contact touch between dustbin and Person so, prevention from germs and diseases.
- Warning message indication when a Smart Trash Bin is nearly full. Also send SMS to garbage collector in particular area.

VIII. CONCLUSION

This project work is the implementation of Automatic Garbage Fill Alerting system using Ultrasonic sensor, Arduino Uno, Buzzer and Wi-Fi module. Cleaning of dustbin is done as the garbage level of dustbin reaches to the maximum level. Alarms when wet garbage is

poured in dry dustbin. If dustbin is not cleaned in fixed time then the message will be send to higher authority and they will take appropriate action on sweeper or concerned contractor. Fake reports cannot be generated as previous data is always available when dustbin is cleaned in this way corruption is reduced in management. By using appropriate algorithm we can reduce the no of trips of collection van and hence we can save expenditure and resources. It ultimately helps to keep city and country clean. Therefore, the Smart dustbin makes garbage collection mechanism more efficient, which will ultimately make our dustbins and also cities smart at the same time.

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