Ingenious Waste Management Using Raspberry PI

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Abstract- *Smart waste management solution reduces waste collection frequency dramatically, which enables you to save on fuel, labor, and fleet maintenance costs. Altogether the solution can reduce the operational costs. In densely populated areas, a rapid waste generation often leads to overflowing due to exponential increase in the waste disposal every day. It creates sanitary issues among people and the environment. The prior solution for this issue is to collect garbage regularly and effectively. The waste collection also includes door to door collection, which has to be monitored to drive the existing system efficiently. By doing so the total expenditure can be reduced. This project provide the integrated solution for the previously discussed problems. The system integrates multiple dustbins located across the city, all connected through a wireless network. The system also have a dedicated module to monitor the door to door waste collection. The authorized employee will have the access to the database and he will be able to monitor the entire process through maps and charts which enables him to have an effective management over the existing waste collection system. By effective planning the cost for collection of garbage from bins can be reduced.*

Keywords- Raspberry Pi, Arduino, Waste Management, Internet of Things (IoT), Door to door Collection, Surveillance system.

I. INTRODUCTION

In the recent years, there was a rapid growth in population which leads to more waste disposal. So a proper waste management system is necessary to maintain a clean city. Managing the smart bins by monitoring the status of it and accordingly taking the decision. The Smart bins are connected to the cloud to get the real time status. There are multiple dustbins are located throughout the city or the Campus. These dustbins are interfaced with micro controller based system with IR Sensors and RF modules. Where the IR sensor detects the level of the dust in dustbin and sends the signals to micro controller thro' Wi-Fi module or a GSM module or Wi-Fi module and an Internet connection is enabled through a LAN cable from the modem. The data has been received, analyzed and processed in the cloud, which displays the status of the Garbage in the dustbin on the GUI on the web browser.

The sensors are placed in the common garbage bins placed at the public places. When the garbage reaches the level of the sensor, then that indication will be given to the Controller. The controller will indicate to the driver of garbage collection truck as to which garbage bin is completely filled and needs urgent attention. RP2 will give indication by sending SMS using GSM technology or using Wi-Fi module.

II. LITERATURE SURVEY

Solid waste management is a major challenge in urban areas for most of the countries around the world. Waste management is an idea to keep the environment safe and clean. In this project they have used various technologies like Radio Frequency Identification (RFID), Global Position System (GPS) [4] .Zig Bee and Global System for Mobile Communication (GSM) is the latest trends and the combination of these two technology is used in the project. A brief description of the project, the sensor is placed in the normal bins placed in public places. When the waste reaches the sensor, then the instructions that will give to the ARM 7 controller. This controller will give instructions to the truck driver for garbage collection. The trash can was filled and require immediate attention. ARM 7 will provide instructions for sending SMS using GSM technology [7].

Waste management is a one among the major and key issues faced by emerging cities across India. People find it difficult to coordinate the available resources and properly utilize them. When corporation people are approached and discussed about various issues, they briefly explained about numerous issues that they were facing daily. One among them was solid waste disposal management. People over there find it difficult to monitor the dustbin in overflowing and the collection is required immediately. As of now the city corporation is taking several efforts to make our city clean but due to the population and ignorance of the people waste management become a tedious process.
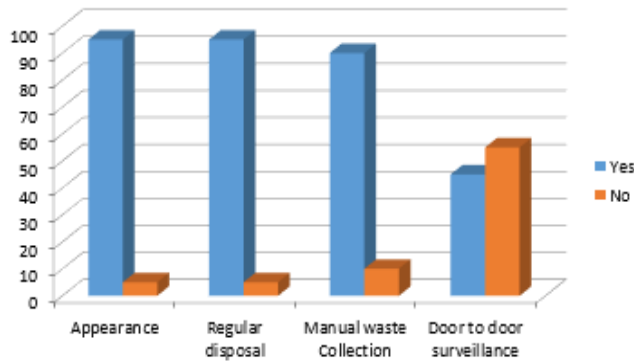
Figure 1. Survey Results

According to a small survey taken among the citizens, the major reasons for waste management failure is said to be 80% due to the unclean appearance and smell arising in and around the bins. Various other problems was also put forward where the regular disposal of waste is not done in a proper way and hence overflow occurs. Also the main problem focused here is the improper monitoring of door to door collection which was been done before. Based on this survey a smart solution was proposed to eliminate all these problem statements.

Problem Statement:

- Unclean appearance in and around the trash bins.
- Over flow of bins due to irregular disposal of wastes.
- Constant scheduled time for waste collection which seems inefficient and wastage of fuel.
- Improper monitoring of door to door collection by workers.

III. PROPOSED SYSTEM

The proposed project enables the authorities to monitor the bin fill-levels in real time and receive notifications of overflows. The solution optimizes waste collection routes and schedules based on the data, provides predictive analytics to enable decision making for the future, and offers consultation on waste bin allocations. By using innovative wireless sensors cellular network, web and mobile technology we have created a market leading solutions at cut reduced costs eliminating unwanted processes. This process can be fabricated into a product which is a robust reliable long lasting required easy to deploy. It is totally a battery cum solar operated wireless device using power management ultrasonic signal processing. .

The modules provide the fill level, geo-positioning, temperature and even more. These sensors achieve best in class reliability with unmatched performance level even under extreme environments. These modules communicate to the network via internet to the secured server live portal. From there the users can get an online platform that can be accessed from anywhere at any time. The smart bin's web application is easy to login which include various features like geo-google maps showing real time status. It requires less service vehicles, less travel time. This system involves duty cycle technique to reduce power consumption and to maximize operational time.
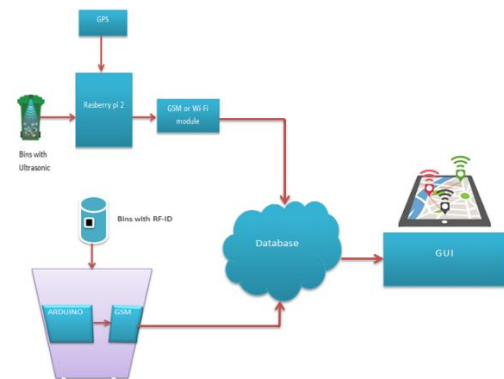
IV. BLOCK DIAGRAM

Figure 2. Interfacing Smartbin and dustbins to Database

DATABASE:

XAMPP is a free and open source cross-platform web server solution stack package developed by Apache Friends, consisting mainly of the Apache HTTP Server, Maria DB database, and interpreters for scripts written in the PHP and Perl programming languages

GPS:

A GPS tracking unit is a device, normally carried by a moving vehicle or person, that uses the Global Positioning System to determine and track its precise location, and hence that of its carrier, at intervals. Here we have used GPS to locate the bins placed in several places and to get the prioritized routes.

GSM:

Global System for Mobile communication is a digital mobile telephony system that is used to send the status of the bins at a certain frequency. GSM uses a variation of TDMA and is the most widely used of the three digital wireless telephony technologies like TDMA, GSM, and CDMA.

RASPBERRY Pi:

Raspberry Pi is a computing device which has evolved through several versions that feature variations in memory capacity and peripheral-device support. The Raspberry Pi 2 uses a 32-bit 900 MHz quad-core ARM Cortex-A7 processor. Its frequency ranges are 1000 MHz ARM, 500 MHz core, 500 MHz SDRAM.
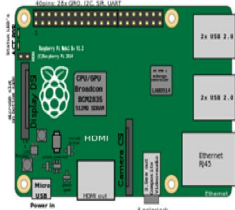

Figure 3. RaspberryPi2 Model B

ULTRASONIC SENSOR:

An Ultrasonic sensor is a device that measures the distance between an object and the sensor using ultrasonic waves. It measures distance by sending out a sound wave at a specific frequency and listening for that sound wave to bounce back. By calculating the time between the sound wave generation and the sound wave bouncing back, it is possible to calculate the distance between the sensor and the object. In this project these sensors are used to sense the level of the waste collected.

ADRUINO:

It is a microcontroller developer module used to interface with the RFID module for door to door collection. A Wi-Fi module is connected to upload the live data to server.
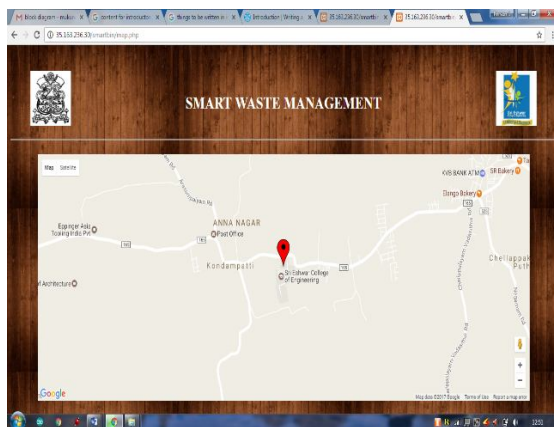
IV. RESULTS AND DISCUSSIONS

Figure 4. Database linked with Google maps locating the position of the dustbin.
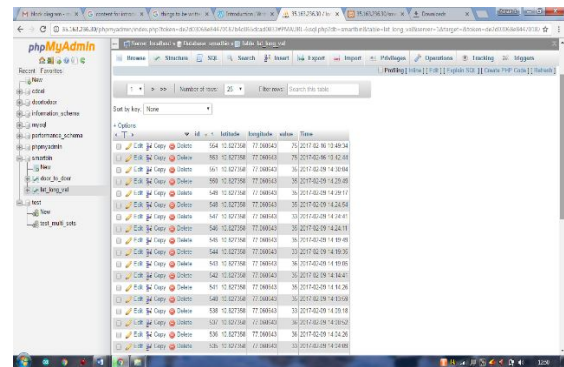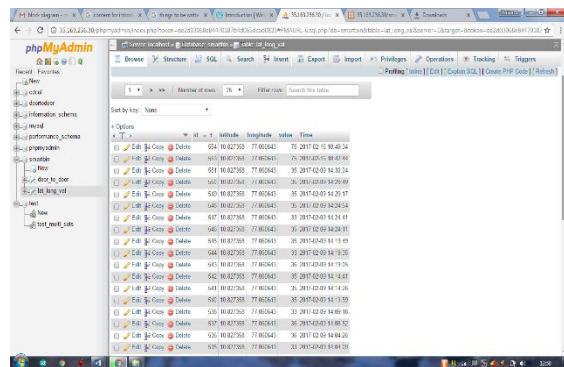

Figure 5. Data logging of Smartbin in Server.

Figure 6. Data logging of Door to Door Collection in Server.

V. CONCLUSION

This project comes in handy for the officials to effectively and efficiently manage the existing system and to bring good level of saving in time, energy, manpower, and other valuable resources. It can be accessed at any time from any place just by logging into the admin server to view the live status of the multiple bins. The data generated by the bins are so valuable that they can be used in future to analyze and to take adaptive measures and also to gain insights about the status of waste around the city. This project also aims at encouraging further research in the topic of waste management.

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