IoT BASED GARBAGE MONITORING USING LOCATION TRACKING SYSTEM

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ABSTRACT

The Collection of waste is a needed municipal service that requires huge expenditures and execution of this operation is high-priced. The high pricing is due to the various factors such as man power, navigation of vehicles, fuel, maintenances and environmental costs. The above factor necessitates the design, implementation and execution of the intelligent smart bin for proper management of waste. This paper focused on the implementation of an IoT based embedded system which integrates IR sensors, Arduino UNO, Bluetooth module for solid waste bin and track monitoring system with their performance measured in real time environment. Web based android applications were developed to interface with a web server to intimate the municipality regarding the cleaning process performed by the workers. This system provides a database containing information of bin status, amount of waste in the bin, time of the collection of waste are transmitted to monitor and efficiently mage the waste collection strategies.

Keyword: - *IoT, Microcontroller, Smart bin, Sensors.*

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1. INTRODUCTION

Solid Waste Management (SWM) is one of the vital indispensable services provided by municipal authorities in the country to keep city clean. Nevertheless, the services rendered are very poor as the executions of this system are unscientific, old-fashioned and disorganized. The quantity of waste is littered all over leading to unhygienic living environment. The identification, monitoring and disposal of wastes are one of the major concerns of the present era.

The generation of waste is increasing by 1.3% per annum. The urban population which is increasing between 3 to 3.5% per annum generates waste around 5% annually. Thus 42.0 million tons of municipal solid wastes are produced annually; approximately 200 gm to 600 gm are generated per day. The collection of solid waste by the yardman varies from 50% to 90%. Urban Local Bodies spend Rs.500/- to Rs.1500/ - per ton on solid waste management of which, 60 to 70% of the amount is on collection alone and 20% to 30% on transportation. The amount of fund that is spent on treatment and disposal of waste is minimal and hence crude dumping of this waste is practiced in most of the cities.

Reasons of Improper Management of Waste

- Inappropriate planning for the management of waste while scheduling the townships

- Lack of Integrated System for the efficient monitoring and disposal of waste.

- Lack of scientific and skilled manpower.

- Involvement and awareness of the public towards waste management is in a nominal level.

- Lack in the use of modern techniques and best practices

- Outdates Management Information Systems

The factors stated above in the management of waste collection necessitate the development of an integrated system to reduce the operational and environmental cost.

2. LITERATURE SURVEY

In the traditional approach, a number of trucks from the municipal authority are sent to the waste bins to collect the Municipal waste (MW). The wastes are loaded in the truck and then transported and transferred to the pre-specified locality. However the group of the people involved in collecting and transporting the wastes are usually not responsible enough to make the job well done. Very often the wastes are not collected from each and every waste bin properly due to driver's attitude and lethargy [1]

To reduce the cost, integrated sensing system were designed using rule based decision procedure that is efficient and intelligent can be used to automate any solid waste bin management and monitoring system [2]. Pavithra et al. [3] developed a system to intimate the clearance of waste to the corporation office by positioning the sensor and microcontroller in the trash bin. An alarm indication is also incorporated to confirm the clearance of waste. This set up helps the municipality for the immediate disposal of bin thus reducing the spread of disease.

The researcher introduced additional sensors, IR sensors, Humidity sensors and Toxic gas sensors to measure the status of bin [4]. The processor transmit the bin filling alert, Humidity alert and Toxic gas alert to the Municipal Corporation via SMS intimation with the help of GSM technology in order to reduce waste dumping. Further modifications were also performed in the category of processing and recycling of the waste. The NIR reflectance spectroscopy scheme helps to distinguish and eliminate plastic item from MSW and provides all biodegradable substance that can be further used in biogas plant [5].

3. SYSTEM DESIGN

3.1 Proposed System

This work has focused on the implementation of smart waste management and monitoring system using sensors, Arduino and Bluetooth technology integrated with IoT. The status of the bin is continuously monitored at the control station to provide a user interaction with the system. The values stored in the database helps a user to have the updated status of the data in the bin as well as the previous values of the parameters of the bin. This system helps to monitor the waste management properly in a real time environment.
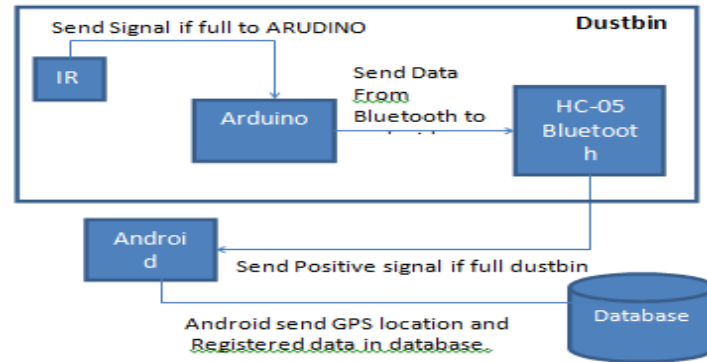
Fig -1: Architecture of IoT Based Waste Management System

3.2 Methodology

The Fig. 2 shows the process flow of the implemented system. An IR sensor is a motion detector sensor which detects the level of waste in bin. Sensing system detects the overflow status of the garbage level in the dustbin using IR sensor. This Smart Trash Bin is interfaced with Arduino UNO and whenever the IR sensing system is activated, the sensor send signal to the android app using Bluetooth module. Data is send by using local cloud or Wi-Fi facility provide to the system. Data is send to the admin from android app accordingly and update the database at a regular interval. After the disposal of waste, the above process is confirmed by the yardman. Every bin has its own unique Id and database shows the list of bins with their Id and exact location.
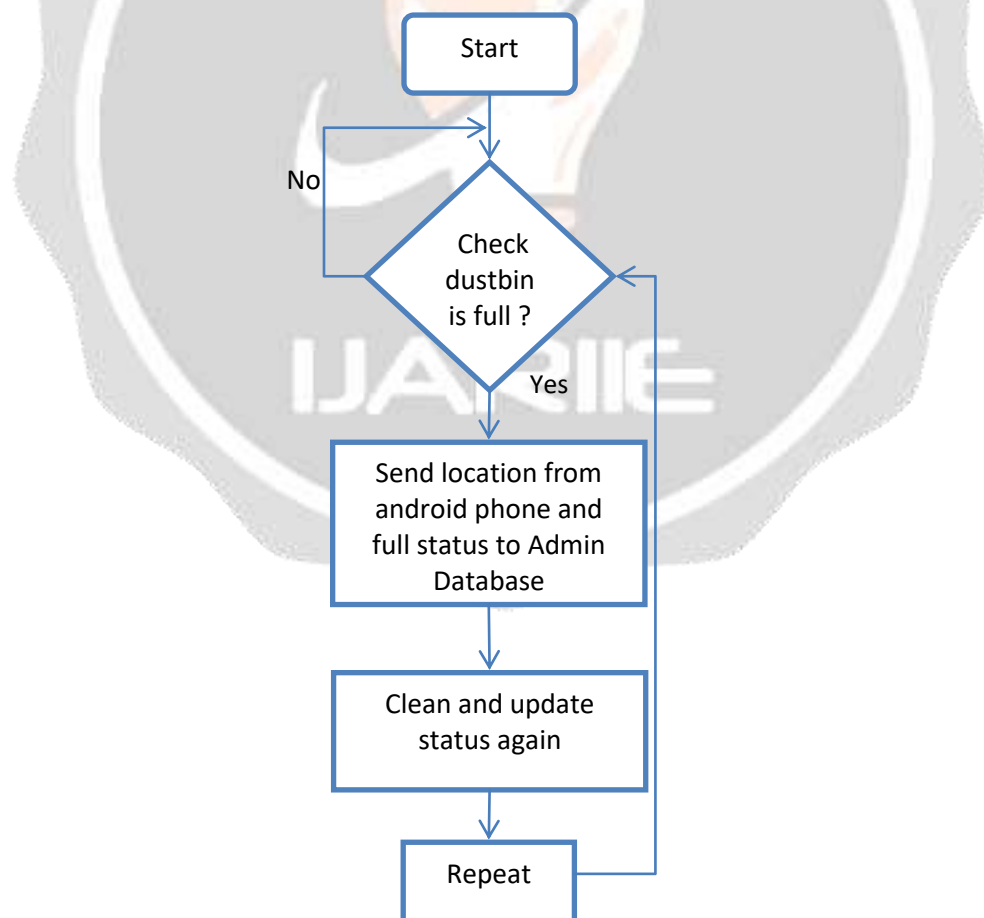

Fig -2: Process Flow of the Implemented System

3.3 Components

    1.   <u>Smart Control and Sensing System</u>

IR Sensor:

    The IR Sensor is used to measure the level of garbage in waste bin. The range of the garbage measurement varies from 2cm – 400cm without non-contact. The module provides transmitters, receiver and control circuit. The length of the implemented garbage bin is 20cm. A predefined threshold level is fixed at 15cm and programmed in the Arduino to predict the overflow status of the bin. The conditions for the activation of the lid based on the output of IR sensor is listed below

- The garbage level in the bin is less than 15cm -

- Garbage Empty

- The garbage level in the bin is greater than 15cm - Garbage Full.

Arduino UNO:

    The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started. An overview of arduino uno is shown in figure 4."Uno" means one in Italian and is named to mark the upcoming release of Arduino 1.1 . The Arduino Uno can be powered via the USB connection or with an external power supply. The power source is selected automatically.

    2.   <u>Transreceiver Unit</u>

Bluetooth module HC05:

    The Bluetooth module HC05 is a master/slave module. By default the factory setting is slave. The role of module (master/slave) can be configuring only by AT COMMANDS. The slave module cannot initiate a connection to another Bluetooth device, but can accept connections . Master module can initiate a connection to other devices. The user can use it simply for a serial port replacement to establish connection between MCU and GPS, PC to your embedded project, etc.

In a system Bluetooth module is use to transmit the signal from Arduino microcontroller to mobile app.

    3.   <u>Smart Display Unit</u>

Monitoring section:

    This section is use to display the outcome of the system. It is connected to the mobile app through a local cloud or a Wi-Fi. It shows the list of dustbins with their Id and location. The list of dustbin is arranged according to the level of waste detected in the bins by a sensor. The data in the database is updated at a regular interval. The system allows adding new bins in the system and also to delete included bins from a system .The admin can monitor the functioning of entire system. A status of dustbins is shown for the proper maintenance and execution.
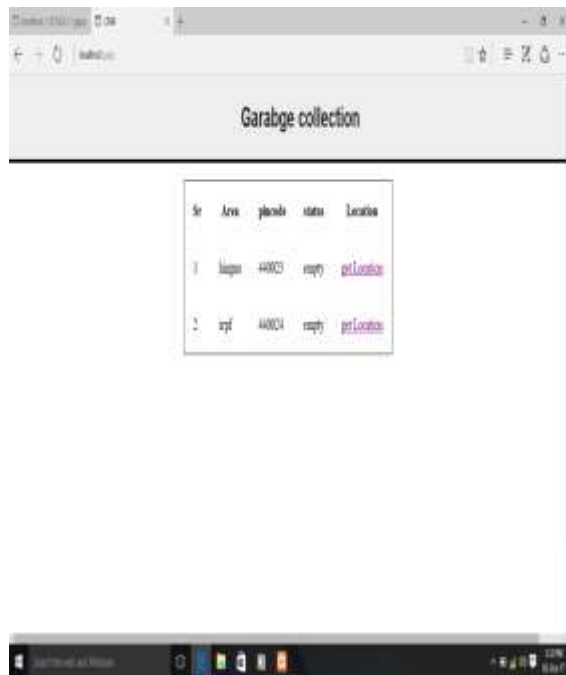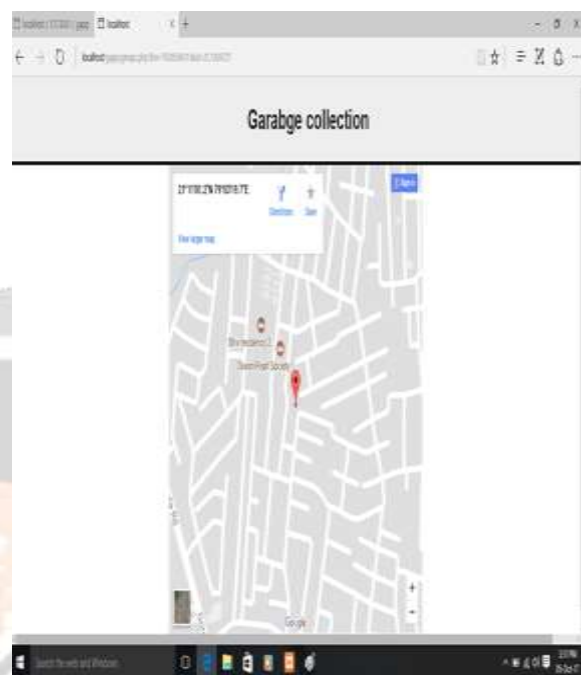
4. OUTPUT

Fig -4: Admin page   **Fig -5**: Bin Location
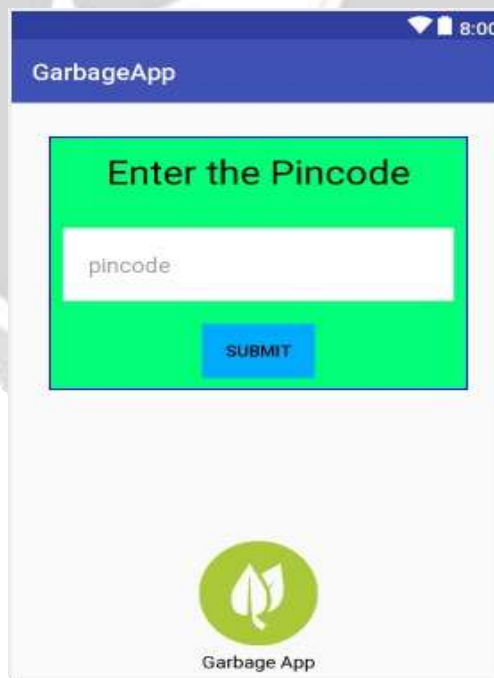

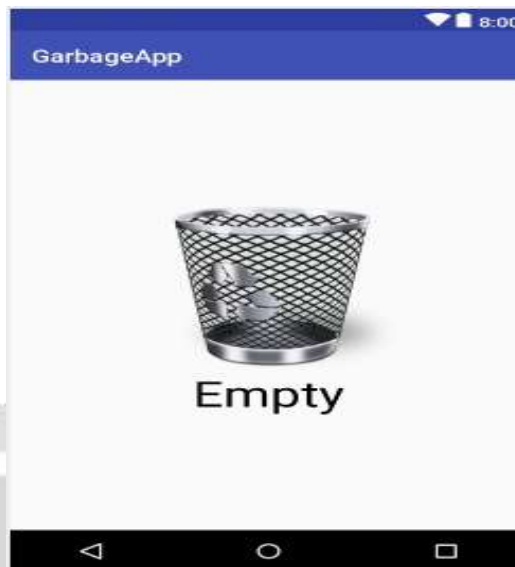**Fig -6**: Mobile App

Fig -7: Dustbin Full   **Fig -8**: Dustbin Empty

5. RESULTS AND DISCUSSION

According to the usage and the information gathered by the sensors the status of bins may display on the screen.

As mentioned in the report, the system is monitor the garbage level, to sense whether the level of waste is increase in dustbin and not overflow outside the dustbin. The sensors collect the respective information and fed to the microcontroller and the microcontroller processes the information and with the help of Bluetooth module, the information is sent to the android app and then forwarded to the database and monitor by an authorized admin regularly. The entire experimental setup for the proposed system and the final data that is displayed on the monitor screen is as shown in above snapshots.

6. CONCLUSIONS

The necessity for the web based waste management application is increasing day by day due to the population and less maintenance in the disposal of waste. The novelty of this proposed work is to develop an intelligent alerting system integrated and IoT for proper management of garbage. A municipal authority can use this type of system to monitor the waste collection status in real time environment and measure the performance of yardman, thereby reducing the manual process of monitoring and verification.

7. REFERENCES

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