

# IoT BASED GARBAGE MONITORING SYSTEM

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**Abstract-** *In our surroundings, many times an observation is made that the garbage bins kept at public places overflows because of increase in the garbage regularly. It results in unhealthy condition for the people and spreads bad smell which results in spreading some serious diseases in Human Beings. So to avoid such a situation, the basic idea is to develop a system named "IOT Based Garbage Monitoring System". In this system multiple dustbins are located throughout the city and these dustbins has micro-controllers which help to track the garbage bins level and a unique ID will be provided for each and every dustbin so it will be easy to identify which particular garbage bin is full. The device will transmit the level along with the unique ID provided to the concern authorities when the garbage bin will reach defined threshold limit. We will be implementing the k-means clustering algorithm to form the clusters of the days according to the percentage of garbage collected so it will be easy to predict the garbage collection and notify accordingly. These details can be accessed by the authorized personnel from their place and action can be taken in shorter time to maintain the dustbins.*

**Keywords -** *Arduino microcontroller, RF module, IR Sensors, GSM Module, K-means Clustering.*

## I. INTRODUCTION

Things (Embedded devices) which are connected to Internet and sometimes these devices can be controlled from the internet is called as Internet of Things. In our system, the Smart dust bins are connected to the internet to get the real time information of the smart dustbins. A proper waste management system is required to keep the city clean and hygienic. There are multiple dustbins situated across the city or the Campus (Educational Institutions, Companies, and Hospitals etc.). These dustbins are connected with micro controller, Ultrasonic Sensors and GSM modules where the Ultrasonic sensor will detect the level of the dustbin and will send the signals to micro controller. The data received will be analyzed and processed and accordingly the dustbin level can be found out on weekly basis. K-means clustering Algorithm will provide with the analysis to figure out on which days the dustbin is been filled more. All this activities can be tracked out through the Android Application. Authorized personnel will have the Android Application which will show the current level of dustbin. This will help in regularly monitoring the current status of dustbin and clean the dustbins at right times so unnecessary bad smell will be reduced.

## II. LITERATURE SURVEY

In this paper, the ZigBee, GSM (Global System for Mobile Communication) and ARM7 controller helps to create a system which will monitor the Garbage Bins. The sensors are placed in the common garbage bins. When the garbage reaches the limit, then message will be given to ARM 7 Controller. The controller will inform to the authority as to which garbage bin is overflowing and requires immediately cleaning up. ARM 7 will send SMS using GSM Module.

The author of the paper came to a point that, it is important to understand the increased rate of garbage and therefore is trying to promote recycling waste to decrease the quantity of garbage. It is being proposed in the paper that use of Geographic Information System, web camera, GPS, Radio Frequency Identification, General Packet Radio Service will help to get rid of solid waste. In this paper motivation of the research was to manage the characterization of the waste. The paper shows scenario of the current Municipal Solid Waste Management (MSWM) system of Municipality. It shows few observations, which might be useful to the authorities for the further progress of current management system.

The paper describes that the Garbage Bins Garbage level can be shown with the help of Ultrasonic Sensor, and will be communicated to the authority through GSM Module. Arduino helps in interfacing the sensor system with GSM Module. A Graphic User Interface is also developed to control information related to the garbage for different regions.

In the paper, it describes the working of "Smart Bin" in monitoring the garbage collection system. The sensors attached to smart bins connected through the cellular network creates a large amount of sensor information, which is analyzed and monitored to get knowledge about the status of garbage bins. This paper also aims at encouraging further research in the topic of waste management. GSM Module It is used to send message to the garbage depot if the Garbage exceeds the set threshold level. With the help of GSM module interfaced, we can send short text messages to the required authorities. GSM module is provided by sim uses the mobile service provider and send sms to the respective worker as per program in Arduino board.

## III. PROPOSED SYSTEM

To create a reliable, cost effective and portable „IoT Based Garbage Monitoring System“ which have to monitor the garbage bins or dustbins. It will inform the current status of respective dustbin to the concern authorities, which will help them to maintain the cleanliness in the city, and make the city a smarter one.

### A. System Description

#### Arduino IDE

The Arduino Software (IDE) is an open source software which helps to interface the Ultrasonic Sensors and GSM Module. It is a Micro-controller having the potential to monitor the level of garbage bins.

#### Arduino Microcontroller

Arduino Uno is a microcontroller board based on the ATmega328P. The code has been written in editor and then deployed on board using upload option in editor. The code contains workers phone numbers which will be useful for sending message to them. One can edit the number and location name from the code.

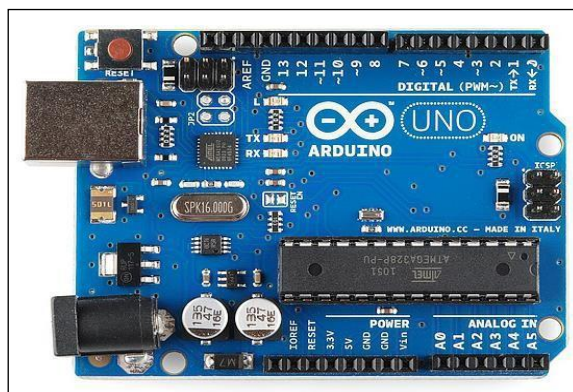


Fig 1. Arduino Uno Board

Ultrasonic Sensor

Ultrasonic sensors will be used to measure the distance between the Garbage and sensors, which will display the distance between them and Garbage level can be found out. Sensor keeps sensing data continuously, once it reaches to 90% value of total dustbin then sends message to worker.

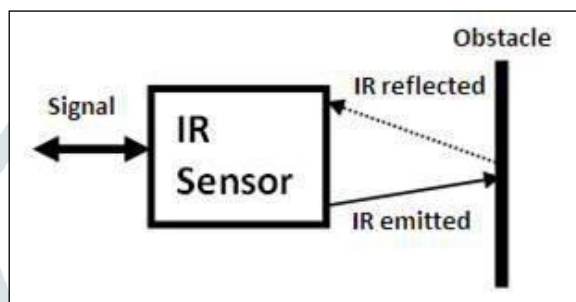


Fig 2. Working of IR sensors

GSM Module

It is used to send message to the authorized personnel if the Garbage Bin crosses the defined threshold level. It is used to send message to the authorized personnel if the Garbage Bin crosses the defined threshold level.

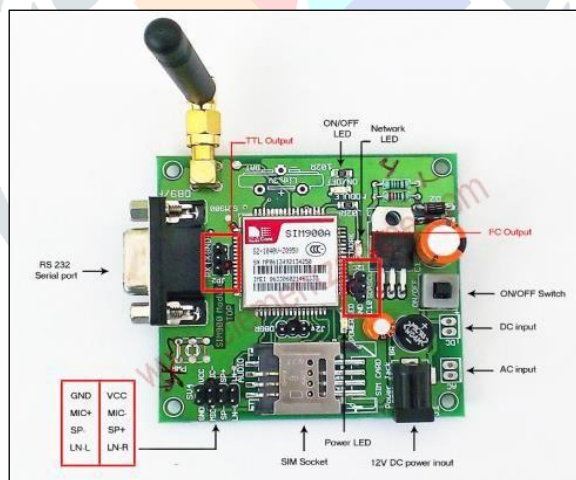


Fig 3. GSM Module for Micro-controller

B .System Working

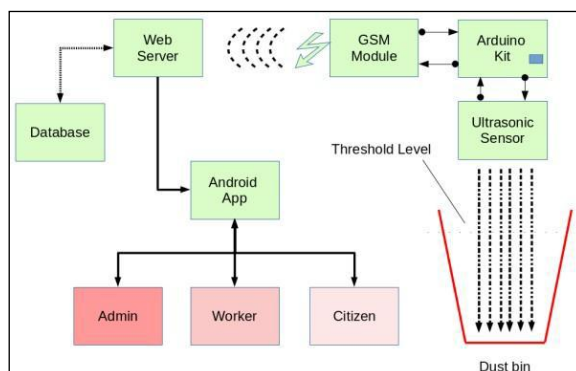


Fig 4. Block diagram of proposed system

The Block diagram depicts various components used in the Garbage Monitoring System. Web Server, GSM Module, Arduino Kit, Ultrasonic Sensor and the android application.

Transmitter section and Receiver section are the two parts in which the project module is divided. Arduino Micro-controller, sensors attached to the dustbin and RF Transmitter are used in the transmitter section whereas Arduino Micro-controller, RF receiver and Android App are used in the Receiver section.

Here sensors help in detecting the level in the dustbin whether the dustbins are full or empty. The sensor acquires the data and the data is then send to Arduino Micro-controller. Battery power supply of +5V is given to the Arduino microcontroller for the functioning of the system and the Arduino takes the sensor data from Ultrasonic Sensor and process it.

RF Transmitter is specially used to transmit the signal to and from Arduino microcontroller. Arduino Micro-controller, RF receiver and Android App are used in the Receiver section. RF Receiver helps to receive the information which is sent by RF Transmitter to the Arduino. The Arduino Microcontroller receives the information which is sent by the multiple transmitters and process the data and the same data is transmitted to the Client i.e., Android App.

#### C. Flow chart

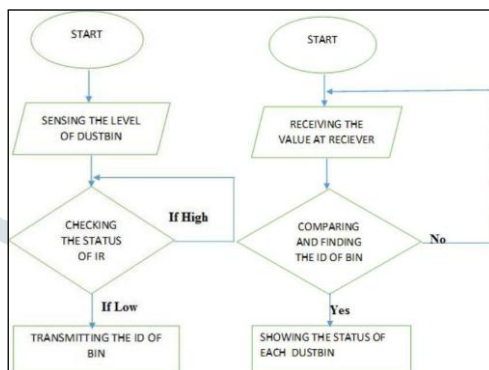


Fig 5. Flowchart of Transmitter and receiver

Fig shows the working of receiver and transmitter. Here in the transmitter section the sensors are attached to get the current level of garbage in the Dustbins and signals are transmitted to the Arduino where the Arduino looks for the current status of dustbins. Arduino sends the current information to the web server. The receiver sections gets the values sent by the sender through RF receiver to the web server and check status of Dustbins and display on the Android App.

#### D. Advantages of the system

With the implementation of this system we will get the Real time information about the current status of dustbin. Apart from it this system is cost effective and resources are optimized. It maintains the environment quality by providing the dustbin to overflow. Also with such a system we can achieve a cleaner and odor free area near the bins which is otherwise very messy. It will also help us to have a smart management of services in the city and effective usage of dustbins. Even the customers can register complain if the system does not work properly.

## IV. RESULTS AND CONCLUSION

### Waste Level detection inside the dustbin

Using this project the garbage level can be detected on the LCD and also a SMS is been sent once the threshold level is reached. Similarly, mobile application facilitates to monitor the waste level.

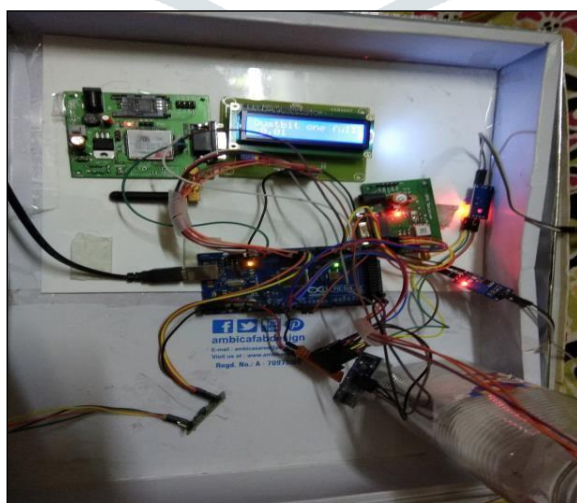


Fig 6. detection of waste level on LCD

#### A. Transmit the information wirelessly to concerned

In the mobile application we have a separate login for the administrator who can monitor all the garbage bins and their status through the application. The worker has a separate login which helps him to locate the garbage bin through maps and once the garbage is collected he can change the status of bin from full to empty.

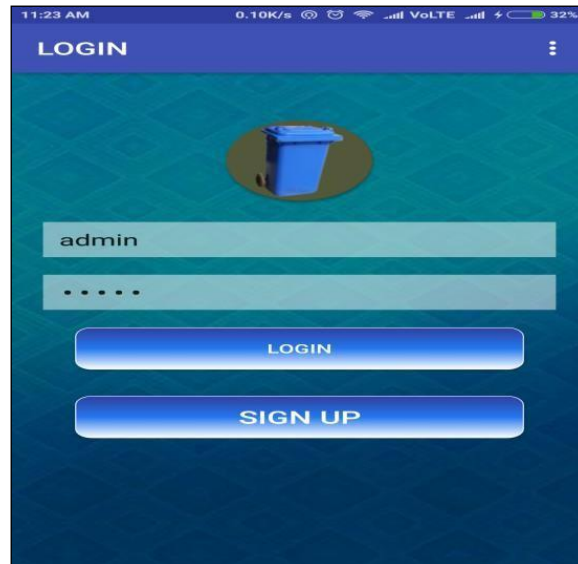


Fig 7. Mobile app login for admin

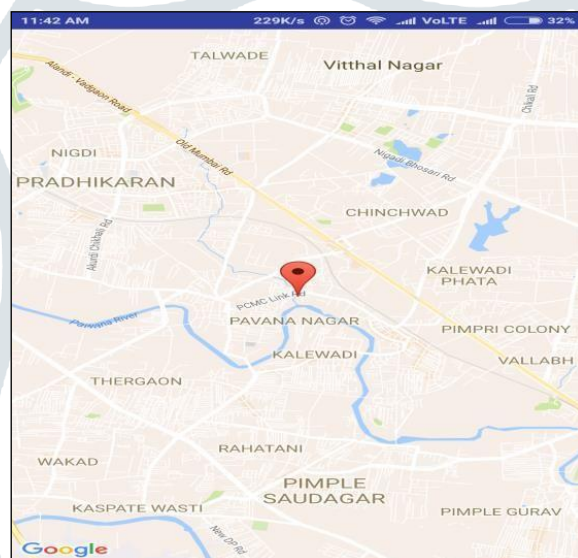


Fig 8. Location of dustbin on Google map

*C. The data can be accessed anytime and from anywhere*

As we are using the mobile application for accessing the status of garbage bins it becomes easier for the worker as well as the admin to monitor the bins and access becomes easy as we can have the status of the bins from anywhere. We just need to have the application installed. Along with the installation of application we need internet connection which ensures the real time status of dustbins. We need to set the IP of the network in which we are connected.

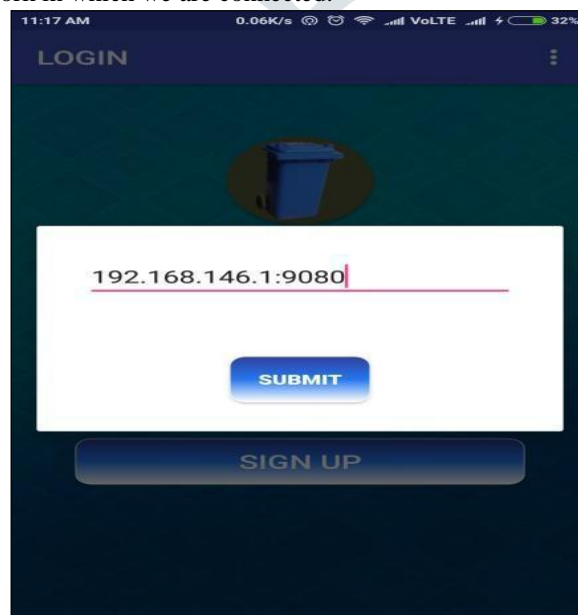


Fig 9. Setting up IP for the mobile app

#### D. Detects Wet Waste in the bin

The prescribed system detects the wet waste in the bin and thus it let the worker know about the moisture content in the bin and helps to take away the waste.



Fig 10. Detection of moisture content in the dustbin

#### E. Comparison with existing system

This IoT based garbage monitoring system must be needed for smart cities. It is been observed that, there are multiple dustbins situated in the various areas and dustbins get overflowed many times and the responsible persons are unaware of this situation. This system is designed to solve this issue and will help in providing the required information about the Garbage Bins level. Detailed status will be provided to the authority so it will be easy for them to take further actions needed.

#### V. FUTURE WORK

The system provides us with the real time information and status of garbage bins located in different areas. With the help of this real time information we can monitor the bins and once the bins are full the workers can collect the garbage and set them to empty again. This system is cost effective and can be accessed from anywhere. Traffic can be controlled as the workers collect the garbage only when the bin is full whereas in traditional way workers collect the garbage daily whether the bin is filled or not. This system has a future scope where this system can be used with time stamp where real-time clock will be made available to the authority stating at what time Garbage bins was full and at what time did the garbage is collected from the smart Garbage Bins.

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