

SMART BIN- A GARBAGE MANAGEMENT SYSTEM

Francis Jency X
Assistant Professor,
Dept. of CSE
Kumaraguru College of
Technology, Coimbatore
francisjency.x.cse@kct.ac.in

Megala I
UG Final year CSE,
Kumaraguru College of
Technology, Coimbatore
megalamoorthy95@gmail.com

Archana Devi V V
UG Final year, CSE,
Kumaraguru College of Technology,
Coimbatore
archanabalu.1995@gmail.com

Abstract-In the present world, usually, the Dust bins placed at public places in the cities are overflowing due to increase in the wastes every day. The overflow of garbage creates unhygienic condition for the human and non-humans and it creates a sense of ugliness in the surrounding. It also degrades the significance of the area. To avoid this and to enhance the cleaning, 'smart bin' is proposed. The system uses level identification sensors, placed above the bins, to detect the garbage level. The system makes use of microcontroller, GSM, Ultrasonic sensors. A Mobile app to monitor the desired information related to the garbage is developed. In the Mobile app, the status of the bins will be displayed, data from the sensors will be available, and worker's database will be maintained. This will help to manage the garbage collection efficiently. In the proposed system, the level of dustbins is detected with the help of Sensors, and communicated to the garbage collectors through GSM system and the complete activities is noted in the app. If these smart bins are implemented on a real world, by replacing our traditional dustbins present today, waste can be managed efficiently as it avoids lumping of wastes on roadside. Foul smell from these wastes that remain untreated for a long time, due to negligence of authorities and carelessness of people may lead to health related and economical problems.

Keywords--Sensor, Mobile application, Microcontroller

I.INTRODUCTION

In recent times, new challenge in the cities is Solid waste management, this is due to urbanisation. Managing waste is a crucial issue to be considered. When a trash filled bin is not emptied within a limited time it creates a foul

smell, which is a cause of pollution and affects health conditions.

The importance of cleanliness with respect to garbage management is degrading continuously. The world is in a stage of positive gradation, there is yet another problem that has to be dealt with. Dustbins being overfull and the waste being spilled out from the bins can be seen all around. As large number of insects and mosquitoes breed on dustbins this leads to various diseases. Hence, smart dustbin is a system which can eradicate the problem of solid waste management or at least reduce it to the minimal level. Minister of India has introduced "Swachh Bharat Abhiyan" mission which was initiated to ensure a clean environment. Polluted environment is the major cause of viruses and bacterial infections. Technological improvements can be used to safeguard the environment. Most of the public environment seems to be polluted with the waste material. Hence, modernization of the restaurants is needed by implementing the smart technology. Amount of wastes are mainly determined by two factors, first, the population in any given area and second, its consumption patterns.

The world population may increase by 20% and reach 8 billion inhabitants according to the research of UN. With the increase in population, the responsibility towards waste management also increases. Our waste management frameworks and our commercial situations are unequipped for taking care of the developing measures of managing waste. Unless a new standard of global cooperation and governance is adopted, the problems in solid waste management will remain the same.

Smart bin gives us one of the most efficient ways to keep our environment clean and green. Dustbin is a common and basic need everywhere. The garbage collected at regular intervals may recur the problem. In the proposed project, a new model of the dustbins for immediate cleaning has been proposed.

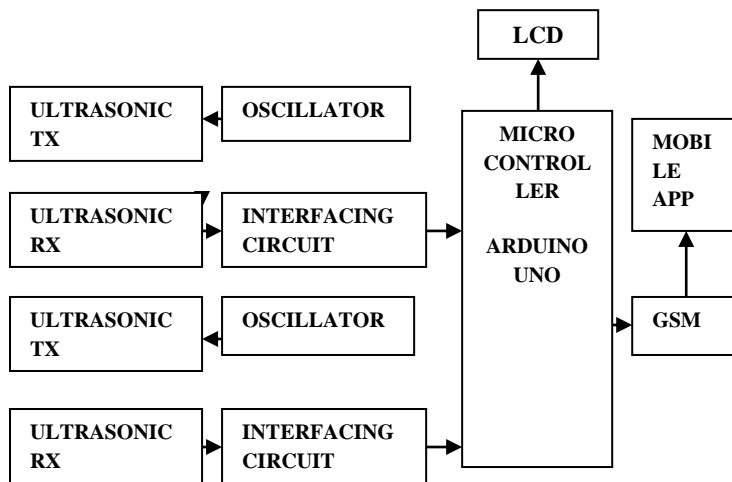


Fig 1.1 Block diagram of the proposed system

II. RELATED WORKS

‘IoT Based Waste Management for Smart Cities’ uses 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, the same signal are encoded and send through RF Transmitter and it is received and decoded by RF receiver at the Central System (Intel Galileo) and an Internet connection is enabled through a LAN cable from the modem. Then a display is done to show the status of the Garbage in the dustbin on the GUI on the web browser. But its LAN cable can often cause damage and RF Transmitter can work well for certain amount of frequencies only, it cannot process many values and also IR sensor cannot detect the dust values accurately [1]. ‘Waste Bin Monitoring System Using Integrated Technologies’ uses two latest technologies namely ZigBee and GSM. ZigBee can be used where the systems that require a lesser rate of data, longer battery life, and secure

networking. But its development and maintenance cost is too high [2].

‘IoT Based Smart Garbage and Waste Collection Bin’ uses both level sensor and weight sensor to detect the level of dust, but to implement weight sensor, load cell has to be mounted. Mounting of load cell is very difficult and calibration is a tedious process. To intimate the cleaner, the system uses Wi-Fi. Wi-Fi can be used only for a limited range since if the signal cannot be detected, the information to the cleaner will not be sent [3]. ‘Smart Dustbin-An Efficient Garbage Monitoring System’ uses ultrasonic sensors at different levels and a GSM module but it fails to monitor the performance of worker and also the level of dustbins [4].

‘A Novel Approach to Garbage Management Using Internet of Things for Smart Cities’ uses the same ultrasonic sensors, Arduino Uno and the GSM modem but it has a drawback that if the bin is filled, the intimation is sent first to the control GUI indicating that “Please inform the cleaner of specific floor as the dustbin of that floor is full”. From the GUI, again a notification will be sent to the cleaner. This is a drawback, where the notification can be sent to the cleaner directly from the GSM rather sending to GUI and from GUI to cleaner [5].

‘Garbage and Street Light Monitoring System Using Internet of Things’ uses camera placed at top of dustbin and a load cell placed at bottom of the dustbin for checking the dustbin level. Though it is effective but load cell is difficult to mount and control [6]. In ‘Smart Trash system: An Application using ZigBee’, ZigBee technology along with gas sensors to detect toxic gases is also implemented [7]. In ‘Smart Bin Implementation for Smart Cities’, Route Optimizing algorithm is used. This algorithm finds the optimized way for the worker to reach the desired place quick [8].

III. PROPOSED SYSTEM

The proposed system is specially designed for any organization to maintain their place clean and neat. The proposed system deals with dustbin monitoring, by making use of

sensors and an android application is developed for controlling the system. The system involves both hardware and software implementation.

A.) Hardware implementation

1) System Architecture

The proposed system consists of Arduino UNO, ultrasonic sensors and GSM module.

i) Ultrasonic Sensor

Ultrasonic sensors work on a principle to evaluate the distance of an object by interpreting the echoes from sound waves respectively. Ultrasonic sensors generate high frequency sound waves and evaluate the echo which is received back by the sensor. The sensors will calculate the distance of objects.

iii) Arduino UNO

Arduino is an open source hardware that creates microcontroller based kits for interactive objects. It is used for building digital devices that can sense and control physical devices. The boards feature serial communication interfaces for loading programs from personal computers using USB. For programming the microcontrollers Arduino provides an integrated development environment (IDE) based on programming languages such as C, C++ and Java.

iv) GSM module

A GSM modem is a specialized type of modem which accepts a SIM card, and operates over a subscription to a mobile operator, just like a mobile phone. From the mobile operator perspective, a GSM modem looks just like a mobile phone. A GSM modem exposes an interface that allows applications such as SMS to send and receive messages over the modem interface. The mobile operator charges for this message sending and receiving as if it was performed directly on a mobile phone.

ii) Power supply

The power supply should be of +5V, with maximum allowable transients of 10mv. To achieve a better / suitable contrast for the display, the voltage (VL) at pin 3 should be

adjusted properly. A module should not be inserted or removed from a live circuit. The ground terminal of the power supply must be isolated properly so that no voltage is induced in it. The module should be isolated from the other circuits, so that stray voltages are not induced, which could cause a flickering display.

v) Operation

The smart bin consists of two ultrasonic sensors S1 and S2. The ultrasonic sensors are placed on the top of the dust bin to sense the level of waste. Ultrasonic sensors measure the distance of the objects. So the sensor is fixed in the way that it can measure the distance of the waste from the top of the dustbin. The threshold value is set between 0 and 20. If the value from the sensor is low, i.e., below 20, the object is near the sensor. It indicates that the waste is near the top of the dustbin, where it represents the dustbin gets filled. The value from the sensor is received by the microcontroller, and in turn it sends the processed value to the mobile Application. If both the sensor values are below the threshold value, the microcontroller induces the GSM module. GSM module gets triggered by microcontroller and it sends the notification to the worker allotted for that corresponding bin. If, after certain time, the allotted worker didn't clean the bin, a re-notification will be sent to the worker. If the bin is not cleaned even after two notifications, then the message will be sent to the next nearest worker. The next nearest worker is the one who has his allotted dustbin which is near to the unclean bin. When the dustbin is cleaned, necessary updates are carried out, and the process gets repeated as in Fig 1.1. The smart bin receptacle finds to be cost effective and a better way of maintaining the environment clean and healthy.

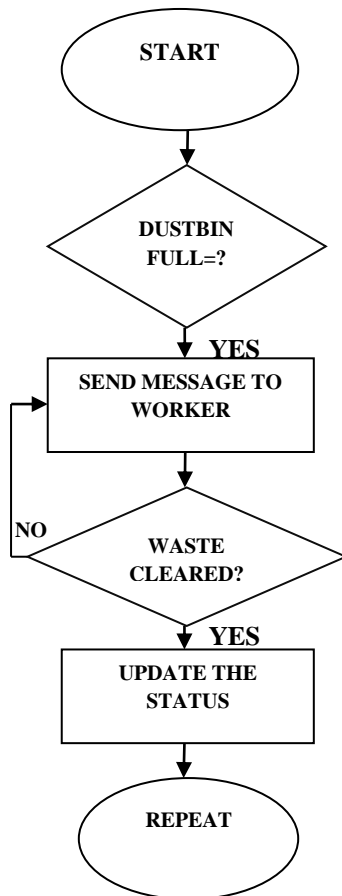


Fig 1.2 Overall Flow Diagram

B.) Software Implementation

The Software used in this system is a mobile application. Mobile application is used for effective and fast communication, since everyone has a smart phone. In the mobile application, the admin or controller can login using their login credentials. Unauthorized users cannot use this mobile application. The application receives the processed values sent from the microcontroller. The data received is displayed in this interface. According to the sensor values, the percentage level of dustbins is calculated and displayed. The values are obtained at a regular interval of 10 seconds. If the sensor values are low say 0 to 20, it means the dustbin is full, so percentage level will be displayed as 100%. As the sensor value increases, the percentage increase will be done correspondingly. The admin can easily check the status of the dustbins. Furthermore, to know details of bins, and information related to when and which bins get filled can be

viewed in the history module. The history module is designed to help the admin to view all details about the worker and dustbin levels.

IV.CONCLUSION AND FUTURE WORK

As urbanisation increases, there is a need for efficient garbage management system. Many government and non-governmental organisations are taking initiatives to manage dustbin spills and reduce waste production. With the improvement in technologies, smart dustbins are developed by implementing technical aspects in a dustbin. Notification mechanism helps in emptying the dustbin at the earliest so that the problem of improper solid waste management is reduced. This can be further enhanced by implementing it on a large scale for a city and allocating the nearest user to the dustbin's location to clean it. The nearest worker can be chosen with the help of GPRS. The application can be further enhanced so that worker's salary can be calculated with respect to the worker's performance. Hence a whole city can be efficiently monitored and cleaned.

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