Automated Garbage Management System

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Abstract- *Recently, it is seen that dustbins placed at public places such as hospitals, educational institutes and industries are overflowing. This overflowing of garbage bins creates unhygienic condition which can spread diseases and spoils the beauty of surroundings. Also rapid increase in population, generates large amount of waste which gives rise to improper waste management. To avoid this situation, we proposed new system "Automated Garbage Management System". In the recent decades, Urbanization has increased tremendously, at the same time there is an increase in waste production. So in order to reduce the spread of harmful diseases, counterbalance the waste production and in order to maintain the beauty of the cities, this paper will prove helpful to achieve this good cause. In this paper, smart bin is built on a microcontroller based platform Arduino Uno board which is interfaced with GSM modem and Ultrasonic sensor. Ultrasonic sensor is mounted on the top of the dustbin which will measure the level of garbage in the dustbin. The threshold limit is set. Arduino will be programmed in such a way that when the dustbin is being filled, the level to which it has been filled will be displayed. Once the garbage reaches the threshold level ultrasonic sensor will trigger the GSM modem which will alert the required authority until the garbage in the dustbin is squashed.*

Keywords- Ultrasonic sensor; Microcontroller; GSM; GUI; Automated System; Arduino Uno

I. INTRODUCTION

Due to rapid growth in population, disorganization of city governments, a lack of public awareness and limited funding for programs, garbage management is becoming a global problem. Due to lack of care and attention given by the authorities the garbage bins are mostly seem to be overflowing. It has to be taken into care by corresponding authorities and should think what method can be followed in order to overcome this. This paper shows some effective solutions.

Internet and its applications have become an integral part of today's human lifestyle. It has become an essential tool in every aspect. Due to the tremendous demand and necessity, researchers have went beyond connecting just computers into the web. These researches has led to the birth of a sensational gizmo, Internet of Things (IoT). Communication over the internet has grown from user - user interaction to device – device interactions these days. The IoT concepts were proposed years back but still it's in the initial stage of commercial deployment. IoT can be used to provide a platform for smart garbage management.

Some of the commonly used methods are implemented using sensors and microcontrollers. The details of each bins are monitored by the authority with the help of integrated GUI. Effective actions can be taken if the corresponding authority is not concerned regarding the cleaning of bins.

The implementation of automated garbage management system using sensors, microcontrollers and GSM module assures the cleaning of dustbins as soon as the garbage level reaches its threshold level. This reduces the number of trips, the garbage collection vehicle has to make and hence reduce the overall expenditure associated with the garbage collection. It ultimately helps to keep cleanliness in the society. Smart collection bin works with the sensors which will show us the various levels of garbage in the dustbins and also gets activated to send its output when its threshold level is crossed. If dustbins are not cleaned in time, the higher authority can observe the situation and handle it accordingly.

II. LITERATURE SURVEY

The garbage management in cities has to be effective and efficient in its implementation. Various proposals have been put forward and some of them already implemented. So a survey was done among different proposals and this paper includes survey about different methods for automated garbage management system.

The paper [1], IoT Based Waste Management for Smart City explains a scenario where there are multiple dustbins located throughout the city or the Campus, these dustbins are provided with low cost embedded device which helps in tracking the level of the garbage bins and also has a unique ID which will be provided for every dustbin in the city so that it is easy to identify which garbage bin is full. The project module is divided into two parts Transmitter section and Receiver section. Here in the transmitter section we are using 8051 microcontrollers, RF Transmitter and sensors these are attached to the dustbin. Where sensor is used to detect the

level in the dustbin whether the dustbin is full or empty. The sensor senses the content of the dustbin and sends the signals to the 8051 microcontroller, Power Supply +9V Battery power supply is given to the 8051 microcontroller to drive the system and the 8051 microcontroller reads the data from the sensor and process the data received from sensor, and the same data wirelessly transmitted to the Central system (Intel Galileo microcontroller) using RF Transmitter. RF Transmitter is used to transmit the signal form 8051 microcontroller to the Intel Galileo microcontroller. Here RF Receiver is used to receive the data sent by RF transmitter to the Intel Galileo microcontroller. The Intel Galileo Gen2 Microcontroller is used to receive the data sent by the multiple transmitters and process the data and the same data transmitted to the Client i.e., Web Browser.

Another method for garbage management is introduced [2] as follows. A dustbin is interfaced with microcontroller based system having IR wireless systems along with central system showing current status of garbage, on mobile web browser with html page using Wi-Fi, hence the status will be updated on to the html page. There by to reduce human resources and efforts along with the enhancement of a smart city vision. Considering the need of modern technology, the smart garbage bin can be expensive but considering the number of dustbin needed in India, sensors are used to reduce its cost and also make it efficient in its application. At the sender side they used only a Wi-Fi module to send and receive data. But because of the use of weight sensor for detection of amount of garbage in dustbin. It will only detect the weight of waste, but not how much level the dustbin has been filled. The message can be sent directly to the cleaning vehicle instead of the contractor's office.

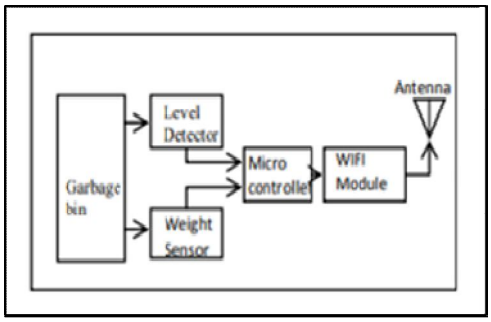

Fig. 1: Transmitter

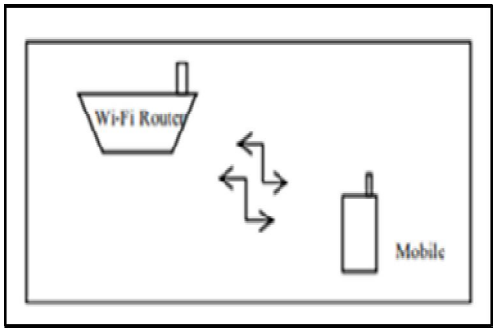

Fig. 2: Receiver

The paper [3] proposed an advanced Decision Support System (DSS) for efficient waste collection in Smart Cities. The system is put together with a model for data sharing between truck drivers on real time in order to perform waste collection and dynamic route optimization. The system handles the case of inadequate waste collection in inaccessible areas within the Smart City.

Surveillance cameras are incorporated for capturing the problematic areas and provide evidence to the authorities. The waste collection system aims to provide high quality of service to the citizens of a Smart City. System architecture aims to suit two main targets. First target is providing software as-a-service (SaaS) products for customers. Mainly, these customers are private companies that are involved in waste collection, owning waste trucks, set up work for drivers, get contracts from municipalities and pass wastes to recycling organizations or city dumps. Second main target is developing a system, which makes possible mutually beneficial communication between all the stakeholders involved in the chain of supplying goods and utilizing solid waste in smart city. This paper presented a novel cloud-based system for waste collection in smart cities. The system aims to provide services for different kind of stakeholders involved in this area - from city administrations to citizens. Still, the design focuses mostly on providing SaaS to commercial waste management companies.

The system proposed by Vishesh Kumar Kurrel [4] assures the cleaning of dustbins soon when the garbage level reaches its maximum. In this management system, IOT is used in the working model for networked radio-frequency identification (RFID), tracking the collection vehicle, dustbin monitoring and other emerging sensing technologies. The IR sensor acts as level detector. The sensor senses the content of the dustbin and sends the signals or the data to the ARM microcontroller then the microcontroller reads the data from the sensor and process the data received from sensor, and the same data will be processed and send to the dashboard section and this section sends mail/message to respective Municipal / Government authority person or collection vehicle. If the

dustbin is not cleaned in specific time, then the record is sent to the higher authority who can take appropriate action against the concerned contractor. This system also helps to monitor the fake reports and hence can reduce the corruption in the overall management system. This reduces the total number of trips of garbage collection vehicle and hence reduces the overall expenditure associated with the garbage collection.

Sr. No.	Paper	Methodology	Advantages	Disadvantages
1	IoT Based Waste Management for Smart City.	The level of garbage is observed using sensors embedded to Intel Galileo Gen2 Microcontroller which is used to receive the data sent by the multiple RF transmitters.	Reduces the total number of trips of garbage collection vehicle and hence reduce the overall expenditure for the garbage collection. Large area can be covered with the help of a single receiver (as the signal is transmitted from various transmitters to a single receiver).	Cost for implementation of the system is high. Number of components used is more such as 8051 microcontrollers, sensors, etc. Complex codes for the implementation of transmitter and receiver.
2	IoT Based Garbage and Waste Collection Bin.	Dustbins are interfaced with microcontroller based system having IR wireless Systems and weight sensor along with central system showing current status of garbage, on mobile web browser with html page by Wi-Fi.	The message can be sent directly to the cleaning vehicle instead of the contractor's office. The dual level check is performed by IR sensors as well as weight sensors.	Cost for implementation of the system is high. System is vulnerable to plundering of components in the system in different ways which needs to be worked on. Accuracy of weight sensors are prone to errors.
3	Waste Management as an IoT-Enabled Service in Smart Cities.	A novel cloud-based system and advanced Decision Support System (DSS) for efficient waste collection in Smart Cities.	The system aims to provide services for different kind of stakeholders involved in this area - from city administrations to citizens. Focuses mostly on providing SaaS services to commercial waste management companies. Dynamic routing models can give a significant increase of cost effectiveness.	Early stages of implementations are difficult as it requires high data analysis. When the truck driver finds a blocked bin or other problem that makes it impossible to collect the waste he/she loses several minutes for reporting the problem.
4	Smart Garbage Collection Bin Overflows Indicator using Internet of Things.	For implementation place a sensor (Infrared sensor / proximity sensor) under the dustbin. When the sensor signal reaches to the threshold value, a mail notification (like email, twitter, WhatsApp message) will be sent to the respective Municipal / Government authority person.	Identification of dustbins by garbage collectors is done using RFID. Centralized system for keeping track of garbage collectors and dustbin throughout the city.	System involves many hierarchical information transfer which makes collecting garbage time consuming. IR sensors does not work properly in dark and dusty environment.
5	Automated Garbage Management System.	Smart bin is built on a microcontroller based platform Arduino Uno board which is interfaced with GSM modem and Ultrasonic sensor.	Once the garbage reaches the threshold level ultrasonic sensor will trigger the GSM modem which will continuously alert the required authority until the garbage in the dustbin is squashed. Various features such as durability, affordability, prevention against damage and maintenance issues are addressed when these smart dustbins are designed.	The technology is new in India; proper awareness should be created among the public before it is implemented on a large scale. Sensitive devices like sensors might be damaged due to rough action of the users.

Table 1: Literature survey

III. METHODOLOGY

The overall working can be divided into two sections as Detection Section and Communication Section. For the Detection Section it makes use of the Arduino Uno (Micro Controller), Ultrasonic Sensor and NodeMCU (Wi-Fi module) as the integrated hardware components for its working. Arduino Uno can be configured using Arduino IDE (Integrated Development Environment) from where the code is uploaded into Arduino Uno. The Arduino Uno can be powered by any power source which in turn powers the ultrasonic sensor and Wi-Fi module with 5 volts and 3.3 volts respectively.

Detection Section

The Figure-5 shows the block diagram of Detection section. Level detector consists of ultrasonic sensors which is used to detect the level of the garbage in the dustbin. The Ultrasonic Sensor is used to measure the distance with high accuracy and stable readings. It can measure distance from 2cm to 400cm. It emits an ultrasound wave at the frequency of 40KHz in the air and if the object will come in its way then it will bounce back to the sensor. By using that time which it takes to strike the object and comes back, the distance for the depth of garbage filled can be calculated. The output of level detector is given to microcontroller. LEDs are used to show the different levels of the amount of the garbage collected in the dustbin. When the dustbin is filled up to the highest level, the microcontroller sends the message to the concerned person via GSM module.

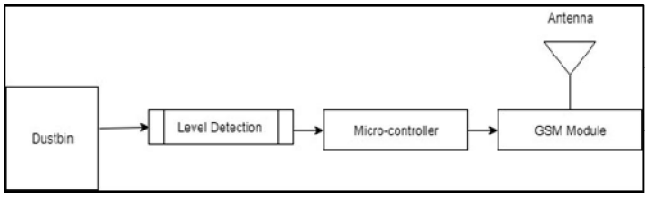

Fig. 5. Detection Section

B. Communication Section

The figure-6 shows the block diagram of communication section. At receiver, admin is the person who manages all the activities. The GSM Module is used to alert the admin about the current status and also informs the cleaner to collect the garbage from the site. The message contains the location of the dustbin which can be viewed using maps. Maps gives accurate location of the dustbin and removes any inconsistencies related to routing. GUI is developed using Php and JavaScript language and is hosted on the network as a website for the monitoring of working system. This GUI can be displayed and accessed on a computer or a mobile node to display the status of the garbage level of the bins integrated in the system.

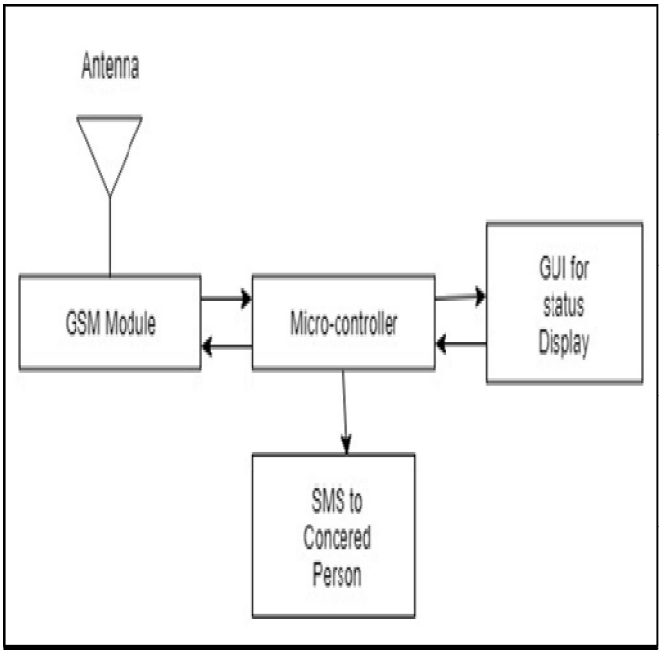

Fig. 6. Communication Section

he overall working of system is systematic design of hardware and software components working in a defined flow to achieve its goal. Arduino Uno board is used as microcontroller platform. Interfacing is done between GSM modem and Arduino board. Threshold height is set to the requirement. Threshold distance is the difference in height at which sensor is placed and the level of garbage fill. During the course of garbage accumulation, whenever the difference falls

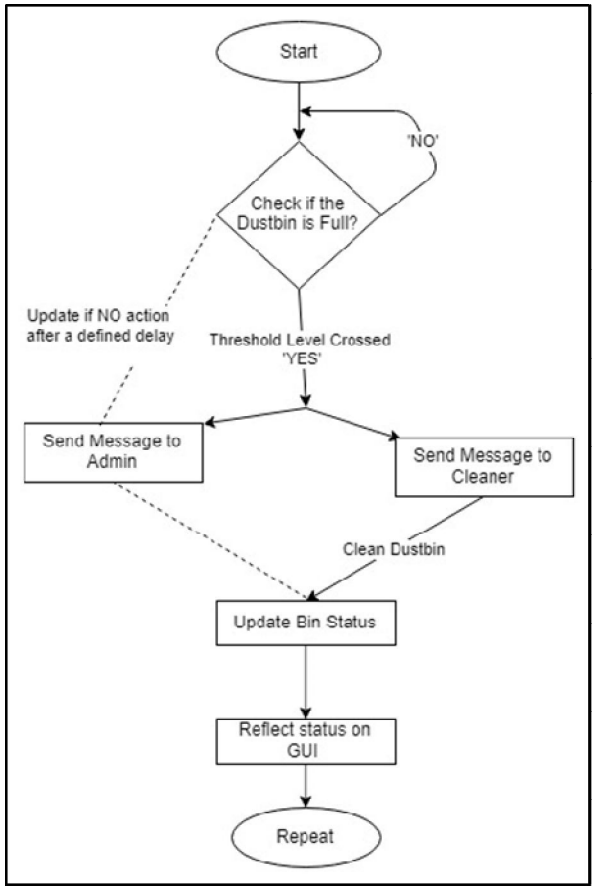

Fig. 7. Flowchart of Working

below threshold value, GSM modem is activated to send an alert signal to the concerned authority through an SMS.

IV. CONCLUSION

This paper shows the implementation of automated garbage management system using Ultrasonic sensor, microcontroller and GSM module. This system assures the cleaning of dustbins soon when the garbage level reaches its maximum. If the dustbin is not cleaned in specific time, then the record is sent to the higher authority who can take appropriate action against the concerned contractor.

This Smart Dustbin can also contribute a lot towards clean and hygienic environment in building a smart city. But since the technology is new in India, proper awareness should be created among the public before it is implemented on a large scale. Otherwise, sensitive devices like sensors might be damaged due to rough action of the users.

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REFERENCES

[1] Parkash, Prabu, IoT Based Waste Management for Smart City.
[2] S.S. Navghane, M.S. Killedar, Dr.V.M. Rohokale, IoT Based Garbage and Waste Collection Bin‖, May 2016.
[3] Alexey Medvedev, Petr Fedchenkov, ArkadyZaslavsky, Theodoros, Anagnostopoulos Sergey Khoruzhnikov, Waste Management as an IoT-Enabled Service in Smart Cities.
[4] Vishesh Kumar Kurrel, Smart Garbage Collection Bin Overflows Indicator using Internet of Things
[5] Vikrant Bhor,Pankaj Morajkar, Maheshwar Gurav,Dishant Pandya, ―Smart Garbage Management System‖, March 2015.
[6] Getting Started with ESP8266 and Arduino: https://www.electronicshub.org/esp8266-arduino-interface/
[7] Arduino Tutorial: https://www.tutorialspoint.com/arduino/
[8] Learning Internet of Things- by Peter Waher.
[9] A Survey on Smart Garbage Management in Cities using IoT Ruhin Mary Saji1, Drishya Gopakumar, Harish Kumar , K N Mohammed Sayed, Lakshmi S.