Comparative analysis of Garbage Management and Tracking System using IOT

Pallavi Chaudhari

Pimpri Chinchwad College of Engineering

Manasi Gokhale

Pimpri Chinchwad College of Engineering

Sonal Jadhav

Pimpri Chinchwad College of Engineering

Rushikesh Wagh

Pimpri Chinchwad College of Engineering

Prof. Smita Khairnar

Pimpri Chinchwad College of Engineering

ABSTRACT

There is a major shift of paradigm towards Internet of Things (IoT) as there are many researches that have been conducted in a wide range of fields. Due to increase in human population, there is a vast increase in the amount of things consumed. Hence, the amount of waste created due to this subsequently increases. The garbage bins thus, placed at various locations get overflowed due to this increased waste and uneven management. If this waste is not managed properly, it can lead to various severe problems. It can propagate multiple deceases and also cause bad odor to propagate in the surrounding environment. Hence, the consequences are too severe. To overcome such kind of situations an efficient system to manage garbage can be developed. Various such kind of methods are developed to make an effort to manage the waste and each has its advantages and disadvantages. This survey includes different efficient techniques that can be used to manage the waste efficiently.

KEYWORDS

Raspberry Pi Zero W, NodeMCU , Ultrasonic Sensor, GSM, GPRS, GPS

INTRODUCTION

In today's world, due to a rapid growth in population, industrialization, lack of awareness among the public, and disorganization in the collection of the waste, the amount of waste is increasing rapidly. Hence, garbage management is becoming a major problem. The authorities are not taking proper care of the waste bins and hence they get overflowed. This creates a huge mess in that particular area. Hence, to enable the authorities to take care and pay proper attention to the waste bins, some intelligent methods can be used that makes the task of garbage collection easier and efficient. This paper includes some efficient solutions [9].

The use of Internet is growing in present world. People rely on Internet for performing various task since it makes lives of people easier. It is an important tool in every aspect. Due to tremendous requirement and necessity the researchers have gone beyond the Internet and developed the technology called Internet of Things (IoT). The IoT has increased the interaction among the devices as well as humans and different

devices. It connects different devices together to accomplish a particular task. Internet of Things can be used for efficient garbage collection.

IoT can be implemented by using microcontrollers and sensors. The sensors collect the information from the external environment and send it to the microcontroller. The microcontroller in turn processes the data collected by the sensors [8]. In garbage management and tracking system, each bin is checked for its garbage level and tracked with the help of a Graphical User Interface (GUI). Manual waste collection generally involves trucks moving around in entire city to empty the garbage bins. This considerably leads to wastage of fuel and energy. Hence, the system uses Global Positioning System along with the interface to provide an optimized route to the garbage collector. The proposed system uses wireless sensor network and is designed to notify as soon as the bin is full. Different implementations are explained in the paper along with the literature survey in the following part.

LITERATURE SURVEY

The garbage management in cities has to be effectively and efficiently implemented. The various proposals were put forward and some of them already implemented. But it cannot be considered as an effective one. So a survey was done among different proposals and this survey paper includes survey among different methods for smart garbage management in cities using IoT.

In paper [1] Infrared sensor is used which is a multipurpose sensor, which can detect the level of garbage. IR sensor emits the light, which is invisible to naked eye. The electronic components can detect it. It has connectors A and B that acts as an expansion port and a connector. C that act as a mini-system port, they carry the signals and these signals are differentiate by different connectors names. Sensor senses level of the bin. The output of IR sensor is acquired by The National Instruments myRIO-1900. The Graphical Interface gives the output of level of garbage filled in bin. When the level in a bin is reached the threshold, the LED placed where bin is located starts blinking. When the LED is Blink, a display opens showing the location of the bin, status of the bin, data and time when the bin gets filled, mobile number and the Message to send to the respective person. But this system does not ensure whether garbage is fully cleaned or not and transportation cost is another major issue.

The paper [2] assures the cleaning of dustbins soon when the garbage level reaches its maximum. It uses the radio-frequency identification (RFID), tracking the collection vehicle, Dustbin monitoring. The IR sensor is act as level detector. This assures a low budget by changing all light traffic servers into Raspberry Pi [10]. The sensor senses the content of the dustbin and sends the signals 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 send to Dashboard section and this section send 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 Respective contractor of that particular area. This system also helps to monitor the fake reports and hence provide controlled environment in the overall management system. This reduces the total number of trips of garbage collector vehicle and also reduces the overall budget associated with the garbage collection.

The input to the sensor module would come from the Dust bin which are placed at different locations in the public area. This is the idea in paper[3]. The sensor is placed in the garbage bin at a max level , if that level is crossed by the garbage in the bin, then sensor will sense that and will communicate to ARM 7 controller through Zig Bee technology [12]. When the Dust bin 1 becomes full, the ultrasonic sensor will detect the level and send a command through zigbee. The zigbee receiver will always receive the command and show the status of Dust bin on the computer.The Message would be that the bin 1 in particular area is filled completely, please collect it. At the same time that same message will be sent to a Garbage collector's mobile that particular garbage bin is completely full through Short Message Service. Same thing will happen when the garbage box 2 becomes full; the ultrasonic sensor will detect the level and send a command through zigbee.

The receiver attached to Zig bee will receive that command and will display that on Display and computer that bin 2 in another area is filled completely, please collect it. At the same time a same message will be sent to a driver's mobile to collect the garbage bins through Short Message Service. By Instance even if both the garbage bin are full at the same time, then also both messages will be displayed on Display and computer of base station one by one. Also Short Message Service will be sent to driver's mobile one by one.

The method in Paper [4] Design of smart waste management system, The system consists of three parts Coordinator node, Router/End device sensor node and web server design. Coordinator node and End device sensor node is linked by radio transceiver. It will allow transmitting garbage bin data from End device sensor node to coordinator node. Attach the two or more sensor node that is Garbage Bins separated from each other. Each sensor node contains a set of three ultrasonic sensors as level sensor , load sensors and one ZigBee transceiver. Ultrasonic sensors will be installed at top portion of the bin along with it there will be load cells for pressure measurement purpose. Ultrasonic sensors will be interfaced with ultrasonic signal conditioning chip. Whereas the signal from array of 4 load cells will be given to Analog to Digital Converter. The programming on the Arduino board is such way that after every minute sensor node sends garbage bin parameter data to coordinator node via the ZigBee wireless communication protocol [11].

This paper [5] provides a smart alert system for trash clearance by providing an alert signal to the municipal corporation web server for immediate cleaning of the bin with proper verification depending upon the level of garbage. This uses the ultrasonic sensor which is interfaced with Arduino UNO to check the level of trash that is filled in the bin and transmit the alert to the municipal corporation web server when the trashbin is filled. Then RFID is used by the driver. RFID is a computer technology that is utilized for the process of verification and it also enhances the garbage alert system by notifying the current status of the trash bin whether it is cleaned or not. The whole process is with the help of an embedded module with RFID and IOT module. The real time status of how waste collection is being done could be monitored and followed up by the municipality authority with the aid of this system. In addition to this the necessary remedial / alternate measures could be adapted. An Android application is developed and linked to a web server to intimate the alerts from the microcontroller to the urban office and to perform the remote monitoring of the cleaning process, done by the workers, thereby reducing the manual process of monitoring and verification. The notifications are sent to the Android application using Wi-Fi module.

The paper [6] is about smart dustbin implementation, solid waste monitoring and management system, the system was integration of communication technologies such as RFID, GPS, GSM and GIS for truck monitoring system. The proposed system is smart bin implementation using ultrasonic, GSM and RFID. The garbage was filling into the bins, after the garbage bin is full the system will sends message to the driver to collect the garbage bin from that area. The proposed system would be able to monitor the garbage collection and monitor the garbage driver of the truck. It would provide in garbage collection of that particular area, tracking the vehicle position through the GIS database and also notice that to reduce the minimum route distance and make it clean and green of the surroundings we can reduce the fuel consumption while reduce the truck no need to visit to that particular place. After the bin is full the particular vehicle is reached to that particular area we identify did the vehicle is reached or not by the RFID. Once RFID reader is detected the tag so it will sends data to the server by the MQTT protocol. After reaching to the server it will store is some database for further clarifications.

COMPARATIVE STUDY

Here we are comparing three proposed garbage systems which are IOT Based Intelligent Bin for smart cities [1], Smart Garbage Collection Bin Overflows Indicator using Internet of Things[2], IOT based smart garbage alert system using Arduino UNO [5].

Table 1. COMPARATIVE STUDY OF SMART GARBAGE SYSTEM

Parameters	Paper 1	Paper 2	Paper 5
Sensors	IR sensor: It is used which is a multipurpose sensor, which can detect the level of garbage.	IR sensor: The IR sensor is act as level detector. The sensor senses the content of the dustbin and sends the signals to the ARM microcontroller.	Ultrasonic Sensor: It is interfaced with Arduino UNO to check the level of trash.
Controller	myRIO-1900: The output of IR sensor is acquired by The National Instruments myRIO-1900. It is an input output device which is portable and reconfigurable.	Raspberry pi: It reads and process data received from sensor, and the same data will send to Dashboard section and this section send mail/message to respective Municipal / Government authority.	Arduino UNO: It will transmit the alert to the municipal corporation web server when the trashbin is filled.
Notification	SMS: When bin gets filled, a display opens showing the location of the bin, status of the bin, data and time when the bin gets filled, mobile number and the Message to send to the respective person.	Mail/Message: Dashboard section send 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.	Android Application: It is developed and linked to a web server to intimate the alerts from microcontroller. The notifications are sent to the Android application using Wi-Fi module.
GUI	The Graphical Interface gives the output of level of garbage filled in bin.	Authenticated person can see the density of the Dustbin through internet on a Dashboard, this is a GUI(Graphical User Interface) dashboard so any of the authenticate person will easy check the present condition of the dustbin.	In this System no User interface is provided to check and track the information about garbage bins.

PROPOSED SYSTEM
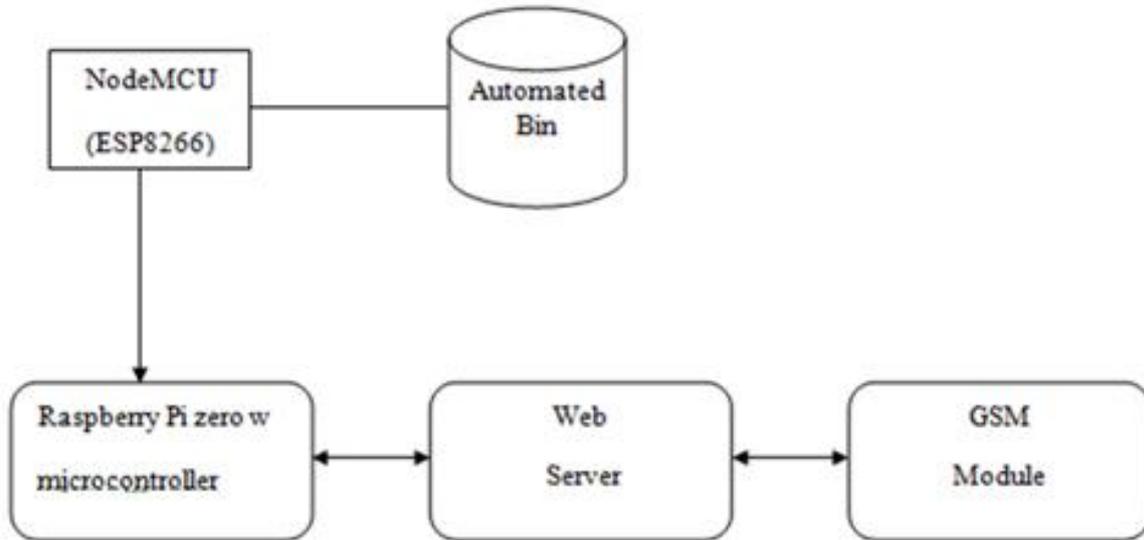
Fig 1: Proposed System

The methodology for the proposed solution is shown in Figure .Each bin is assigned with a unique id and consist of some amount of garbage. The hardware which is the electronic device (ie.Node MCU) is already connected to the dustbin, later each time the garbage is added to the bins the sensors identify the level and if the bin is 80% full, the unique id of the bin is transmitted to the controller [7]. The sensors are not just for level indication, but also for sensing state of matter of waste being disposed. For this the system uses two bins one for solid waste and one for liquid waste collection. The solid waste, is any garbage refuse or rubbish that we make in our homes and other places. These include old car tires, old newspapers, broken furniture and plastics, paper, rubber, metals, leather, cloth rags, wire, glass and things etc. fall under the category of dry waste. Wet waste includes cooked and uncooked food, waste from fruits and flowers, fallen leaves, dust from sweeping and other eatable items. Then the controller indicates (ie sends) unique id to the garbage collector truck. Then the truck collects the garbage of that bin.

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