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IOT BASED SMART GARBAGE COLLECTION USING RFID AND SENSORS

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Abstract -- Most of the places in India suffer from poor garbage disposal. In Indian cities due to the growth of population garbage disposal has become a challenging task for the municipality authority. Trashes are spread over the roads and vacant land in most of the places. This is due to disposal of garbage on the road instead of garbage bins. People are not able to dispose the garbage in garbage bin due to garbage overflow and not disposing the garbage frequently. If a city is aiming for smart city then it has to maintain the hygienic condition of the city, if garbage is not disposed properly then it becomes a crucial health issues since maintaining hygiene becomes a challenging task. So to overcome this and to maintain the garbage system the dust bins are attached with sensors and the data collected through the sensors are sent to the corporation office control room. This is enabled used a wireless communication technology. The level of the garbage is supervised using an Graphical user Interface which is integrated with the Android application. The dust bin location is traced with a help of GPS enabled in the garbage bin. The location of dustbin information is also tracked using the GPS system integrated with the garbage bin. If these devices are integrated then it will enable to reduced the overall time in tracking and disposing the dustbin on time, thus the dustbin is regularly monitored. The bin is attached with RFID reader, load cell, gas sensors, and humidity sensors. The bin is operated based on the RFID reader and sensors which opens the bin according to the dry and wet waste. The RFID tag is given to the public. The public needs to display the RFID tag to throw the trash in to the dustbin. The person who is throwing the maximum number of garbage is rewarded with points. The weight of the garbage thrown by the user is calculated by the load cell placed in the dustbin. By this way we can avoid the public throwing the garbage on streets. The humidity sensor is placed to separate the wet and dry waste. Thus it helps in the disposal of the garbage and avoid in spreading of diseases due to the trashes spread across the streets.

Keywords—Garbage, Microcontroller, RFID, Sensors

1. INTRODUCTION

The Smart Garbage collector is a specially designed method to dispose the garbage in a smart way which solves the social issues of hygiene in the country. The IoT technology is slowly emerging in all the fields of city administration. The “swachh Bharat” is a campaign that is encouraged by the government of India and many. Youth of the nation are interested in propagating it. In addition to the garbage collector a way to attract the people to properly dispose the garbage also has to be introduced. This can be done by giving a bonus points to the citizens who are disposing the



garbage properly by using a RFID tag. The garbage collected is recorded. The RFID tags are used for automatically identifying and giving alerts to the users based on the values in the RFID tags. This RFID tag is embedded into an IoT module for easier execution. The optimal route can be taken by the garbage collector vehicle since all the information reaches the control room on time. This proposed system will give points and encourage the citizens to follow the rules and rewards will encourage them to do their duty in a correct way by disposing the garbage properly. This also enables the corporation authorities to take action immediately in a smarter way. This method also helps the human to live in a health environment. Even plants and animal will have a health life since the waste is disposed at the correct time and gives the importance of disposing the waste on time.

2. REVIEW OF THE LITERATURE

Smart cities should aim for safe and efficient means of communication. The level of garbage from the garbage collect kept in the streets can emit hazardous gas. This can be reduced by a wireless device to indicate the level of garbage [1]. The level of garbage in the dustbin kept in the streets can become full if it not properly disposed. So a waste management systems is proposed by giving alerts through SMS and through the GSM module [2]. The use of Smart garbage collector enables in saving the fuel and time. The smart bins have a threshold limit, the garbage can be filled till the threshold limit. If it reaches the limit then the condition is updated of the bin is sent via cloud and the status is updated. This status are accessed by the in charge person and the immediate measures clear the dustbin is taken, so the garbage are disposed in an effective manner without any human intervention and waste of time [3]. The conditions of the dustbin is checked with the help of sensors, the input is sensed through the sensors and it is passed on to the control room through the GSM system. The sensors are connected to the micro controller which will process the data from the sensors and communicate to the GSM system. An android based system is also designed to sense the information at various locations and collect the garbage in an effective manner.[4]. The smart alert system is proposed for garbage clearance, this is done by giving an alert to the system using a web server. Instant clearance of the garbage and cleaning of the dustbin is done using the verification based garbage level filling. The garbage cleanliness is confirmed with the help of the RFID tags. Where RFID tags is used for automatic identification and gives alert based on the readings of the RFID tags. This module is also embedded in IoT. The real time action of waste collection is monitored by corporation authorities for taking immediate action [5]. Since India supports for clean India movement and intelligent dustbin with well-equipped RFID, LCD with sensors and micro controller is introduced this system will display the name of the person in the LCD attached to the dustbin. After seeing the identity of the person the door of the dustbin is opened. The person is detected using the sensor and to open the door of the dust bin servo motors are used.[6]. A cost effective and intelligent waste container for small scale uses is developed with Arduino Nano board. SMS alert is given using the GSM module. The bin is operated by a solar cell and an audio message will be given if the bin is full [7]. A smart and innovative use of the dustbin is designed for use in railway station and bus stands. The micro controller adjusts the movement of the motor and compresses the waste in dustbin and will increase space for putting more garbage. It reduced the vehicle time to collect the waste frequently [8]. Garbage is collected using the IoT device the ultra-sonic sensor and infrared sensor detects the waste and gas and passes the information through the Raspberry pi micro controller [9, 10].

3. SMART GARBAGE

A. *Smart Garbage Architecture*

The architecture of the Smart Garbage collector has sensor which is used to collect the input data. The ultrasonic sensors are attached to deduct whether the dustbin has become full or not. If the dustbin becomes full, it is deducted by the ultrasonic sensors. The gas sensor is attached to deduct the toxic gases. The IR sensor is used to open the dustbin automatically. The dustbin is also

attached with the RFID reader. The persons throwing the waste in the dustbin have RFID tags with them. The person can open the dustbin by showing the RFID tag. The points are rewarded to the user throwing the waste in the bin by using the RFID reader. The other important components used are the jumper wires, servo motor. The programming language used is the python. The operating system used is Ubuntu.

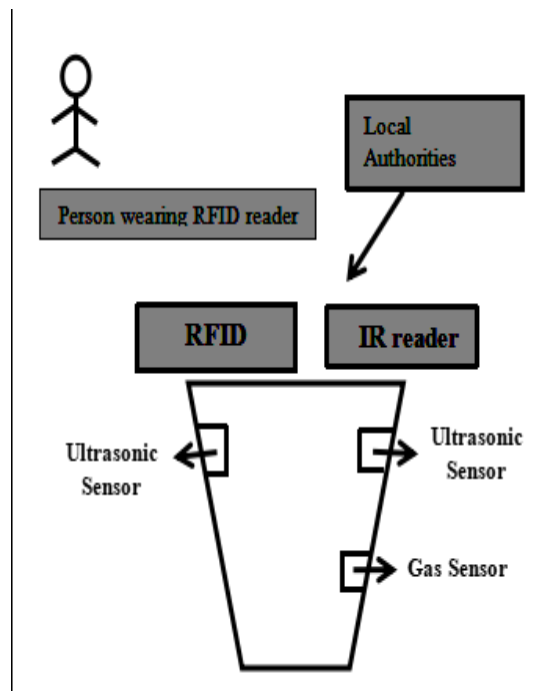


Fig. 1: Structure of the smart garbage

4. GARBAGE SYSTEM ARCHITECTURE

The micro controller used is the raspberry pi. The various sensors attached to it are the ultrasonic sensors, gas sensors, IR

A. Deduction of Toxic Gas

Sometimes the bin doesn't get full so the waste remains in the dustbin for a long time and it starts to emit odor. To remove the waste from the dustbin, the gas Sensor is attached to deduct the toxic gases that are present in the dustbin. Waste gets decomposed and starts to emit gases which emit odor. This can be deducted by the gas sensor.

B. Reward Points

The Dustbin has one RFID reader attached to it. The user can open the bin only through the RFID tag. When the person throws the waste into the dustbin, the person's name and unique identity is noted. Each time when the user throws the waste in the dustbin, a point is rewarded to that user. The user is given points accordingly. By this way, the user will have an awareness to throw the waste in the dustbin only.

C. *Working principles*

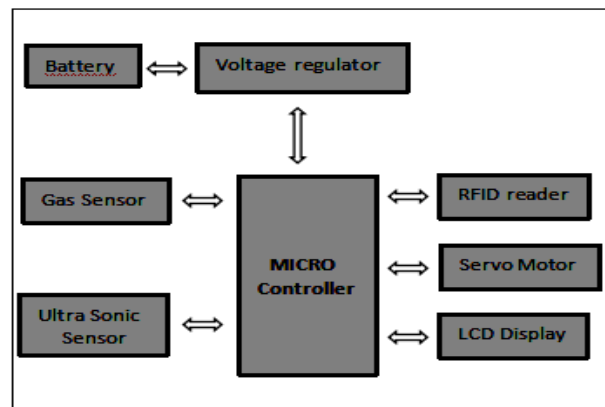


Fig. 2: Block diagram of smart garbage

The working of the smart garbage is explained form the below steps

- 1) If a person throws the waste in the dustbin, the RFID reader reads the information about the person.
- 2) The points are calculated when the person throws the waste in the dustbin by using the RFID reader. A point is added each time when the person throws the waste into the bin using the RFID reader and tag.
- 3) When the dustbin is full, it is deducted by the ultrasonic sensors and the message is sent to the local authorities to collect the waste.
- 4) When the bin is not full but the waste is there for a long time, odor comes from the dustbin. To deduct the odor, a gas sensor is placed inside the

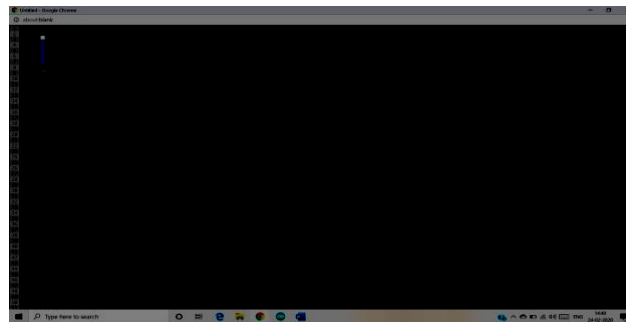
5. RESULTS

The micro controller used is the raspberry pi. The various sensors attached to it are the ultrasonic sensors, gas sensors,



Fig.3 : Experimental setup

IR. The components are assembled and placed in the dustbin and the sensors are integrated with the bin also with the RFID reader and jumper wires. as shown in figure 3

**Fig.4 :Coding for Smart Garbage**

The coding is done on micro controller using the embedded c language by taking the input from the sensors as shown in figure 4

6. CONCLUSIONS

A prototype is build for smart garbage disposal using the dustbin that can open the lid automatically if it detects the garbage bag. It is also used in detecting the level of the garbage collected inside the garbage collector and if it reaches a threshold then through the sensors attached the data is collected and the information is send to corporation offices through the IoT device integrated with the RFID tag which is used to give reward points for the users. The gas sensors and humidity sensors enables to identify the toxic gas and enables the corporation authorities to sprinkle the chemicals to control it. This sensor is integrated with the Raspberry pi which sends the information to the control room. The user interface is designed for the corporation authority to know the information through the dash board and the dash board information is updated frequently and proper disposal is done by sending the garbage disposal vehicle on time. This save the time and money and also avoid people suffering the various disease due to garbage. This Smart Garbage collector will also pay a way for Smart city.

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