

Wastebin Monitoring System using Integrated Technology and IoT

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Abstract—There is an implicit need of smart dustbins, as our country is expanding rapidly but the infrastructure is not expanding at the same pace that of urbanization. The govt. of India has launched the smart city project and ‘Swach Bharath Abhiyan’ to improve the city’s infrastructure. Solid waste management is must in developing countries mainly due to the increasing generation of waste. The burden posed on the municipal budget is high associated to waste management. Even with great route optimization, the worker must still physically go to the dustbin to check waste levels so, dustbin is integrated with microcontroller and sensors, and elevated the normal dustbin to work smart. The system sends the real time information about the status of the dustbin such as level, garbage thrown out, smell, smoke, fire etc. using GPS and displays the status of the dustbin on LCD. The authority receives the status along with the voice message using software application.

Keywords— GPS, LCD, Microcontroller.

I INTRODUCTION

There is an implicit need of Smart waste management to improve the infrastructure of our cities. The idea of Smart Dustbin is for the Smart cities, buildings, educational institutes, Hospitals, Bus stands and any other public places. The Smart Dustbin is an improvement of normal dustbin by elevating it to be smart using sensors and logics. Often garbage is thrown outside the dustbin this makes surrounding look dirtier and often it has been witnessed the ideal place for planting bombs has found out to be public dustbins for mass bombing. This has created serious problem concerning the cities security. In order to overcome all these problems, the idea of smart waste management system which helps in auto-management of waste without human interaction in order to maintain a clean environment. The concept of smart waste management is implementable in cities where waste production is domestically high but the effort put to control it is relatively very low. All cities, regardless their size, their geographical location or their economic level, spend huge amount of money every year for waste collection.

II LITERATURE SURVEY

IOT based architectural solution to tackle the problems faced by the solid waste management system. MQTT (Message Queue Telemetry Transport) protocol and LoRa technology are used for communication. Scope of improvement

mentioned is to provide communication security. Monitoring the energy produced from the bio-gas plant has to be developed and integrated into the system [1]. IOT based methodology has been proposed as a new solution for waste management. Raspberry Pi and infrared sensors are used to collect data from bins and to communicate. The technology is cost effective [2]. The paper proposes a smart alert system for garbage clearance by giving an alert to the server. Ultrasonic, infrared sensors are used to sense the filling and Arduino Uno and wifi module are used for communication. For confirmation RFID tags are used. The main concepts of the paper are solution in environmental maintenance, avoiding human intervention in garbage maintenance of the municipality and pollution monitoring system [3]. The main motto of the mission is to cover all the rural and urban areas of the country. The paper proposes that it saves times, money, fuel and reduce exhaust gas emission. Even garbage truck tours can be reduced by 30% [5]. The work presents the concept and methodology as well as the architecture and physical implementation of an integrated node for smart-city applications. RFID and ultrasonic sensors are used in the project. The presented system has been designed and implemented in the framework of the national funded Dynacargo [5].

III IMPLEMENTATION

In proposed work implementation of IoT based smart bin monitoring system is designed. Garbage bins need human monitoring for its cleaning, collecting, transporting and management this is a tedious process. Regardless of size, geographical location, economic level of cities it consumes huge amount of cost and time. So to overcome these problems smart dustbin is designed which is integrated with sensors and GSM module gives real time information about the status of the dustbin. It mainly consists of transmitter and a receiver. Where transmitter is the dustbin system and receiver is the concerned authority. When any of the sensors in the dustbin gets activated it sends message to the concerned authority where they can answer the problem immediately. Level, Fire, smoke, smell, motion and metal detectors are used to sense any danger which may cause accidents in the dustbins and GSM module is used to send messages. The Figure 1: shows the block diagram of the smart dustbin.

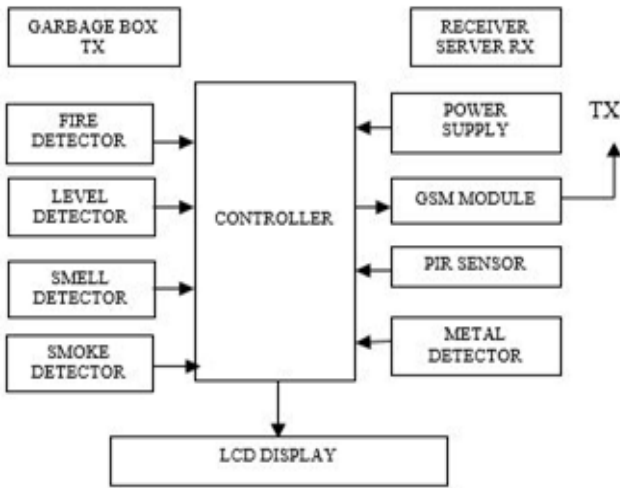


Figure 1: Block Diagram of Smart Dustbin

Level sensor is used which can detect the level of the garbage in the dustbin and send the status to the authority for the collection, PIR (passive infra-red) sensor which can detect the garbage which has been thrown outside the dustbin and send information to the concerned authority, fire sensor which can detect the fire which may be started accidentally in the dustbin, smell detector which can detect the harmful gases in the dustbin, smoke detector senses the smoke which may lead to fire. These are the sensors which are used to elevate the normal dustbin to smart dustbin.

The system has three software based applications.

1. Dustbin Module
2. Guardian Module
3. Public Module

Dustbin Module

Dustbin Module is shown in Figure 2 which is placed in dustbin acts as the sender and it has the access to GPS and camera. Whenever there is request for location or the status of the dustbin it accesses the GPS for location and camera to take the pictures of the condition of dustbin where it sends the location and status of the dustbin to the concerned authorities.

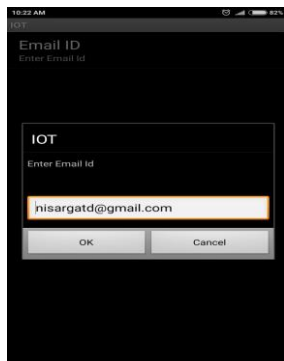


Figure 2: Dustbin Module

Guardian Module

Guardian Module is shown in Figure 3 and it is for the authority which acts as the receiver and receives the status of the dustbin for example the level of the garbage in the dustbin or about the emergency situations like fire, smell, smoke etc. where authority can take actions accordingly.

If the concerned authority wants the location of the dustbin, they need to select LOC option and the application automatically sends SMS to the dustbin module. If concerned authority wants image of the dustbin they need select PHOTO option and application automatically sends SMS to the dustbin module.

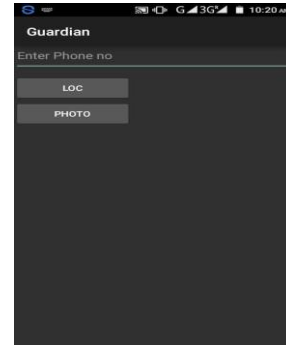


Figure 3: Guardian Module

Public Module

Public Module is shown in Figure 4 for the public who can login and send complaints or the feedback to the authority. Here any public person faced any problem regarding dustbin, they can login and send SMS to authority.

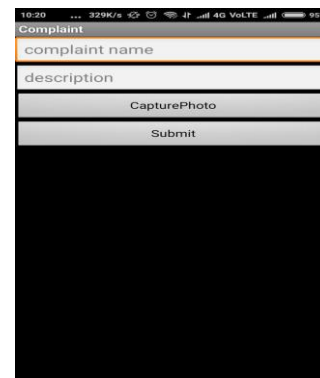


Figure 4: Public Module

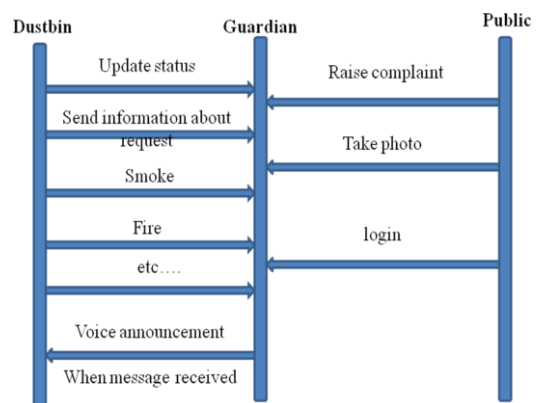


Figure 5: Contextual Diagram

The contextual diagram in Figure 5 shows the visual representation of the communication between the modules. Three modules exchange messages between them. The public can login and raise complaint to guardian. The dustbin module sends message about the status of the dustbin. The guardian module gives the voice message about the status.

The flow diagram in Figure 6: shows the working flow of the system.

When the dustbin system is powered, the sensors starts checking the status of the dustbin if any of them is activated it sends message to the concerned authority about the status if not it goes on checking until its power offed. When there is message about the dustbin status in the authority it takes action to the situation immediately and this flow repeats continuously.

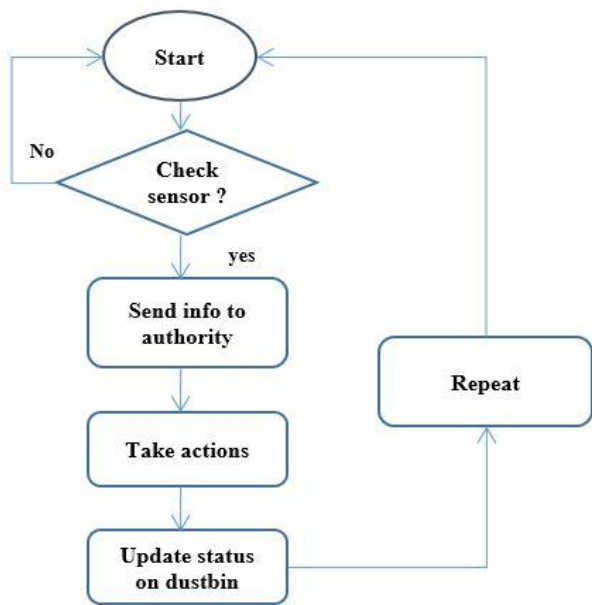


Figure 6: Flow Diagram

IV RESULT

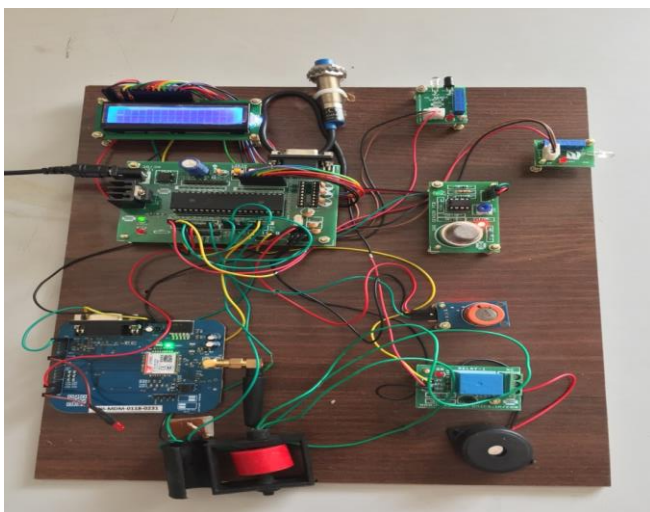


Figure 7: Proposed System

When the garbage volume is reached to the maximum the system sends message and there will be voice announcement about the status. Shown in Figure 8.

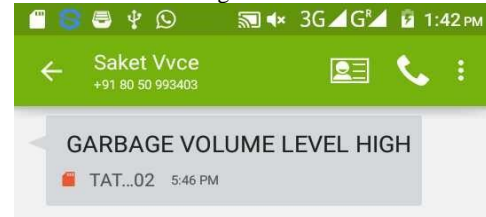


Figure 8: Garbage Volume High

When the garbage is found outside the dustbin the system sends message to concerned authority. Shown in Figure 9.

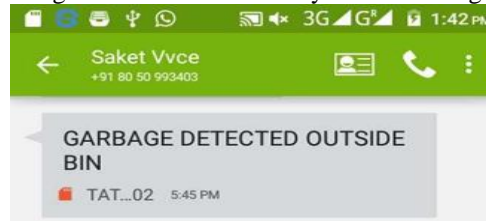


Figure 9: Garbage outside the Dustbin

When the fire is detected in the dustbin it sends the report to the concerned authority about the situation where they can take immediate action about the situation. Shown in Figure 10.

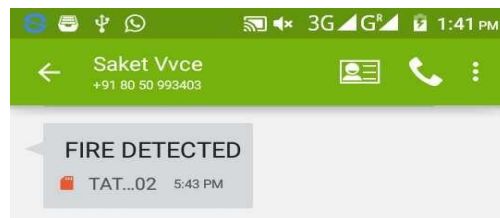


Figure 10: Fire Detected

When the Smoke is detected in the dustbin it sends the report to the concerned authority about the situation where they can take immediate action about the situation shown in Figure 11.

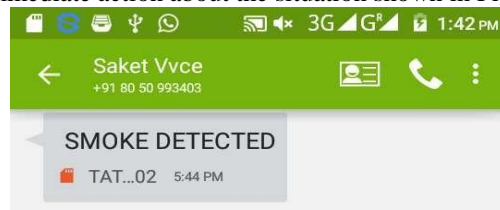


Figure 11: Smoke Detected

When the Smell is detected in the dustbin it sends the report to the concerned authority about the situation where they can take immediate action about the situation shown in Figure 12.

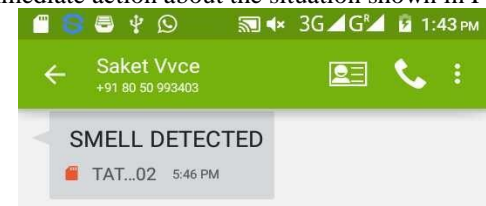


Figure 12: Smell Detected

V CONCLUSION AND FUTURE WORK

The system assures the cleaning of trash cans once the garbage level reaches its maximum limit. Helps in route optimization for collection of garbage and overall management and it helps to find the garbage thrown outside the dustbin. Sends the real time information about the dustbin status. The smart bin monitoring system makes the garbage collection more efficient and easier. It ultimately helps to keep cleanliness in the society and ensures the security of the city. The smart dustbin system has lot of scope regarding improvisation. The public dustbins in the cities where the crowd is more are suitable for bombing and other criminal activities hence; such dustbins can be integrated with bomb and explosive detectors where the smart dustbin can send information to the authority to maintain the security of the city.

ACKNOWLEDGEMENT

The authors express sincere gratitude to Dr. B. Sadashive Gowda, principal VVCE, Mysuru. The authors also express sincere thanks to Dr. D.J. Ravi, HOD, Dept. of ECE, VVCE. We also express gratitude to our guides Shilpa R, Associate Professor, VVCE. and Girijamba D L, Asst. Professor, VVCE. for their helpful contribution in this project work and for their encouragement and support.

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