

IOT BASED SMART GARBAGE AND WASTE GATHERING BIN

Panasa Naveen¹ Dr.S.Koteswari²,

¹B.Tech Student (159P1A0433), DNR college of Engineering,,Bhimavaram,,Andhra Pradesh,India.

²Professor, & HOD ,Department of ECE, DNR college of Engineering,Bhimavaram,Andhra Pradesh,India.

ABSTRACT: To make the cities greener, safer, and more efficient, Internet of Things (IoT) can play an important role. Improvement in safety and quality of life can be achieved by connecting devices, vehicles and infrastructure all around in a city. In the present day scenario, many times we see that the waste bins or Dust bin are placed at public places in the cities are overflowing due to increase in the waste every day. It creates unhygienic condition for the people and creates bad smell around the surroundings this leads in spreading some deadly diseases & human illness. Thus we present a waste collection management solution based on providing intelligence to waste bins, using an

IoT prototype with sensors. In this proposed system there are multiple dustbins located throughout the city or the Campus, these dustbins are provided with embedded device which helps in tracking the level, gases and odour statuses of the waste bins. When the level reaches the threshold limit, the device will transmit the information of level and gas statuses of the bin. These details can be accessed by the concern authorities from their place with the help of Internet and an immediate action can be made to clean the dustbins.

KEY WORDS: Internet of things(IoT), Smart waste management, Embedded device,safety.

1.1 INTRODUCTION:-

Municipal solid waste management is one of the major environmental problem of Indian

cities. Improper management of municipal solid waste causes hazards to inhabitants. Various studies reveal that about 90% of MSW (Municipal Solid Waste) disposed of unscientifically in open dumps and

landfills creating problems to public health and the environment. Presently our government has following three types to

collect solid waste. Community bin collection House-to-House collection Collection on regular pre-informed

timings Out of these three collecting methods Community bin collection requires less man power, takes less time and at low cost. But this method has some drawbacks. To avoid those problems by using IoT based smart dustbin is the main objective of our proposal. IoT or Internet of Things refers to the network of connected physical objects that can communicate and exchange data among themselves without the desideratum of any human intervention. It has been formally defined as an “Infrastructure of Information Society” because IoT sanctions us to amass information from all kind of mediums such as humans, animals, conveyances, kitchen appliances. Thus, any object in the physical world which can be provided with an IP address to enable data transmission over a network can be made part of IoT system by embedding them with electronic hardware such as sensors, software and networking gear.

IoT is different than Internet as in a way it transcends Internet connectivity by enabling everyday objects that utilizes embedded circuits to interact and communicate with each other utilizing the current Internet infrastructure. Since then the scope of IoT has grown tremendously as currently it consists of more than 12 billion connected devices and according to the experts it will increase to 50 billion by the end of 2020. With the advent of IoT both manufacturers and consumers have benefited. Manufacturers have gained insight into how their products are used and how they perform out in the real

world and increase their revenues by providing value added services which enhances and elongates the lifecycle of their products or services. Consumers on the other hand have the ability to integrate and control more than one devices for a more customized and improved user experience.

An Embedded system can be defined as a computing device that does a specific focused job. Appliances such as the air-conditioner, VCD player, DVD player, printer, fax machine, mobile phone etc. are examples of embedded systems. Each of these appliances will have a processor and special hardware to meet the specific requirement. The embedded software is also called “firm ware”. The desktop or laptop is a general purpose computer. we can use it for a variety of applications such as playing games, word processing, accounting, software development and so on. In contrast, the software in the embedded systems is always fixed.

Embedded systems do a very specific task they cannot be programmed to do different things. Embedded systems have very limited resources, particularly the memory. Generally, they do not have secondary storage devices such as the CDROM or the floppy disk. Embedded systems have to work against some deadlines. A specific job has to be completed within a specific time. In some embedded systems, called real-time systems, the deadlines are stringent. Missing a deadline may cause a catastrophe-loss of life or damage to property. Embedded systems are constrained for power. As many embedded systems operate through a

battery, the power consumption has to be very low.

Our proposal system equipped with Embedded system and Internet of Things(IoT) and mainly useful to immediate cleaning of the dustbins. As dustbin is considered as a basic need to maintain the level of cleanliness in the city, so it is very important to clean all the dustbins as soon as they get filled and producing any harmful conditions. We will use ultrasonic sensor and gas sensors for this system. These sensors will be placed on the top of the bin which will help in sending the information from the dustbin to municipal office and vehicle driver when the dustbin has reached its threshold levels and producing harmful gases then the immediate action should be taken as soon as possible. The concept of IoT when used in this field will result in a better environment for the people to live in. No more unsanitary conditions will be formed in the city. With the help of this system minimal number of smart bins can be used around the whole city and the city will still be much cleaner. There has been an unprecedented growth in the number of devices being connected to the internet since past few years. All these devices connected to the internet are part of the IoT infrastructure which can communicate with each other. The Iot network consists of embedded electronics, sensors and software that allows these devices to send and receive data among each other. This is why it is beneficial to use such an existing infrastructure for designing the proposed security system.

The disadvantage of the existing system is that the employees have to go and check the bins daily whether they are

filled or not, it results in high cost. If the bin doesn't get emptied on time then the environment becomes unhygienic and illness could be spread. The proposed system will help in removing all these disadvantages. The real-time information can be gained regarding the level and gas status of the bin on the system itself. It will also help in reducing the cost as the employees will have to go only at that time when the bin is full. This will also help in resource optimization and if the bins will be emptied at time then the environment will remain safe and free from all kinds of diseases. The cities will become more cleaner and the smells of the garbage will be much less.

1.2 MOTIVATION

We are presently studying India is a developing country from decade of years but other countries as developed countries even India having same resources as like other countries. Solid waste management is also a vital reason for being India as a developing country as per the records of the past. India is in the top 10 countries list that produces solid waste. But in environmental performance index India Ranks 177 out of 180. This is the reason why we are motivated towards this project. Our proposal definitely useful to make India clean and thus helpful to be India as a developed country.

1.3 PROBLEM DEFINITION

We frequently observe community bins as in the condition of over-flow at highly populated areas. These dustbins create harmful effects to

the environment as well as human beings and animals. For example butter food material at some conditions produce methane gas. Methane is the dangerous green house gas and which is in high concentration produces harmful conditions.

1.4 OBJECTIVE OF THE PROJECT

The objective of our proposal is to reduce the man power by monitoring the condition of the dustbin from anywhere in the world by using IoT and alerts concerned authorities. Then certain actions are to be taken if any unconditional and harmful results are occurred at particular dustbin. Thus our proposal saves money and time.

2. LITERATURE REVIEW

We are living in an age where tasks and systems are fusing together with the power of IOT to have a more efficient system of working and to execute jobs quickly! With all the power at our finger tips this is what we have come up with. The Internet of Things (IoT) shall be able to incorporate transparently and seamlessly a large number of different systems, while providing data for millions of people to use and capitalize. Building a general architecture for the IoT is hence a very complex task, mainly because of the extremely large variety of devices, link layer technologies, and services that may be involved in such a system. One of the main concerns with our environment has been solid waste management which impacts the health and environment of our society. The detection, monitoring and management of wastes is one of the primary problems of the present era. The

traditional way of manually monitoring the wastes in waste bins is a cumbersome process and utilizes more human effort, time and cost which can easily be avoided with our present technologies. This is our solution, a method in which waste management is automated. This is our IoT Garbage Monitoring system, an innovative way that will help to keep the cities clean and healthy. Based on the growing technology the features of the smart dustbins are enhancing from one level to next level. Previously the dustbins were facilitated with the technology to monitor the level of the dustbin and alert the concerned authorities by using IoT and GSM technologies. The previous method also contains GPS facility by that the vehicle driver can track the location of dustbin easily. Now our proposal is to enhance the features of the previous model by overcoming its limitations and drawbacks.

2.2 PREVIOUS MODEL

Actually smart dustbin is an basic concept which is in the process of implementation from couple of years, After the IoT field finding its grip in our lives. This is, however an original plan for designing a smart garbage bin with weight sensor, IR sensor and Wi-Fi module for transmission of data. In the previous model the dustbin having only one feature of sensing that is for level monitoring. An ultrasonic sensor which is placed on the top of the dustbin tracks the level of the bin for every predefined intervals of time. When the dustbin level reaches the threshold value then it sends

the information to the microcontroller. Then the microcontroller alerts the workstation with the help of the IoT technology by using Wi-Fi module through cloud as well as alerts the vehicle driver by sending a message with the help of GSM and shows the location of the dustbin by GPS. This information helps concerned authorities to take immediate action on the dustbin.

[1]. A State of the Art review on Internet of Things by P. Suresh, Vijay. Daniel, R.H. Aswathy, Dr. V. Parthasarathy. It gave the idea of IoT subject and addition details about IoT. The proper smart environment and various applications.

[2].Internet of Things: Challenges and state-of-the-art solutions in Internet-scale Sensor Information Management and Mobile analytics by Arkady Zaslavsky, Dimitrios Georgakopoulos. This paper gave us the details about mobile analysis and sensor information management that will help in data segregation of various dustbins.

[3]Top-k Query based dynamic scheduling for IoTenabled small city waste collection by Theodoros Anagnostopoulos, Arkady Zaslavsky, Alexey Medvedev, Sergei Khoruzhnicov. It gave us the concept of dynamic scheduling required for the cleaning of dustbin and the Top-k query led us to priority based cleaning of dustbins

[4]City Garbage collection indicator using RF(Zigbee) and GSM technology. This paper gave the details for the module

required for the transmission of the data to the receiver side and also the main channel follow of the project. Initially we used GSM technology for our project but later on decided to us Wi-Fi module for the ease of data transmission.

[5]Smart Garbage Management System by Vikrant Bhor, Pankaj Morajkar, Maheshwar Gurav, Dishant Pandya. It provided us with additional details and designs needed for flow and management of garbage while collection

[6]IoT-Based Smart Garbage System for efficient food waste management by Insung Hong, Sunghoi Park, Beomseok Lee, Jaekeun Lee, Daebeom Jeong, Sehyun Park. This paper gave the overview working of the IoT based smart garbage bin and the food management.

2.3 LIMITATIONS AND DRAWBACKS OF PREVIOUS MODEL

It can't detect the gases and odour that are forming in bin.

- It unable to detect if any space left in the bin while any object is placed on the top of the bin.
- It can't detect the liquid waste.
- Using GSM module is a drawback because it needs 12V source.

2.4 PROPOSED MODEL

To overcome the some of the limitations and drawbacks of the previous model and thus enhancing the features of the dustbin is the main objective of this paper. Our proposal requires totally four

sensors, Ultrasonic sensor for monitoring the level of the bin and other three are MQ135, MQ4 and MQ9 for detecting the gases that are produced in the bin. The sensed information is passed to the municipal office and vehicle driver by using IoT and the information is appeared on Things speak server with the help of ESP8266 module. The process of sensing and communication is done by a Arduino Nano microcontroller. The required power supply for the system is taken from the solar source and is converted to required voltage rating by using step down transformer and voltage regulators. Our proposal can communicate and alert the concerned authorities effectively at the unsuitable conditions of the bin to the environment and Society.

2.5 ADVANTAGES OF PROPOSED MODEL

It detects gases and odour of the dustbin.

- No GSM module is used. Thus it consumes less power.
- No GPS module is used.
- Low cost and simple to design.

3. IMPLEMENTATION AND DESIGN

The Internet of Things(IoT) is a system of ‘connected things’. The things generally comprise of an embedded operating system and an ability to communicate with the internet or with the neighboring things. One of the key elements of a generic IoT system as shown in figure

1, that bridges the various ‘things’ is an IoT service. An interesting implication from the ‘things’ comprising the IoT systems is that the things by themselves cannot do anything. At a bare minimum, they should have an ability to connect to other ‘things’. But the real power of IoT is harnessed when the things connect to a ‘service’ either directly or via other ‘things’. In such systems, the service plays the role of an invisible manager by providing capabilities ranging from simple data collection and monitoring to complex data analytics. The below diagram illustrates where an IoT service fits in an IoT ecosystem:

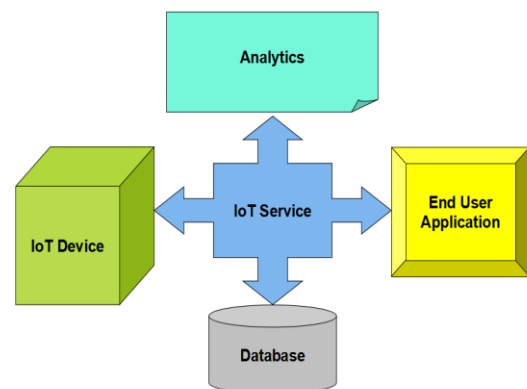


Figure1: implementation design

One such IoT application platform that offers a wide variety of analysis, monitoring and counter-action capabilities is ‘ThingSpeak’. Let us consider ThingSpeak in detail.

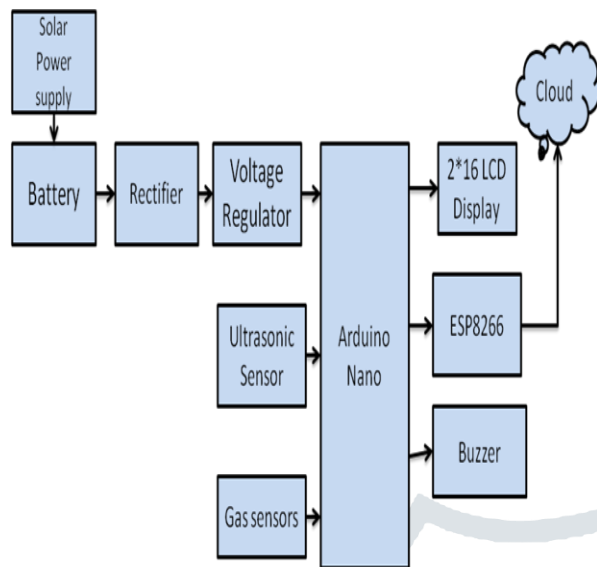
BLOCK DIAGRAM:-

Figure 2. Components Interfacing With Arduino Nano Board

In our implementation we are using Microcontroller ARDUINO NANO, ESP8266, 2*16 LCD Display, MQ series sensors, Ultrasonic sensors, buzzer, battery, voltage regulator and solar power source as shown in figure 2.

3.1 INTERFACING ESP8266 WITH ARDUINO:-

Step 1: Turn on Your ESP8266 Module:

Turn On Your ESP8266 Module by Using Arduino Nano 3.3V Dc Output Pin. Remember sometimes Arduino board is not delivering sufficient voltage to the ESP8266 module. You can use a 3.3 V (Do not exceed input voltage from 3.3v) regulator (AMS1117) to power this module. A voltage divider circuit is used to drop the Arduino 5V to ESP8266 3.3 V.

Step 2: Schematic Diagram:

Here is the schematic Diagram and connecting Digital pin D2 as a Tx and D3 as an RX.

THING SPEAK ESP8266:-

ThingSpeak is an IoT analytics cloud platform service that allows you to aggregate, visualize and analyze live data streams in the cloud. **ThingSpeak** provides instant visualizations of data posted by **ESP8266 to ThingSpeak**. ThingSpeak is often used for prototyping and proof of concept IoT systems that require analytics.

Uploading of ESP8266 sensor data is done using Internet. It is three step process.

1. Connect to your WiFi hot spot having internet access.
2. Read Sensor data
3. Upload data to ThingSpeak

Step 1: Sign up ThingSpeak:

Its simple just enter your email id and verify your account.

Step 2: Configuring ThingSpeak:

Configuration is just few clicks job

Step 2.1: Create New Channel:

Click on New Channel

Step 2.2 Virtuino **MOBILE APPLICATION:-** Virtuino is a mobile application software which is available in the Google play store. This application is used to send the information from the thingspeak server to the mobile of the

particular persons who are installed this app. The connection is done by the channel ID, Write and Read API codes which are generated by the thingspeak server and those codes are entered in the Virtuino app. Then the connection is established between the devices and the cloud by that the information of the bin is visible in the mobile.

Step-1: Install Virtuino mobile app from the Google play store and click on the app icon to start and then click on the top right side corner option then select the new project option as shown in figure 3.

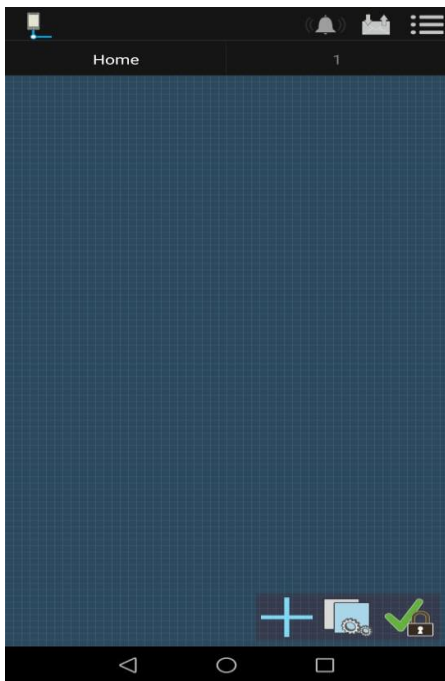


Figure 3. Creating New project

Step-2: Now click on the top left corner option and then select the server from the list if the server is not in the list then add the server by clicking on “PLUS” symbol at bottom right corner. Fill the options of server like channel ID, write and read API keys.

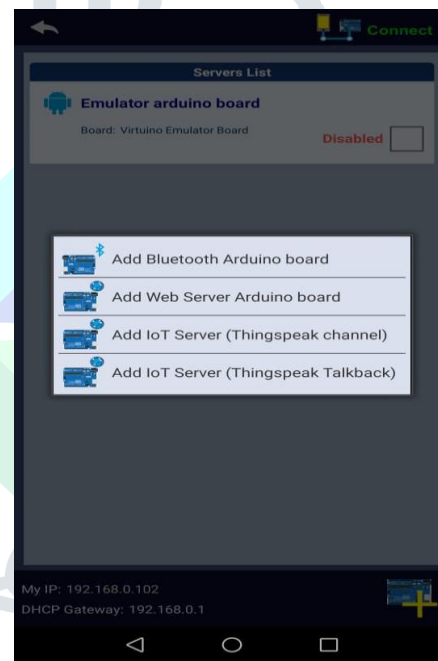
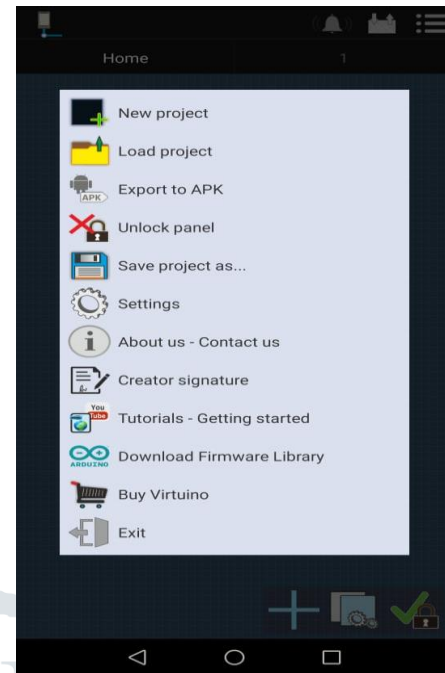


Figure 4-a : Connecting to Thingspeak server

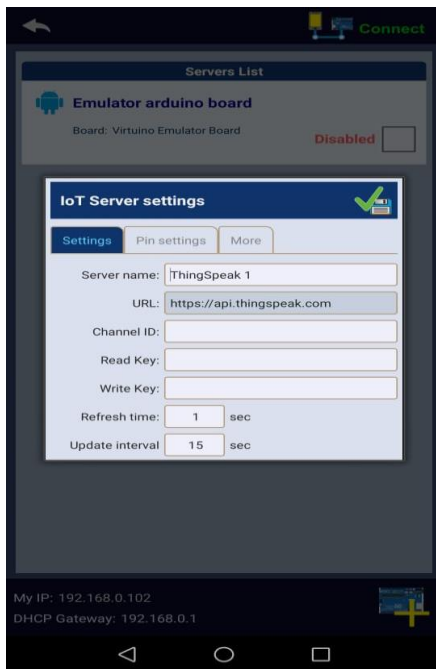


Figure 4-b : Connecting to Thingspeak server

Step-3: Then add the fields by clicking on the “PLUS” symbol at the bottom and choose which type of measuring graphs, scales and sizes as required. Choose the server option that from where it access the information as shownb in figure 4-a, and 4-b.

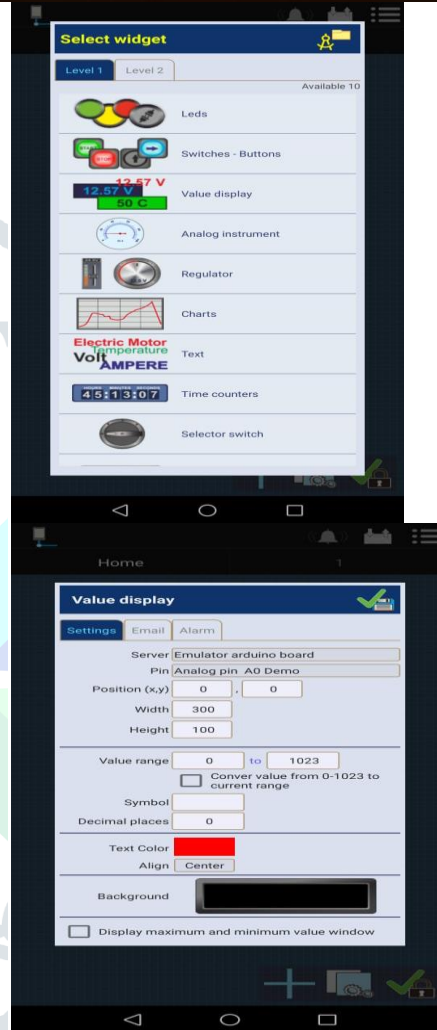


Figure 5: Creating the fields & setting threshold values

Step-4: Finally the required fields are setted and click on the top left corner option to connect the server. These fields are showing the information by accessing from the server as shown in figure 5.

4.RESULTS

Step-1: After switch on the kit the LCD displays “WELCOME TO DNR” in the first row and DEPT OF ECE in the second row.

Step 2: solid waste then it shows bin level in the first row and “EMERGENCY CLEAR” in the second row then it activates the buzzer. If bin is at good condition LCD shows the result as “BIN IS HEALTHY”.



Step-3: The gases are formed in the dustbin then it shows “EMERGENCY CLEAR” irrespective to the level of bin. The buzzer activates to alert the Society.



Figure shows that the Device showing result when the gases are formed in the bin

Step-4: The monitoring of bin level and each gas sensor in the municipal office is done by using the Thingspeak server. The information is shown in the server as mentioned below

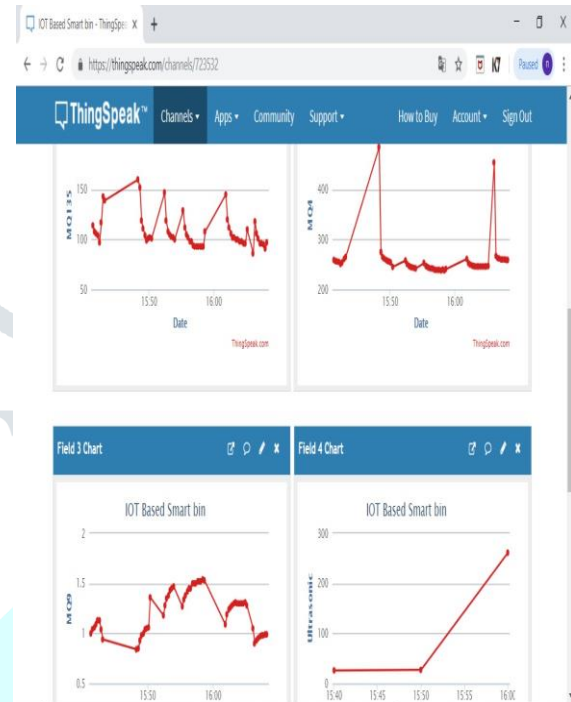


Figure 6: Results of the fields displayed in the thingspeak server.

Step-5: The vehicle driver get the information of the bin by the Virtuino application in the mobile phone. It shows all the information of the bin that a thingspeak server shows in the municipal office and also gives alarm automatically when the threshold levels are crossed.

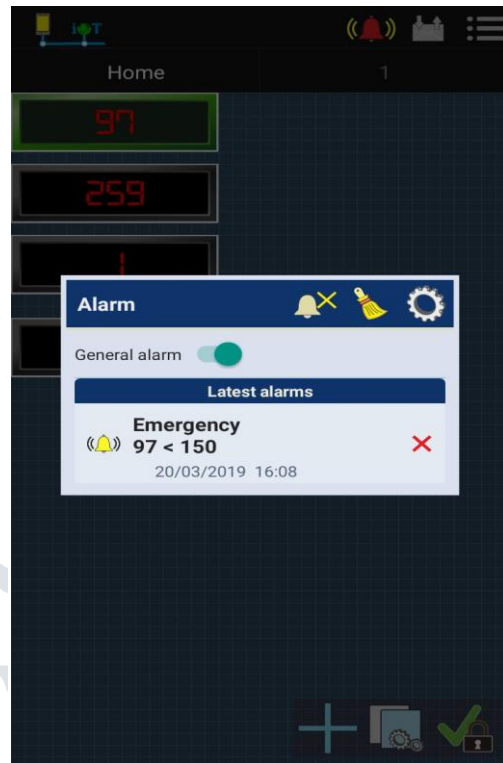


Figure 7: Field results and alarms showing in the Virtuino mobile app.

Figure 8 : The final prototype model

The figure 8 is the complete representation of the proposed prototype model.

ADVANTAGES:-

- Requires less man power
- Cost effective and save money and time
- Installation and maintenance is easy
- System can be Chargeable either by solar power or domestic power.
- It makes our system transparent between Municipal Corporation, workers and public.

APPLICATIONS:-

- Mostly useful for the hospital dustbins.
- Real time based cleaning of our cities and as well as home.
- Easily control the environmental pollution.
- Empower the Swatch Bharat Mission.

5.CONCLUSION AND FUTURE ENHANCEMENT

The main objective is to maintain the level of cleanliness in the city and form an environment which is better for living. By using this system we can constantly check the level of the garbage in the dustbins and gases status of dustbins which are placed in various parts of the city. If a particular dustbin has reached the maximum level or producing harmful gases then the employees can be informed and they can immediately take certain actions to empty it as soon as possible. The employees can check the status of these bins anytime on their mobile phones. This can prove to be a very useful system if used properly.

The system can be used as a benchmark by the people who are willing to take one step further for increasing the cleanliness in their respected areas. Ultrasonic sensor is being used in this system to check the level of garbage in the dustbins and MQ series sensors for detecting particular gas levels but in future various other types of sensors can be used to get more precise output and to

take this system to another level. Now this system can be used in certain areas but as soon as it proves its credibility it can be used in all the big areas. As this system also reduces manual work certain changes can be done in the system to take it to another level and make it more useful for the employees and people who are using it. In future, a team can be made which will be in charge for handling and maintaining this system and also to take care of its maintenances.

FUTURE SCOPE WORK

The main aim of this project is to reduce human resources and efforts along with the enhancement of a smart city vision. We have often seen garbage spilling over from dustbins on to streets and this was an issue that required immediate attention.

The proverb "Cleanliness is next to god and clean city is next to heaven" inspired us to conceptualized the project. Smart dustbin helps us to reduce the pollution. Many times garbage dustbin is overflow and many animals like dog or rat enters inside or near the dustbin. This creates a bad scene. Also some birds are also trying to take out garbage from dustbin. This project can avoid such situations. And the message can be sent directly to the cleaning vehicle instead of the contractor's office. Swatch Bharat Abhiyan (English: Clean India Mission and abbreviated as SBA or SBM for "Swatch Bharat Mission") is a national campaign by the Government of India, covering 4,041 statutory cities and towns, to clean the streets, roads and infrastructure of the country.

In our system, the Smart dustbins are connected to the internet to get the real time information of the smart dustbins. In the recent years, there was a rapid growth in population which leads to more waste disposal. So a proper waste management system is necessary to avoid spreading some deadly diseases.

REFERENCES

[1] P. Suresh1, J. Vijay Daniel2, Dr. V. Parthasarathy4” A state of the art review on the Internet of Things (IoT)” International Conference on Science, Engineering and Management Research (ICSEMR 2014)

[2] Arkady Zaslavsky, Dimitrios Georgakopoulos” Internet of Things: Challenges and State-of-the-art solutions in Internet-scale Sensor Information Management and Mobile Analytics” 2015 16th IEEE International Conference on Mobile Data Management

[3] Theodoros. Anagnostopoulos1, Arkady. Zaslavsky 2,1, Alexey Medvedev1, Sergei Khoruzhnicov1” Top-k Query based Dynamic Scheduling for IoT-enabled Smart City Waste Collection” 2015 16th IEEE International Conference on Mobile Data Management.

[4] “City Garbage collection indicator using RF (Zigbee) and GSM technology”

[5] Vikrant Bhor, Pankaj Morajkar, Maheshwar Gurav, Dishant Pandya4 “Smart Garbage Management System” International Journal of Engineering Research & Technology (IJERT) ISSN: 2278-0181 IJERTV4IS031175 Vol. 4 Issue 03, March-2015

[6] Insung Hong, Sunghoi Park, Beomseok Lee, Jaekeun Lee, Daebeom Jeong, and Sehyun Park, “IoT-Based Smart Garbage System for Efficient Food Waste Management”, The Scientific World Journal Volume 2014 (2014), Article ID 646953

[7] Marian Look, “Trash Plant: India”, earth911B.

[8] Basic Feature, “Solid waste Management Project by MCGM.