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Iot Based Smart Garbage Bin

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Abstract

We often see dustbins located in public places are overflowing. It puts people in unsanitary situations. It also adds to the unpleasantness of the area. At the same time, a foul smell is produced. One of the key environmental problems has been solid waste management, which influences society's health and ecology negatively. One of the most influencing issues nowadays is identifying, monitoring, and managing the trash. The conventional method of physically monitoring garbage in bins was inefficient, requiring more human labor, time, and money, all of which could be eliminated with today's

technologies. Smart garbage bin is described in this paper. Garbage level is measured by triggering the ultrasonic sensor, showing the garbage level, and connecting to the internet to transmit garbage level data to ThingSpeak Dashboard. And it triggers the webhooks which in turn triggers the If This Then That (IFTTT) software platform and sent the alert as message to the mentioned mobile number.

Keywords— *ThingSpeak, Internet, smart, Garbage bin, waste, dustbins, IFTTT*

I. INTRODUCTION

The Internet of Things (IoT) will be able to integrate a large number of diverse systems in a transparent and seamless manner, while also giving data for millions of people to use and profit from. Building a generic architecture for IoT is thus a difficult task, accounting to the enormous number of devices, link layer architectures, and services which could be involved in such a system. This paper explains the IOT-based scrap level monitoring system is a modern technology which is used to monitor the level of rubbish in public and industrial garbage bins and assist municipal services in picking up rubbish at the appropriate time before a waste bin overflows and causes public discomfort.

II. PROBLEM STATEMENT

The dustbins become overflowing and concerned individuals do not receive timely information, resulting in an unconscious state in the surrounding area, as well as a foul odour emanating from the garbage that spreads across the area. Some hazardous illnesses are easily spreadable in a specific area due to an unclean atmosphere. The current procedure for cleaning the trash can be ineffective. So, the implementation of smart garbage bin using IoT is an effective solution to overcome the above problem.

III. LITERATURE REVIEW

Each paper gives different ideas and methodologies for detecting the garbage level and sending data to IOT cloud. Kanchan Mahajan and Prof.J.S.Chitode [1] proposes a simple method of garbage collection which employs ZigBee, GSM and ARM7 to create an integrated system for remotely monitoring waste bins. The sensors are attached in typical garbage cans found in public places. An indication is transmitted to the ARM 7 Controller when the waste reaches the sensor's level. The garbage collection truck driver will be informed by the controller as to which rubbish bin is entirely filled and requires immediate attention. ARM 7 will send an SMS utilizing GSM technology to indicate its presence. Vishesh Kumar Kurre [2] proposed a method in which smart garbage collection aids in the monitoring of false reports, hence reducing corruption in the entire system. As a result, the overall number of garbage journeys is reduced and the entire cost is reduced by using a collection vehicle. Trash collection is a term used to describe a service that collects garbage. It is beneficial to maintain society's cleanliness

Aswathi Vinu et al. [3] proposed a system that uses sensors and the Internet to monitor the garbage bins and deliver information about the amount of waste collected. An Arduino gadget with a power supply is used in this setup. To detect rubbish outside the container, ultrasonic sensors are put on the lids of the bins. If there is any waste around, an infrared sensor is utilised to detect it. When rain is detected, sensors are employed to automatically lock the bin. The setup connects a web page to an Arduino board with a microcontroller linked to SPI over Ethernet. Theodoro's Anagnostopoulos et al. [4] presented e-client dynamic garbage collection, an IOT-enabled system architecture. To deal with the demanding nature of scheduling timing, they also suggest a Top-K query based dynamic

scheduling approach. Finally, a garbage collecting scenario is evaluated using synthetic and real-world data using an Android application with a user-friendly GUI.

Harshita Chugh et al. [5] created an intelligent bin that monitors garbage using sensors and provides extensive data and information. Initially, all the sensors from various locations are connected over the Internet. Sensors at each place will measure and compute waste, and data will be transferred to the server. The data will be processed at the server before being transmitted to the appropriate authorities for actions. Murugaanandam. S et al. [6] proposed a systems incorporate an ultrasonic sensor, an ir sensor for measuring waste levels, and a Raspberry Pi3 hardware portion. Moisture sensor detects wet and dry trash. Ultrasonic sensors measure the amount of rubbish in the bin. A motor revolves, collecting moist and dry garbage for the appropriate container. Things speak was formerly used to graphically depict the volume of rubbish in the bin. If the bin is full, send an email to the people who are responsible for waste collection. Using the Raspberry Pi3 as the controlling board, a large amount of data may be transferred and processed quickly.

IV. METHODOLOGY

The methodology for this project is shown in Fig. 1 and it starts with finding the problem and analyzing the main cause of the problem and listing out the chain of actions related to this which affects in a direct or indirect way.

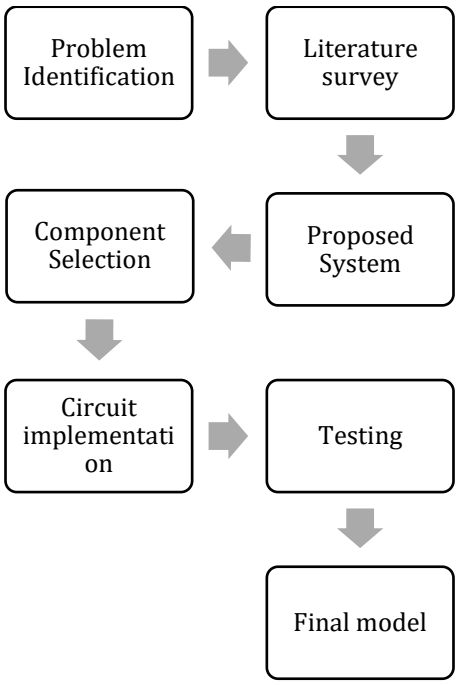

Fig 1. Methodology

The final thing in the problem identification is the root cause which is the uncertainty in where to look for the workers. Since the real problem and its cause is known. The next thing is to look for the works already done related to this and identify the idea behind every approach and list out what could have been done better. That's enough to create the solution and set the target specifications. Based on the literature survey, the target specifications to achieve and some simulations, the components can be selected. Once the components are selected, then circuit design can be

completed keeping in mind the target specifications. After the components were purchased, the proposed idea for solving the problem can be implemented and should be shown for validation along with the implementation of the circuit with hardware. The next phase of this product is to go under the testing phase and look for the glitches. After the validation of the design and some fine tuning, the product will be ready to use and implement in the real world where it could bring a change and help social workers in organising their works.

V. EXISTING AND PROPOSED SYSTEM

A. Existing System

Each person in the world disposes the waste in the dustbin and it full, they empty the waste Almost any individual on the planet disposes of their trash in a dustbin, which they then empty once it is full. This is the simplest usage of a regular trashcan, with no components, no programming, and everything done manually. The bin's upkeep is also lacking, as the lid is preventing the garbage from spilling. The second way is to utilise a trashcan with different segregations, such as green and blue bins that are located together or a dustbin that only accepts recyclable material.

B. Proposed System

The main objective of the proposed system is to develop a system that ensures that trashcans are cleaned as soon as the scrap level reaches its maximum level and maintain a clean environment in society. Several methodologies have been proposed and their differences are mainly in hardware robustness and cloud. However, it is difficult to expect high accuracy rate by sensors in different environmental condition and also different kind of wastes affect the sensor readings. Therefore, the use of sensors which can resist the different environmental conditions and the use of modified protective covering for sensors as well as micro controller can solve this problem.

The Fig. 2 shows the proposed system which works in such a way, that the ultrasonic sensor value will be continuously updated to the microcontroller ESP 8266. In the microcontroller, the processing takes place since the value measured by the ultrasonic sensor is analog and the 10-bit ADC present in the A0 port of the ESP 8266 module will convert the measured analog value into digital values ranging from 0 to 1023. It must be normalised in terms of 0 to 100 to present the values measured in a good readable and understandable way. After converting the sensor value to 0-100, the threshold value is set. Upon reaching the threshold, ESP module will send the data to ThingSpeak, where the data will be updated for every few minutes. The user interface will display the values in a chart and analog meter. In the ThingSpeak, upon reaching the 90% of the capacity of the dustbin the webhooks will trigger the IFTTT which in turn will send a message and a call for the respective person who oversees the garbage collection in that area.

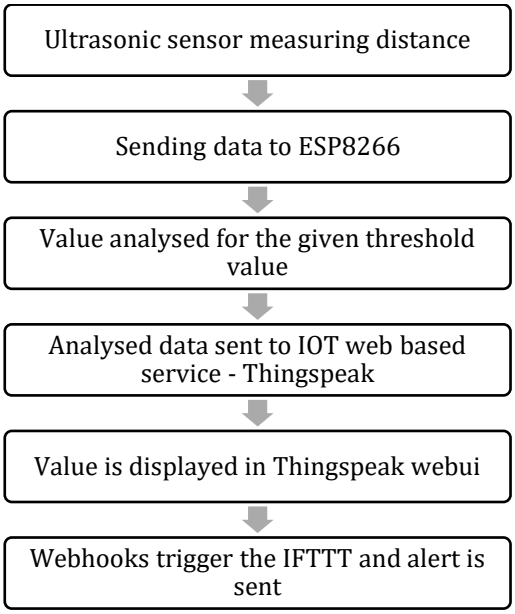

Fig. 2. Proposed System

VI. BLOCK DIAGRAM

The block diagram consist of the sensor for sensing waste level is attached to the trash bin's lid. Ultrasonic waves with a frequency of 40 kHz are emitted and reflected to the sensor. The time it takes for waves to be emitted and received is used to calculate the level of garbage filling. The data is subsequently transferred to the IoT cloud. Then it shows alert in the dashboard as indicated in the algorithm implementation. The block diagram of smart garbage bin is shown in Fig. 3.

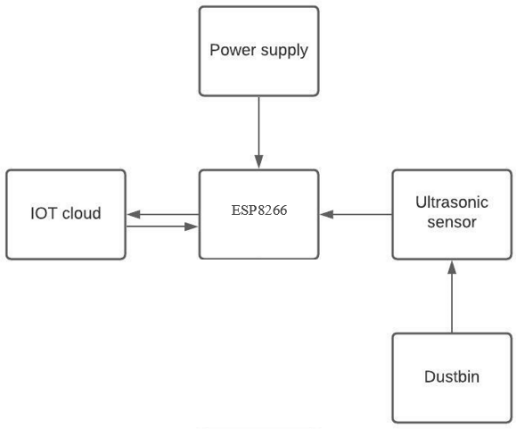

Fig. 3. Block Diagram

VII. COMPONENT SELECTION

A. Ultrasonic sensor

Ultrasonic sensor includes a transmitter and a receiver. The distance between the objective and the user is measured using this sensor. The time it takes to transmit and receive waves determines the distance between the sensor and the object. This sensor, which is based on non-contact technology, uses sound waves. The injection of high-frequency sound waves into a test object to

collect information about it without inflicting any harm or change is known as ultrasonic detection. The ultrasonic sensor is show in Fig. 4.

Distance = 1/2 * time between the emission and reception
* speed of light

Fig.4. Ultrasonic sensor

To measure speed, a microcontroller or other controller, such as Arduino, must be connected to an ultrasonic sensor. Ultrasonic sensors consist of two transducers, one of which serves as a speaker, converting electrical pulses into sound pulses and emits them at a high frequency of over 40 kHz. Similarly, the other functions as a microphone, capturing sound pulses reflected after interacting with a certain item. Because an ultrasonic sensor is linked to a microcontroller or any controller, the controller's timer starts counting pulses when sound waves are released and stops counting pulses when sound waves are received by the microphone. The microcontroller or any controller determined the speed of that specific object based on transmitting and receiving sound pulses.

B. NodeMCU ESP8266

The ESP8266 that shown in Fig.5 is a low-cost Wi-Fi module from the ESP family that may be used to control your electronics projects from anywhere on the planet.

Fig. 5. Node MCU ESP8266

It features a built-in microprocessor and a 1MB flash memory that allows it to connect to a Wi-Fi network. The module can connect with Wi-Fi signals thanks to the TCP/IP protocol stack. Because the module's maximum operating voltage is 3.3 volts, you can't use 5 volts because it would damage the module.

VIII. SOFTWARE USED

A. Arduino IDE

The Arduino IDE is used for programming the Arduino UNO with some inbuilt functions and a serial monitor for calibrating the sensors. The programming can be done with either C or C++ for structuring. It generally consists of a setup function for initialising the program and it will be executed

for once and another function is loop which repeatedly executed the instructions present within it until the power is cut off.

B. Thingspeak

ThingSpeak is a cloud based IoT analytics software that lets you gather, visualise, and analyse live data streams. You can use online services like Twitter and Twilio to deliver data to ThingSpeak, build rapid visualisations of live data, and issue alarms. You may use MATLAB analytics within ThingSpeak to do pre-processing, visualisations, and analysis by writing and compiling MATLAB code. Engineers and scientists may use ThingSpeak to prototype and design IoT solutions not requiring to set up servers or write web software.The general visualisation of ThingSpeak is show in Fig. 6.

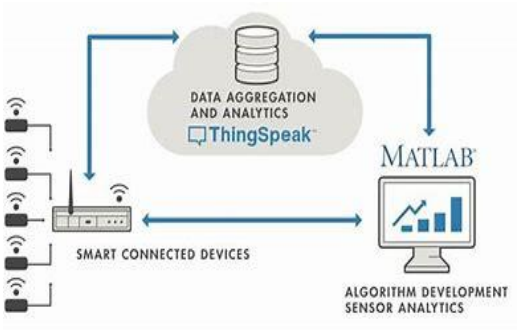

Fig. 6. Thinkspeak

C. Webhooks

Webhooks are a convenient and useful method for your Particle devices to deliver data to other apps and services on the Internet. The general working of webhooks is shown in Fig. 7.

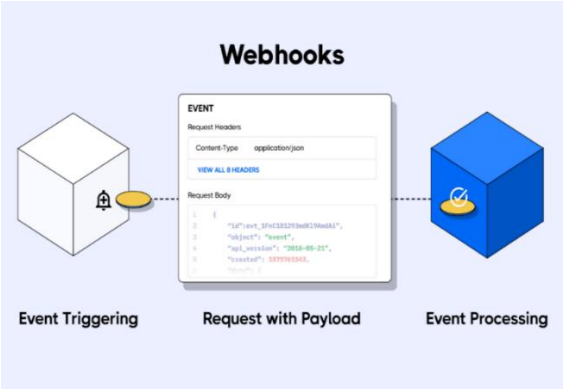

Fig. 7. Webhooks

Webhooks let you get your data that you need it by bridging the gap between the real and digital worlds. A webhook may be used to preserve important data in a database, visualize data obtained from a sensor, transmit the latest weather report to your device, initiate a payment, send a text message, and much more.

D. IFTTT

If This Then That, or IFTTT, is the easiest method to connect applications, gadgets, and services. Each service comes with a ready-to-use set of triggers and actions. You may develop automations that

help you reach your objectives, be more productive, and improve your smart home by mixing and combining these triggers and actions. Fig. 8 shows the IFTTT dashboard for alerts.

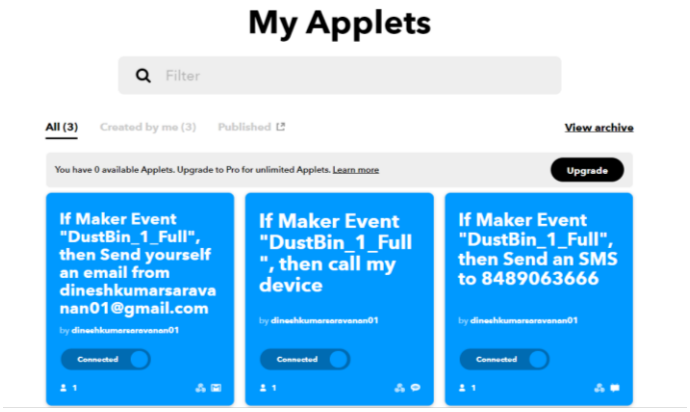

Fig.8. IFTTT

IX. CIRCUIT CONNECTION

Connect the Trig pin of sensor to GPIO 15(d5) of nodemcu and the Echo pin of sensor to GPIO 18(d6) of nodemcu and connect Vcc of sensor to vin of ESP8266. and connect both the ground of sensor and nodemcu. The circuit connection of smart garbage bin is shown in Fig. 9.

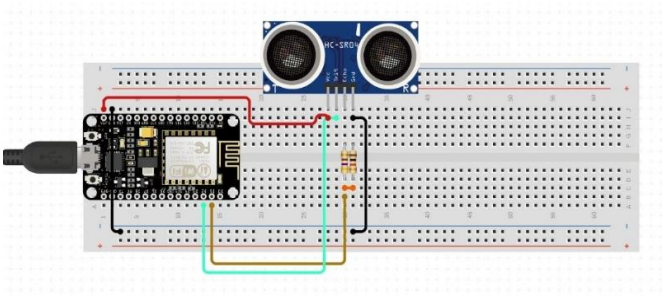

Fig. 9. Circuit connection

X. IMPLEMENTATION

A. Hardware Implementation

Wire the HC-SR04 ultrasonic sensor to the ESP8266 as shown in the circuit diagram. Once the hardware is set up, create ThingSpeak Channel. Fig. 10 shows the realtime circuit components interfacing of smart garbage bin.

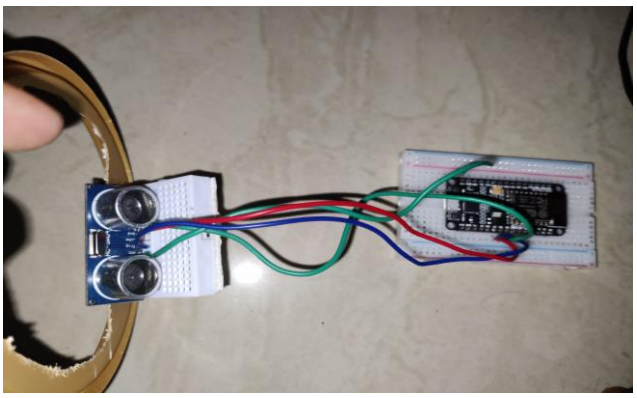

Fig. 10. Circuit Components Connection

B. Code Implementation

Create ThingSpeak Account and login to that Account. now create a New Channel. Enter the channel details. In channel details fill the field based on no. sensors data need to be displayed. In channels - API key tab gets the Channel ID and API Keys. Now Open Arduino IDE and Install the ThingSpeak Library. Now add the assign credentials. Network SSID, Password, ThingSpeak Channel and API Keys In the program. In void setup function, the assign credentials are called inside void setup function. now using the SSID and Password the void setup function will connect the ESP8266 module to the Wi-Fi network. next using the internet connectivity, the micro controller will be connected to the thingspeak cloud using the above-mentioned channel id and API key. In void loop function, sensor output converts to analog reading in percentage and it send the values to thingspeak cloud within the specied delay

XI. RESULT

A. Measuring the garbage level

The ultrasonic sensor was positioned at its maximum level to an empty trashcan, and the NodeMCU was attached to it. An ultrasonic sensor measures the distance and level of the trashcan, and a code is uploaded to NodeMCU. And check a Thingspeak dashboard to show a garbage bin percentage. Then if the percentage of waste is above the threshold value .it will display alert in the dashboard and also trigger webhooks which in turn triggers the IFTTT to send alert as message to the mentioned mobile number

B. Empty bin

The same procedure is done with no waste in bin. And the percentage of garbage filled is less than the threshold value .so no alert will be displayed, and no message will be sent. The empty bin is shown in Fig 11 and the ThingSpeak dashboard of that bin is shown in Fig 12

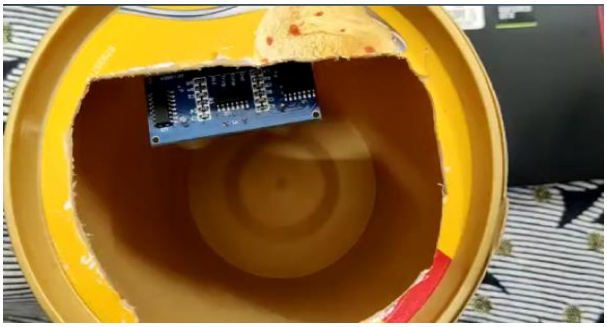

Fig. 11. Garbage bin with no garbage

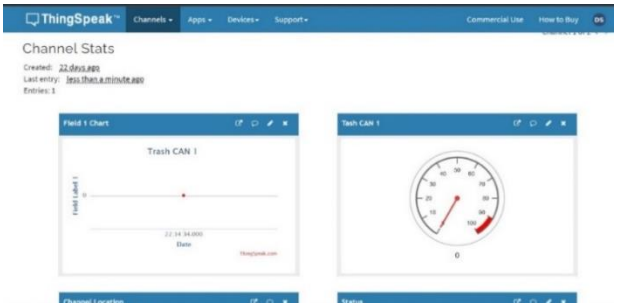

Fig. 12. Thingspeak dashboard for 0% filled

C. Garbage bin ¼ filled

The same procedure is done with ¼ filled in bin. And the percentage of garbage filled is less than the threshold value. Here threshold value is 80%.so no alert will be displayed, and no message will be sent. The ¼ filled bin is shown in Fig. 13 and the ThingSpeak dashboard of that bin is shown in Fig. 14.

Fig. 13. Garbage bin filled with ¼ of garbage

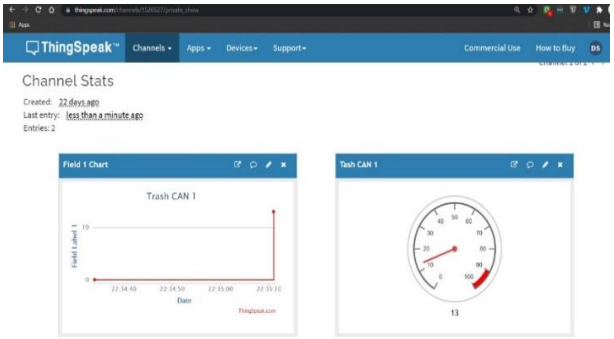

Fig. 14. Thingspeak dashboard for ¼ filled

D. Garbage bin fully filled

The same procedure is done with fully filled in bin. And the percentage of garbage filled is greater than the threshold value. Here threshold value is 80%.so alert will be displayed, and it triggers the webhooks which in turn triggers IFTTT, it will send alert as message to the given mobile number. The fully filled bin is shown in Fig. 15 and the thingspeak dashboard of that bin is shown in Fig. 16. And the Fig. 17, Fig. 18 show the alert received via SMS, IP voice call and email respectively

Fig. 15. Garbage bin with fully filled garbage

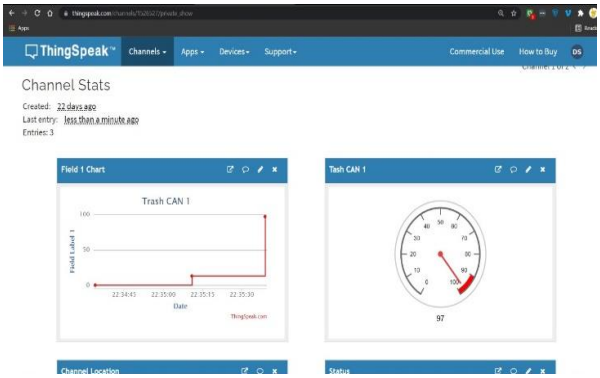

Fig. 16. Thingspeak dashboard for fully filled

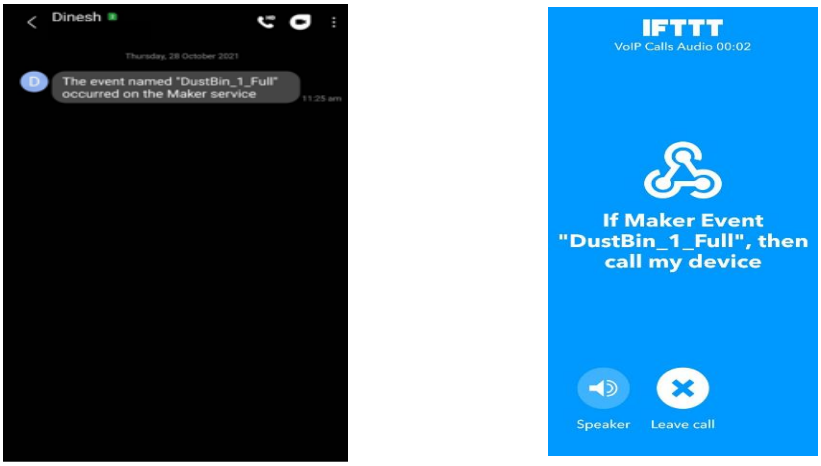

Fig. 17. Alerts via SMS, IP voice call

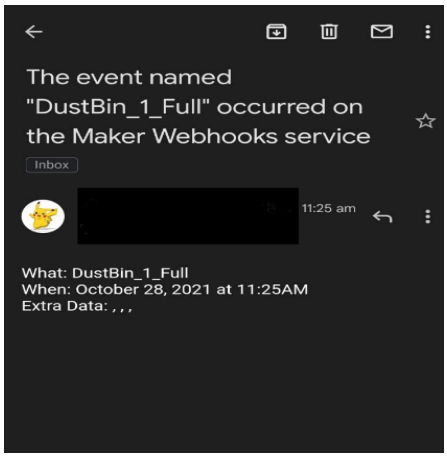

Fig. 18. Alerts via email

XII. CONCLUSION

Thus, the smart bin with real-time trash monitoring technology implemented and it checks the amounts of trash in the dustbins to see if they are full or not. This approach is primarily designed for cities with a large or expanding population. By introducing these smart bins across the world, the bins will become more user-friendly and the area surrounding them will become more sanitary. It will

also be beneficial to the authorities, who will be able to notify the appropriate parties to prevent the trash from overflowing, reducing the need for human monitoring.

REFERENCES

1. Kanchan Mahajan and Proof's. Chitode, "Waste Bin Monitoring System Using Integrated Technologies," International Journal of Applied Information Systems (IJAIS), vol. 8-No.6, April 2015.
2. Vishesh Kumar Kurre, "Smart Garbage Collection Bin Overflows Indicator using IOT," International Research Journal of Engineering and Technology (IRJET), vol. 03, May 05 2016.
3. Aswathi vinu, Abhijith S, Sruthy AR, Suhail V, "Waste management system with thingspeak," International Research Journal of Engineering and Technology (IRJET), vol. 06, June 06 2019.
4. Theodoro's Anagnostopoulos, Arkady Zaslavsky, Alexey Medvedev and Sergei Khoruzhnicov, "Top k Query based Dynamic Scheduling for IOT-enabled Smart City Waste Collection," 16th IEEE International conference on mobile data management, 2015.
5. Harshita Chugh, Dushyant singh, Shahensha shaik, Ashwani Singla, "IOT Based Smart Bin," International Research Journal of Engineering and Technology (IRJET)," vol. 04, Sep 09 2017.
6. Murugaanandam. S, Ganapathy. V, Balaji. R, "Efficient IOT Based Smart Bin for Clean Environment," International Conference on Communication and Signal Processing, April 3-5 2018.
7. R. Fujdiak, P. Masek, P. Mlynek, J. Misurec and E. Olshannikova, "Using genetic algorithm for advanced municipal waste collection in Smart City," 10th International Symposium on CSNDSP, Prague, pp. 1-6, 2016.