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Automated Smart Bin with Fire Alert System

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Abstract*: Nowadays certain actions are taken to improve the level of cleanliness in the country.As our Indian government has taken the step called Swachh Bharat Mission where people are getting more active in doing all the things possible to clean their surroundings. Various movements are also started by the government to increase cleanliness. We will try to build a system which will notify the corporations to empty the bin on time. In this system, we will put a kit having a sensor at the top of the garbage bin which will detect the total level of garbage inside it according to the total size of the bin. When the garbage will reach the maximum level, a notification help in cleaning the city in a better way. By using this system people do not have to check all the systems manually but they will get a notification when the bin will get filled and also a flame sensor with the kit so that we get notified in case of fire in the bin.

Keywords: Garbage bin, ESP8266, Flame, Swachh Bharat Mission, iot, automated, sensor.

I. INTRODUCTION

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.

In this paper, we are going to propose a system for the 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. We will use ultrasonic sensors for this system. The sensors will be placed on top of bin which are ultrasonic and flame sensors which will help in sending the information to the office that the level of garbage has reached its maximum level and flame sensor will respond in case of fire. After this the bin should be emptied 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.We have tried this same for our campus at New Horizon College of Engineering, Bangalore. 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 disadvantages of the existing system are 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 of the dustbin filled 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.

II. LITERATURE REVIEW

A Smart Dustbin proposed by [1], based on IoT in which the smart bin was built on a platform which was based on Aurdino Uno board which was interfaced with a GSM modem and an ultrasonic sensor. The sensor was placed on the top of the bin. A threshold level was set as 10cm. As the garbage reaches the level of threshold, the sensor triggers the GSM modem which alerts the associated authority till the garbage in the bin is emptied. At the end a conclusion was made that various issues like affordability, maintenance and durability were addressed when these smart bins were designed. It also contributed towards a hygienic and clean environment in the process of building a smart city.

The researchers [2] suggests the method for garbage management which is as follows. The bin was interfaced with a system based on microcontroller which had IR wireless systems with a central system that showed the current status of the garbage in the bin. The

status was seen on a mobile based web browser with a html page by using Wi-Fi. To reduce the cost, they only used weight based sensors and on the sender's side they only used a Wi-Fi module to send and receive the data. In the end the sensor could only detect the weight of waste present in the bin but not the level of waste.

The author proposed a method for organizing the collection of the garbage in the commercial and residential areas of the cities [3]. In this system, the level of garbage in the bin was detected by the ultrasonic sensor which will send the data to the control room using the GSM module. A GUI was also developed to check the information that was related to the garbage for different locations, GUI was based on MATLAB so it was different. Two units were present in the system, slave unit was in the bin whereas the master unit was there in the control room. The sensor will check the level of garbage and send it to the slave unit which will further send the data to master unit which at last will inform the authorities to clean the bin.

This paper proposed Decision Support System which would be used for garbage collection in the cities[4]. This system handled the ineffective waste collection in the inaccessible areas of the city. The cameras were placed in those parts of the cities which were facing the most problems. The system worked in two parts, the first part was to find the companies that were involved in collecting the waste and owned trucks and who could also organize some drivers for collecting the garbage from various parts of the city in the truck and pass on the city dumps or the recycling organizations. The second part was to make a system which could handle all the communications of all the people involved and could also maintain the data which will be collected while working around in the city. Various bins were placed around the city which were provided with an embedded device which was low in price and helped in tracking the garbage level in the bins [5]. A different ID was provided to each bin so that it could be easier to detect that which is bin is full and ready to be emptied. The project is divided into two sections one being the transmitter section and other the receiver section. The transmitter section consists of a microcontroller and sensors which check the level of the garbage and the data is passed onto the system with the help of the RF Transmitter, then RF Receiver receives the data and sends it to the client associated so that the bin can be emptied quickly. Anitha et al (2016) proposed an home automation system using IOT uses raspberry for the implementation [6]. Also proposed a model for cyber security systems using artificial system to have secured transactions [7].

III. MATERIALS AND METHODOLOGY

A. *Flame Sensor*

Flame detector is a sensor designed to detect and respond to the presence of a flame or fire, allowing flame detection. Responses to a detected flame depend on the installation, but can include sounding an alarm, deactivating a fuel line (such as a propane or a natural gas line), and activating a fire suppression system. When used in applications such as industrial furnaces, their role is to provide confirmation that the furnace is working properly; in these cases they take no direct action beyond notifying the operator or control system. A flame detector can often respond faster and more accurately than a smoke or heat detector due to the mechanisms it uses to detect the flame. Flame Sensor shown in figure 1.

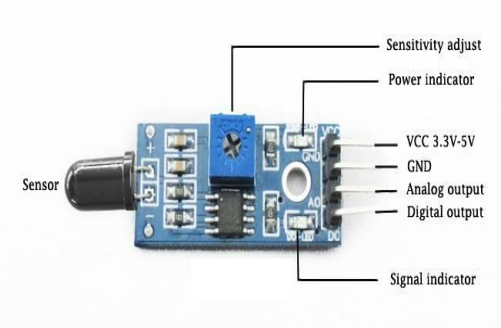

Figure 1. Flame Sensor

B. *ESP8266 (Wi-Fi Module)*

ESP8266 is a Wi-Fi module which will give your projects access to Wi-Fi or internet. It is a very cheap device but it will make your projects very powerful. It can communicate with any microcontroller and make the projects wireless. It is in the list of most leading devices in the IOT platform. It runs on 3.3V and if you will give it 5V then it will get damage. The ESP8266 has 8 pins; the VCC and CH-PD will be connected to the 3.3V to enable the wifi. The TX and RX pins will be responsible for the communication of ESP8266 with the Arduino. The RX pin works on 3.3V so you will have to make a voltage divider for it as it used for implementation. ESP8266 is shown in figure 2

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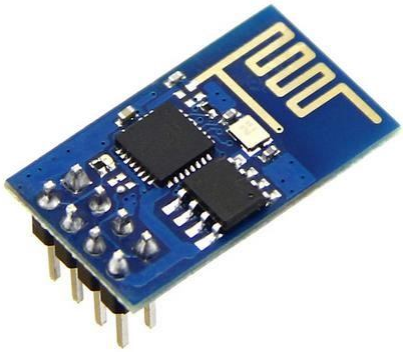

Figure 2. ESP8266.

C. Ultrasonic Sensor

The Ultrasonic Sensor is used to measure the distance with high accuracy and stable readings. It can measure distance from 2cm to 400cm or from 1 inch to 13 feet. It emits an ultrasound wave at the frequency of 40KHz in the air and if the object will come in its way then it will bounce back to the sensor. By using that time which it takes to strike the object and comes back, you can calculate the distance. Distance can be measured by equation 1.

Distance = Time * sound speed /2. (1)

Where Time = the time between an ultrasonic wave is received and transmitted. It has four pins. Two are VCC and GND which will be connected to the 5V and the GND of the Arduino while the other two pins are Trig and Echo pins which will be connected to any digital pins of the Arduino. The trig pin will send the signal and the Echo pin will be used to receive the signal. To generate an ultrasound signal, you will have to make the Trig pin high for about 10us which will send a 8 cycle sonic burst at the speed of sound and after striking the object, it will be received by the Echo pin. Ultra sonic sensor as shown in figure 3.

Figure 3.Ultrasonic Sensor.

D. Bread board and Jump wires

A modern solderless breadboard consists of a perforated block of plastic with numerous tin plated phosphor bronze or nickel silver alloy spring clips under the perforations. The clips are often called tie points or contact points. The number of tie points is often given in the specification of the breadboard. The spacing between the clips (lead pitch) is typically 0.1 in (2.54 mm). Integrated circuits (ICs) in dual in-line packages (DIPs) can be inserted to straddle the centerline of the block. Interconnecting wires and the leads of discrete components (such as capacitors, resistors, and inductors) can be inserted into the remaining free holes to complete the circuit. Where ICs are not used, discrete components and connecting wires may use any of the holes.A breadboard is utilized to build and test circuits expeditiously afore finalizing any circuit design. The breadboard has many apertures into which route components like ICs and resistors can be connected.. A typical breadboard that includes top and bottom power distribution rails is shown below figure 4. Jump wires are generally used to establish connectivity with bread board as shown in figure 5.

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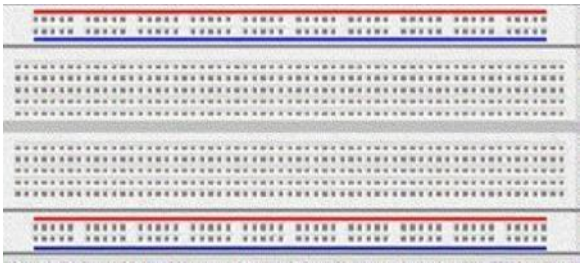

Figure 4. Bread board.

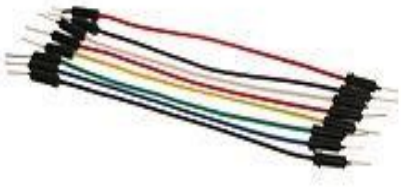

Figure 5. Jump Wires.

IV. PROPOSED SYSTEM

The existing system has the limitations as time consuming, trucks go and empty the containers, even they are empty. The cost is high with unhygienic environment. Even the bad odour causes the unhealthy environment. So, proposed model talks about how to make use of the recent advancements in technology to make our place clean and tidy.

The implementation starts by setup ESP8266 by flashing the latest version of the firmware. This enables the Blynk libraries efficiently communicate and avoid producing error.. To flash the latest firmware, download the ESP8266 flasher tool and the latest firmware from the internet which would be in the bin format and flash the ESP8266 with it. Once the ESP8266 flashing done, other components can be added to the configuration. we need a breadboard to connect the microcontroller, ultra sonic sensor, buzzer and the ESP8266 and flame sensor using the jumper wires. The breadboard is used to interface between the various components available. It also makes it easy to connect multiple inputs to a single pin on the arduino board also connect three led lights which will indicated the level of garbage present in the bin. We have connected a flame sensor to the kit so in case of any fire it notify the team indicating danger because once the garbage catches fire it pollute the environment, so, in various situations this kit can be useful. We have made all theire internal connection bellow the board onlly the core hardware connection are visible for the reader. The connection of hardware parts are shown in figure 6.

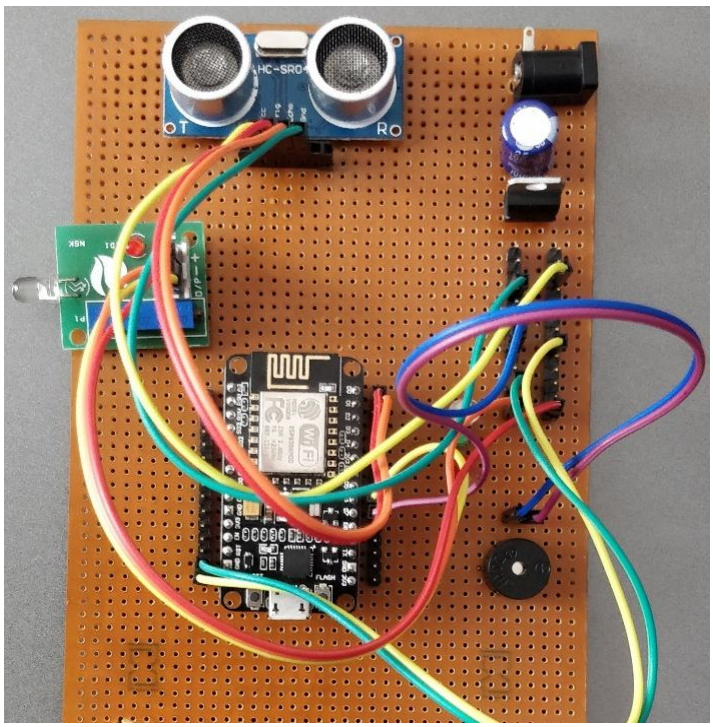

Figure 6. Hardware components connection.

The above picture shows the exact kit we are using for our project which has all the mentioned hardware compnents such as Esp8266 module, flame sensor, ultrasonic sensors etc.

Following sketch diagram as shown in Figure 7, shows how the components are supposed to be connected together using the breadboard and the jumper wires.

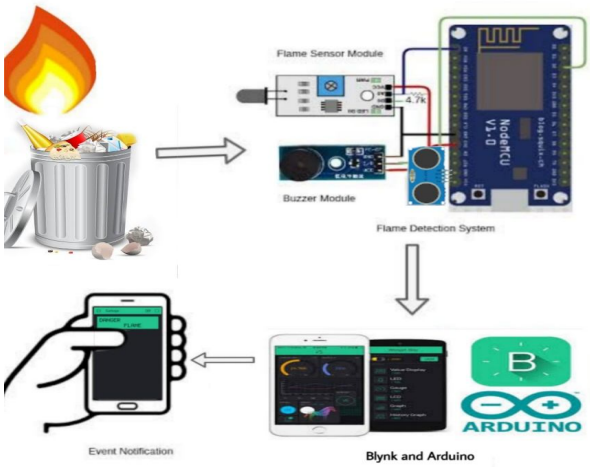

Figure 7. Sketch Diagram.

V. CONFIGURING BLYNK APP

To connect to the internet we make use of a prebuilt platform called Blynk app. After the user installs the Blynk app on the smartphone, an account to be created in the app to access its services. The services are enabled for the signed users. Let us create an account and add a new project to get started. An unique authentication code is used by the code to communicate with the project. The Blynk needs to be running in the background for the user to get real time notifications. The working process of the proposed model can be clearly seen in the following figure 8.

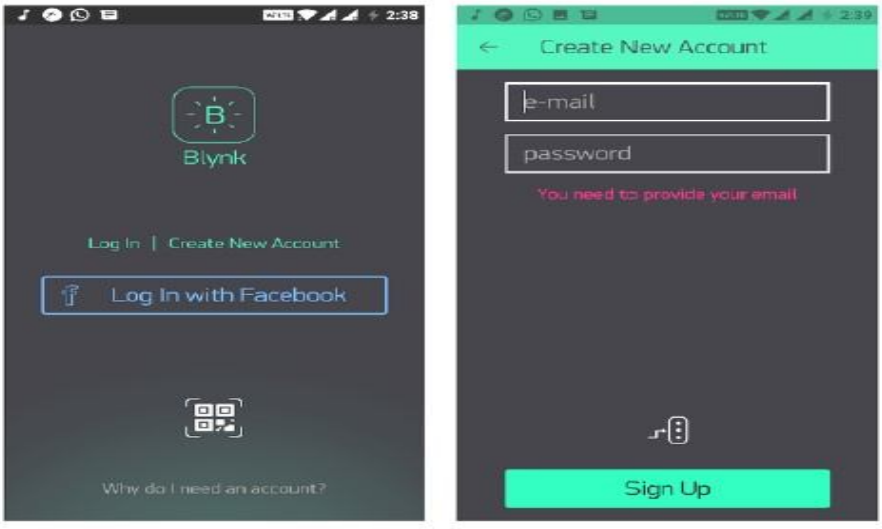

Figure 8. Configuration with Blynk app and account creation

This particular Figure says about the logging in to the blynk app which can be created using your facebook id or with the user's mobile number. Once you login to the app you need to create a work space according to your reuirements and put the keys,screen,buttons and modules according to your project. Now, your mobile app is ready to connect to to your system or your code for that you need to generate an auth code as mentioned in above para thereafter you need to connect your code and blynk app with the help of your auth code and provide a connection again an important thing to notice is that both your pc and mobile should have the same connection or connectivity module.

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Workflow of blink app from logging in to registration till the output screen on the app is shown in figure 9. This needs to give an Auth code and that code needed to be set in arduino app on your pc so that it connects to your mobile app and that app can get a connection to your Wi-Fi module.

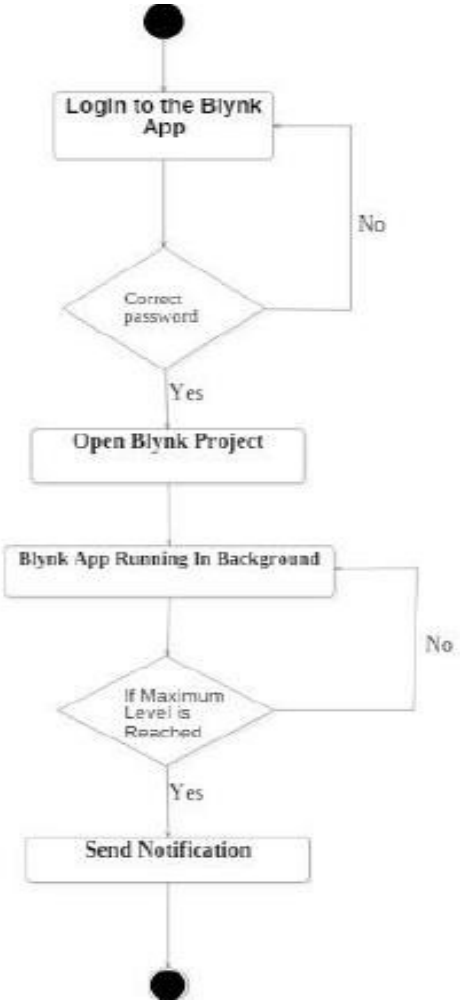

Figure 9. Working process of the proposed model

As you click to the login option you need to provide correct password then only your app will take you to the next screen and you are already done with the app setup from the previous explainantion and once the dustbin reach your mentioned level it will send a notification to your pc,mobile app as well as to your kit.

E. Working Process

After the account creation, the arduino will first read the ultrasonic sensor, It will send the signal with the speed of sound. It revert back after striking the object and the travel time is store based on equation1. Thus the distance of the object is calculated. Based on the distance we can identify the garbage level to be low or high. We used the term “overflow” to indicate the necessary for cleaning process. Thus the mobile is enable with the term as “Overflow”. Sample code is given below- implemented in the proposed work.

Sample Code:

```
#include <ESP8266WiFi.h>
#include <BlynkSimpleEsp8266.h>
#define TRIGGERPIN D0
#define ECHOPIN    D1
// You should get Auth Token in the Blynk App.
// Go to the Project Settings (nut icon).
```

```
char auth[] = "6fa7885a859b446dafddb599553496d3";
int x=0;
// Your WiFi credentials.
// Set password to "" for open networks.
char ssid[] = "Budhil Vyas";
char pass[] = "budhil1234";
WidgetLCD lcd(V1);
void setup()
{
  // Debug console
  Serial.begin(9600);
pinMode(TRIGGERPIN, OUTPUT);
 pinMode(ECHOPIN, INPUT);
pinMode(D2, OUTPUT);
pinMode(D3, OUTPUT);
pinMode(D4, OUTPUT);
pinMode(D6, INPUT);
pinMode(D7, OUTPUT);
  Blynk.begin(auth, ssid, pass);
  // You can also specify server:
  //Blynk.begin(auth, ssid, pass, "blynk-cloud.com", 8442);
  //Blynk.begin(auth, ssid, pass, IPAddress(192,168,1,100), 8442);
  lcd.clear(); //Use it to clear the LCD Widget
  lcd.print(0, 0, "Distance in cm"); // use: (position X: 0-15, position Y: 0-1, "Message you want to print")
  // Please use timed events when LCD printintg in void loop to avoid sending too many commands
  // It will cause a FLOOD Error, and connection will be dropped
}
void loop()
{
  lcd.clear();
  lcd.print(0, 0, "Distance in cm"); // use: (position X: 0-15, position Y: 0-1, "Message you want to print")
  long duration, distance;
.
.
.
.
(****you can mail author for full code****)

 (D4,LOW);
  lcd.print(0, 0, "DANGER");
  lcd.print(7, 1, "FLAME");
  delay(5000);
       digitalWrite(D7,HIGH);
     }
     else
     {
       digitalWrite(D7,LOW);
     }
      Blynk.run();
}
```

Once the code has been compiled, upload it to the Arduino Uno board by connecting the board to the computer using a 2.0 USB cable. The code for uploading is given in figure 10.

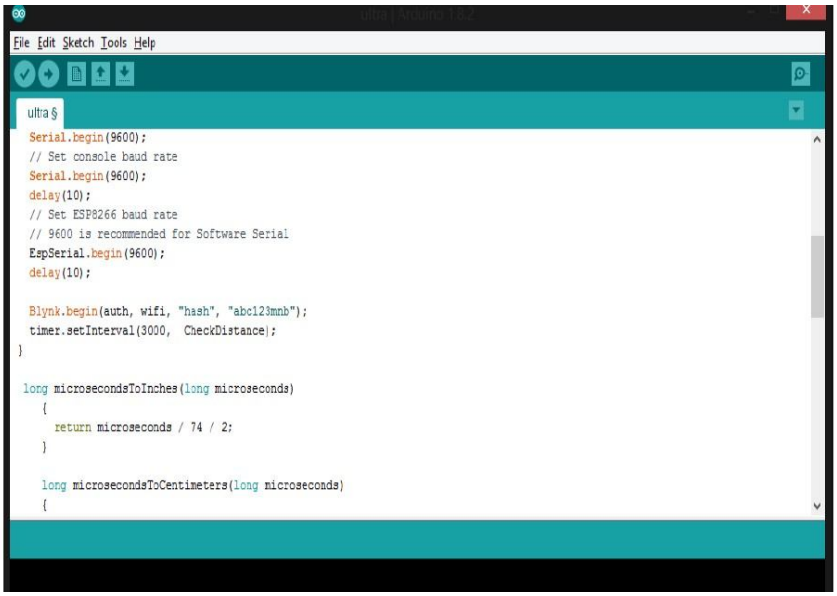

Figure 10. Upload the code.

After uploading the program click on "Serial monitor" to start running the code. Once the code starts to run, first thing it will do is to try and connect to ESP8266 to the access point pre-defined in the code. if the ESP8266 connects the model starts via the Blynk servers by sending a ping message.

Figure 11. ESP8266 successfully connected to Blynk app

VI. EXPERIMENTAL RESULTS

The system was checked repeatedly by increasing and decreasing the level of garbage in the bin. Notification was sent each time the level got changed. The user checked the notification was checked by the user on the blynk app, so it can be said that the system has worked in the way we planned. Proper security was also given to the hardware components so that the output which comes is accurate because further actions have to be taken based on the output. The result of the notification is provided in figure 12 and also if there is any flame inside the bin then it shows the notification shown in figure 12 itself.

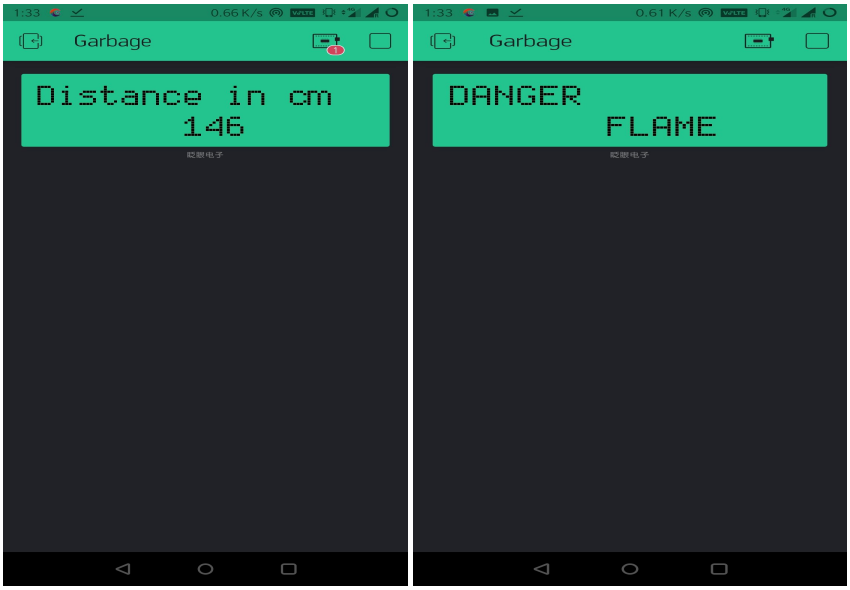

Figure 12. Experimental result.

VII. 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 which are placed in various parts of the city. If a particular dustbin has reached the maximum level 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 but in future various other types of sensors can be used with the ultrasonic sensor 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.

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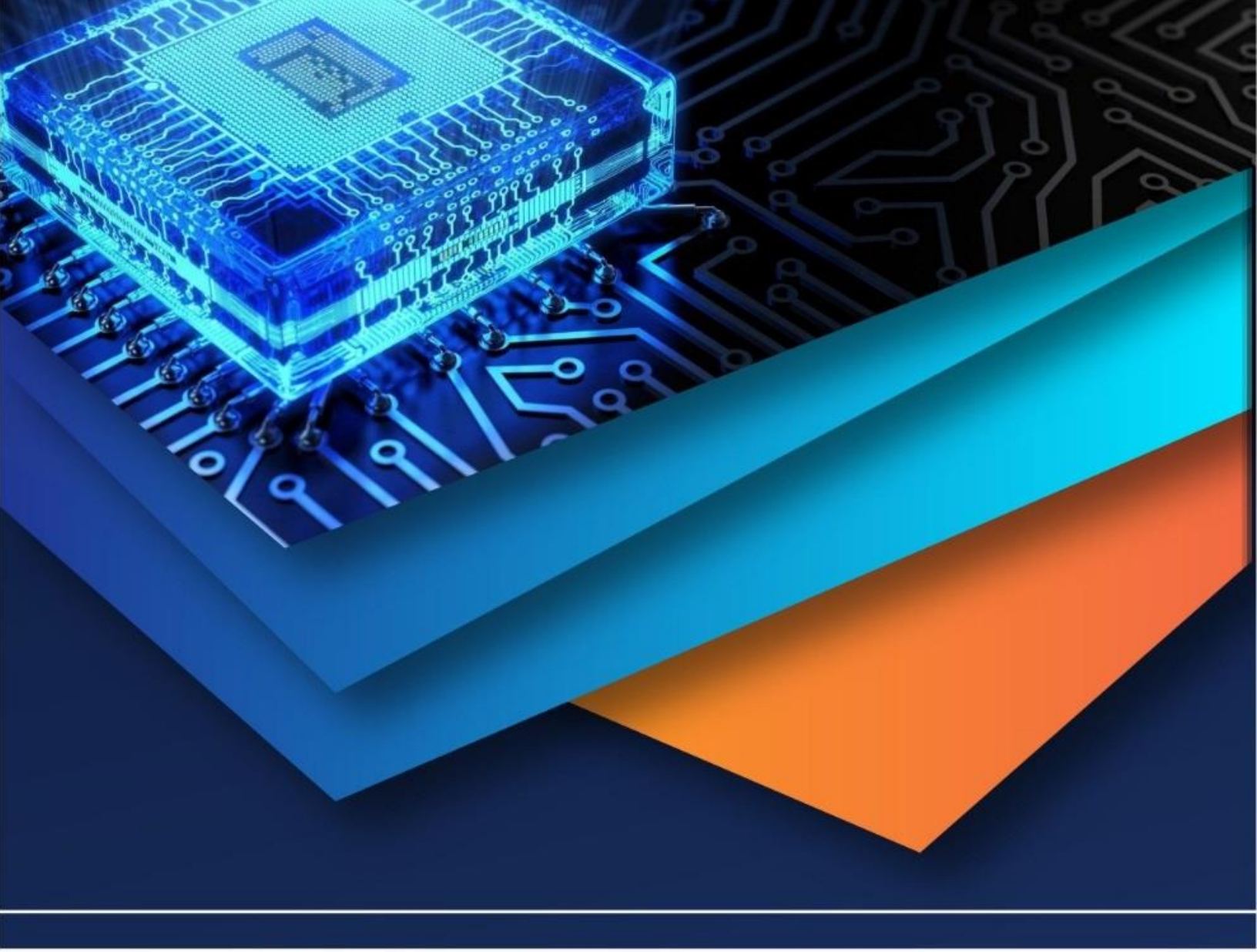

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