Smart Waste Management Using IoT

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Abstract- *In present condition of our world waste management is a major concern in the metropolitan cities of the developing and developed countries. As the population is growing, the garbage is also increasing day by day. Garbage management is becoming a global problem.. Garbage monitoring is an essential issue for most of the cities in India. The current garbage monitoring and management system are highly ineffective contributing to high transportation and collection costs. Due to poor monitoring and collection, garbage bins are seen overflowing in certain areas which can lead to long-term problems such as bad odor and harmful diseases. On the contrary, in some places, garbage collection trucks end up collecting garbage from bins which have low garbage levels leading to high petrol consumption and increased air pollution. To overcome these problems "NodeMcu based smart garbage monitoring system" can be introduced as an effective solution. This smart garbage monitoring system employs NodeMcu as its main microcontroller. It uses the ultrasonic sensor as a level detector to detect the amount of garbage in the bin. It also employs a DHT sensor to monitor temperature and humidity data respectively. This information is then transmitted via the NodeMcu to Blynk application. In the Blynk application, the live monitored information is displayed using a graphical interface. Thus, this system provides a web platform as well as a mobile platform for efficient garbage monitoring..*

Keywords- NodeMcu, Ultrasonic Sensor, DHT Sensor, IR Sensor, Blynk

I. INTRODUCTION

Internet of Things (IOT) built embedded system is the technology where an integrated developer connects various embedded devices to the internet. IOT for embedded system includes of multiple things like collect large amount of data and analyse it from different perception and brief them in useful data to improve the way devices and services are used today and making way for the embedded device smarter than before. Architecture, which suits for real-time operation, is needed by smart embedded systems. With billions of gadgets expected to take part in the coming years, experts expect IOT to have a significant impact on device design. In today's age as the population is increasing day by day, in many towns,

unhygienic environment resulted due to the overflowed bins which further increases different types of unknown illnesses and degrades the standard of living.

The system monitors the dustbins in different locations and updates the status of each dustbin on a server. For this, the system uses ultrasonic sensor placed over the bins to detect the garbage level, selected the espresso chip for this purpose which is a node MCU ESP8266 platform, Global system for mobile communication to send a message to the garbage collector. Besides, the shortest path to reach the dustbin will be given via link.

Garbage monitoring is an essential issue for most of the cities in India. The current garbage monitoring and management system are highly ineffective contributing to high transportation and collection costs. Due to poor monitoring and collection, garbage bins are seen overflowing in certain areas which can lead to long-term problems such as bad odor and harmful diseases. On the contrary, in some places, garbage collection trucks end up collecting garbage from bins which have low garbage levels leading to high petrol consumption and increased air pollution. To overcome these problems "NodeMcu based smart garbage monitoring system" can be introduced as an effective solution. This smart garbage monitoring system employs NodeMcu as its main microcontroller. It uses the ultrasonic sensor as a level detector to detect the amount of garbage in the bin. It also employs a DHT sensor to monitor the temperature and humidity data respectively. This information is then transmitted via the NodeMcu to Blynk application. In the Blynk application, the live monitored information is displayed using a graphical interface. Thus, this system provides a web platform as well as a mobile platform for efficient garbage monitoring.

A major challenge in the urban towns is waste management, as the pace of the urbanization is growing rapidly hence it is essential to have supportable development plans. Smart cities success cannot be done without a smart waste management system. A scheme requires being in place that provides previous data about bin filling that alerts the municipality to clean the bin on time and protect the environment. To prevent dustbin overflow, the intention is to

suggest a solution to this "Smart Garbage Bin" issue, which alerts and informs the authorized person when the garbage bin is about to be filled. The message will then be sent to the individual approved to retrieve the trash from the region assigned to the garbage collector. This system will help in keeping the environment hygiene and clean with the help of reduction in garbage bin overflow.

II. LITERATURE REVIEW

Many times it happens that Municipal Corporation employee's shows irregularity for dustbin inspection of the different localities as they have to do too much efforts for the same. Therefore, IoT built embedded devices technology is used for reduction in their manual efforts which introduces smart garbage collection systems.

JyotiSakhare, Prof. L. M. Deshpande [1] has done survey on Smart Waste Management in which they proposed Iot based Waste management by using Raspberry Pi. In is this system ultrasonic sensor is used of level detecting of waste, along with this humidity sensor also used to check the humidity of waste. The commutation to the server is established through Wi-fi Module ESP8266 which gives the message that dustbin is full. This system has master salve smart dustbin. The Infrastructural needs such as garbage containers and trucks are reduced as the collection is based on fill level data and optimized route planning. Manpower required for waste collection and transportation is reduced. Therefore, the smart waste management system makes the garbage collection more efficient.

Maya Chavan [2], has done survey on Municipal waste management in which details regarding different methods of waste collection has been collected. They suggested as one of the applications of Smart City, Waste Management in a city is a formidable challenge faced by the public administrations. IoT is a network of sensors where data is exchanged, using different connectivity protocols, with systems. Also, to find out the effective methods which are useful to provide hygiene environment to cities. To avoid such challenges faced they have proposed a system where efficient routes are defined shortest route to collect the garbage filled bins. The recent research works use mostly the heuristic solutions and methods dealing with the municipal waste collection as with a Travelling Salesman Problem (TSP). They discussed different challenges and issues which occurs in waste management system along with their solutions. Their solution was based on the idea of IoT infrastructure, which will provide enough information to handle this Smart City issue more efficiently.

S.A. Mahajan [3] In this paper, a model has been proposed for real-time monitoring the garbage level of respective garbage bins and to detect the level when threshold value is reached using combination of Sensors and Raspberry pi. This data will be sent to the control unit and updated timely with the help of WiFi- module, depending on which optimized route have to be found for Garbage Collecting Van (GCV), depriving the fuel consumption, cost, time and labor. The data will be provided whether the waste is segregated completely or not by wet sensor and humidity sensor which will help for recycling, disposal and reuse of waste. Using data mining, qualitative analysis will be carried out to generate reports. The main objective of this system to be implemented is to supersede the tedious existing system which will aid city to become a Smart City. This proposed system assures the collection of garbage soon when the garbage level reaches its maximum level. Thus, the dustbins will be cleared as and when filled, giving way to cleaner city, better infrastructure and increased hygiene.

Zainal Hisham CheSoh [4] This paper presents a Smart Waste Collection Monitoring and Alert System (SWCMAS) using IoT technology on Ubidots Cloud. They have suggested new solution to enhance waste collection efficiently using the Arduino Uno with Arduino Ethernet Shield technology and ultrasonic sensor systems. In this proposed system, the garbage overflow of garbage can be avoided and managed efficiently. This will intimate or send SMS or email to the authorized person through Ubidots platform. Ubidots Dashboard to display and visualize the waste bin depth level data and Ubidots Event manger to notify an alert to consumer via telegram/SMS on smartphone when the waste bin is nearly filled. this system provides the information when the bin gets completely filled with garbage, it reduces the number of times the arrival of vehicle which collects the garbage. This method finally helps in keeping the environment clean. Thus, the waste collection is made more efficient.

ParkashTambare [5] has suggested that managing the smart bins by monitoring the status of it and accordingly taking the decision. There are multiple dustbins are located throughout the city or the Campus (Educational Institutions, Companies, Hospital etc.). These dustbins are interfaced with micro controller-based system with IR Sensors and RF modules. Where the IR sensor detects the level of the dust in dustbin and sends the signals to micro controller the same signal are encoded and send through RF Transmitter and it is received and decoded by RF receiver at the Central System(Intel Galileo) and an Internet connection is enabled through a LAN cable from the modem. The data has been received, analyzed and processed in the cloud, which displays

the status of the Garbage in the dustbin on the GUI on the web browser This has suggested a system that information of all smart dustbins can be accessed from anywhere and anytime by the concern person and he/she can take a decision accordingly. By implementing this proposed system, the cost reduction, resource optimization, effective usage of smart dustbins can be done. This system indirectly reducing traffic in the city.

Amrutha P.V.[6] In this system multiple dustbins are located throughout the city or the Campus, these dustbins are provided with a sensor which helps in tracking the level and weight of the garbage bins and a unique ID will be provided for every dustbin in the city so that it is easy to identify which garbage bin is full. When the level and weight of the bin reaches the threshold limit, the device will transmit the reading along with the unique ID provided. In order to avoid the decaying smell around the bin harm-less chemical sprinkler is used which will sprinkle the chemical as soon as the smell sensors detect the decaying smell. They have suggested implementation of smart garbage Bin indicator receptacle, gives a solution for unsanitary environmental condition in a city. The implementation of Smart Garbage collection bin using internet, IR sensor, and raspberry pi. The system assures to send mail notification and status on dashboard of dustbins when the garbage level reaches its maximum. If the dustbin is not cleaned in specific time, then the record is sent to the higher authority who can take appropriate action against the concerned contractor. This system also helps to monitor the fake reports and hence can reduce the corruption in the overall management system. This reduces the total number of trips of garbage collection vehicle and hence reduces the overall expenditure associated with the garbage collection. Its ultimate helps to keep cleanness in the society. Therefore, the smart garbage management system makes the garbage collection more efficient the use of solar panels in such systems may reduce the energy consumption.

PavanKumar[7] In this paper the garbage containers transmit signals to indicate that they are over 80% or 90% full and should be emptied. Via the mobile communications network, the signals are sent to a web based software application used by the waste management company. They have suggested method the collection of waste in the city becomes more easier. It helps in reducing air pollution, traffic flow, man power, time and money. With the help of proper technology (GPS & SOFTWARE APPLICATIONS) we can guide the trucks in selecting the shortest path for garbage collection. The project can add an edge to the cities aiming to get smart and people-friendly.

KusumLata[8] has suggested the Smart waste management system that identifies fullness of the bin using a

wireless sensor network (WSN) and embedded Linux board and inform the authorized person for the cleaning of the bin. The system provides a web interface to the cleaning authority so that they can monitor and clean the garbage bin. In this paper, Raspberry Pi is used as an embedded Linux board which is designed based on the arm 11 microcontroller architecture. Embedded Linux board makes the communication with all distributed sensor nodes placed in the tested area through ZigBee protocol and itself act as a coordinated node in the wireless sensor network. The goal of coordinator node is to collect the parameters like level of the bin and odor wirelessly. Each sensor node consists of level sensor and gas sensors and one ZigBee RF antenna device for communication with the coordinator node. Raspberry Pi stores collected data in the database and analyzes the stored data. The board has an Ethernet interface and runs the simple data web server. Hence coordinator collects the data over ZigBee wireless communication protocol and allow user to monitor the data from a web browser. Cleaning authority can collect the garbage on time. Through this smart approach, the data is shared between devices so that the responsible authority can take further steps for cleaning of the garbage bin.

Ms. Rupa[9] has suggested smart garbage management system based on IOT for urban areas acts as one of the innovative system to keep the cities clean. The system monitors the dustbins in different areas and update about their status on a website. For this, the system uses ultra sonic sensor placed over the bins to detect the garbage level, Advanced Virtual Reduced (AVR) instruction set microcontroller ATmega16 for controlling the whole system working, Global system for mobile communication (GSM) to send message to higher authority, GPRS (General Purpose Radio Service) for updating status on designed website. The website designed for this purpose gives a tabular view of the status of dustbin along with date and time and the 16X2 LCD display equipped with system will show the changing status of dustbin. 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 by visiting corresponding website. This can prove to be a very useful system if used properly. One of important advantage of this system is it is really helpful in improving the quality of environment and is a step towards fulfilling goal of SWACH BHARAT ABHIYAN a government initiative for environment cleanliness.

Rishabh Kumar Singhvi [10] In this paper we are using Internet of Thing (IoT) based technique and GSM/GPRS

technique for interfacing between transmitter and receiver. Our proposed "IoT based smart waste management system: India prospective" provide the real time status of dustbin. It measures the percent filling of the dustbin and level of toxicity. It sends data to website so it can be seen in future. It stores the time and date in the database with percent filling and toxicity level of the dustbin. It sends message to the concern person when dustbin is full or toxicity is high. Our whole system is described in the fig.1. Arduino is connected with ultrasonic sensor and Gas sensor that sends data through the GSM module to the municipal corporation. They have suggested Smart system provides the filling status of dustbin using message and it will save time, fuel and money of Municipal Corporation. As there was a problem of checking real time status of dustbin so it will be cleaned timely. So, in this project this problem is solved and proper database is managed online.

SapnaSuryawanshi [11] This paper proposes a smart alert system for garbage clearance by giving an alert signal to the municipal web server for instant cleaning of dustbin with proper verification based on level of garbage filling. This process is aided by the ultrasonic sensor which is interfaced with Arduino UNO to check the level of garbage filled in the dustbin and sends the alert to the municipal web server once if garbage is filled. After cleaning the dustbin, the driver confirms the task of emptying the garbage with the aid of RFID Tag. The whole process is upheld by an embedded module integrated with RF ID and IOT Facilitation. The real time status of how waste collection is being done could be monitored and followed up by the municipality authority with the aid of this system. In addition to this the necessary remedial / alternate measures could be adapted. An Android application is developed and linked to a web server to intimate the alerts from the microcontroller to the urban office and to perform the remote monitoring of the cleaning process, done by the workers, thereby reducing the manual process of monitoring and verification. The notifications are sent to the Android application using Wi-Fi module. They have suggested providing the services for the different kind of stake holders involved in this area. On-board surveillance cameras and reporting system. Development of application for city administration.

KellowPardini [12] has surveyed on IoT based Solid waste management solutions. In which different types of waste are highlighted. An in-depth review of state-of-the-art on solid waste management Presentation of architecture models for solid waste management identified in the literature based on IoT requirements emptying requirements, such as distances and type of waste. Considering IoT requirements, a review analysis of waste management models available in the literature is performed in detail in this paper. Then, a deep review is undertaken of the related literature based on IoT infrastructure for efficient handling of waste generated in urban scenarios, focusing on the interaction among concessionaires and waste generators (citizens) from the perspective of a shorter collection time with reduced costs, as well as citizenship promotion. An IoT-based reference model is described, and a comparison analysis of the available solutions is presented, with the goal to highlight the most relevant approaches and identify open research issues on the topic.

Kumar, N. Sathish [13], has embraces implementation of smart garbage system with the help of microcontroller, IR sensor and RFIC. Only alerts provided by this system as and when maximum level of the garbage reached in dustbin. In addition, it may be possible to adopt the other required remedial/alternate measures. An Android application is created and connected to a web server the alerts at the urban office from the microcontroller that subsequently executes the cleaning process remote monitoring, thereby reducing the manual intervention for monitoring and verification. Android application is notified of the alerts with the help of Wi-Fi module.

Yang Lv Yu Tian [14] proposes the new architecture is suggested with the objective of on-site management and waste management process optimization. A remote monitoring system has been introduced and with the help of web browser the opportunity id provided to the user to interact with the system. Every single sensor node performs data acquisition and transfer in such architecture. The data obtained Monika K A; researcher describe the Arduino's use as the source of power selected automatically. External (non-USB) energy can be drawn from either battery or an ADC adapter. Leads from a battery are linked in the POWER connectors of Vin and GND pin headers. With the external supply of 5-20-volt board can work. These characteristics make the job easier is sent to supervisory system, which helps the user in getting solution to decision problems, such as resources organization (people, trucks and specific machinery) optimization, with the key task to accomplish cost optimization.

Pramodhini. R [15] has discussed as of now there are traditional waste management system like periodic and routine clearing by civic bodies. To avoid these situations, they have implemented an IOT based dustbin monitoring system. These bins are interfaced with Ultra-Sonic sensor and Load cell, GPS receiver for location of the bin with Raspberry Pi-3 as main control processing unit showing current status of garbage on web browser and android application with help of PHP page by Wi-Fi and internet service. An automatic garbage level

detecting system informing the concerned authorities. The idea of smart bin for smart buildings, colleges, hospitals, and public parks and its improvements of normal dustbin with sensor and transducer. They have implemented real time waste management system by using smart dustbins to check the fill level of smart dustbins whether the dustbin is full or not. In this system, the information of all smart dustbins can be accessed from anywhere and anytime by the concern person and he/she can take a decision accordingly.

Ms. AnkitaKhedikar[16] In our system, the Smart dustbins are connected to the internet to get the real time information of the smart dustbins. In this system Motor is used for opening and closing of the Garbage bin lid. This can be done by forward and reverse direction rotation of motor. For smooth running, good speed regulation and operating of motor Drive IC L293D is used. In all condition we receive data on web portal using Wi-Fi module and the same thing will be displayed on LCD screen connected to the Garbage Bin. Wi-Fi Module helps us to send the details of the dustbin at the receiver side. At the receiver section a mobile handset is needed to be connected to the Wi-Fi router so the details of the garbage bin is displayed on the web page and a mail notification (like email) will be sent to the respective Municipal / Government authority person.

NehaShinde [17] This paper involves applying IoT technology (electronics and applications) to the current urban waste management scenario and enables a two-way communication between the infrastructures deployed in the city and the operators/administrators. A centralized system for real-time monitoring is our goal to achieve. In this way both the municipal and citizens benefit from an optimized system which results in major cost savings and less urban pollution. Therefore, the smart garbage management system makes the garbage collection more efficient.

Ruhin Mary Saji [18] This paper is a survey based on Smart Garbage Management in Cities using IoT. This survey involves various smart garbage management ideas that can be easily implemented. This survey has been performed for collecting the details of smart garbage management methods and to find out effective methods which are useful for providing hygiene environment in cities. As the level of garbage in the bins crossed the threshold, it will be informed to the corresponding authority, if it was found ignored then the details will be forwarded to the higher authority to take necessary actions. Thus, a hygiene and clean environment can be provided. This survey helps in identifying all possible smart garbage management methods that can be implemented to make city clean.

Priti K. Gadge [19] This paper helps to minimize the garbage disposal problem. In this paper Garbage Monitoring system is a very innovative system which will help to keep the cities clean. This system monitors the garbage bins and informs about the level of garbage collected in the garbage bins via a web page. For this the system uses ultrasonic sensor placed over the bins to detect the garbage level and compare it with the garbage bins depth. The system makes use of Arduino family microcontroller, LCD screen. The web page gives a graphical view of the garbage bins and highlights the garbage collected in bins in color in order to show the level of garbage collected. The LC status of the garbage level. Thus, this system helps to keep the city clean by informing about the garbage levels of the bins by providing graphical image of the bins via a web page.

Monika K A [20] In this paper, smart bin is built on a microcontroller-based platform Aurdino Uno board which is interfaced with GSM modem and Ultrasonic sensor. Ultrasonic sensor is placed at the top of the dustbin which will measure the stature of the dustbin. Aurdino will be programmed in such a way that when the dustbin is being filled, the remaining height from the threshold height will be displayed. Once the garbage reaches the threshold level ultrasonic sensor will trigger the GSM modem which will continuously alert the required authority until the garbage in the dustbin is squashed. Once the dustbin is squashed, people can reuse the dustbin. At regular intervals dustbin will be squashed. Once these smart bins are implemented on a large scale, by replacing our traditional bins present today, waste can be managed efficiently as it avoids unnecessary lumping of wastes on roadside .Foul smell from these rotten wastes that remain untreated for a long time, due to negligence of authorities and carelessness of public may lead to long term problems. Breeding of insects and mosquitoes can create nuisance around promoting unclean environment. This may even cause dreadful diseases. This Smart Dustbin can contribute a lot towards clean and hygienic environment in building a smart city.

III. SYSTEM ARCHITECTURE

In this section, a brief explanation regarding on the project development and methodology will be described. This project proposed a system to control a waste material from overflow from the waste bin and alert is send to cleaner for waste collection. Using the anticipated system, monitoring of the waste collection status could be monitored effectively. This project designates a technique in which could monitor the garbage level at regular intervals as overflow of the bin can be prevented. The filling level of the garbage in the dustbin and its original level height could be sensed/ monitored by the

ultrasonic sensor. Programming in the Arduino IDE is done in such a way that once a particular level of filling is sensed, information as a message is sent to the user, requesting for cleaning of the dust bin.

Referring to the block diagram in Figure 1 below, the developed system consists of a 1) sensor node that implemented using Microcontroller which will be Node Mcu, ultrasonic sensor, DHT11 sensor; IR Sensor.
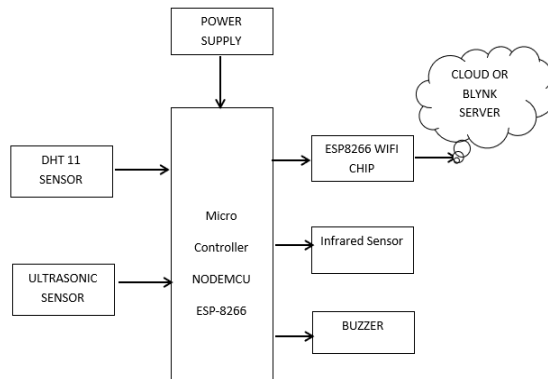

Fig.3.1: Block Diagram of Smart waste management system

Fig – Architecture

This proposed architecture will have configuration of Master Slave dustbins. Which would overcome the issues in related to connectivity remote areas. Each master dustbin shall be equipped with a micro-controller. Each of the dustbins has 3 types of sensors:

1) Level sensor: It will provide continuous information of level of dustbin filled to the server. When the waste in dustbin reaches to its threshold level, an alert message goes to the server through cloud.
2) Humidity sensor: This sensor gives the information of humidity present in the waste.
3) IR Sensor: An infrared sensor is an electronic device, that emits in order to sense some aspects of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion.
4) On checking these parameters time to time the performance rate will increase. This system will lead to have a clean city, clean country, approximately clean world.

IV. HARDWARE DISCRIPTION

4.1Ultrasonic sensor:

As the name indicates, ultrasonic sensors measure distance by using ultrasonic waves.The sensor head emits an ultrasonic wave and receives the wave reflected back from the target. Ultrasonic Sensors measure the distance to the target by measuring the time between the emission and reception.

Fig. 4.1: HC-SR04 Ultrasonic Sensor

4.2DHT11 Sensor

DHT Sensors have been employed for measuring the temperature and humidity surrounding the garbage bin. These are slow sensors with basic design. The two main components of DHT sensor are a capacitive humidity sensor and a thermistor. It also has an analog to digital converter that is used for analog to digital conversion of sensed data. The digital data is then read using a microcontroller, in this case, it is a Node Mcu.

Fig.4.2: DHT11 Humidity Sensor

4.3NodeMcu

The NodeMcu is an open-source Wi-Fi system on chip produced by Espress if Systems. It is an integrated chip that provides full internet connectivity to the embedded circuit in which it is present. It can be programmed through USB port using Arduino IDE. It has a total of 30 pins in which 9 pins are digital pins while 1 pin is analog pin. It is a tool that is employed for Wi-Fi networking. It has low power consumption. In this project it has been employed as the main microcontroller owing to its inbuilt Wi-Fi connecting capacity which can be exploited to transmit real-time monitored sensor data to web and mobile interfaces
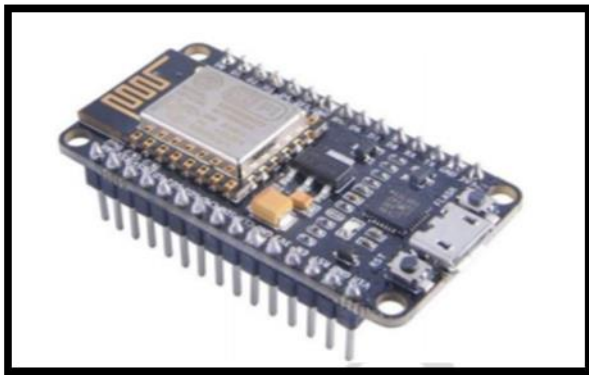
Fig 4.4: : Image of Node-MCU ESP8266

4.4 Blynk

Blynk is an android application that allows the user to build user-friendly mobile output interface for operating, monitoring and controlling hardware projects. It can be operated on both android and iOS platforms. Blynk supports different types of microcontrollers such as Arduino boards, Raspberry Pi models and ESP8266. Here Blynk has been employed as a mobile interface to monitor sensor output data obtained from hardware module of smart garbage monitoring system.
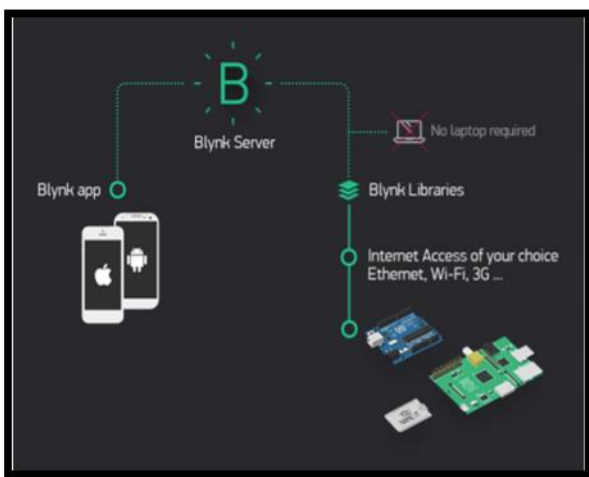

BLYNK **Architecture**

## V. METHODOLOGY OF SYSTEM IMPLEMENTATION

In this paper, master slave dustbins are configured. The main system is present in master dustbin and the sensor with Iot infrastructure is present in slave dustbin. The communication between these dustbins will take place through NodeMcu module. The work of NodeMcu is to collect the information from the sensors and according to the information the message should be send to the server within the time limit.

According to the information the concerned authorities will send the message to the nearest waste collection in charge. So, that waste will be collected within the time period. This system will reduce the consumption of time.
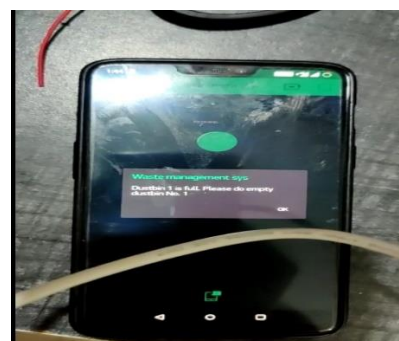
VI. RESULTS AND SIMULATION
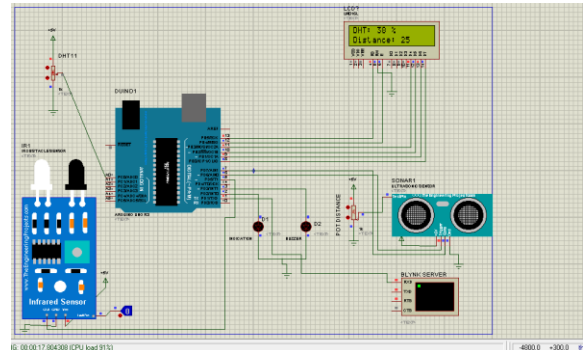
Simulation of Waste Management system
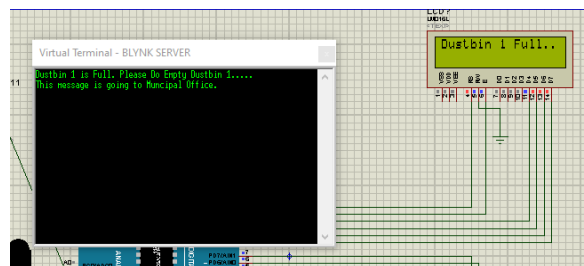
Notification alert output

Smart Dustbin with system

Notification alert on BLYNK app

Comparison of different system is mentioned below

Sr .no	Name Of Methods	Author Name	MCU	Sensors	Feedback
1	Proposed System	-	NodeMcu	1.Ultrasonic 2.DHT11 3.IR	Blynk app
2	Smart Waste Collection Monitoring and Alert System via IOT	Zainal Hisham Che Soh[1] ,Mohamad Azeer Al-Hami Husa[2] ,Syahrul Afzal Che Abdullah[3] ,Mohd Affandi Shafie[4]	Ardunio Uno	1.Ultrasonic	Ubidots
3	Design of Monitoring System for waste management using Iot	D.Saida Reddy1, G.Neelima2	Raspberry Pi	1.Ultrasonic Sensor	web
4.	Smart Garbage Management System Using Iot	Ms. Rupa[1], Ms. Rajni Kumari[2], Ms.Nisha Bhagchandani[3] Mr. Ashish Mathur[4]	ATMega16	1.Ultrasonic	GPRS/GSM

VII. CONCLUSION

The main aim of the project is to obtain real time data of percentage of garbage from garbage bins placed in various parts of the city. Along with the fill level data other important parameters such as humidity, and temperature of the bin are monitored and sent to Blynk interface. When the garbage level in 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. It will reduce the wastage of time, cost and energy of the human. It will also prevent the occurrence of any disease. The truck drivers easily get information about the clearing process and do their work immediately. Thus this method of monitoring garbage level enhances the overall efficiency of the whole processes.

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