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# Research on Waste Bin Monitoring System Based on IOT

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**ABSTRACT:** One of the major issues confronting our society at the moment is the segregation of massive amounts of waste on a daily basis. Our garbage cans are overflowing on a regular basis, causing many issues and creating unsanitary conditions. The sewage from the bins, as well as its foul odour, often invites a variety of communicable diseases such as diarrhoea, dengue fever, and other water-borne illnesses. As a result, the prevention, tracking, and effective handling of waste has been a top priority in the modern world. The conventional method of manually inspecting waste in waste bins is a complicated, costly, and time-consuming operation that requires more human work, time, and money, and is in no way consistent with modern technology. As a result, the project Waste Bin Monitoring System based on IOT emerges, which is a one-of-a-kind system for keeping the mounting volume of waste under control and dealing with the growing garbage in a more sustainable and time-saving manner. This is a cutting-edge form of waste disposal that has been streamlined. The garbage bins are monitored by this device, which uses ultrasonic sensors to measure the depth of the bins and sends the information to a microcontroller, which stores it and shows the amount of waste accumulated in the bins via a web screen. This system also transfers all of the data to garbage disposal trucks, and the driver can only go to the bin when the garbage volume has dropped below the threshold.

**KEYWORDS-** Arduino, GSM, GPS and Internet of Things (IOT) are some of the terms used to describe this project.

## I. INTRODUCTION

A large number of flats and apartments have been constructed in the rapid urbanisation area in recent years. This is due to high housing demand, which has skyrocketed as a result of people migrating from villages to cities in search of jobs. The government has also built more residential complexes to meet the increasing population in the urban area. The tenants of the flats are dealing with a number of problems. Solid waste management is one of them. Unlike in private homes, all occupants of the apartments share a single trash can, which easily fills up. Garbage leakage is a sanitary problem that may lead to diseases like cholera and dengue fever.

Furthermore, it is a waste of fuel to drive through a complex or an area only to discover that some garbage cans are full and others are not. In special occasions, there can be issues with the truck's capability due to a large amount of garbage. The notion came to us when we noticed that the garbage truck used to drive through the town twice a day collecting solid waste. While this scheme was comprehensive, it was ineffective.

We live in an era where tasks and processes are fusing together with the power of IoT to create a more flexible working environment and to complete jobs more rapidly! This is what we've come up with with all the strength at our fingertips. The Internet of Things (IoT) would be able to integrate a vast variety of different technologies in a straightforward and streamlined manner, while also delivering data for millions of users to access and profit from.

Building a general infrastructure for the Internet of Things is therefore a difficult challenge, owing to the vast number of computers, connection layer technologies, and utilities that may be included in such a scheme. One of our biggest environmental issues has been solid waste disposal, which has an effect on our society's health and climate. One of the most pressing issues of our day is the prevention, tracking, and treatment of wastes. Manually inspecting waste in waste bins is a time-consuming procedure that requires more human work, time, and money, both of which can be eliminated with today's technology. This is our solution, an automated waste management system. This is our Internet of Things Garbage Monitoring system, a revolutionary solution for keeping communities safe and secure

## II. PROPOSED SYSTEM

In proposed system, there will be one embedded device attached to garbage bin which will keep track of garbage level in garbage bin with the help of ultrasonic sensor which sense the object. Level of garbage in bin will be shown on webpage in graphical representation so that authorized person can see this information from anywhere, information will contain id of bin, location of bin, level of garbage, in percentage form, timestamp of level of garbage bin. This system will

send one alert SMS to authorized person or garbage collector when garbage bin gets full. The Arduino UNO Board is used in this project. This system tracks the waste bins and shows level of waste bin on web page .For data transmission, the device uses GSM modem. Transformer or Adapter is used to run the system. The LCD screen shows the current state of the garbage collection in the bins. A web page is created to display the level of the garbage bin as well as the location of the garbage bin using a GPS module. The web page displays a schematic representation of the garbage bin and highlights the level of garbage in bin, as well as the location and ID of each bin. The garbage level is shown on the LCD panel. Thus, this system contributes to keeping the city healthy by reminding to garbage collector or authorised person of garbage levels in bins and delivering a graphical representation of the bins using an IOT web development system. Additionally, this system sends an SMS alert to the garbage collector when a bin is full.

### Existing system

The corporation collects garbage once or twice a week under the current system. Despite the fact that trash shrinks and overflows the garbage can, it pollutes the environment and spreads along the roads. The stench will be unbearable, polluting the air and causing disease to spread. The waste food is consumed by street dogs and animals, causing a dirty environment to spread across the region. Many times these days, we see trash or dust bins placed in public places in towns overflowing due to a daily rise in waste. It creates an unsanitary environment for people as well as a foul odour in the surrounding area, leading to the spread of deadly diseases and human illness; to avoid this, we plan to design IOT-based waste management for smart cities.

#### A. Disadvantages of the existing system

- a) Trucks go and empty containers whether they are complete or not, which is time consuming and ineffective.
- b) Costs are very high.
- c) The city's unhygienic climate and appearance.
- d) Humans can become ill as a result of the foul odour.

### Objectives of proposed system

- a) Main objectives of this system is to reduce human efforts, cost of fuel. Authorised person get know by SMS when garbage bin is full
- b) To keep city's climate hygienic.
- c) To provide location and id of garbage bin which is full so that garbage collector can go quickly and can make garbage bin empty.

## III. METHODOLOGY

The Internet of Things (IoT) is a networked environment in which objects, animals, and people are assigned unique identifiers and the ability to exchange data without requiring human-to-human or human-to-computer interaction. There are smart home devices that can be tracked remotely and are synchronised with one another, for example. The Internet of Things is only getting better as users are able to control devices based on their usage patterns and save resources. Consider a fridge with smart capabilities that can detect when an item in your fridge is running low and automatically replenishes it through automatic shopping. This application is more practical, but it just scratches the surface of what IoT can really do. One of the main principles of the Internet of Things is to make it as simple as possible for users to control devices and save resources according to their needs. When it comes to the waste industry, waste and recycling collectors are constantly looking for ways to cut costs and improve productivity. This would result in better resource utilisation, lower fleet costs, and greater per-person efficiency by automating what was previously a time-consuming fixed-route collection method [8].



Fig 1: Internet of Things

Internet of Things in Garbage Monitoring IoT can be defined as internetworking of different physical entities, vehicles, buildings, and other items— embedded with electronics, software, sensors, actuators, and network connectivity that enable these objects to collect and exchange data. The IoT allows objects to be sensed and/or controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic IoT is useful in building a robust system that can measure the level of garbage in the dustbins and help to reduce it and to decrease human interference in monitoring the garbage to reduce waste and provide a healthy environment. IoT can be used in making the garbage monitoring a wireless system. It can protect the environment from pollution generated due to untreated waste. IoT can help build a unique system that evaluates the garbage continuously and indicates when there is an increase in the level of garbage in the bins and takes action to control it using wireless technology. These improvements can be used to develop and implement a new environmental policy and manage the waste in a time efficient manner.

IV. BLOCK DIAGRAM OF PROPOSED SYSTEM

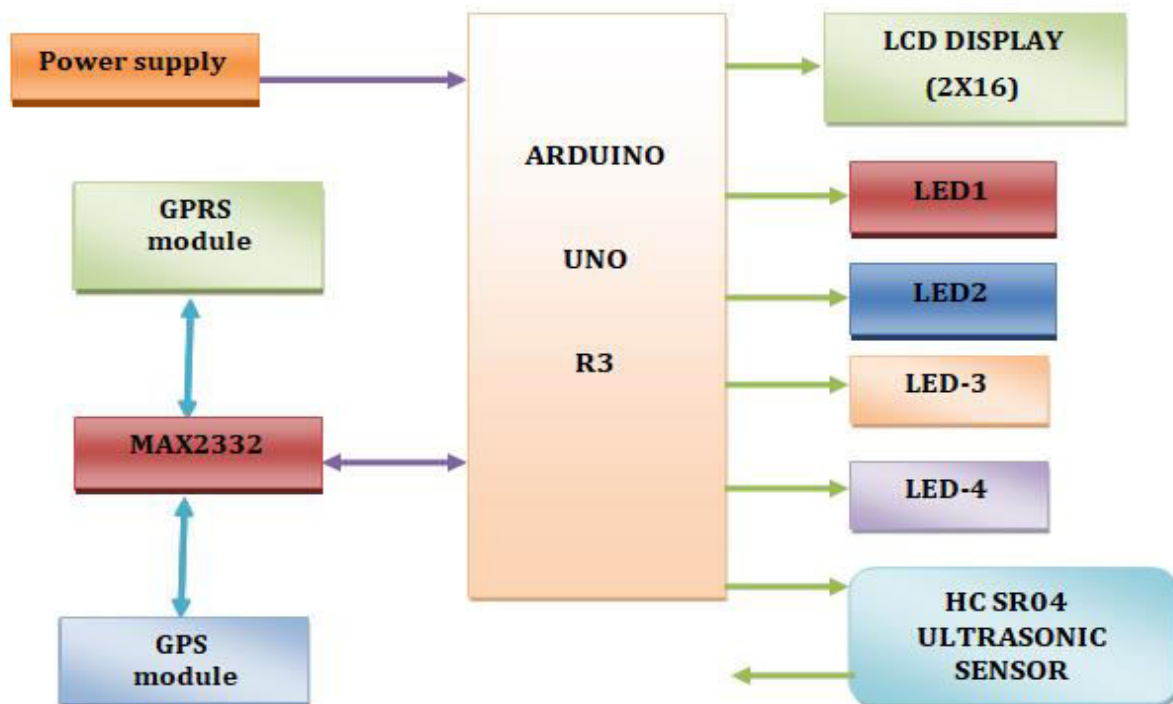


Fig 2: Block Diagram of Waste Bin Monitoring System based on IOT

Team used Arduino UNO microcontroller for controlling all the functionalities. one GPS Module module, GSM module, Max 232 IC for serial communication between GSM, GPS and Arduino UNO. One LCD display for displaying what process going on. One ultrasonic sensor for sensing garbage level. 4 LED's attached to garbage bin to status of bin .LED's are controlled Arduino controller .At Website part Arduino get sensor data from ultrasonic sensor through programming scripts. Arduino makes connection to website through the script and also sends data through programming scripts. The sensor data is shown on the webpage. Including location of Garbage bin, ID of bin ,Level of garabge, in bin in percentage form, timestramp of level in bin.

### Hardware Description

**1.Arduino:** Arduino is an open source computer hardware and software corporation, project, and user community that designs and produces single-board microcontrollers and microcontroller kits for building digital devices and interactive objects that can sense and control physical and digital objects. The project's hardware and software are distributed as open-source hardware and software under the GNU Lesser General Public License (LGPL) or the GNU General Public License (GPL), allowing anyone to make Arduino boards and distribute software. There are arduino boards available. arduino boards are commercially available preassembled or as DIY kits [10]

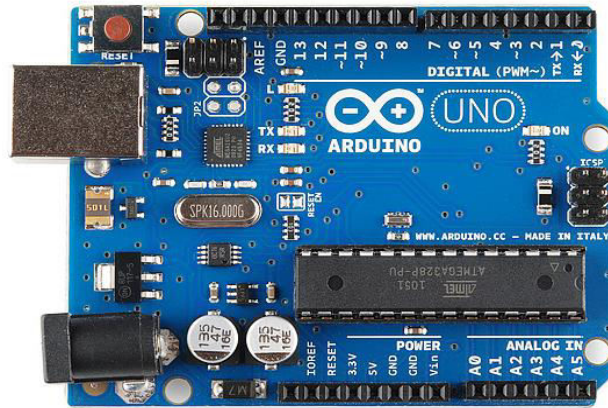


Fig3 : Arduino UNO

**2.HCSR04Ultrasonic Sensor:** The sensor is used to determine the amount of dust in the trash can. A sound transmitter and receiver are used. A pulse is produced by an ultrasonic sensor. Listen for the pulse reflection when you call ping. A sonar projector with a signal generator, power amplifier, and electro-acoustic transducer array generates the sound pulse electronically. To focus the acoustic power into the beam, a beam former is commonly used.



Fig 4 : HCSR04 Ultrasonic Sensor

**3. GPS module-** used for mapping. Or locating. One of the global positioning system (GPS) devices utilizes data from satellites to locate a specific point on the Earth in a process named trilateration. **GPS modules** contain tiny processors and antennas that directly receive data sent by satellites through dedicated RF frequencies.



Fig5: GPS Module

**4. An LCD Driver:** also referred to as an LCD Display Driver or LCD Controller is an integrated circuit that provides an interface between a microprocessor (MPU) or microcontroller (MCU) system and a liquid crystal display (LCD) [11]. It is a flat-panel display which uses light modulating properties of liquid crystals to display the content.



Fig 6: LCD Driver

**5. Wi-fi/GSM /GPRS Module** is used to enable communication between a microcontroller (or a microprocessor) and the GSM / GPRS Network. Here, GSM stands for Global System for Mobile Communication and GPRS stands for General Packet Radio Service.

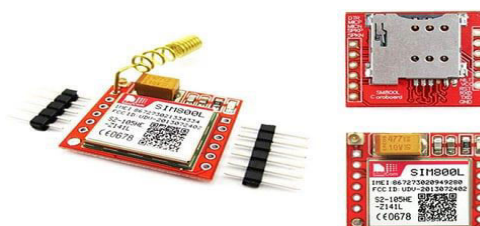
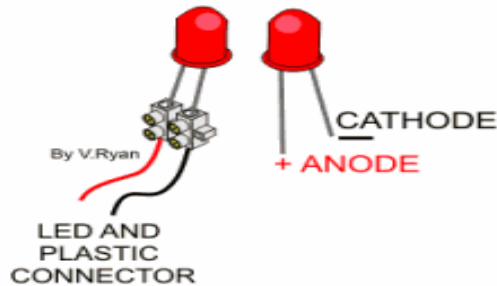


Fig 7: GSM Module

**6.LED indicators-** A light-emitting diode (LED) is a semiconductor light source that emits light when current flows through it.



**Fig 8: LED**

**7.MAX 232 IC-** The MAX232 is an integrated circuit first created in 1987 by Maxim Integrated Products that converts signals from a TIA-232 (RS-232) serial port to signals suitable for use in TTL-compatible digital logic circuits. The MAX232 is a dual transmitter / dual receiver that typically is used to convert the RX, TX, CTS, RTS signals.



**Fig 9: MAX 232 IC**

## 8. POWER SUPPLY

In this work there will be 9 volts transformer for continuous power supply. By using this ,continuous power will come. Otherwise If battery is used sometimes the total currents will loss so that's why team using A.C Transformer. A.C transformer is giving the input to Bridge Rectifier. Bridge Rectifier converts A.C to D.C. After that there is one filter capacitor 1000uf/25v electrolytic capacitor .Capacitor will be connected in parallel section. The main purpose of this capacitor is if there is any alternate peaks it reduce that peaks. Nothing but a filtering that repull's. After that there will be LM7805 Regulator Most digital logic circuits and processors need a 5 volt power supply. By using these parts it will build a regulated 5 volt source.It make a 5 volt power supply, The LM7805 is simple to use. First connect the positive lead of our unregulated DC power supply Input pin, connect the negative lead to the Common pin and then when turn on the power, system get a 5 volt supply from the Output pin. Here there will be one red color led to indicate the power.

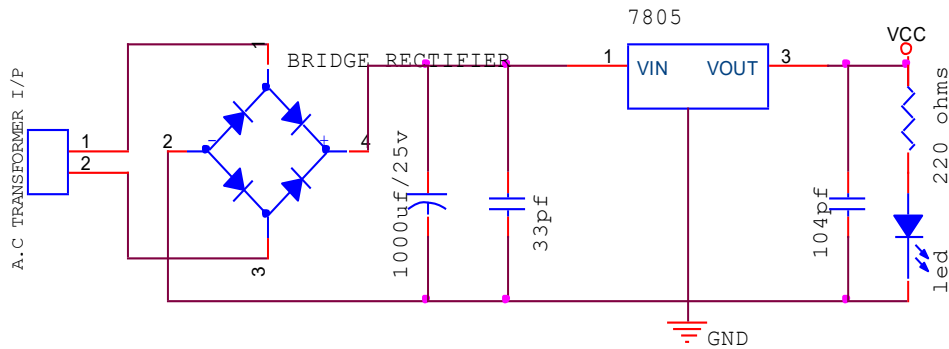


Fig 10: Circuit Diagram of Power Supply

### System Architecture

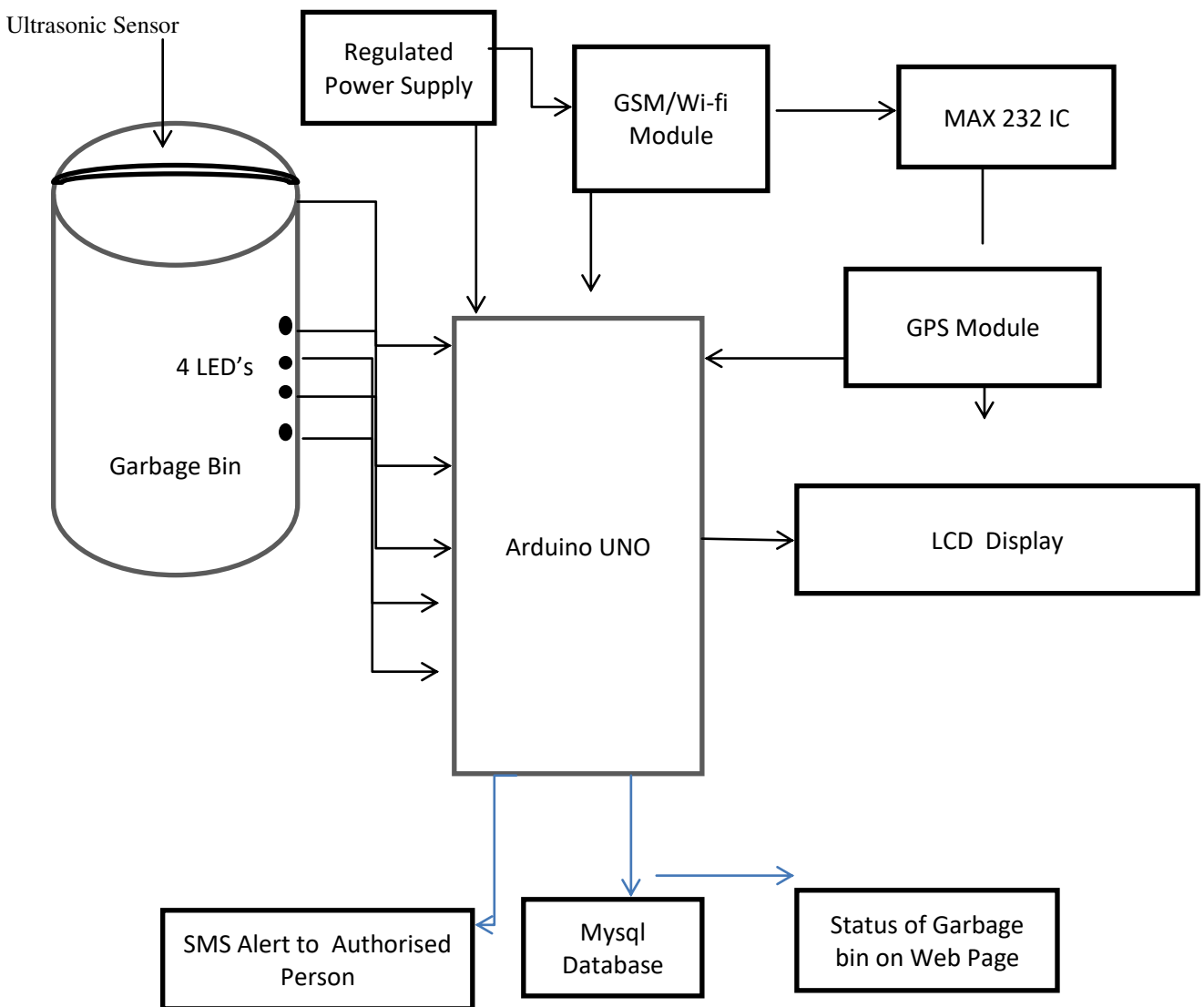


Fig 11: System Architecture



In this work, one Arduino UNO Board, one GSM module, GPS Module, MAX 232 IC for serial communication between GSM and GPS module. Here we are enabling the internet on the SIM card, so we are using the Internet with the help of SIM card. We are using one GPS module and one IoT webpage consist of PHP code and Google map integration and my SQL database and after that if the garbage box is full it will send the message to the particular mobile number that is Truck driver. We are also providing google map link and webpage link that shows status of garbage level every 15 minutes to the particular mobile number. Figure 1, 2 shows the block diagram which consist of Arduino UNO, GSM, GPS module, MAX 232 IC, HC-SR04 ultrasonic sensor and one LCD display. Whatever the process is going on will displayed on the LCD Board and we have a four LED 1, LED 2, LED 3 and LED 4 shows full, mid, low and empty status respectively. We attach ultrasonic sensor on the garbage box also four LED's attached on it. Firstly we need to give the power to GSM Module, in that board one network LED is there, so when it is blinking we can insert our SIM card in GSM module. GSM module consist of bridge rectifier, filter capacitor, LM317 adjustable voltage Regulator so it is getting the 4.5v output. Whereas GPS module consist of bridge rectifier, filter capacitor, 7805 voltage regulator, one LED, 5v power supply to the board, and one LCD display board. Now we are giving power source to the main module, "Waste monitoring System" text will be displayed on the LCD board. It will take the latitude and longitude value from the satellite. One's the internet established it shows the status of the dustbin whether it is empty or full and it send data to webpage. Here in our webpage we can see the status of the bin. If we put some garbage to the box when it is come to level 1, here it can send the information parallel in our web page. We can see the status at level 1. same procedure is carried out with mid, low and full. We are going to use Ultrasonic sensors which are getting information of the garbage value will be collected with the help of this sensors and that information we will be passing to the Arduino UNO Board, which is acting as a gateway here. So what this board is doing will push this data that is sensor data on to the internet with the help of Wi-Fi module i.e GSM module.

#### IV. RESULT

The following are the results which obtained from this work.

- Detection of the waste volume inside the bin.
- Wirelessly transmit the knowledge to the people who need to know.
- The information can be obtained at any time and from any place.
- Data delivery and access in real time. This prevents the dustbin from overflowing.

Arduino sends sensor data i.e level of dustbin through internet connection of GSM to the webpage

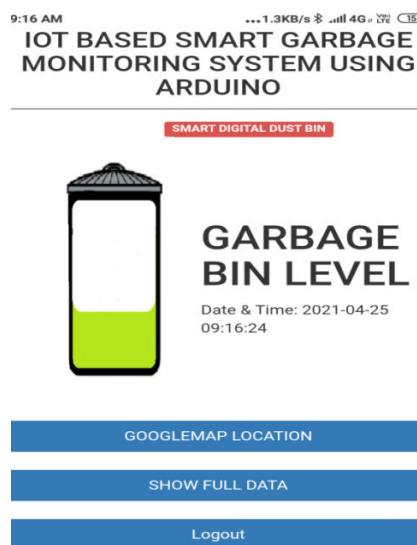


Fig12 : webpage shows level of of garbage in graphical format

Arduino controller sends data includes id of bin,timestamp of level and garbage level in form percentage and location garbage bin to webpage's sql database

| IoT Based Garbage Monitoring |                |               |                     |
|------------------------------|----------------|---------------|---------------------|
| GOOGLEMAP LOCATION           |                |               |                     |
| GOTO MAIN PAGE               |                |               |                     |
| Longitude                    | Garbage Box ID | Garbage Level | Date & Time         |
| 77.742462                    | 01             | 95            | 2021-04-25 09:40:53 |

Screenshot 1: Webpage shows full data of garbage bin

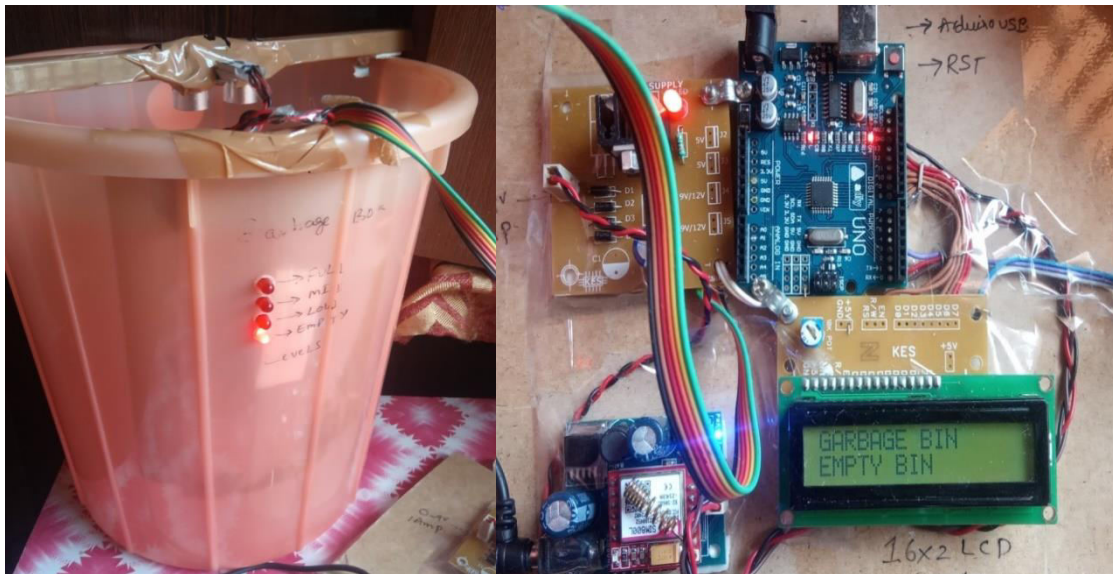


Fig 13: Garbage Bin with ultrasonic sensor Fig 14: Status of garbage bin displays on LCD driver

### V. CONCLUSION

The proposed waste monitoring scheme is a cost-effective and time-saving procedure. This waste automation often removes human intervention and, as a result, lowers the operation's total expense. In a short amount of time, this unit can be installed in any area. The costs of implementing automation are also fair. This propose scheme proposed a revolutionary way to promote the method of maintaining the environment safe, orderly, and suitable for living. The suggested solution presented the design and execution technique to strategically track and monitoring the level at which garbage bins are filled and can potentially help avoid overflow, which in most situations contributes to environmental emissions. This paper describes the design and implementation of an IoT-based system using Arduino microcontroller that uses ultrasonic sensors to detect the amount of waste in garbage bins and displays the status information as "low," "mid," or "empty," "full" at regular intervals on an LCD screen, as well as send the content level information at those intervals to a central web-server system that displays the garbage bin levels graphically. A microcontroller, a Wi-Fi

module, and ultrasonic sensors are used to do this. The Arduino Uno microcontroller was programmed using the Arduino IDE and the embedded C programming language. The hypertext preprocessor PHP scripting programming language was used to communicate with the web server. Proteus 8.0 advanced simulation software was used to build and simulate the prototype. This method aids in the automation of garbage bin monitoring and control. The findings of the experiments revealed a potential solution for waste monitoring and control. For sustainable growth, the proposed framework may be expanded to track and manage waste in remote areas.

## VI. FUTURE ENHANCEMENT

In future, I would like to enhance system of disposal of waste or reuse of waste in some manner. The machine will provide us with real-time information on the location and state of garbage bins in various locations. We can track the bins using this real-time data, and if the bins are complete, staff can retrieve the garbage and set them to empty again. This machine is inexpensive and accessible from anywhere. Workers can gather garbage only when the bin is full, but in the conventional method, workers collect garbage every day regardless of whether the bin is full or not. This machine has a potential scope where it will be used as a time stamp where the authority will be given a real-time clock showing when the garbage bins were filled and when the garbage was removed from the rt Garbage Bins.

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