



# Trash Bin Level Monitoring System Using Iot

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## ABSTRACT

Municipal Solid Waste Management remains a major problem in urban areas, leading to serious health and environmental issues. Consequently, trash bins are placed in many places to handle municipal solid waste. These bins can overflow, spreading around the area, polluting the environment and causing inconvenience to the public. There is a need for areal time monitoring system that alerts the level of garbage in the trash bins to a municipality or a waste management company. In this proposed system is, "Trash Bin Level Monitoring System using IoT". The trash bin unit is used to monitor the waste in the Dustbin. We are using ultrasonic sensor, Gas sensor, Microcontroller and GPS. Solar panel is used to charge of the battery for trashbin unit. In this system, the ultrasonic sensor is used to monitor the level of garbage and gas sensor is used to detect the garbage gases. If the sensor values are continuously updated to IoT via cloud and can be displayed to LCD. If any sensor values are greater than the set of threshold value, then trash bin location send to the IoT/Municipality using GPS module.

Keywords:—Internet of Things, sensor systems, solid waste management, trash bin, solar-powered,GPS.

## INTRODUCTION

"Swachh Bharat" is a national campaign by the tatutory cities and towns to clean the roads streets and infrastructure of the country. When the massive amount of waste material is collected, it is difficult to separate and unhygienic. Now a day's garbage is separately thrown i.e. dry and wet. The Internet of Things (IoT) shall be able to incorporate transparently and coherently a large number of different and heterogeneous end systems, while providing open access to selected subsets of data for the developing a digital services. Building a general architecture for the IoT is hence a very complex task, mainly because of the extremely large variety of devices, link layer technologies. One of the main concerns with our environment has been solid waste management which in addition to disturbing the balance of the environment also has adverse effects on the health of the society. The detection, monitoring and management of wastes are one of the primary problems of the present period. The traditional way of manually monitoring the wastes in waste bins is a complex, cumbersome process and utilizes more human effort, time and cost which is not compatible with the present day technologies in any way. This is an advanced method in which waste management is automated. In this "IOT based garbage monitoring and sorting system"

Pollution is the spread of contaminants into an environment that causes instability, disorder, harm or discomfort to the environment. Solid waste management is one of the major environmental problems of India. Solid waste management is the collection, transport, disposal, managing and monitoring of waste material. Garbage may consist of the municipal solid waste construction waste, commercial Garbage may consist of the municipal solid waste construction waste, commercial waste ,industrial waste etc... left over the city. This project is useful for creating "Smart City" and it is based on "Internet of Things". For healthy lifestyle cleanliness is needed and it

begins with the use of trash bins. This project will help to eradicate or minimise the solid waste disposal problem. In present scenario, many times we see the garbage bins gets overloaded due to increase in solid waste everyday. It creates unhygienic environment and bad smell in the society and because of this many disease get spread in the society to avoid this situation we are designing “Trashbin monitoring system using Internet of Things” In this proposed system the multiple trash bins are located throughout the city, these trash bins are embedded with low cost embedded device. When the dustbin gets half filled that is when the threshold value become 50% then the corporation will get notification and when the garbage level will reach the threshold value 80% then the notification will get half filled. The proposed system is cost effective because it will notify twice to the organization and they will get time to optimise the cost of transportation.

## LITERATURE SURVEY

### 1). Dan Zeng; Shun Zhang, “Multi-Scale CNN Based Garbage Detection of Airborne Hyperspectral Data” *IEEE Access* 2019.

Garbage detection is important for environmental monitoring in large areas. However, the manual patrol is time-consuming and labor-intensive. This paper proposes a method for monitoring garbage distribution in large areas with airborne hyperspectral data. Since there is no public hyperspectral garbage dataset, a hyperspectral garbage dataset Shandong Suburb Garbage is labeled and published. For garbage detection, a new hyperspectral image (HSI) classification network MSCNN (Multi-Scale Convolutional Neural Network) is proposed to classify the pixels of HSI data and generate binary garbage segmentation map. Unsupervised region proposal generation algorithm Selective Search and Non Maximum Suppression (NMS) are used to extract the location and the size of garbage areas based on the garbage segmentation map. The experiment results show that the proposed algorithm has a good performance on garbage detection in large areas. In addition, the MSCNN has achieved better performance in comparison with other HSI classification methods in the public HSI datasets Indian Pines and Pavia University.

### 2). Zhihu Yang; Dan Li, “WasNet: A Neural Network-Based Garbage Collection Management System”, *IEEE Access* Vol. 3, Issue 7, July 2020.

This proposed network's 1.5 million parameters on the ImageNet dataset are one-half of mainstream neural networks, while at 3 million floating point operations per second (FLOPs) it is one third of mainstream neural networks that have obtained the best performance among known lightweight neural networks. The accuracy on the ImageNet data set is 64.5%, on the Garbage Classification dataset it is 82.5%, and on the TrashNet dataset it is 96.10%. Furthermore, we transplanted the model to the hardware platform and assembled an intelligent trash can; we developed a garbage recognition application to facilitate users to directly identify and receive platform information; we built a visualization and decision support platform to help managers monitor traffic in real time. We combined the intelligent trash can, application, visualization and decision-making platform into a system, which is the most complete and effective system among the known research works. The results of the test we conducted on our platform using our extended dataset showed that our scheme is very reliable. At the same time, we also open source our extended datasets for use by other researchers.

### 3). Zhuang Kang; Jie Yang, “An Automatic Garbage Classification System Based on Deep Learning” *IEEE Access* ( Volume: 8), Issue 4, February 2020.

Garbage classification has always been an important issue in environmental protection, resource recycling and social livelihood. In order to improve the efficiency of front-end garbage collection, an automatic garbage classification system is proposed based on deep learning. Firstly, the overall system of the garbage bin is designed, including the hardware structure and the mobile app. Secondly, the proposed garbage classification algorithm is based on ResNet-34 algorithm, and its network structure is further optimized by three aspects, including the multi feature fusion of input images, the feature reuse of the residual unit, and the design of a new activation function. Finally, the superiority of the proposed classification algorithm is verified with the constructed garbage data. The classification accuracy of the proposed algorithm is enhanced by 1.01%. The experimental results show that the classification accuracy is as high as 99%, the classification cycle of the system is as quick as 0.95 s.

#### 4). Shiyu Cai; Kang Chen; Mengxing Liu; Xuyang Liu, “Garbage collection and data recovery for N2DB”, *Tsinghua Science and Technology* ( Volume: 27, Issue: 3, June 2022)

Non-Volatile Memory (NVM) offers byte-addressability and persistency. Because NVM can be plugged into memory and provide low latency, it offers a new opportunity to build new database systems with a single-layer storage design. A single-layer NVM-Native DataBase (N2DB) provides zero copy and log freedom. Hence, all data are stored in NVM and there is no extra data duplication and logging during execution. N2DB avoids complex data synchronization and logging overhead in the two-layer storage design of disk-oriented databases and in-memory databases. Garbage Collection (GC) is critical in such an NVM-based database because memory leaks on NVM are durable. Moreover, data recovery is equally essential to guarantee atomicity, consistency, isolation, and durability properties. Without logging, it is a great challenge for N2DB to restore data to a consistent state after crashes and recoveries. This paper presents the GC and data recovery mechanisms for N2DB. Evaluations show that the overall performance of N2DB is up to 3.6× higher than that of InnoDB. Enabling GC reduces performance by up to 10%, but saves storage space by up to 67%. Moreover, our data recovery requires only 0.2% of the time and half of the storage space of InnoDB.

## SYSTEM DESIGN

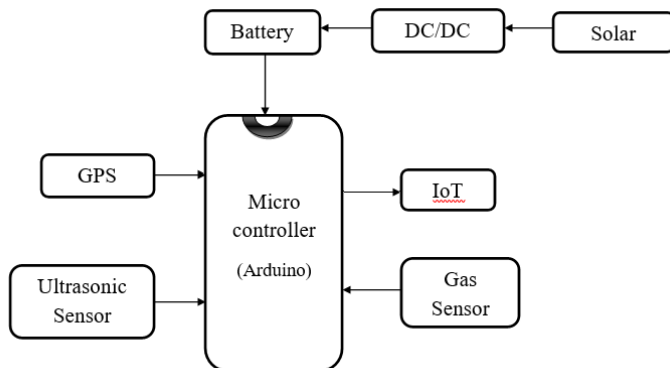
### EXISTING SYSTEM

The purpose of this paper is to provide a comprehensive overview of the existing research in the field of systems, applications, and approaches vis-à-vis the collection and processing of solid waste in SWM systems. To achieve this objective, we performed a systematic literature review. This study consists of 173 primary studies selected for analysis and data extraction from the 3,732 initially retrieved studies from 5 databases. We 1) identified the main approaches and services that are applied in the city and SGB-level SWM systems, 2) listed sensors and actuators and analyzed their application in various types of SWM systems, 3) listed the direct and indirect stakeholders of the SWM systems, 4) identified the types of data shared between the SWM systems and stakeholders, and 5) identified the main promising directions and research gaps in the field of SWM systems. Based on an analysis of the existing approaches, technologies, and services, we developed recommendations for the implementation of city-level and SGB-level SWM systems.

### PROPOSED SYSTEM

This project IOT 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 gas & the level of garbage collected in the garbage bins via a web page. For this the system uses ultrasonic sensors placed over the bins to detect the garbage level and compare it with the garbage bins depth. The system makes use of Arduino microcontroller, LCD screen, IOT modem for sending data. The system is powered by a 12V transformer. The LCD screen is used to display the status of the level of garbage collected in the bins. Where as a web page is built to show the status to the user monitoring it. The web page gives a graphical view of the garbage bins and highlights the garbage collected in color in order to show the level of garbage collected. The LCD screen shows the status of the garbage level.

If the garbage level increase or if any gases is detect in the Trash bin, when the trashbin location is send to the cloud using GPS module. Thus this system helps to keep the city clean by informing about the garbage levels of the bins by providing data of the bins via IoT MIT companion app development platform.

**BLOCK DIAGRAM:****Trash Bin Unit:****Hardware Used:**

- 1) Arduino UNO
- 2) IoT Module(ESP 8266)
- 3) LCD display
- 4) Gas sensor
- 5) Ultrasonic Sensor
- 6) GPS

**Software used:**

- 1) ARDUINO IDE – Arduino UNO programming software
- 2) Embedded C language

**CARBON MONOXIDE SENSOR**

A **carbon monoxide detector** or **CO detector** is a device that detects the presence of the carbon monoxide (CO) gas in order to prevent carbon monoxide poisoning. CO is a colorless and odorless compound produced by incomplete combustion. It is often referred to as the "silent killer" because it is virtually undetectable without using detection technology. Elevated levels of CO can be dangerous to humans depending on the amount present and length of exposure. Smaller concentrations can be harmful over longer periods of time while increasing concentrations require diminishing exposure times to be harmful.

CO detectors are designed to measure CO levels over time and sound an alarm before dangerous levels of CO accumulate in an environment, giving people adequate warning to safely ventilate the area or evacuate. Some system-connected detectors also alert a monitoring service that can dispatch emergency services if necessary.

While CO detectors do not serve as smoke detectors and vice versa, dual smoke/CO detectors are also sold. Smoke detectors detect the smoke generated by flaming or smoldering fires, whereas CO detectors go into alarm and warn people about dangerous CO buildup caused, for example, by a malfunctioning fuel-burning device. In the home, some common sources of CO include open flames, space heaters, water heaters, blocked chimneys or running a car inside a garage.

## Sensors

Early designs were basically a white pad which would fade to a brownish or blackish colour if carbon monoxide were present. Such chemical detectors are cheap and widely available, but only give a visual warning of a problem. As carbon monoxide related deaths increased during the 1990s, audible alarms became standard.

The alarm points on carbon monoxide detectors are not a simple alarm level (as in smoke detectors) but are a concentration-time function. At lower concentrations (eg 100 parts per million) the detector will not sound an alarm for many tens of minutes. At 400 parts per million (PPM), the alarm will sound within a few minutes. This concentration-time function is intended to mimic the uptake of carbon monoxide in the body while also preventing false alarms due to relatively common sources of carbon monoxide such as cigarette smoke.

There are four types of sensors available and they vary in cost, accuracy and speed of response.<sup>[10]</sup> The latter three types include sensor elements that typically last up to 10 years. At least one CO detector is available which includes a battery and sensor in a replaceable module. Most CO detectors do not have replaceable sensors.

## RESULTS AND DISCUSSION

Trashbin level monitoring using IoT is an efficient and effective approach to managing waste in smart cities. The IoT-enabled trashbin sensors can track the fill level of the trashbins in real-time and transmit the data to the central control system. The data can be analyzed to optimize waste collection schedules, reduce collection costs, and improve environmental sustainability. The result of the trashbin level monitoring using IoT is that waste management can be streamlined and optimized in a smart city. With real-time data on the fill level of trashbins, waste collection can be done on a need basis rather than a fixed schedule. This means that trashbins are only emptied when they are full, leading to significant cost savings for the waste management department.

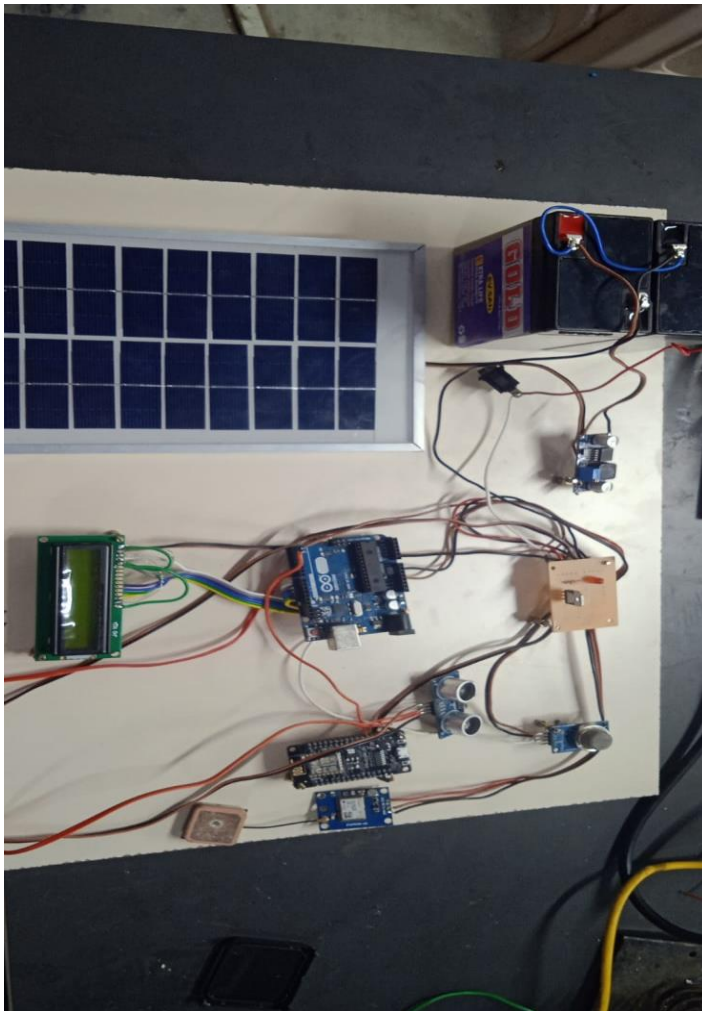


Fig.1 Hardware Trash bin level monitoring system

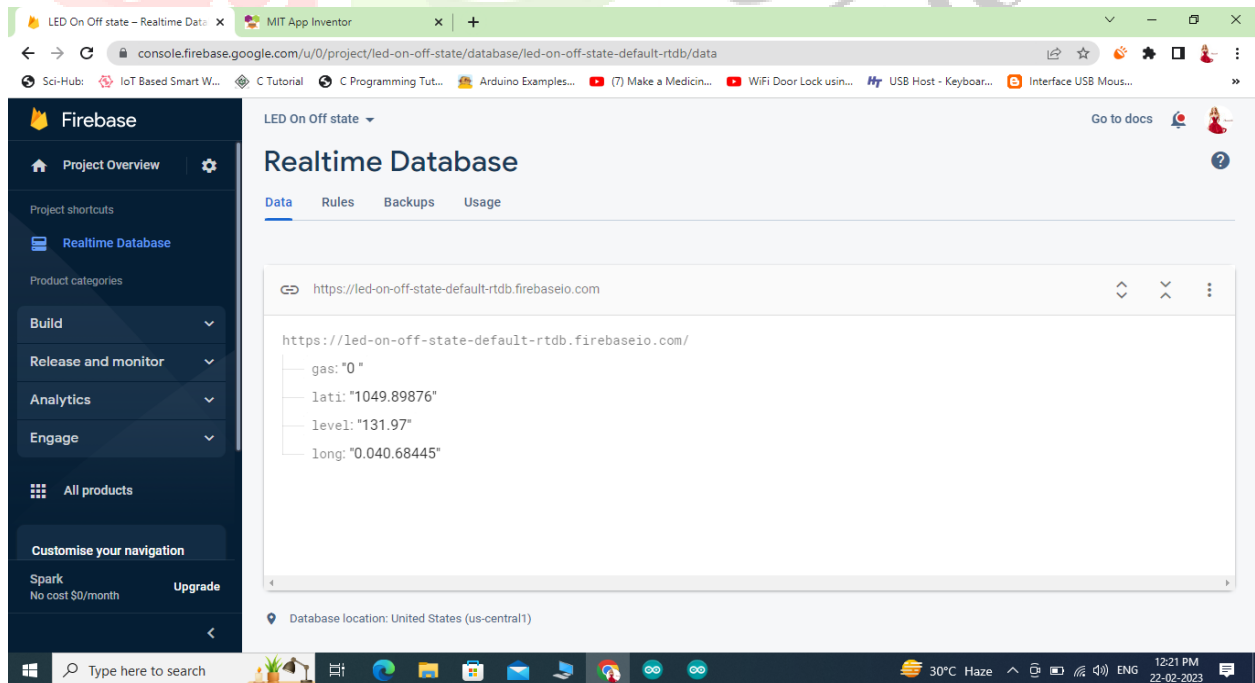


Fig.2 Firebase result of Trashbin

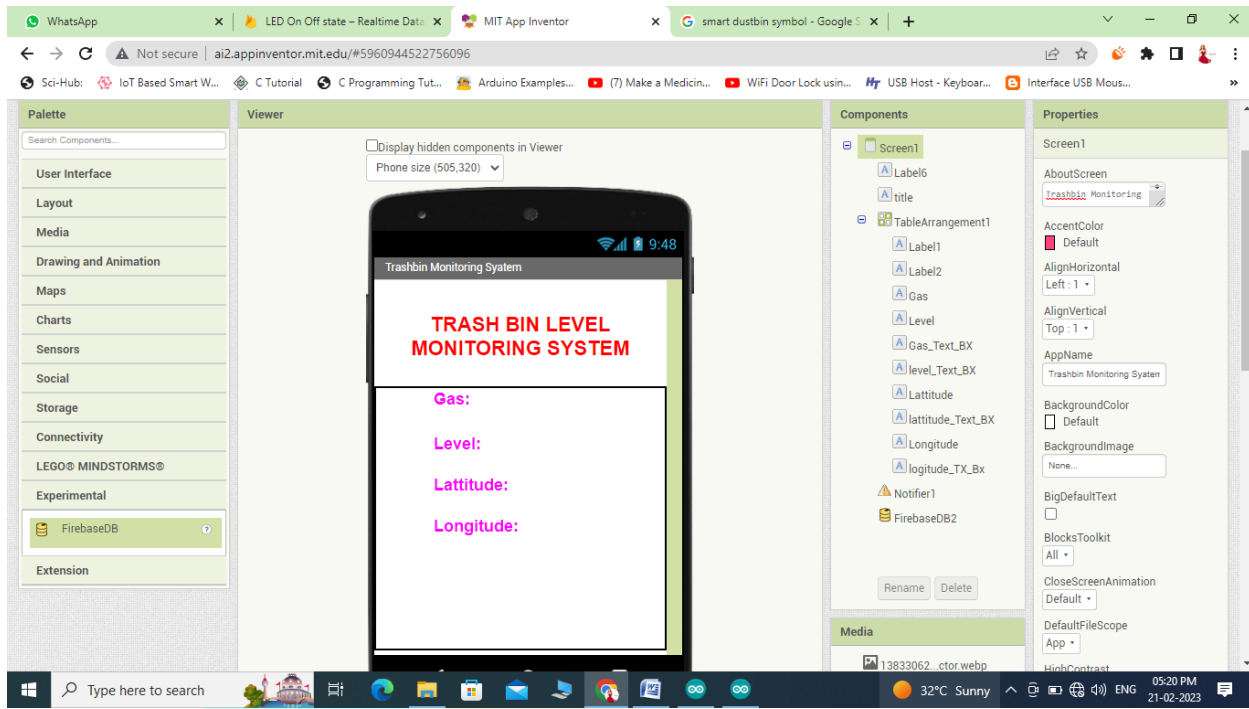
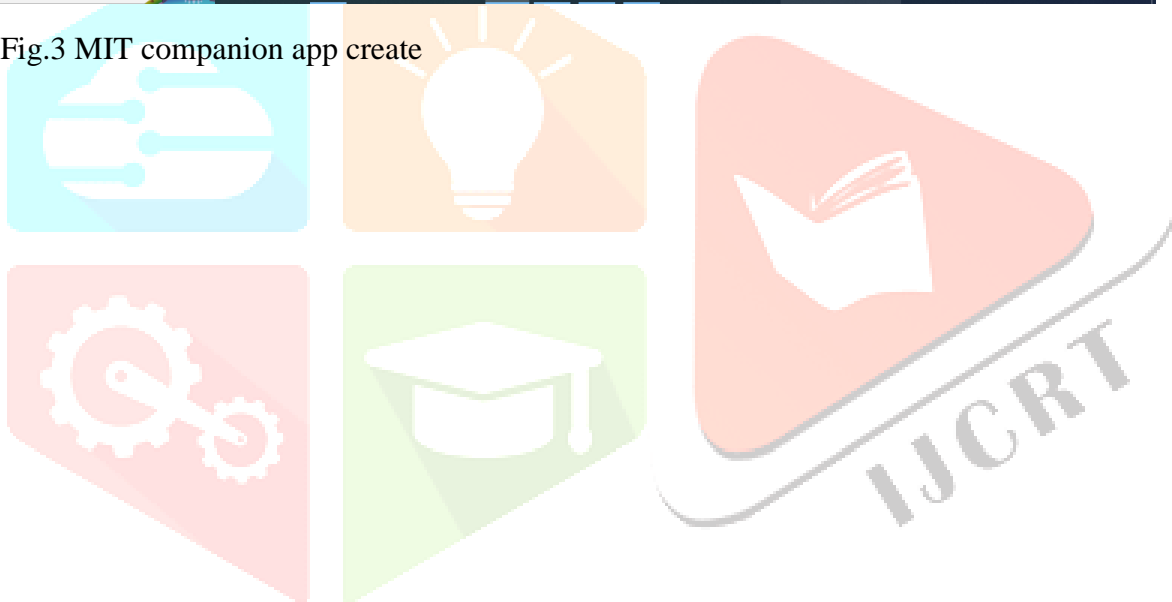


Fig.3 MIT companion app create



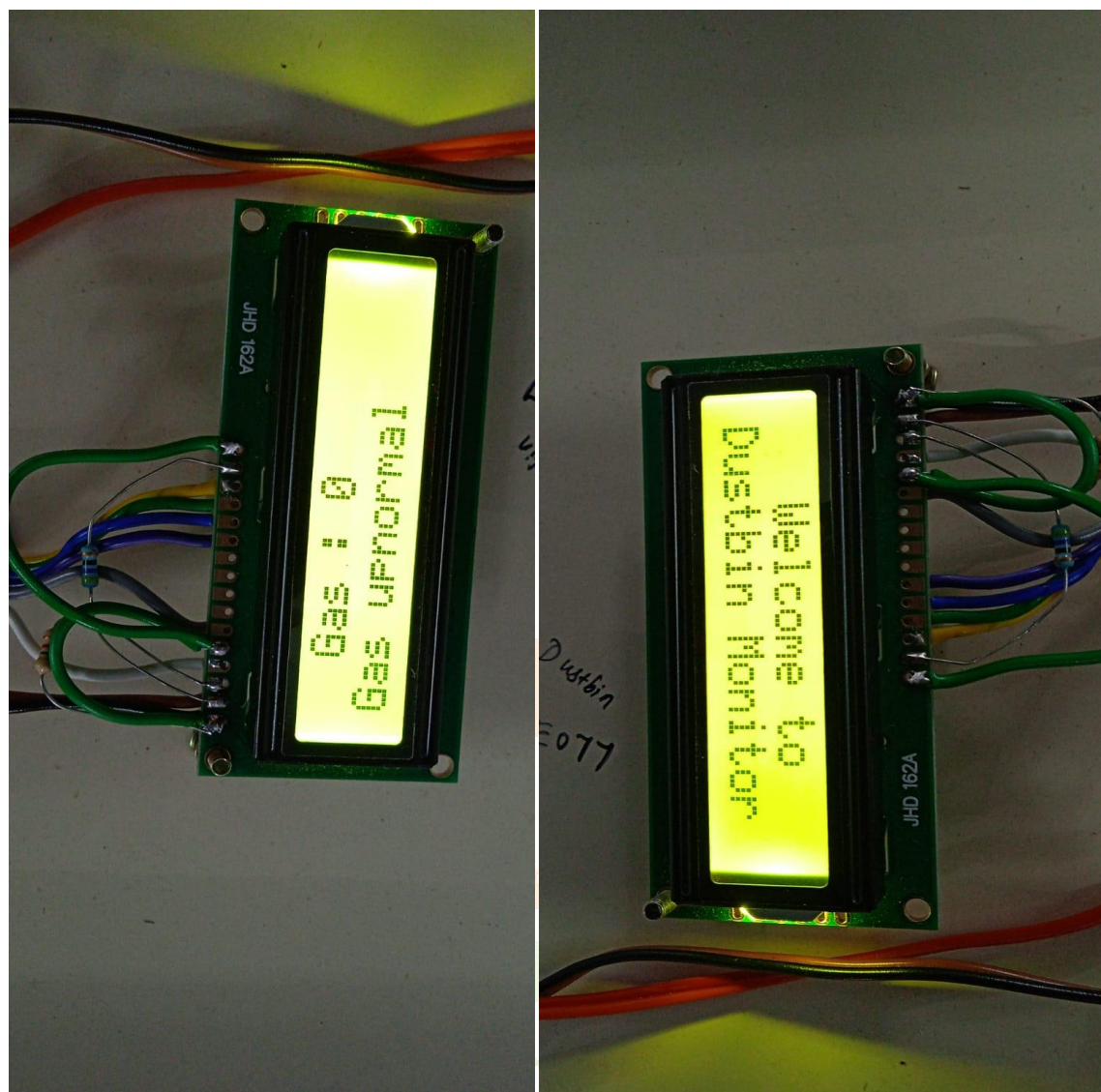


Fig.4 Output of trash bin

## CONCLUSION

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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