

# **SMART CITY AUTOMATED GARBAGE COLLECTING MANAGEMENT SYSTEM USING IOT**

**A Project Report Phase – II**

Submitted in partial fulfillment of the requirements for the award of  
Bachelor of Engineering degree in Electronics and Communication Engineering

By

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**SATHYABAMA**

**INSTITUTE OF SCIENCE AND TECHNOLOGY  
(DEEMED TO BE UNIVERSITY)**

**Accredited with Grade “A” by NAAC**

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**APRIL - 2023**



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## **DEPARTMENT OF ELECTRONICS AND COMMUNICAITON ENGINEERING**

### **BONAFIDE CERTIFICATE**

This is to certify that this Project Report is the bonafide work of TELLA NAVEEN (39130469) and B. Satya Revanth (39130075). who carried out the project entitled "SMART CITY AUTOMATED GARBAGE COLLECTING MANAGEMENT SYSTEM USING IOT" under our supervision from November 2022 to April 2023.

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## DECLARATION

We, **TELLA NAVEEN**(Reg. No. **39130469**) and **B.SATYA REVANTH** (Reg.No. **39130075**) hereby declare that the Project Report entitled “**SMART CITY GARBAGE COLLECTING MANAGEMENT SYSTEM USING IOT**” done by us under the guidance of Assistant Professor **Dr. BALAMURUGAN V, M.Tech., Ph D.**, Assistant Professor, Department of Electronics and Communication Engineering, at **SATHYABAMA INSTITUTE OF SCIENCE AND TECHNOLOGY, CHENNAI** is submitted in partial fulfillment of the requirements for the award of Bachelor of Engineering degree in **ELECTRONICS AND COMMUNICATION**.

**DATE:**

**PLACE:**

**SIGNATURES OF THE CANDIDATES**

*Naveen T*

*Sathyarevanth*

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We would like to express my sincere and deep sense of gratitude to our Project Guide **Dr. BALAMURUGAN V, M. Tech, Ph.D.**, Assistant Professor, Department of Electronics and Communication Engineering, for her valuable guidance, suggestions and constant encouragement paved way for the successful completion of our project work.

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## ABSTRACT

Garbage disposal is one of the main problems faced in India regardless of the growth of the states and the area of development. It is a major problem in the under developed places. It is found that most cases the trashes are spread across the road side because it is not collected on time. This trash leads to spread of disease and cause illness. There is a possibility of having some deadly disease. So, the proposed systems find the solution for the garbage disposal by designing a smart dust bin by managing the garbage. In this modern society certain quick actions are taken to improve the level of cleanliness in the country. 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 use sensor to detection of garbage, when 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 will be sent to the corporation's office, for this we use Wi-Fi module, then the employees can take further actions to empty the bin. This system will help in cleaning the city in a better way. By using this system people do not have to check all the garbage bins manually but they will get a notification when the bin will get filled.

**Keywords:** - Arduino UNO, Ultrasonic sensor HC-SR04, Wi-Fi module ESP 8266, Arduino IDE, Thing speak apps, servo motor.

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# **CHAPTER 1**

## **INTRODUCTION**

### **1.1 GENERAL INTRODUCTION**

Germs, insects, bacteria, and viruses can be found in this dump and cause many diseases. In a traditional waste management program, detergents are sent to empty bins at certain times of the day. This strategy has many disadvantages. This is inefficient and time-consuming. At certain times of the day, the cleaners check and empty the garbage bins. The waste management strategy is not a viable strategy and there is a lot of room for improvement.

As the smart city concept spreads around the world, there are many roles to play. A smart city requires people to have a smart life, and cleanliness is a basic requirement for a smart lifestyle. Therefore, there is a need to develop smart waste management strategies with the help of technology worldwide to make cities cleaner, greener, healthier, and smarter. This article proposes an alternative waste management strategy to deal with the increasing amount of waste due to population explosion and increasing deurbanization. To pursue this alternative, it is planned to build a new bin equipped with several sensors for time tracking of the waste in the bin. When the level of waste in a bucket exceeds the predetermined limit, an alert is sent to the authorities to prepare the base for removal. Therefore, this alternative method of waste management using real-time monitoring not only solves the problem of waste material, but also makes the problem of garbage very close. As such, other ideas could lead to a clean, green. Internet devices, sometimes web-controlled tools, often referred to as the Internet of Things. In our framework, Smart Containers are associated with the network to constantly receive information about Smart Containers.

The rapid increase in population in recent years has led to more changes. Therefore, extermination policy is very important to prevent the spread of certain harmful diseases. Use containers effectively by monitoring their condition and choosing one. Many trash cans are found in the city, hospitals, companies, and other buildings. These boxes are associated with microcontroller-based frameworks and ultrasonic sensors.

The waste level in the waste container will be detected with the help of ultrasonic sensors and connected to the microcontroller. The data is sent by the Wi-Module to the cloud, where it is parsed and prepared, and the status of the garbage level in the garbage is displayed in the web program. With more and more cities emerging, more work needs to be done. The first condition of a good life begins with cleanliness, and cleanliness begins with the trash can. Ordinary people's garbage will be properly disposed of as long as garbage is properly organized and stored. The main problem with the current waste management system in most cities in India is the poor quality of solid waste. In this paper, we provide research and hardware to use the valuable information provided by smart containers to change the overall process of waste collection. Waste development can be monitored throughout the city and these roads can be separated efficiently and reliably. Today, many apartments and houses are being built rapidly in the region. This is due to the demand for good housing as people migrate from rural areas to cities in search of work. People living in apartments face many problems. Waste treatment is one of them. Unlike private homes, all units share a community bin that can fill up quickly. Therefore, waste disposal is an important problem that can cause diseases such as cholera and dengue fever. Also, walk around the room to see that some of the boxes are filled with waste oil.

Therefore, smart trash is a solution that can eliminate or reduce this problem. The main purpose of the project is to create an alarm system for garbage collection that will send a warning signal when the floor is full so that it can be cleaned immediately. The aim of this project is to create smart trash cans that can be used in small parks, schools, colleges, and hospitals. This will help remove the trash when it is full, so we can save people from throwing garbage on the road or on the street. We see garbage in the garbage many times in our city. Knowing the daily need of the internet, which creates pollution and worsens the environment, leaves a bad smell and is aware of the daily need of the internet, we decided to provide free Wi-Fi to people in exchange for a clean environment. Now, the population of the city has been increasing rapidly in recent days.

Due to the large population of the city or state, the city or state will face many problems such as environmental problems such as garbage, many diseases are increasing and cause health problems. Garbage collection and management has been an important issue in recent years. For this, 2 October 2014 Mr. Prime Minister

of India. Narendra Modi announces Clean India Mission by the Government of India. This project covers the infrastructure of 4,041 cities and countries. Inspired by this mission, we propose an automated waste management system for smart cities using IoT. The study presented in this document shows that smart trash cans are used in railway stations, international shopping malls, colleges, hotel, etc. It shows how it can improve the cleanliness of public places such as Therefore, the system can help improve overall productivity and cleanliness.

## **1.2 OBJECTIVE: -**

The school will identify, evaluate, and comply with all applicable laws, regulations, permits and other obligations or requirements regarding waste management by Newmont and contractors/vendors/vendors. To manage solid and non-hazardous waste and wastewater from generation to generation, the school must have a waste management plan or equivalent that includes applies to laws, regulations, licenses and other obligations or requirements, collective agreements, and records. Wastewater definition, quantity/volume characteristics produced, classification, inspection procedures, labels, monitoring/monitoring requirements, storage and disposal, and location of affected areas. Minimize/reduce waste, reuse, recycle and dispose. Risk assessment of potential impacts on streams. Clear responsibilities, including contractor responsibilities, emergency response, contacts and procedures, and training plans and implementation. The school should design and construct storage facilities for temporary, non-hazardous waste storage. Hazardous waste areas should include fences, signs, roofs, lighting, emergency communications and lightning protection. The second volume is designed and manufactured in accordance with the waste material to be stored and can hold 110% of the maximum tank capacity in the space while achieving a maximum permeability of  $1 \times 10^{-6}$  cm/sec or designed and manufactured as specified in the country regulations, whichever is more stringent. Facilities should identify and identify wastewater and its sources based on data analysis or information processes during the development of plans or before adding existing systems or replacing existing or wastewater.

The storage, processing and disposal of waste must be evaluated and

designed to avoid the influence of the prevailing climate. The school must determine whether new facilities or existing facilities undergoing renovation will produce elemental mercury. In this case, plans for the collection, storage and permanent decommissioning of elemental mercury should be developed and implemented. Wastewater (sewage) should be designed and constructed according to current needs and future plans, local climatic characteristics, water quality standards, and if there is unplanned or spilled waste. Septic systems must be designed and built using industry codes or architectural standards. A penetration test should be performed before placing and installing the septic tank to see if the receiving area has sufficient capacity to meet the output. However, the technology is developed for the foundation, realization of a smart city, energy distribution, garbage storage, traffic management, smart home etc. It is a very complex task involving many departments. Our activities are wasting materials only to keep the city clean and free from pollution. In waste management, we try to implement an intelligent waste management system that takes care of business effort and helps prevent people from getting sick from unwanted waste. It helps to create a healthy environment and keep the city clean and free of pollution.

## **CHAPTER 2**

### **LITERATURE SURVEY**

#### **2.1 INFERENCES FROM LITERATURE SURVEY**

IoT-enabled smart trash cans are used for waste and landfill. It can be used for waste management. This may be the lack of general and public grade IOT-based smart waste disposal devices. This is a technologically complex field at a time when all your data is stored in the cloud with access to high-speed data in real time, and its data relies on the trash of IoT management racks. Associate Applied to sensible towns. Devices that connect to a network to exchange information and communicate with other devices with an assigned UID to reduce human-to-human or human-to-laptop interactions Research and Competitive Garbage Overview. Solid waste is a low-level development problem, as evidenced by the volume of urban waste due to rapid development and economic development, using non-substituted quasi-static and dynamic waste storage methods. Smart cities are the next step in human settlement focused on the integration of the business and residential environment. The network of the future and the Internet of Things have changed the small devices that form the background of human life on earth, such as the smart dust system used to deal with the hard waste in the city. Assistants from the Ministry of Health should find effective educational solutions by involving stakeholders in projects that take advantage of the city's IoT resources, reducing the ecological footprint, thereby reducing the natural layer of capital. Residents can now move to larger cities to create Brobdingnagian cities. These cities can incorporate stack devices into their backbone, thus supporting new IoT-based service routines, security routine services, and shared privacy. IoT service provider is the solution for today's new smart city policy. The third part of the report contains recommendations for smart city scenarios that support the results of previous articles on smart waste analysis. Garbage that comes from cities, public places, communities, universities, homes, etc. may contain unwanted materials. This project is called a "smart city" and supports the "Internet of Things" (IOT). Therefore, cleanliness is essential for a good life attitude and cleanliness starts from garbage.

## **TITLE 1: A Garbage Disposal Management System to Support Swachh Bharath Mission**

**AUTHOR:** - Denicke Solomon H, Abishek R, Ramachandra T, et al

**YEAR:** - April 2022

**Abstract:** Currently, people prefer to live in a clean environment to be healthy. Both organic and inorganic waste from homes is disposed of in community bins managed by local councils or municipalities or companies. Wastewater generated by stray dogs pulling their food out and people throwing garbage out of moving vehicles causes serious problems for neighbors. While the Indians are aware of the Swachh Bharath Mission, there are many challenges. The work presented in this paper is to facilitate waste management using Arduino, connected network, two ultrasonic sensors, servo motors, GSM/GPRS module, 4 X 4 matrix keypad, piezo buzzer and LEDs. The waste management system is ideal for busy public areas such as universities, shopping malls, train stations and airports. While it's designed to cost more than regular trash, it lasts longer and is easier to dispose of.

**Keywords:** Arduino, Ultrasonic Sensors, GSM, GPRS, LED, Buzzer, Garbage Disposal Management System, Swachh Bharath Mission.

**Proposed System Architecture:** The functional block diagram shows the waste disposal device with main components and structures such as ultrasonic sensor, servo motor, GSM/GPRS module, 4x4 matrix keypad, parallel switching network and Arduino Mega 2560 microcontroller.

**Conclusion:** - Smart storage boxes are popular because they are easy to manage and user-friendly. The standard prohibits the public from throwing garbage on the trash can. It is also used to reduce waste. Going one step further and sending materials to local storage instead of the website will save a lot of time and also keep existing cleaners safe on the job. Investing in designs is inexpensive because they last longer without changing. Therefore, the waste management strategy will assist in the realization of the Swachh Bharath Mission concept.

## **TITLE 2: A Smart Automated Garbage Management System to Replace Human Labour**

**AUTHOR:** - Souvik Mondal, Sayantani Das, Shirsendu Banerjee, Koushik Pal

**YEAR:** - April 2022

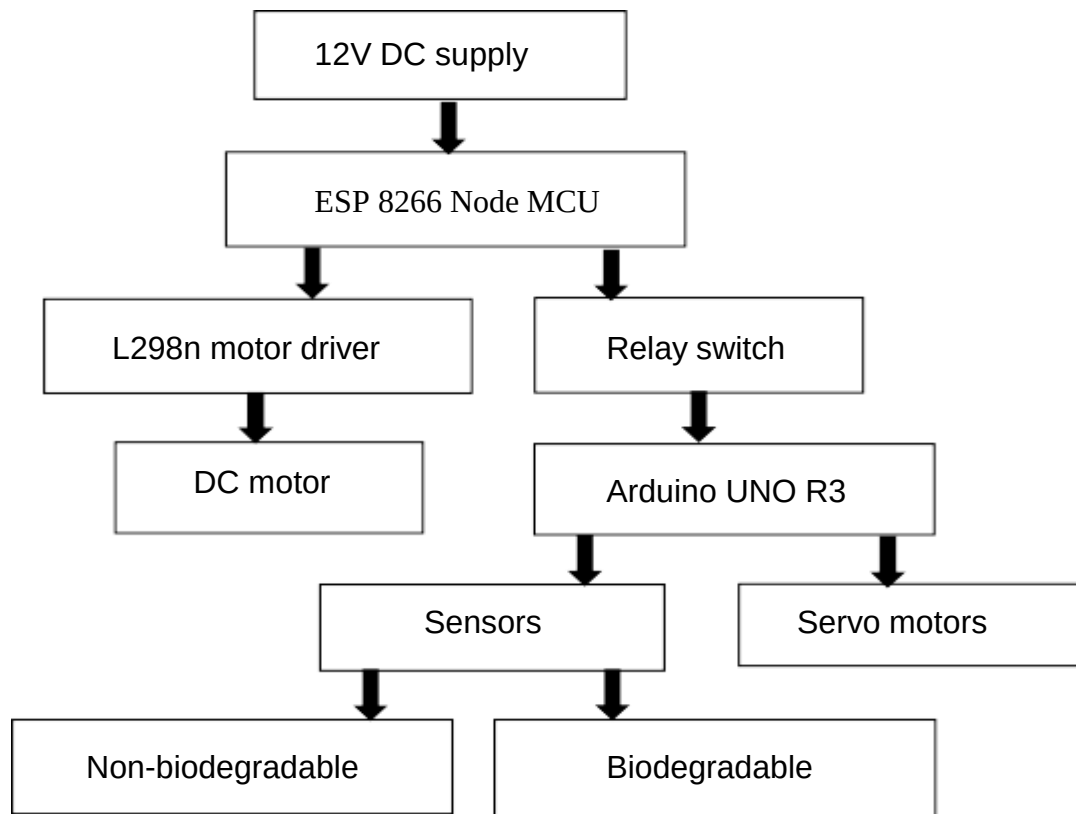
**Abstract:** About 100,000 tons of municipal solid waste are thrown away every day in India. These wastes are mostly fruits and vegetables, animal skins, wastepaper, plastic cloth bags, batteries, metal scraps and many other materials. An intelligent waste management system is required to manage and dispose of this large amount of waste. This waste management process also includes the separation of biodegradable and non-biodegradable wastes, which is carried out manually by them at the landfill. It is very unhygienic and can give them deadly diseases. Power to be housed in a removable enclosure and able to work remotely over Wi-Fi connection. As a result, workers working in municipal waste do not have to enter directly with waste and poison. Thus, they can do their job by having knowledge about health and cleanliness.

**Keywords:** - Garbage management, robotic arm, integrated system, garbage sorting.

### **OBJECTIVE: -**

The main purpose of this project is to create an intelligent waste management system that uses a movable chassis and a robot arm placed on a two-shelf bin, sensors and some electronic equipment. Urban waste is known to employ large numbers of workers to sort and manage waste. This process of identifying waste is done by workers with their own hands, which puts them in direct contact with waste and poison. It is very dangerous and bad for their health and can be caused by some bacteria, viruses or methane, carbon dioxide etc. They will be affected by many deadly diseases caused by certain pollutants such as the robot arm of Model will first pick up the garbage, then sensors will recognize the material, determine whether it is biodegradable or non-biodegradable waste, and place it in the appropriate place. In other words, the system works in a way that makes human hands. Thus, the system ensures that workers are not directly exposed to harmful and toxic wastes in addition to pollution. This will help them help the community learn about health.

## BLOCK DIAGRAM



***Fig 2.1: Literature Survey block diagram***

## CONCLUSION

In conclusion, we can say that in this work plan we are trying to create an electric generator for intelligent waste management and describe some controls by connecting them to robots. In this concept, we present a brief description of the layout components and circuit connections. This is the perfect solution for handling large volumes of waste. The logic behind the different waste is very simple because it is just our sensor design compared to other models applying machine learning or spectroscopy, so it's easy to design and use. The main aim of the program is to follow people's efforts to distinguish between biodegradable and non-biodegradable waste. Therefore, by using this combination, those working in the landfill will be able to maintain hygiene and not be affected by pollution or diseases.

**TITLE 3: - Deep Learning based Garbage Detection for Smart City Applications**

**AUTHOR:** - Dr.K. Lakshmi, Iswarya.k, N. Sheik Abdullah, K.R. Monica Bharathi

**YEAR:** - April 2022

**Abstract:** The implementation of smart cities continues across India. Smart cities focus on the work that needs to be done to take care of the management and efficient use of resources. An important task in city management is to keep the city clean, and employees are used to it. Waste Management Program will help manage the planning and distribution of waste products. This article presents an automated scum monitoring system that uses the Faster CNN method to monitor scum flow.

**Keywords:** - Object Detection, Garbage Collection, YOLO V3, Deep learning, Smart City

**Proposed Method:** - YOLOv3 is a real-time item detection set of rules that identifies precise gadgets in videos, stay feeds, or images. YOLO makes use of functions found out via way of means of a deep convolutional neural community to come across an item. YOLO in a one-step item detection approach in contrast to R-CNN and Faster R-CNN.

**Conclusion:** - The plan is used to identify debris in the road image. It is able to detect deposits in all test images used. However, the system cannot identify all residues in the image. A closer look at the training and test images reveals that the size of the image is the main factor affecting the accuracy of the test. Garbage disposal shows a different picture.

More research is needed to confirm the effect of image size on device detection accuracy. The plan can be used to classify items on the road as garbage. Similarly, the same concept can be used for waste management in cities or towns and separates non-degradable waste from computer vision.

**Title 4: Smart Waste Management System using IoT.**

**AUTHOR:** - Abdulla Al Mamun, Et al

**Year:** - 2020

**Keywords:** Cloud, ESP8266, Arduino Uno, US Sensor, IR Sensor, GSM, LED's and Garbage Collecting Vans.

**Abstract:** With rapid increase in population, the issues related to sanitation with respect to garbage management are degrading immensely. It creates unhygienic conditions for the citizens in the nearby surrounding, leading to the spread of infectious diseases and illness. To avoid this problem, IoT based “Smart Waste Management” is the best and trending solution. In the proposed system, public dustbins will be provided with embedded device which helps in real time monitoring of level of garbage in garbage bins. The data regarding the garbage levels will be used to provide optimized route for garbage collecting vans, which will reduce cost associated with fuel. The load sensors will increase efficiency of data related to garbage level and moisture sensors will be used to provide data of waste segregation in a dust bin. The analysis of ceaseless data gathered will help municipality and government authorities to improve plans related to smart waste management with the help of various system generated reports.

**Introduction:** Waste management includes waste planning, collection, transportation, treatment, recycling, and disposal, as well as monitoring and management. The current waste management system, which collects waste from the streets, houses and other places every day, cannot manage the waste properly.

**Conclusion:** This article shows how to implement smart waste management using IoT. When the waste reaches the maximum level, the instructions ensure that the waste is collected as soon as possible. Thus, the system will provide accurate information that will increase the efficiency of the system. Monitoring waste in real time with the help of sensors and wireless communication will reduce all the trips required by GCVs, thus reducing all expenses related to garbage collection. As a result, trash cans will be thrown away when full, giving way to cleaner cities, better infrastructure, and a cleaner environment. Good idea for good waste management. The system combines information and algorithms for waste management processes. Box detection is achieved by combining multiple detection methods. Various experiments were conducted by the authors to evaluate the performance of the model, and the authors concluded that these results show that the proposal and algorithms are of good value for waste management.

## **Title 5: - Design and Implementation of Different Types of Smart Dustbins System in Smart Campus Environments**

**Author:** - Arifin N. Asyikin, Aulia A. Syahidi Subandi

**Year:** -2020

**Abstract:** - Garbage is still a big problem in Indonesia. Litter can cause bad odors, air pollution, disease and even flooding. Everyone generates waste of all types and forms from their family and business, whenever and wherever. The knowledge of the public about throwing the garbage in the right place is often lacking, laziness is more established when the garbage can is not widely used, it is very dirty, the open and closed system is still a book, so it is easily contaminated by hand. bacteria when interacting with litter. The aim of this study is to start small, that is, to use smart garbage in the school environment and to educate the school community to be satisfied with the disposal of garbage in good places. There are many recommended types of smart trash cans, which are smart trash cans and smart trash cans. The waterfall method was used in the design and implementation process. Observations, interviews, research documents and questionnaires were used to collect data. The test results show that the smart vacuum cleaner can work normally. A total of 50 participants participated in the evaluation of the smart garbage application with an average of 87 points.80% agreed that the existence of these smart bins can be beneficial and create satisfaction in knowing how to dispose of waste in the right place. It is also recommended to improve the process and strengthen the cooperation of all school communities involved in the mission.

**Keywords:** Smart Dustbin, Smart Campus, Smart City, Smart Environment, Smart System

**Introduction:** - Garbage has become a huge problem in Indonesia and a social, economic and cultural problem. Almost all cities in Indonesia have waste management problems. The biggest concern is plastic waste. This waste issue will also be brought up by the Indonesian Environment Week 2020 government event in Palembang. Everyone wants everything to be nice and beautiful, and one of them is a clean place. There are still many people who do not know about environmental cleaning. This is reflected in the abundance of garbage on the city's streets and parks. It is certain that this situation will cause dissatisfaction among public service users. The bins provided by the sanitation department are waste products from the

street, unsanitary, ugly and dirty. Perhaps this is one of the important things that makes people increasingly lazy. A special way is to create and use a smart container. This is a smart dry waste bin, the lid can be opened and closed after adding garbage. There are two types of smart trash we recommend: one smart bin for each teacher/staff desk and an extra-large bin for each room. Our research is the first to start and use a variety of information technologies and skills on a small scale to support smart schools and smart centers to meet the 5.0 revolution where Technology continues to evolve.

**Conclusion:** - this research is the first pilot on campus and has many shortcomings. So, the future work is to improve the performance of smart dustbins, detect the fullness of waste, monitor waste, manage real-time information, be able to detect organic and inorganic waste.

#### **Title 6: - Smart Wi-Fi Dustbin System**

**Author:** - Akshay Bandal, Pranay Nate, Rohan Manakar, Rahul Powar

**Year:** -2019

**Abstract:** - We realize that Garbage causes damage to local ecosystems, and it is a threat to plant and human life. To avoid all such situations, we are going to implement a project called IoT Based Smart Garbage. "When somebody dumps trash into a dustbin the bin ashes a unique code, which can be used to gain access to free Wi-Fi". Sensor check garbage fills in dustbin or not and Router provides Wi-Fi to user. Major part of our project depends upon the working of the Wi-Fi module; essential for its implementation. There are two types of smart trash we recommend: one smart bin for each teacher/staff desk and an extra-large bin for each room. Our research is the first to start and use a variety of information technologies and skills on a small scale to support smart schools and smart centers to meet the 5.0 revolution where Technology continues to evolve the main aim of this project is to enhancement of a smart city vision.

**Keywords:** Robotics, Sensors, Local and Wide-Area Networks Internet, Routers, Software Development Kit (SDK).

**Introduction:** - Most of the time we see garbage in the garbage in our city. It creates

pollution for people, makes the environment bad, leaves a bad smell, and knowing the need of the internet in daily life, we decided to offer free Wi-Fi to people in exchange for a clean environment. Now, the population of the city has been increasing rapidly in recent days. Due to the large number of people living in a city or state, the city or state may face many problems such as environmental problems such as garbage, many diseases increase and cause health problems. Garbage collection and management has been an important issue in recent years. For this purpose, on 2 October 2014, the Prime Minister of India, Mr. Narendra Modi announced the Clean India Mission initiated by the Government of India. This project covers the infrastructure of 4,041 cities and countries. Inspired by these projects, we offer a smart Wi-Fi system for smart waste collection. The study presented in this document shows that smart waste products are used in train stations, international shopping malls, buildings, colleges, hotels, etc. It shows how it can improve the ability to clean public spaces such as Real-time detection of cleaning problems. Therefore, the system can help improve overall productivity and cleanliness.

### **Conclusion: -**

In Smart Wi-Fi Dustbin system design two main modules:

1. Hardware module which include Dustbin with sensor, and Display
2. Software module which include Web Application.
3. Also Wi-Fi Router for providing Internet.

They set some specific tasks: In this system, we propose an IoT Based Smart garbage system. When someone trashes somewhere, the trash can flash a unique code that can be used to access free Wi-Fi. The sensor checks if the base is full and the router provides Wi-Fi to the user. A significant part of our work depends on the operation of the Wi-Fi module; Its use is important. The main purpose of this project is to develop the smart city vision.

## **Title 7: - IOT BASED SMART GARBAGE MONITORING SYSTEM USING ZIGBEE**

**Author:** - V. ASWIN RAAJU, J. MAPPIILLAI MEERAN, M. SASIDHARAN

**Year:** -2018

**Abstract:** - IoT-based smart waste management of the future by analyzing the height of the waste on the garbage bins in the city using a sensor system. An Android application has been created to identify and connect it with the necessary information about the different warehouse levels in different locations. When the hopper is full, a notification will be sent to the driver with details of where he has been. Senior managers will be informed and will be able to monitor and track their employees. The system is powered by a solar panel, which is also a type of renewable energy. With the help of ZigBee, we propose an intelligent waste management system based on the intelligence of waste disposal using sensors and modules as well as IoT. It can read, write and transfer data over ad-hoc networks. When such information is uploaded to the cloud, it can be used to track waste products.

**Keywords:** Garbage, Arduino pro mini, Arduino nano and NodeMcu used as Microcontrollers, IoT, ZigBee, Sensors.

**Introduction:** - The Internet of Things (IoT) is said to be a vast system with use cases. These devices are connected to a network that is used to collect data from the environment via sensors or to enable other systems to join the world and operate via actuators. They can be connected to general equipment that you are already familiar with, or to new special equipment whose potential has not yet been exploited. They may be items that you personally own and carry with you or keep in your home, or they may be incorporated into furniture or part of the fabric of your city. Each has the ability to bring important real-world insights into digital information that can improve understanding of how your users interact with your products, services or usage. Real-world use cases and opportunities abound across industries, and many opportunities are on the way in the IoT world. These applications include different hardware devices, different operating systems and software, and have different gateway requirements. The Internet of Things (IoT) is a network of physical devices, vehicles, household appliances, and other devices that includes electronic components, software, sensors, actuators, and connections.

It enables these things to be connected and exchange information, enabling direct integration of the physical world into computer-based systems with better performance and less work. With the use of technology, these devices can communicate and interact over the internet, can be monitored and controlled remotely.

**Conclusion:** - If waste is not properly managed or cleaned, it causes many diseases and pollutes the environment. There should be a system that can be used for waste collection to reduce health problems. This work does something necessary to clarify management of a comfortable, clean and green environment. It also provides many opportunities for the development and future development of the Swachh Bharat program. All over the world, the responsibility of managing household waste is a daunting task. If waste is not properly managed or cleaned, it causes many diseases and pollutes the environment. There must be a new machine that can be used for garbage collection. The sensors will show the daily status of containers that are often in poor condition and not cleaned, including garbage. A cloud server has also been set up where city officials can get information about unattended items and containers. Work is carried out in a relaxed manner; necessary things are done to clarify the care of the green environment. In the future, intelligent waste monitoring can be developed using WANET, which can replace ZigBee. The contribution of each node can be increased. By using other technologies, the cost of a node can be reduced.

## **2.2 PROBLEM STATEMENT**

There are millions of public boxes out there for people to use and are released by public authorities within days. Now the problem is that not all bins are filled for the same price and waste trucks waste time checking each base. This results in higher fuel consumption, performance, and costs. Since most of the litter boxes available in the market are made by hand, users must walk to the litter box. Therefore, the existing trash can is not a user-friendly system as it can only be used by normal people and not by the disabled.

It has also been observed that most people do not use the litter box because they have no interest in going near the litter box. The sensors will show the daily

status of containers that are often in poor condition and not cleaned, including garbage. A cloud server has also been set up where city officials can get information about unattended items and containers. Work is carried out in a relaxed manner; necessary things are done to clarify the care of the green environment. In the garbage system, most people do not want to touch the lid of the garbage because it is not clean. In addition, there is no smart waste management system in the market that can separate wet and dry waste. These problems are overcome by intelligent waste management, which includes an IoT-based monitoring system that issues instructions to authorities to easily remove waste when full.

## CHAPTER 3

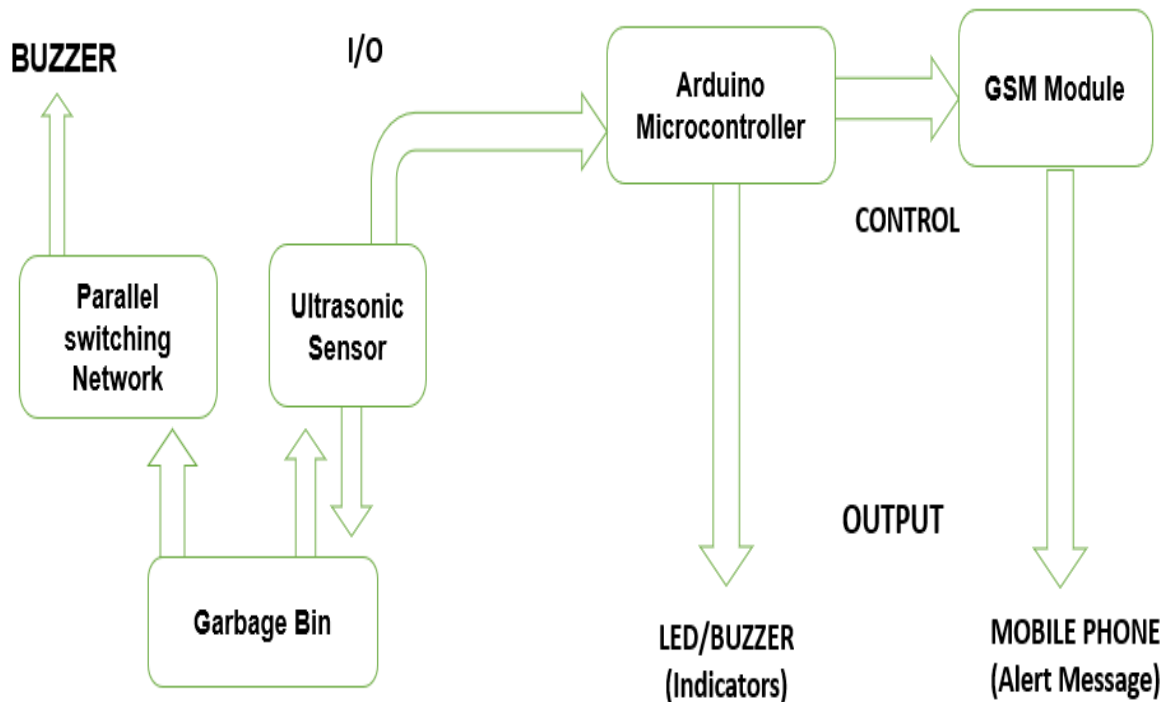
### METHODOLOGY

#### 3.1 EXISTING SYSTEM

- Manual systems in which employees clear the dumpsters periodically.
- No systematic approach towards clearing the dumpsters.
- Unclear about the status of a particular location
- Employees are unaware of the need for a particular Location
- Very less effective in cleaning city

#### 3.2 EXISTING METHOD

The functional block diagram of the proposed garbage disposal system which consists of major components and modules such as Ultrasonic sensors, Servo motors, GSM/GPRS module, 4x4 matrix keypad, Parallel switching network and Arduino Mega 2560 microcontroller.

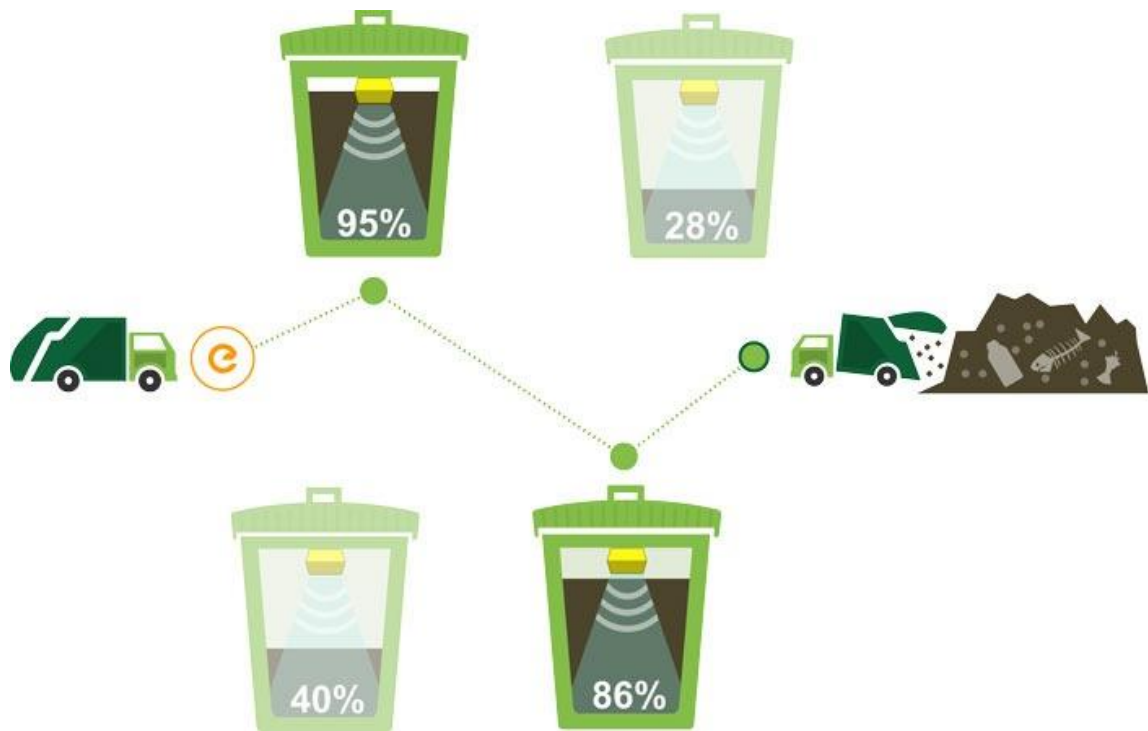


**Fig 3.1: Existing method Block diagram**

In the Existing system, an ultrasonic sensor is placed on the top of the garbage bin to detect the hand of the person who comes to throw the trash. Another ultrasonic sensor is placed inside the garbage bin to detect garbage level. Two servo motors are attached with the lid and are connected with the Arduino microcontroller. The Arduino microcontroller calculates the distance of trash level in the garbage bin with respect to the threshold distance. When the garbage bin is full, the processor activates the GSM/GPRS module to send an alert message to the local garbage collector. The uniqueness of the garbage disposal system is achieved by placing the parallel switching network on the top of the lid.

### **3.3 PROPOSED METHOD**

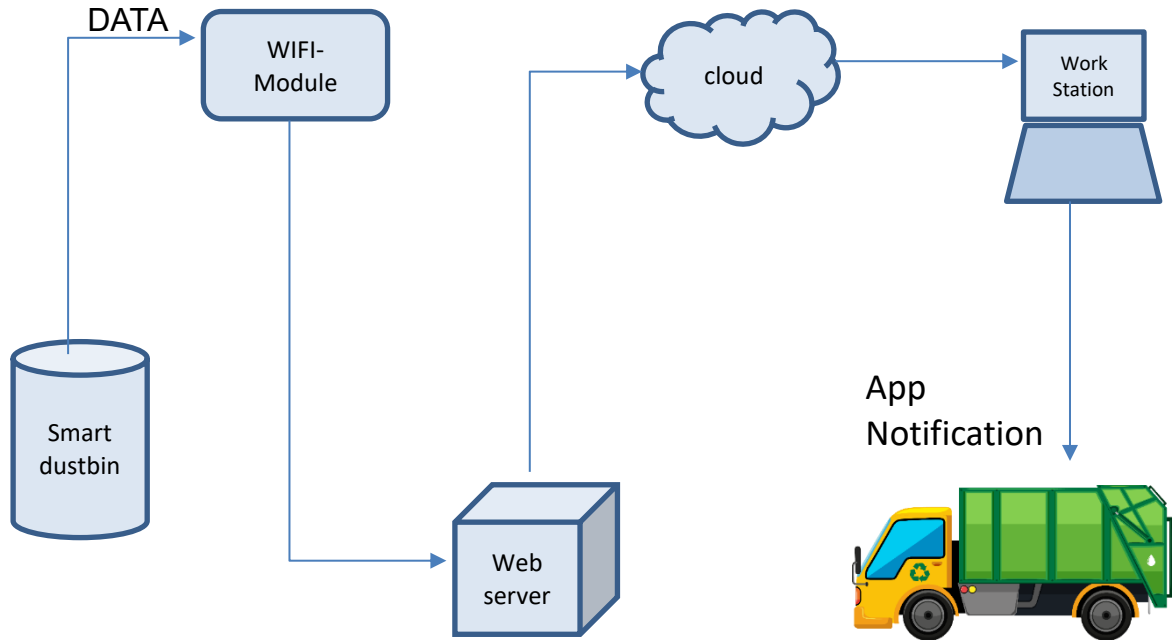
Smart bins may be affordable given the needs of today's technology, but considering the need for bins in India, expensive bins will not be the first test, so we decided to use sensors to reduce cost while increasing efficiency. in all applications. Different types of waste are generated in our homes every day. People will skip it in the trash. The trash can is sometimes full, sometimes not. Every day garbage collectors come and throw away this garbage. Since all the bins are full, the waste material will be used in the future, and not full will mean a waste of fuel, time and manpower, it is best to do it right after the bins are finished. Use them all after a day or a few days. So, to know if the container is full, we create a smart container where the container will have a sensor and the sensor will report if the container is full. Therefore, garbage collectors will go to garbage collection in a special way as it saves fuel, time and labor. This project is based on the use of an electronic device using Arduino and Ultrasonic Sensing Module. The purpose of this project is to make a trash can that can be opened and closed by itself when needed. In this mechanism, Arduino is used to control the servo motor and ultrasonic sensor. The ultrasonic sensor works when a person walks in front of the sensor, it can detect person.



***Fig 3.2: proposed method block diagram***

This project is based upon automation using an Arduino and an ultrasonic sensing module. The project focuses on making a garbage bin that can open or close itself when required. In this mechanism an Arduino is used to command the servo motor and ultrasonic sensor. The project works when a person walks towards the sensor. The sensor detects the person.

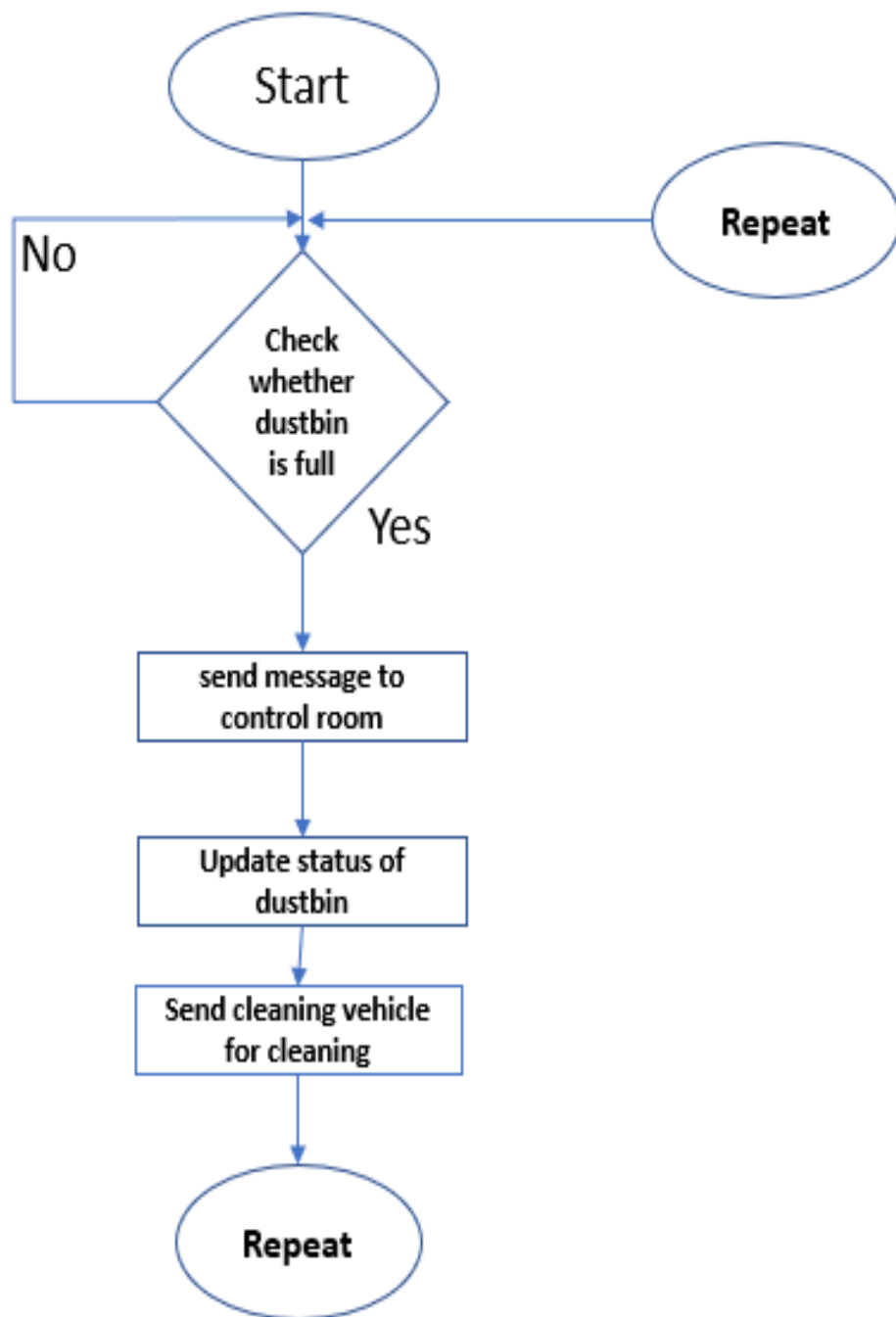
### 3.4 ARCHITECTURE OF PROPOSED METHOD



***Fig 3.3: Architecture of proposed method***

In our proposed system, the dustbin having sensor to collect the data from the bin Whether Bin is completely filled or not and also it connects to Wi-Fi module, it will upload the data time to time in cloud server, by using desktop applications and some mobile applications to monitor the Smart Dustbin status and according to that worker plan their path to clean dustbins.

### 3.5 FLOW CHART OF PROPOSED METHOD



*Fig 3.4: Flow chart of proposed method*

### **3.6 ADVANTAGES OF PROPOSED METHOD**

- Less Time Consumption
- Low Maintenance cost
- Reduces Overflow of Wastage
- Reduces the Spreading of disease caused by bacteria
- There will be no contact with the dustbin
- Optimized path
- Real time analyses of municipal corporation

## **CHAPTER 4**

### **EXPERIMENTAL MATERIALS AND METHODS USED**

Here in this project, we have used both hardware and software, all the details have been explained clearly below,

#### **4.1 Hardware Requirements:**

- POWER SUPPLY
- WIFI MODULE ESP32
- ULTRASONIC SENSOR HC-SR04
- SERVO MOTOR
- IR SENSOR
- CONNECTING WIRES

##### **4.1.1 Power Supply:**

This is the first condition of the job. For this, a 12v-0-12v converter is used. The voltage we use is 5v. The regulated output is 5v produced by the 7805 excited controller. This is a 3-pin voltage regulator capable of supplying up to 800mA. Devices used for rectification are called rectifiers. Rectification is the process of changing current or voltage in one direction. The power supply components are: capacitors, diodes and 30v step-down transformers. A power supply is an electrical device that supplies electric power to an electrical load. The main purpose of a power supply is to convert electric current from a source to the correct voltage, current, and frequency to power the load.

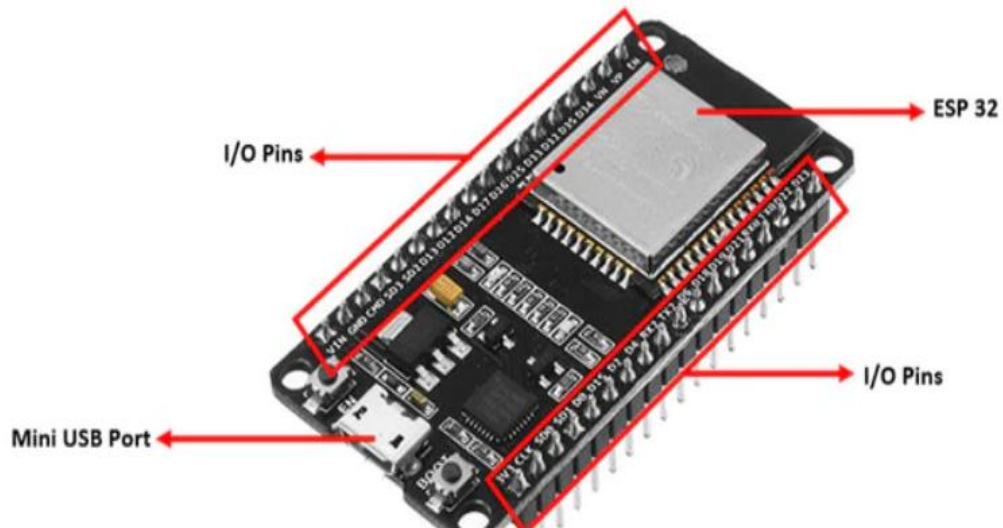
##### **4.1.2 WIFI Module ESP32: -**

ESP32-WROOM-32 is a general-purpose Wi-Fi + Bluetooth® + Bluetooth LE MCU module suitable for a variety of applications from low power to the most demanding applications such as speech encoding, music streaming and MP3 decoding. At the heart of the module is the ESP32-D0WDQ6 chip\*. Embedded chips are designed to be scalable and flexible. There are two independent CPU cores and the CPU clock frequency can be adjusted between 80 MHz and 240 MHz the chip

also has a low-power engine that can be used in place of the CPU to save power when performing tasks that don't require much power, such as monitoring devices. ESP32 integrates a rich set of peripherals such as capacitive touch sensors, SD card interface, Ethernet, high speed SPI, UART, I2S and I2C. The combination of Bluetooth, Bluetooth LE and Wi-Fi provides a wide range of application suitability, and the models are versatile: using Wi-Fi allows a large body that connects directly to the Internet through a Wi-Fi router, and using Bluetooth allows users to easily connect to a mobile phone or broadcasting a low-power network for discovery. The sleep current of the ESP32 chip is less than 5  $\mu$ A, making it suitable for battery and power consumption. The module supports data rates up to 150 Mbps and 20 dBm antenna output power to provide the widest body. So, this module truly has industry specifications and best performance in terms of electronic integration, versatility, power consumption and connectivity's option for ESP32 is a free RTOS with LWIP; Hardware accelerated TLS 1.2 is also built in. Secure (encrypted) over-the-air (OTA) updates are also supported, so users can update their products with minimal cost and effort even after they're released. ESP32 works as a standalone processor or as a slave to a master MCU, reducing the communication load of critical applications. The ESP32 can interface with other devices via SPI/SDIO or I2C/UART interface to provide Wi-Fi and Bluetooth functionality. ESP32 is integrated with onboard antenna, RF balun, power amplifier, low noise receiver amplifier, filter and power control module. ESP32 adds power and efficiency to your application with minimal printed circuit board (PCB). The ESP32 can operate in industrial environments with an operating temperature of -40°C to +125°C, removing external obstacles and adapting to external changes. Designed for mobile devices, wearable electronics and IoT applications, the ESP32 integrates multiple software designs, providing low power consumption. ESP32 also includes cutting-edge features such as fine-tuned clock gates, multiple power modes, and dynamic power scaling. ESP32 is integrated with onboard antenna, RF balun, power amplifier, low noise receiving amplifier, filter and power control module. ESP32 adds power and efficiency to your application with minimal printed circuit board (PCB).

| Categories | Items                                     | Specifications                                                                                                    |
|------------|-------------------------------------------|-------------------------------------------------------------------------------------------------------------------|
| Wi-Fi      | Protocols                                 | 802.11 b/g/n/e/i (802.11n up to 150 Mbps)<br>A-MPDU and A-MSDU aggregation and 0.4 $\mu$ s guard interval support |
|            | Frequency range                           | 2.4 ~ 2.5 GHz                                                                                                     |
| Bluetooth  | Protocols                                 | Bluetooth v4.2 BR/EDR and BLE specification                                                                       |
|            | Radio                                     | NZIF receiver with -97 dBm sensitivity                                                                            |
|            |                                           | Class-1, class-2 and class-3 transmitter                                                                          |
|            |                                           | AFH                                                                                                               |
|            | Audio                                     | CVSD and SBC                                                                                                      |
| Hardware   | Module interface                          | SD card, UART, SPI, SDIO, I2C, LED PWM, Motor PWM, I2S, IR                                                        |
|            |                                           | GPIO, capacitive touch sensor, ADC, DAC, LNA pre-amplifier                                                        |
|            | On-chip sensor                            | Hall sensor, temperature sensor                                                                                   |
|            | On-board clock                            | 40 MHz crystal                                                                                                    |
|            | Operating voltage/Power supply            | 2.7 ~ 3.6V                                                                                                        |
|            | Operating current                         | Average: 80 mA                                                                                                    |
|            | Minimum current delivered by power supply | 500 mA                                                                                                            |
|            | Operating temperature range               | -40°C ~ +85°C                                                                                                     |
|            | Ambient temperature range                 | Normal temperature                                                                                                |
|            | Wi-Fi mode                                | Station/SoftAP/SoftAP+Station/P2P                                                                                 |
|            | Wi-Fi Security                            | WPA/WPA2/WPA2-Enterprise/WPS                                                                                      |
|            | Encryption                                | AES/RSA/ECC/SHA                                                                                                   |
| Software   | Firmware upgrade                          | UART Download / OTA (download and write firmware via network or host)                                             |
|            | Software development                      | Supports Cloud Server Development / SDK for custom firmware development                                           |
|            | Network protocols                         | IPv4, IPv6, SSL, TCP/UDP/HTTP/FTP/MQTT                                                                            |
|            | User configuration                        | AT instruction set, cloud server, Android/iOS app                                                                 |

ESP32-WROOM-32E integrates ESP32-D0WD-V3, which is more stable and secure. It is a general-purpose Wi-Fi + BT + BLE MCU module suitable for many applications such as low power for the most demanding tasks such as speech encoding, audio Music streaming and MP3 decoding. A device is a controller of an electronic device or device that performs a specific function according to the intended application.



**Fig 4.1: ESP32-VROOM-32D**

#### **4.1.3 Ultrasonic sensor HC-SR04: -**

HC-SR04 is an ultrasonic sensor which is used for measuring the distance between the top of the lid to the top of the garbage.

| <u>PIN NUMBER</u> | <u>PIN NAME</u> | <u>DESCRIPTION</u>                                                                                                                                     |
|-------------------|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.                | VCC             | The Vcc pin powers the sensor, typically with +5V                                                                                                      |
| 2.                | Trigger         | Trigger pin is an Input pin. This pin has to be kept high for 10us to initialize measurement by sending US wave.                                       |
| 3.                | Echo            | Echo pin is an Output pin. This pin goes high for a period of time which will be equal to the time taken for the US wave to return back to the sensor. |
| 4.                | GND             | This pin is connected to the Ground of the system.                                                                                                     |

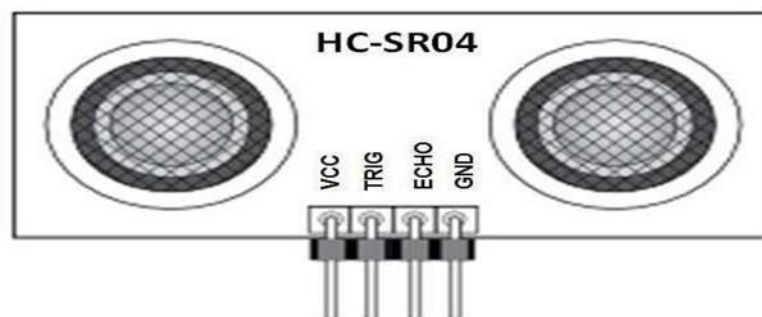
#### **4.1.3.1 Features of Ultrasonic sensor.**

- Operating voltage: +5V
- Theoretical Measuring Distance: 2cm to 450cm
- Accuracy: 3mm
- Measuring angle covered:  $<15^\circ$
- Operating Current:  $<15\text{ma}$
- Operating Frequency: 40Hz

#### **4.1.3.2 Ultrasonic Sensor Working**

The SR04 Ultrasonic (US) sensor is a 4pin module, and the pin names are Vcc, Trigger, Echo, and Ground. This sensor is a popular sensor used in many applications that require distance measurement or detecting objects. There are two eyes in front of the module, which is an ultrasonic transmitter and receiver, as in the project. This measurement uses the simple high school formula **distance = speed x time**. The ultrasonic transmitter emits ultrasonic waves, this wave propagates in the air, when it hits an object, it returns to the sensor, and this reflected wave is seen by the ultrasonic receiver module. Now we need to know the speed and time to calculate the distance using the above formula. Since we use ultrasound, we know that the speed of the American wave at home is 330m/s.

The circuit built in module will calculate the time it takes for the US wave to return and set the pin high to the same specific time so we can know how long it will take. Now automatically calculate distance using microcontroller or microprocessor.



**Fig 4.2: Ultrasonic Sensor**

#### **4.1.4 SERVO MOTOR**

A servo motor is a simple electric motor that can be controlled with the help of a servo motor. If the motor is used to control the device and the servo mechanism is associated with a DC motor, it is often called a DC servo motor. If the motor is controlled by alternating current, it is called an AC servo motor.

Servo motor has some unique uses where only a few turns of the hull are required. For these applications, we need some special motor type and some special arrangement to make the motor rotate at a certain angle to the electrical equipment (symbol). For this purpose, the servo motor appeared. Servo Motor is basically a simple DC motor that can control an angle of rotation with the help of an additional servo mechanism (usually closed loop feedback controlling the system). Today, servo systems are widely used in businesses.

The application of servo motor is also in the remote-control toy car to control the motion direction, and it is also widely used as motion motor tray in CD or DVD player. Apart from these, there are hundreds of servo motor applications that we see in our daily lives.

The main reason to use a servo is because it provides angular precision, so it just flips the angle we want, then stops and waits for the next signal to continue working. A servo motor differs from a motor in that it starts spinning when we turn it on and continues to rotate until we turn off the power. We cannot control the rotation of the motor, we can only control the rotational speed, which can be turned on and off. Many Arduino starter kits include small servo motors as they are easy to work with as part of a small project.

- A servo motor has everything built in a motor, a feedback circuit, and most important, a motor driver.
- The Servo motor is used to open the lid on the trash bin through the command of the ESP32 and IR sensor.
- Servo motors are small, have built-in control circuitry and have good power for their size.
- Servos are used in radio-controlled aero planes, a robot, or operating rudders, etc.

- It consists of a suitable motor coupled to a microcontroller for position feedback.



**Fig 4.3: SERVO MOTOR**

#### **4.1.5 IR SENSOR**

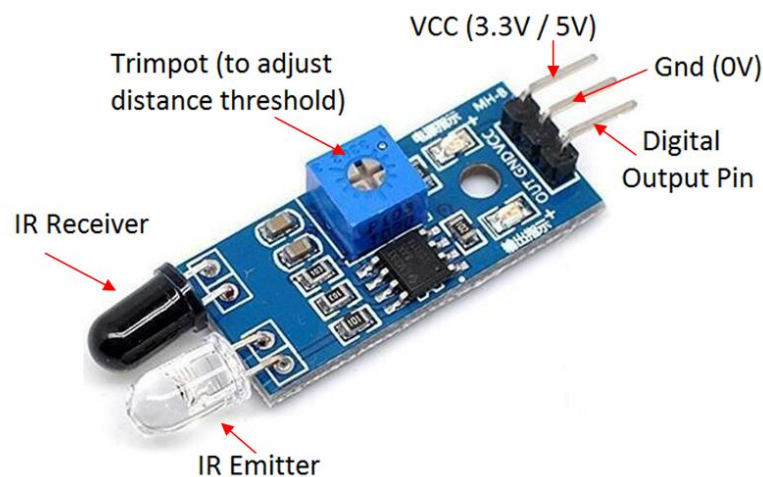
An infrared (IR) sensor is an electronic device that measures and detects infrared radiation in the surrounding environment. When measuring the temperature of each color of light (separated by a prism), only red light is found to have the highest temperature. Infrared is invisible to the human eye, as it has a longer wavelength than visible light (although still in the same electromagnetic spectrum). Anything that emits heat (anything with a temperature higher than five degrees Kelvin) emits infrared radiation. There are two types of infrared sensors: active and passive.

Active infrared sensors can emit and detect infrared radiation. An active infrared sensor has two components: a light emitting diode (LED) and a receiver. When an object reaches the sensor, the infrared light emitted by the LED is reflected from the object and is detected by the receiver. Active infrared sensors act as proximity sensors and are often used in obstacle sensing systems such as robots.

To see. They are often used as a measurement tool in PIR. PIR sensors are often used in security alarms and automatic lighting. PIRs are available in various configurations for various applications. Most models have multiple Fresnel faces or mirrors, have an effective range of about 10 meters (30 feet) and a field of view of less than 180°. Models with wide viewing angles (including 360°) are available and are primarily designed for ceiling mounting. Some of the larger PIRs are made with a single piece of mirror that can detect changes in infrared energy up to 30 meters (100 feet) away from the PIR. There are also rear-mirror PIR designs with sections that can be individually selected for wide (110° wide) or narrow "standard" coverage or both for "good" coverage.

*Passive infrared:* (PIR) sensors only detect infrared radiation and do not emit it from an LED. Passive infrared sensors are comprised of:

- Two strips of pyroelectric material (a pyroelectric sensor)
- An infrared filter (that blocks out all other wavelengths of light)
- A Fresnel lens (which collects light from many angles into a single point)
- A housing unit (to protect the sensor from other environmental variables such as humidity)



**Fig 4.4: IR SENSOR**

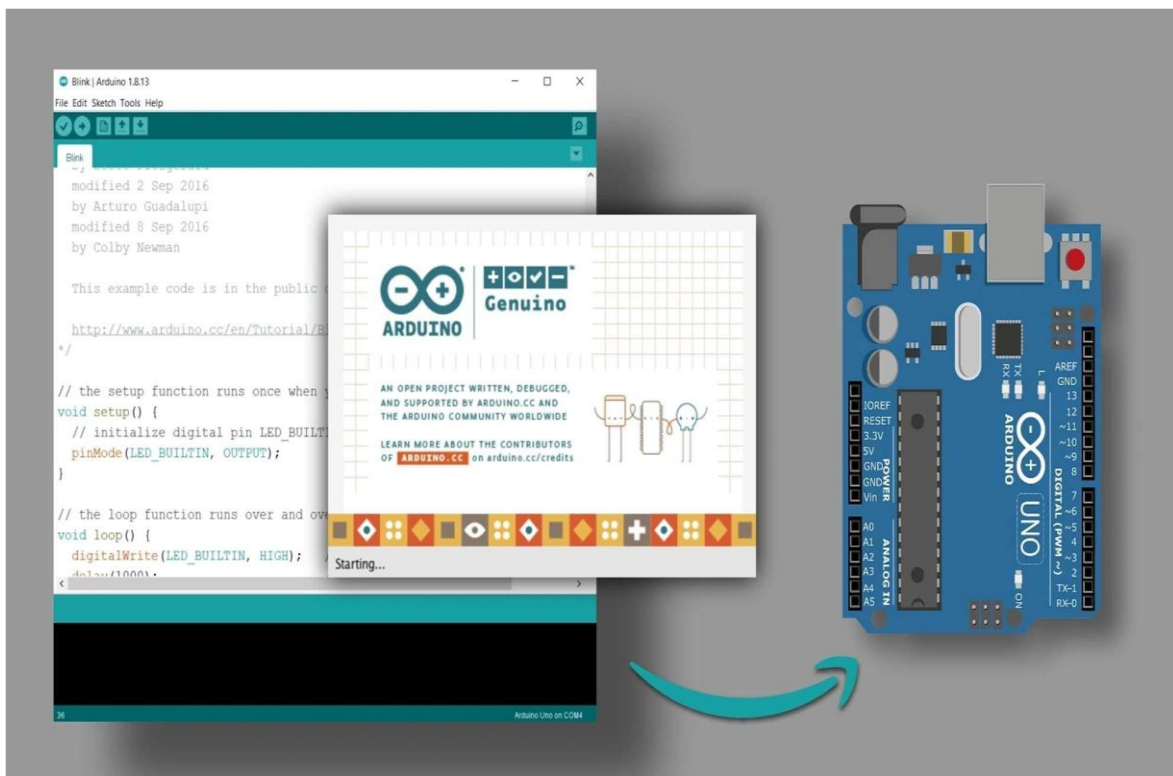
## **4.2 Software Requirements: -**

### **4.2.1 Arduino IDE**

The Arduino Integrated Development Environment, or Arduino Software (IDE), contains a text box for writing code, a text field, a console text box, a toolbar with buttons for programming, and several manuals. It connects to Arduino hardware to load programs and communicate with them. Programs written using Arduino software (IDE) are called sketches. These graphics are written as text and saved with the file extension (.ion). Toolbar buttons allow you to define and load programs, create, open and save drawings, and turn on the serial monitor. Electronic development is now easier thanks to Arduino software (IDE) and Arduino boards (hardware). These devices help to create digital and interactive products with the help of other products. In our previous article, we talked about the Arduino development board. In this article, we will learn what Arduino software (IDE) is and how to use it. Arduino Software (IDE) is open source software for programming Arduino board, a development environment developed by arduino.cc. Allows writing and sending code to the Arduino board. It has many libraries and a mini-project example. Arduino software (IDE) is compatible with different operating systems (Windows, Linux, Mac OS X) and supports programming languages (C/C++). Arduino software is easy to use for both beginners and advanced users. It is used to get started with electronic programming and robotics and to create interactive prototypes.

Therefore, Arduino software is a tool for creating new things. And create new electronic projects by anyone (kids, geeks, engineers, programmers, etc.). The Arduino Coordinate Development Environment or Arduino Program (IDE) has a word processor for writing code, a language area, a comfort zone, a toolbar with normal limits and menus for development. It cooperates with Arduino and Real time devices with which it can exchange services and communications. What you do with the Arduino program (IDE) is called graphics. In addition, these descriptions are created in a word processor and stored with the report. ion. Edit manager has features to cut/save and find/replace content. Local messages provide input and display errors during backup and replacement. Comfort shows everything from the Arduino computer program (IDE), including all error messages and other information. The main board and serial port are explained in the upper right corner

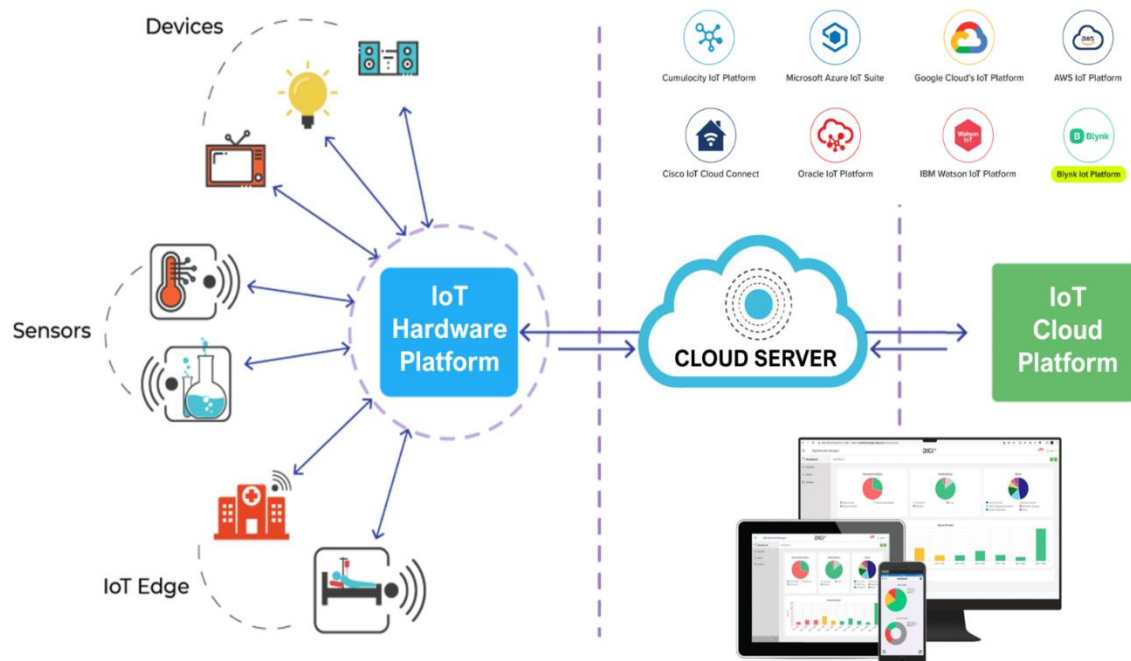
of the window, open it, add a picture and open the serial port screen. The Arduino Integrated Development Environment (IDE) is a cross-platform application (available for Microsoft Windows, macOS, and Linux) written in the Java programming language. It has become an IDE for word processing and wiring. It includes a code editor with features such as cut and paste, search and replace text, auto indentation, bracket matching and syntax highlighting, and provides an easy click mechanism to write and upload programs for the Arduino board. It also has a message area, a text console, a toolbar with buttons for frequently used functions, and a hierarchical task menu. The source code of the IDE is released under version 2 of the GNU General Public License. Arduino IDE supports C and C++ languages using proprietary code formats. The Arduino IDE provides a software library from the Wiring project that provides various input and output methods. User written code requires only two simple functions to start the drawing and main function loop, the program is bundled with stub main () and linked to the loop executable with the GNU toolchain, also available in the IDE distribution environment. The Arduino IDE uses the argued program to convert the completed code into hexadecimal code text that is uploaded to the Arduino board by the loader in the board's firmware.



**Fig 4.5: Arduino IDE**

#### 4.2.2 Blynk 2.0: -

Blynk is the complete software package needed to model, deploy and manage connected electronic devices of any size, from individual IoT projects to millions of connected commercial products. With Blynk, anyone can connect their devices to the cloud and create code-free iOS, Android, and web apps to analyze real time and historical data from devices, manage them from anywhere in the world, receive important notifications and much more. This Blynk ESP8266 Smart Control Relay has the following functions: Control Home Appliances via Wi-Fi (Blynk IoT App). Manage your home appliances with the Blynk web dashboard. Control home appliances with switches or buttons. Monitor real-time feedback in the Blynk IoT App. Thus, you can easily complete a home automation project in your home using only Node MCU and relay modules. Or you can use a standard PCB design for this project. IoT technology has the potential to revolutionize business, but many companies struggle to use it effectively due to competition, lack of expertise, uncertain business models, and lack of experienced engineers. Whether you're starting a new business or an established company to accelerate growth, Blynk will help you break these barriers and create IoT solutions that solve your real business problems.



**Fig 4.6: Blynk Cloud**

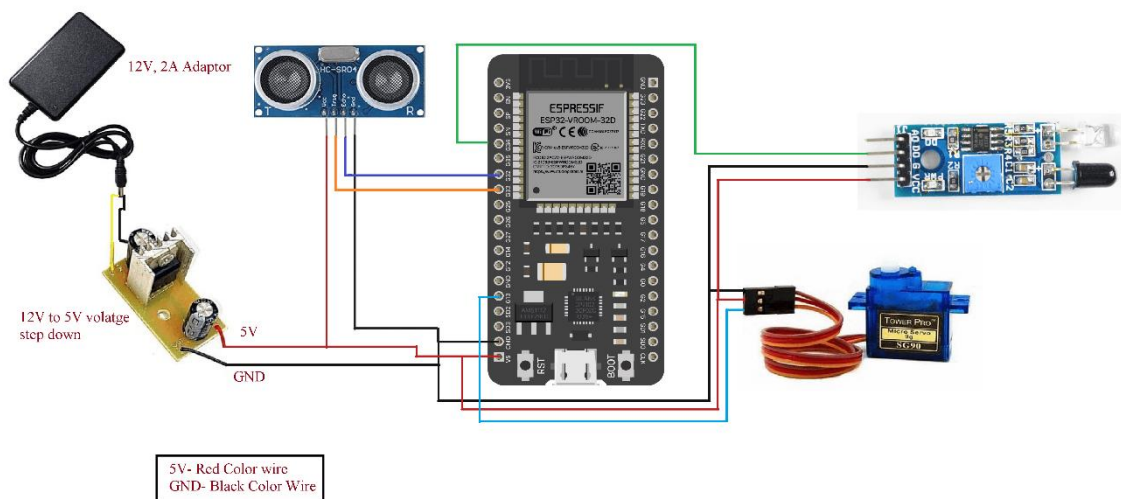
## CHAPTER 5

### Result and Discussion

This section describes step-by-step the system analysis and the results obtained. The system was designed and simulated in proteus and a working prototype was developed using the different hardware components with data being sent to the cloud platform.

#### 5.1 Circuit Diagram Setup

The below circuit Diagram shows how the components are connect to each other.

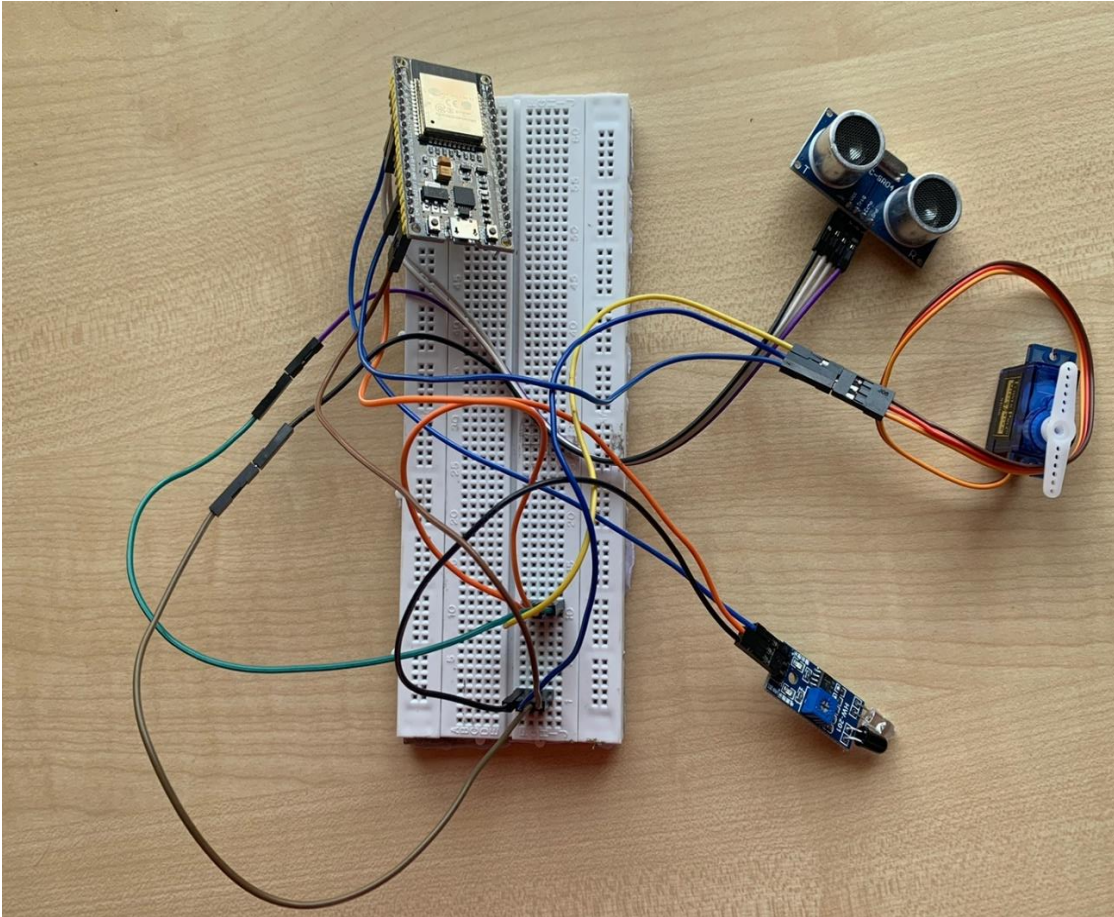


**Fig 5.1: Circuit Diagram Setup**

In this diagram, ultrasonic sensor Vcc pin is connected to V5 pi of ESP32-VROOM-32D, pin to G33, Echo pin to G32 and CMD to IR SENSOR pin on ESP31-VROOM-32D. (A0, D0, GVK), A0 pin not connected to any pin of ESP31-VROOM-32D, D0 pin connected to G32, ground pin connected to ground pin of ultrasonic sensor, Vcc pin connected to V5 pin of ESP31-VROOM-32D .SERVO MOTOR has 3 pins, one pin is ground, second pin is connected to V5 pi of ESP31-VROOM-32D and third pin is G13 Check the circuit after connecting all the components, now we have to power up. Now one pin and ground of V5 of ESP31-VROOM-32D are

connected via step-down transformer, then we use 12v, 2A adapter to get power.

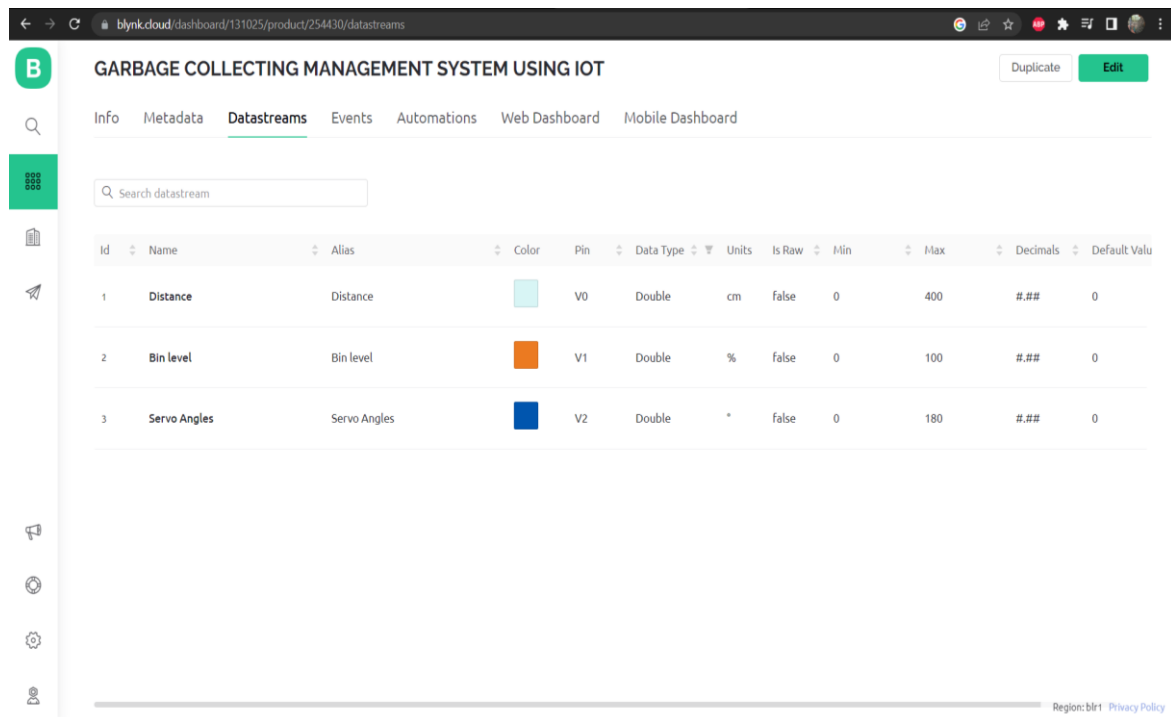
## 5.2 Experimental Setup



***Fig 5.2: Experimental Setup***

After making all the connections and uploading the code to the microcontroller we will be able to see the output on Blynk 2.0 software and Blynk Mobile Phone Application. The testing was conducted using an Arduino IDE Software and Blynk 2.0 Software frequently we were checking it is working properly or not.

## 5.3 BLYNK 2.0 Software Interface



The screenshot displays the Blynk 2.0 Software Interface. The browser address bar shows the URL: `blynkcloud/dashboard/131025/product/254430/datastreams`. The page title is "GARBAGE COLLECTING MANAGEMENT SYSTEM USING IOT". The "Datastreams" tab is selected, showing a table of three datastreams. The table has columns: Id, Name, Alias, Color, Pin, Data Type, Units, Is Raw, Min, Max, Decimals, and Default Value. The datastreams are: 1. Distance (light blue square), 2. Bin level (orange square), and 3. Servo Angles (dark blue square). The footer indicates the region is "blt1" and provides a link to the Privacy Policy.

| Id | Name         | Alias        | Color                                    | Pin | Data Type | Units | Is Raw | Min | Max | Decimals | Default Value |
|----|--------------|--------------|------------------------------------------|-----|-----------|-------|--------|-----|-----|----------|---------------|
| 1  | Distance     | Distance     | <span style="color: lightblue;">■</span> | V0  | Double    | cm    | false  | 0   | 400 | ###      | 0             |
| 2  | Bin level    | Bin level    | <span style="color: orange;">■</span>    | V1  | Double    | %     | false  | 0   | 100 | ###      | 0             |
| 3  | Servo Angles | Servo Angles | <span style="color: blue;">■</span>      | V2  | Double    | °     | false  | 0   | 180 | ###      | 0             |

**Fig 5.3: Software Interface**

After creating Blynk cloud account we have to create a project and we will give that project as our project name and we will create DataStream's

Here, Distance is to calculate the size of the DUSTBIN. In level DataStream is used to Know the DUSTBIN level in percentage. Servo Angle DataStream is used to determine whether Dustbin lid is properly opened or not.

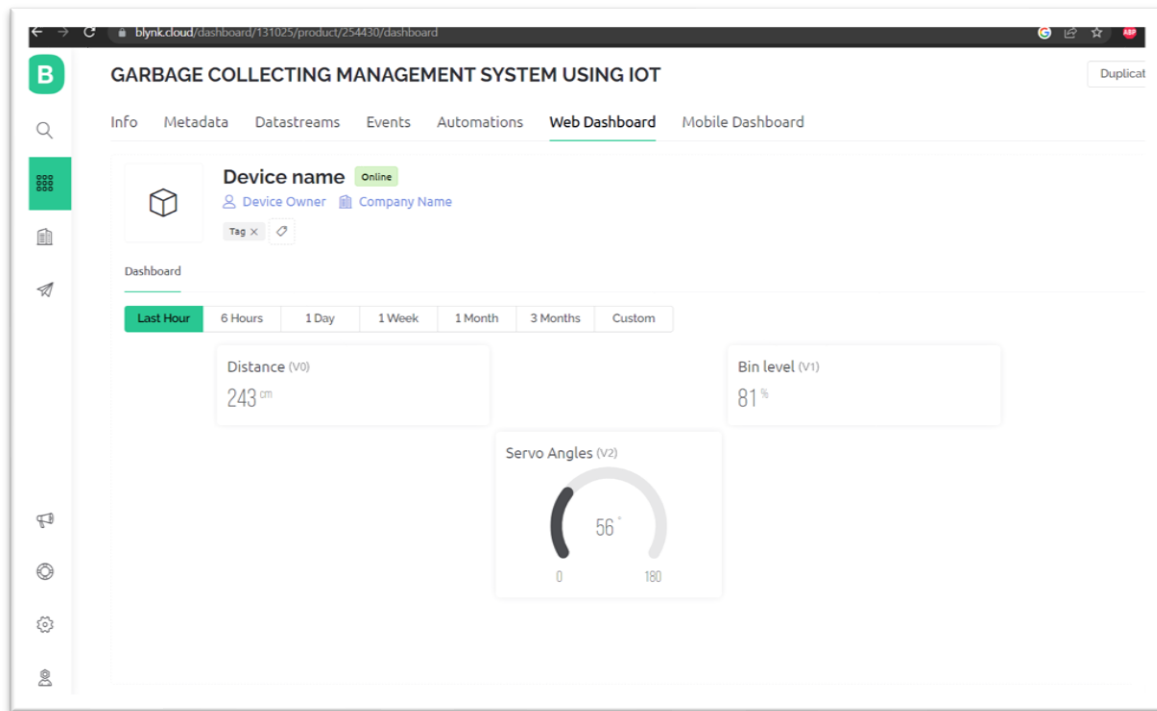
## 5.4 OUTPUT AND RESULTS

After all these steps Now, we are able to monitor the data about the Dustbin in Blynk 2.0 desktop site and mobile application.



***Fig 5.4: project output***

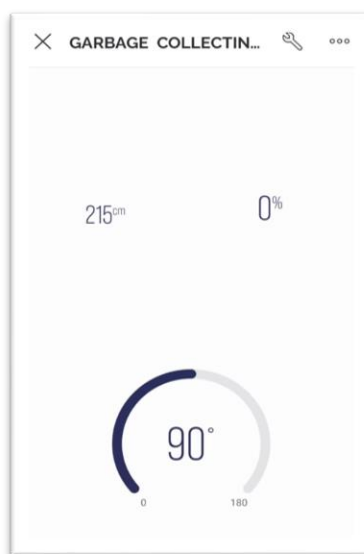
### 5.4.1 DESKTOP VIEW OF RESULT



**Fig 5.5: DESKTOP VIEW OF RESULT**

- It will give the all information about the Dustbin
- It will show the high the bin, how bin is filled.
- It shows whether servo motor is properly working or not.

### 5.4.2 MOBILE APPLICATION



**Fig 5.6: MOBILE APPLICATION**

## **CHAPTER 6**

### **CONCLUSION**

#### **6.1 Conclusion**

The accompanying is acquired from this work are: Waste Level recognition inside the dustbin and when person comes in front of dustbin, it will identify the person and automatically open and closed within the time, Transmit the data remotely to concerned, the information can be gotten to whenever and from anyplace the ongoing information transmission and access avoids the floods of Dustbins. This IOT based waste administration is exceptionally helpful for shrewd urban areas in various perspectives. In urban communities there are numerous dustbins situated in different spots, when it is overflown the concerned experts did not get any dataabout it. By this task the issue arrangement is outlined in such way that it will give finish points of interest of the dustbin situated in the diverse territories all through the city. The concerned expert can get to the data from anyplace and whenever. In this manner they cantake the choice on this quickly.

#### **6.2 Future Work**

The main goal of the project is to reduce and work on human resources while developing the smart city vision. We often see rubbish spilling out of the garbage cans and this is a problem that needs immediate attention. The proverb " love after God, clean the city after heaven " inspired us to conceptualize the project. The Smart Trash helps us reduce pollution. Many times, the litter may overflow and various animals such as dogs or rats may get into or near the litter. This makes things worse. Also, some birds try to remove waste from the litter box. This project can avoid this situation. And messages can be sent directly to the car wash instead of the contractor's office. Swatch Bharat Abhiyan (English: Clean India Mission, abbreviated as SBA or SBM, meaning "Swatch Bharat Mission") is a national campaign by the government of India that includes 4,041 policies in cities, clean roads and streets in India, and the country's infrastructure. In our system, the smart trash can is connected to the internet to get real information about the smart trash. In recent years, the rapid increase in population has led to more waste. Therefore, there must be proper waste management to prevent the spread of some deadly diseases.

Our project still has a lot of space for improvement and possibilities in the future like any other project.

- The whole system can be implemented by using machine learning for advanced system management.
- We can improve the accuracy of the data by using more high-end sensors, i.e., a better version of the sensors compared to that we have used in this system for each measurement parameter.
- To solve the problem of internet connection in rural areas, we can use portable Wi-Fi modules and wireless routers, which will be able to provide Internet connectivity up to a certain range of regions. We will then use as many such Wi-Fi devices to extend the connectivity to an expanded range of areas. Besides this, use of Wi-Fi repeaters will be beneficial in case of poor network regions. The Wi-Fi repeater operates by connecting to the portable Wi-Fi network and rebroadcasting the signal to a larger area.
- The prototype can be converted into any type of wearable device that is easy to carry and can monitor the mother for a longer period of time.
- The waste materials can be segregated into biodegradable, non-bio degradable and metals by using more sensors.
- The discarded things can be processed to extract or recover materials in an effective way and resources or convert them to energy as usable heat, electricity, fuels. The large-scale introduction of automatic waste management in villages, platforms, hospitals, industries, etc. Real time monitoring and controlling of waste management by using IoT. A prediction system by the given data to predict the variation in the amount of waste and to adjust the timing of management

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## APPENDIX

### A. SOURCE CODE:

```
#define BLYNK_TEMPLATE_ID "TMPLzQci73ih"
#define BLYNK_DEVICE_NAME "Smart Dustbin"

#define BLYNK_FIRMWARE_VERSION "0.1.0"
#define BLYNK_PRINT Serial
#include "BlynkEdgent.h"

#define USE_WROVER_BOARD

#define echoPin 32
#define trigPin 33
#include<Servo.h>
Servo servo;
long duration;
int distance;
int binLevel=0;

void sendSensor()
{
  int ir=digitalRead(34);
  if(ir==HIGH)
  {
    servo.write(90);
    for(int i=0; i<50; i++)
    {
      Blynk.virtualWrite(V2, 90);
      ultrasonic();
      delay(100);
    }
    servo.write(0);
    Blynk.virtualWrite(V2, 0);
  }
  if(ir==LOW)
  {
    ultrasonic();
    delay(200);
  }
}

void ultrasonic()
{
  Serial.println("Blynk.air updated");
  digitalWrite(trigPin, LOW);
  delayMicroseconds(2);
  digitalWrite(trigPin, HIGH);
  delayMicroseconds(10);
  digitalWrite(trigPin, LOW);
  duration = pulseIn(echoPin, HIGH);
  distance = duration * 0.034 / 2; //formula to calculate the distance
  for ultrasonic sensor
```

```

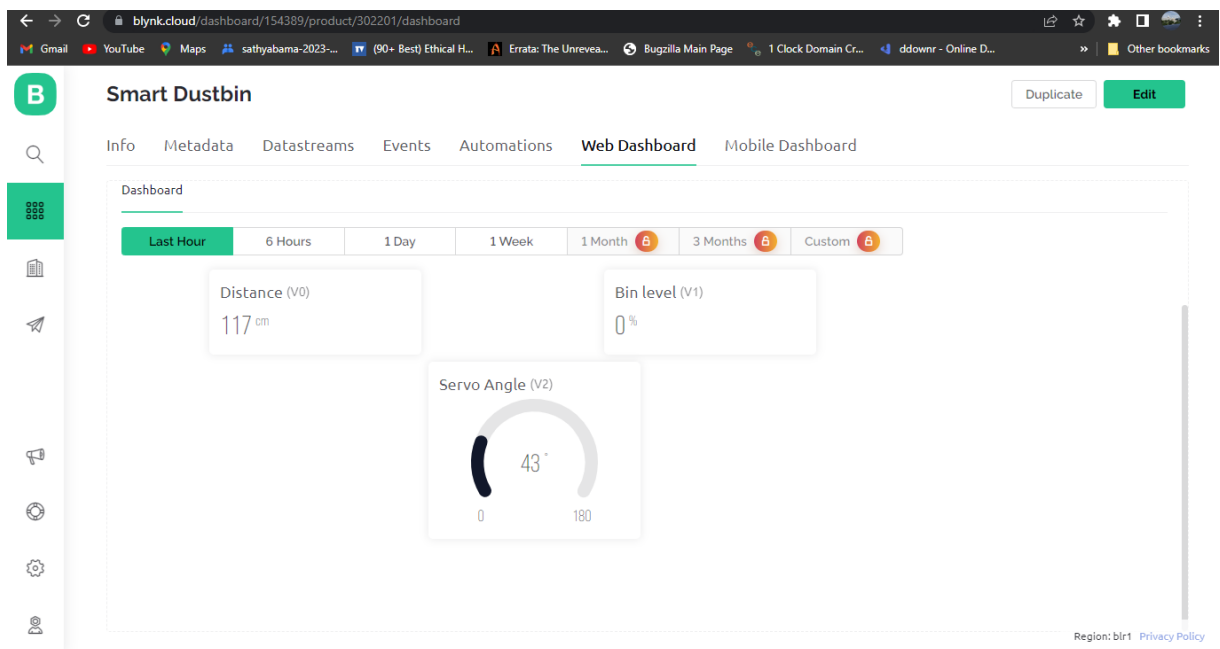
        binLevel=map(distance, 21, 0, 0,100); // ADJUST BIN HEIGHT HERE
        Blynk.virtualWrite(V0, distance);
        Blynk.virtualWrite(V1, binLevel);
    }
    void setup()
    {
        Serial.begin(9600);
        servo.attach(13);
        pinMode(34, INPUT);
        pinMode(trigPin, OUTPUT);
        pinMode(echoPin, INPUT);
        BlynkEdgent.begin();
        delay(2000);
        timer.setInterval(1000L, sendSensor);
    }

    void loop()
    {
        BlynkEdgent.run();
        timer.run(); // Initiates SimpleTimer
    }

    extern "C" {
        void app_loop();
        void eraseMcuConfig();
        void restartMCU();
    }

```

## B. SCREENSHOTS:



```
smart_code | Arduino IDE 2.0.5-nightly-20230403
File Edit Sketch Tools Help
DOIT ESP32 DEVKIT V1
smart_code.ino
1 #define BLYNK_TEMPLATE_ID "TMPL2_Stx22x"
2 #define BLYNK_TEMPLATE_NAME "Blynk smart Dustbin"
3 #define BLYNK_AUTH_TOKEN "TCRz-nYmqHS_zWiAFTdJQv2V-2V7cbih"
4
5 #define BLYNK_PRINT Serial
6
7 #include <WiFi.h>
8 #include <WiFiClient.h>
9 #include <BlynkSimpleEsp32.h>
10
11 char auth[] = BLYNK_AUTH_TOKEN;
12 char ssid[] = "Venky";
13 char pass[] = "Tenda@395";
14
15 BlynkTimer timer;
16
17 #define echoPin 32
18 #define trigPin 33
19 #include <Servo.h>
20 Servo servo;
21 long duration;
22 int distance;
23 int binLevel=0;
24
25 void SMeSensor()
26 {
27   int ir=digitalRead(34);
28   if(ir==HIGH)
29   {
30     servo.write(90);
31     //Serial.println("Servo moved to 90 degrees");
32   }
33 }
```

Output

Ln 63, Col 18 DOIT ESP32 DEVKIT V1 [not connected]

## C.RESEARCH PAPER

# SMART CITY AUTOMATED GARBAGE COLLECTING MANAGEMENT SYSTEM USING IOT

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**Abstract.** Waste disposal is one of the major problems in India irrespective of the state's growth and development area. This is a big problem in underdeveloped areas. Most of the time, garbage is not collected on time, so you see it littering the roadside. This waste causes epidemics and epidemics. A potentially life-threatening illness. Therefore, the proposed system finds a solution for waste disposal by designing a smart trash can that manages waste. The system uses sensors to detect the trash when the trash detects the total volume of the trash based on the total size of the trash. A notification is sent to the company office when the maximum level of trash is reached. This is done using a Wi-Fi module. This system helps in making the city clean. With this system, you don't have to check all your bins manually and get notified when your bins are full.

**Keywords:** WIFI module ESP32, Ultrasonic sensor HC-SR04, IR Sensor, Arduino IDE, Blynk 2.0, servo motor.

## 1 Introduction

Smart dustbins are growing at an exponential rate with the population. Migration is at an extreme. People's lifestyles are changing dramatically all over the world. One of the main problems it causes is the increase in waste volume. Pathogenic germs, insects, bacteria and viruses can multiply on this waste, leading to the spread of various diseases. In traditional waste management systems, cleaners are assigned to empty bins at specific times of the day. Such a strategy has several drawbacks. Inefficient and time consuming. At certain times of the day, cleaners will visit and empty the bins.

Is gaining importance worldwide and has many functions to perform. A smart city requires a smart lifestyle for its residents, and cleanliness is a basic requirement for a smart lifestyle. Therefore, we need to use technology to develop smart waste management strategies worldwide that make cities cleaner, greener, healthier and smarter. This white paper explores alternative waste management strategies to tackle the growing waste problem due to population explosion and increasing urbanization. To implement this alternative strategy, a new bin design with multiple sensors for real-time monitoring of waste levels in the bin is proposed. Whenever the level of waste in a bin exceeds a certain threshold, a notification is sent to the agency to ensure cleaning of the bin. Therefore, this alternative waste management strategy using real-time monitoring not only solves the problem of under-utilization of waste bins, but also the problem of over-filled waste bins, which litter the surrounding area. In our framework, smart managed containers are connected to the Internet and continuously receive data from smart containers. In recent years, the population has increased rapidly, which has increased the movement of waste.

## 2 Problem Statement

A major concern with our environment is waste management, which affects society in many ways and detection, monitoring and management of waste is a major problem in our present era. Throwing garbage into the trash is a laborious process and consumes more human effort, time, and cost which can be easily avoided with our proposed model, and no one needs to touch the dustbin while throwing the trash to reduce the spread of bacteria.

### 2.1 Related Work

Denik Solomon Hetal., in this paper they described how people prefer to live in a clean environment to live a healthy lifestyle. Both organic and inorganic waste from households is disposed of in common bins maintained by panchayats or municipalities or businesses. Garbage bins are overflowed by stray dogs dragging food waste from plying vehicles and garbage thrown by people, posing a serious health risk to nearby residents. There is awareness among Indians about Swachh Bharat Mission, but there are many challenges. The work proposed in this paper uses Arduino, a parallel switching network, two ultrasonic sensors, a servomotor, a GSM/GPRS module, a 4 x 4 matrix keyboard, a piezoelectric buzzer, and LEDs to implement a waste disposal management system. To enable it. The proposed waste management system is suitable for busy public places such as university campuses, shopping malls, railway stations and airports. It costs more to design than a regular trash can, but it lasts longer and is easier to use.

### 3 Methodology

In this section we introduced the Existing Methodology and explains the detailed working procedures of the proposed Methodology. The required hardware tools to design the device have been described in the subsequent paragraphs.

#### 3.1 Existing methodology

Functional block diagram of the existing garbage disposal system which includes the main components and modules like ultrasonic sensors, servo motors, GSM/GPRS module, 4x4 matrix keypad, parallel switching network and Arduino Mega 2560 microcontroller.

In the present method, the data collected by the ultrasonic sensor will be sent to the Arduino microcontroller, then an alert message will be sent to the target mobile phone using a GSM module.

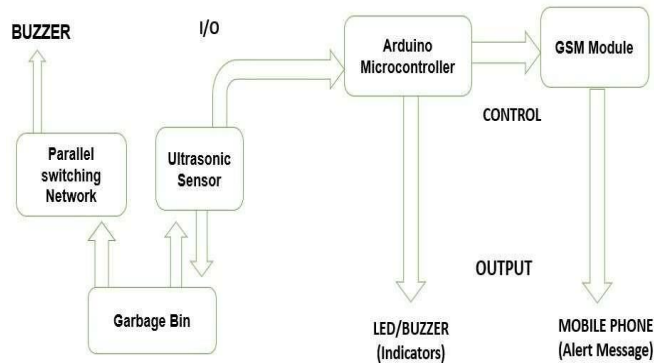


Fig. 1. Existing methodology

#### 3.2 Proposed methodology

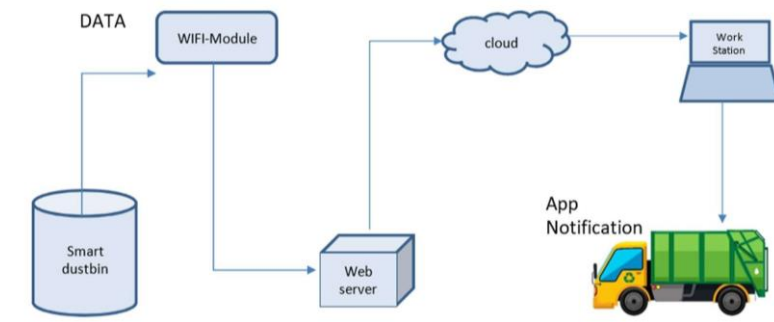
Every day, different types of waste accumulate in our homes. People will throw it in the trash. Some days the bin is full, some days it is not. A garbage collector comes every day and picks up this garbage. If the trash can is full, you have to use the incoming garbage collector, otherwise it will be a waste of fuel, time and effort, so please wait for another day or a few days. To know if the trash can is full, we designed a smart trash can with a sensor on the trash can, and the sensor will tell you if the trash can is full. This saves fuel, time and manpower, so garbage collectors can go to every street full of bins.



**Fig. 2.** Working diagram

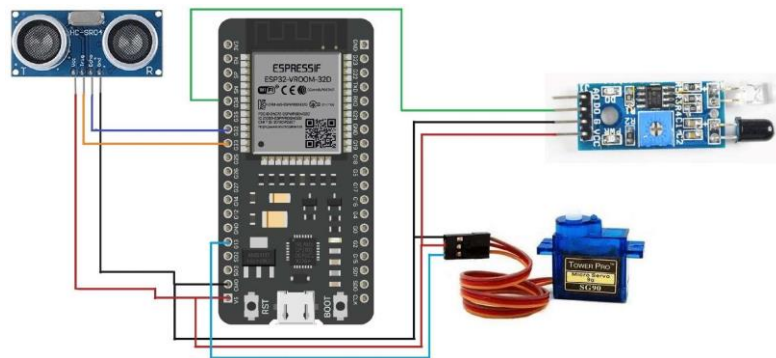
### 3.3 Architecture of Proposed Methodology

The data from the smart dustbin will be collected by the wifi module ESP32 and then it connects to web server, using this the collected data will be stored on Blynk cloud. Data from the cloud will be accessed by the work station, it gets processed to Truck drivers.



**Fig. 3.** Architecture of proposed methodology

### 3.4 Circuit Diagram



**Fig. 4.** Circuit Diagram

All connection given as per circuit diagram. Here we use Wi-fi Module ESP32, Servo Motor, IR Sensor, Ultrasonic Sensor, Arduino IDE, Blynk Cloud, Jumper wires and 12Watts power supply.

## 4 Conclusion

In this proposed method, this smart dustbin detects the amount of garbage in the trash can, and when a person comes in front of the trash tin, it recognizes the person and automatically opens and closes in time. Sending data remotely to data subjects allows them to access information anytime, anywhere, and on-going information transmission and access avoids flooding the trashcan. This IoT-based waste management is very useful for smart urban areas from many perspectives. In urban communities, there are countless trash bins in various places, and when they fly, the experts involved can We have not received any data on This task outlines the layout of the problem to show points of interest for trash cans in different areas of the city. Your subject matter expertscan access your data anytime, anywhere. This way they can make their choice quickly.

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