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Survey on IOT Based Smart Garbage Monitoring System Using GSM and GPRS

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Abstract: The level of hygiene in relation to the waste management system has drastically deteriorated as a result of population growth. The overflow of garbage from public locations results in a contaminated state in nearby areas. For those in the vicinity, it may exacerbate several serious illnesses. This will degrade the affected area's appraisal. "Smartness based waste management system" is needed to remove or mitigate the garbage and preserve cleanliness. In this study, a smart waste clean management system based on IOT is proposed. Sensor systems are used to monitor the waste level above the dustbins. As soon as it recognized, this system changed to worry about authorization via GSM/GPRS. The GSM/GPRS system and the sensor system in this system are interfaced by a ESP32(WROOM 32).

Key Terms: IOT, Waste Monitoring, ESP32(WROOM 32), GSM/GPRS, HC-SR04 Ultrasonic Sensor

I. INTRODUCTION

For most countries worldwide, managing garbage is one of the most difficult jobs when it comes to metropolitan or city areas. Maintaining a green environment requires a well-organized garbage removal system [1].

Numerous expert mechanisms are currently available for both dealing and controlling garbage. However, there is a big, difficult duty absent in the information gathering process. The rapid national expansion rate in dense suburban areas will be impacted by this misconception, which is also driving up demand for urban ecological protection. The lack of cooperation between the government, the populace, and local authorities for the transportation and processing of garbage makes it extremely difficult to develop a prototype for the waste management system. The current method of collecting rubbish is conventional, requiring a lot of labor and taking a long time [1].

The Internet of Things, or IoT, is a network of related physical objects that can be accessed over the internet. A physical device with sensor capabilities that can send data via an IP address and automatically communicate with a base station might be considered the "thing" in the Internet of Things. This technology facilitates the object's interaction with its inside and outside while revolving around the selected option. The Internet of Things allows multiple systems to communicate with one another. The items can incorporate modern technology that is globally operative and monitorable. This will benefit those who are able to include more data from other sources, which is assurance of boosting efficiency and recovering defense and safety.

The technology known as the GSM and GPS Based Garbage and rubbish collecting Bins Overflow Management System monitors the amount of rubbish in the waste collecting bin by using GSM and GPS that are powered by satellites and ground-based stations. A level sensor is used for monitoring, and when the amount of rubbish in the bin hits the threshold, the GSM module is triggered. In this instance, a short message service (SMS) is used by the GSM module to alert the person in charge of collecting. The GPS receiver also gives the exact location of the bin that is ready for collection at that moment. As a result, this project offers an effective method of collecting trash.

This research is crucial since it will enable timely waste collection and prevent overflow.

Control system functionality will be better understood by researchers, which will improve national sanitation standards overall.

But this project addresses the simple function of tracking the amount of trash in the bins and providing the precise position of the bins at a specific time.

This project makes use of an ESP32(WROOM 32), SIM800L GSM module, GPS modem, HC-SR04 Ultrasonic sensor, and the 9V DC power supply to achieve the objectives

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II. LITERATURE SURVEY

The literature reviewed several publications to get details on the previous research that has been done.

S. Vinoth Kumar, T. Senthil Kumaran, A. Krishna Kumar and Mahantesh Mathapati proposed, A smart waste management system using IoT is proposed to address this issue. The system checks waste levels in bins using sensor systems and then adjusts to GSM/GPRS when detected. A microcontroller is used as an interface between the sensor system and GSM/GPRS system. An android application is developed to monitor and integrate waste levels in different locations, promoting greener environments and supporting the Swachh Bharat for cleanness. The IoT technology can be used to connect physical devices with sensor capabilities, enabling Smart Garbage Monitoring and Clearance System using Internet of Things to interact with various systems over the internet [1].

Krishna Nirde, Prashant S. Mulay and Uttam M.Chaskar proposes an IoT-based solid waste management system for smart cities, allowing municipal corporations to remotely monitor dustbin status and keep cities clean. The system optimizes cost and time by detecting when dustbins reach their maximum level, and alerts the waste management department via SMS via a GSM module. The aim is to enhance the practicality of this system, reducing operational costs and improving waste management. The system can be deployed in general-purpose dust bins in public places, allowing for efficient waste management [2].

Miss. Megha S. Chaudhari, Mrs. Bharti Patil and Mrs. Vaishali Raut proposed the implementation of a smart garbage management system using ultrasonic/weight sensors, microcontrollers, and communication modules. The system ensures the cleaning of dustbins when the trash level reaches its maximum, and if not cleaned within a specific time, the record is sent to a higher authority. The system also screens fake reports, reducing the number of trips to trash collection vehicles and reducing waste consumption. The paper also discusses the use of genetic algorithms (GA) as a tool for garbage collection optimization, helping to use garbage trucks more efficiently in overloaded areas. The paper also discusses the importance of collecting urban knowledge on a city-wide scale in smart cities, introducing Cruisers, an automotive sensing platform for smart cities [3].

Ngosa Willie, Kapata Lucy, Katawa Shadrick, Phiri David Victor and Sinonge John proposed a project focuses on a dust bin monitoring system using GSM for low cost and easy implementation. It uses an ultrasonic sensor to detect waste material levels in garbage bins and communicates with a control room via GSM. A GUI is developed to supervise garbage collection and management, ensuring a healthy environment. The system uses an Arduino Mega 2560, HC-SR04 ultrasonic sensor, SIM900 GSM Module, and GPS Modem for wireless communication [4].

III. PROPOSED SYSTEM DESIGN

The ESP32(WROOM 32), HC-SR04 Ultrasonic Sensor, GPS Modem, SIM800L GSM Module, and the 9 V DC supply are all integrated into the proposed system.

The ESP32(WROOM 32) activates the ultrasonic sensor, which is positioned on top of the trash can and measures the amount of waste within. The sensor signals the ESP32(WROOM 32), which then turns on the GPS modem and the GSM module, when the amount of trash in the bin meets the threshold value. The location of the bin is recorded by the GPS modem and relayed to the GSM module.

The message and the bin's location (coordinates) are then combined by the GSM Module. The truck driver, who is the waste collector, is now notified with this combination. In addition, a second communication alerting the Central Office of the collector's notification is delivered. The system's overall block diagram is displayed in Figure 1.

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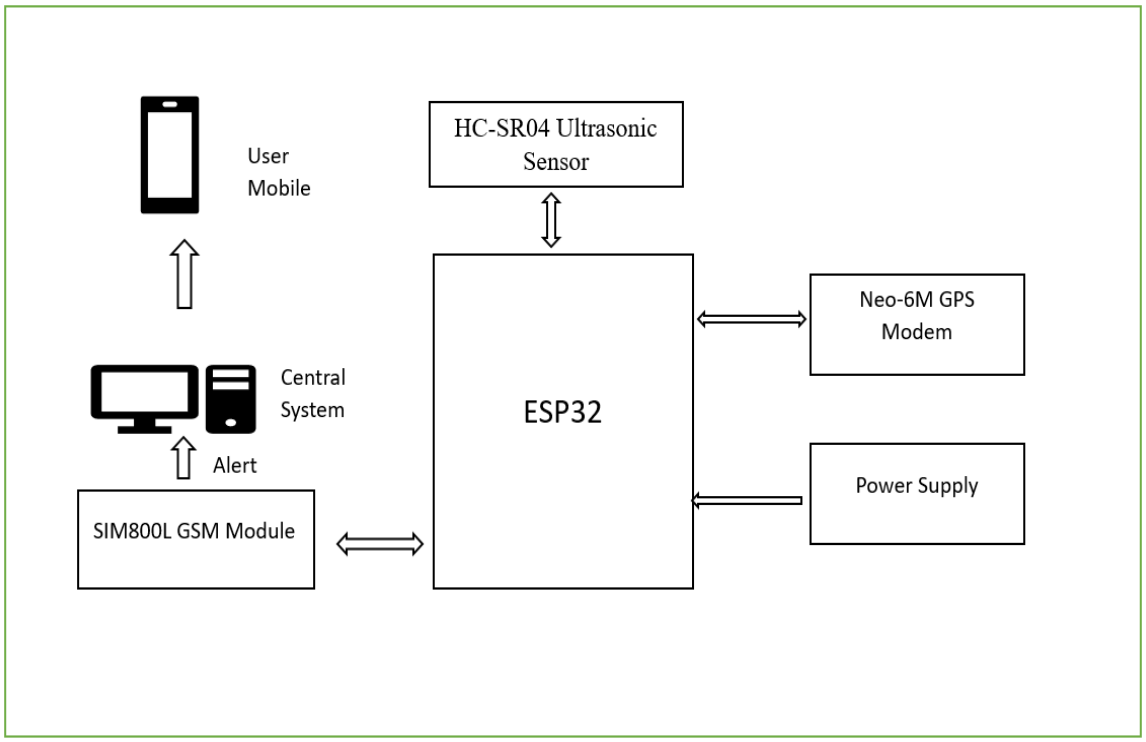

Figure 1: Block Diagram of GSM and GPS Based System

Sensor: The system typically begins with a sensor, such as the HC-SR04 Ultrasonic Sensor, which collects data from the microcontroller (such as the ESP32(WROOM 32)) and measures a certain parameter, such as the amount of trash in a bin. The ESP32(WROOM 32) microcontroller serves as the system's brain. It gathers information from the sensor, analyzes it, and uses that information to guide decisions.

The microcontroller initiates additional actions when a predetermined condition is satisfied, such as when the trash can is filled. GPS Module: The system's location is determined using the GPS module. In order to obtain accurate latitude and longitude coordinates, which offer real-time location data, it communicates with GPS satellites. GSM Module (SIM800L): Communication is handled by the GSM module.

It can connect to the internet via a cellular network and send and receive text messages. It communicates with the microcontroller through an interface to send commands, data, or alerts. The Central Office component is usually a cloud-based platform or a central server that receives and processes data from various system installations. In addition, it may have to oversee and manage the concurrent operation of several systems.

The sensor provides data to the microcontroller by continuously measuring the parameter (such as the trash level). After processing the data, the microcontroller triggers the GPS module when a predetermined condition is satisfied (e.g., the trash can is full).

The GPS module sends the microcontroller the coordinates of its current location. The microcontroller transmits the pre-programmed message ("Trash bin is full") along with the location data to the GSM module.

The central office and the waste collector (such as a truck driver) may be among the predefined recipients to whom the GSM module sends this message via the cellular network. Multiple arrows demonstrate the various systems from which central office receives data. It can carry out a number of operations, such as scheduling waste. The overall flow of system is shown in the figure 2.

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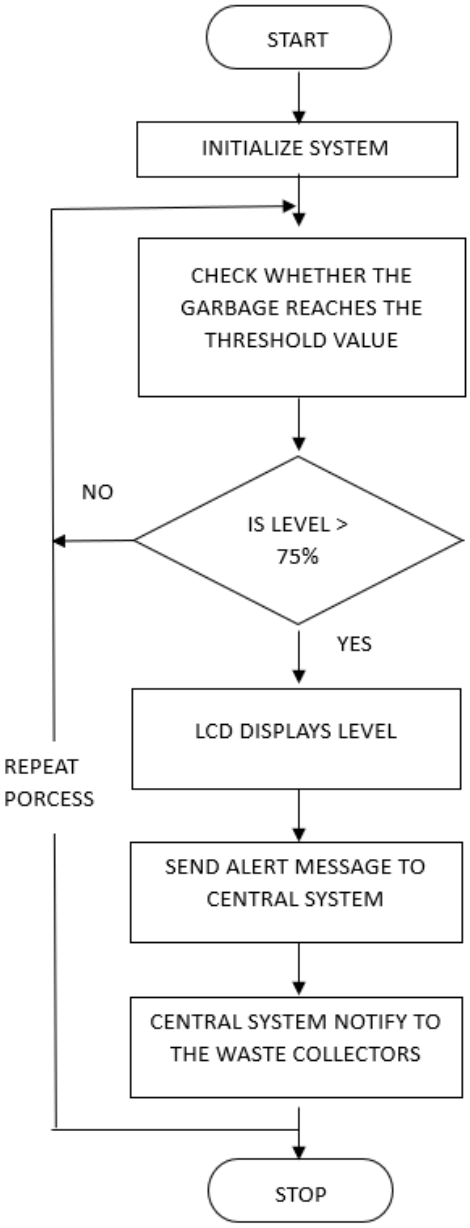

Figure 2: System Flowchart

IV. CONCLUSION

Waste management is one of the most difficult problems in the entire world. If it is not disposed of or cleaned properly, it will ruin the green environment and lead to many diseases. To dispose of the waste properly, new mechanisms are required. We have created a productive waste management system for our project. Better methods of disposing of waste in cities are made possible using technology.

To show whether the bins are filled or empty, we have sensors. A truck driver is alerted to clean the bin once it is filled. With the help of this system, the current state of the bins—which are frequently left in a pitiful state, full of trash and not cleaned is being eliminated.

This project was completed in a comfortable manner and provided valuable insight into preserving the environment.

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