IOT BASED SMART DUSTBIN MONITORING AND ALERT SYSTEM USING GSM

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Abstract

Waste management is a critical aspect of developing smart cities. The "Smart Dustbin for Smart City with SMS Alert Using Arduino GSM" aims to address this challenge by introducing an efficient and technologically advanced solution for waste collection. This system integrates a smart dustbin with sensors and GSM technology to automate the waste monitoring process.The smart dustbin is equipped with an ultrasonic sensor to monitor the fill level of waste in real-time. When the dustbin reaches its capacity threshold, an SMS alert is sent to the municipal authorities or waste management team using an Arduino microcontroller interfaced with a GSM module. This ensures timely waste collection, reducing overflow and promoting cleanliness in urban areas.The system is cost-effective, easy to implement, and scalable, making it suitable for large-scale deployment in smart cities. By leveraging IoT and GSM technology, this solution minimizes manual monitoring efforts, enhances operational efficiency, and contributes to a cleaner and more sustainable urban environment.This project represents a step forward in leveraging technology for smart waste management, aligning with the goals of smart city initiatives worldwide.

***Keywords*:** Ultrasonic Sensor, GSM Module, Arduino Uno,Gps Neo 6M, Lcd display.

I. INTRODUCTION

As the world is in a stage of up gradation, there is one stinking problem we have to deal with. Garbage!In our daily life, we see the pictures of garbage bins being overfull and all the garbage spills out. Thisleads to the number of diseases as large number of insects

and mosquitoes breed on it. A big challengein the urban cities is solid waste management not only in India but for most of the countries in the world. Hence, such a system has to be built which can eradicate this problem or at least reduce it to the minimum level. The project gives us one of the most efficient ways to keep our environment cleanand green. The smart city concept is still new in India, although it has received a lot of attention in few years when our present Prime Minister gave the idea of building 100 smart citiesthroughout India.Now, with the upcoming large number of smart cities, large numbers of responsibilities are also required to be fulfilled. The prime need of a smart lifestyle begins with cleanliness and cleanliness begins with dustbin. A society will get its waste dispatched properly only if the dustbins are placed well and collected well. The main problemin the current waste managementsystem in most ofthe Indian citiesisthe unhealthystatus of dustbins. In this paper we have tried to upgrade the trivial but vital component of the urban waste management system.

II. LITERATURE SURVEY

- **"Smart Waste Management Using IoT and GSM Technology"**

This study highlights the role of Internet of Things (IoT) and GSM technology in automating waste management processes. It discusses systems where sensors monitor dustbin fill levels and send notifications to designated authorities using GSM modules. The study emphasizes cost-effectiveness and reduced human intervention as key benefits.

- **"IoT-Based Garbage Monitoring System for Smart Cities"**

Researchers proposed a solution to integrate smart sensors in dustbins to detect waste levels and communicate the data to municipal servers through IoT platforms. While primarily focused on Wi-Fi and Bluetooth-based communication, the paper outlines the challenges of network dependency in large-scale implementations, making GSM a more reliable alternative for remote areas.

- **"Smart Dustbin System for Efficient Waste Management in Urban Areas"**

This research introduces the use of ultrasonic sensors to measure waste levels in bins. The integration of GSM technology is suggested as an effective method for sending SMS alerts when bins are full. The study highlights the environmental benefits of optimized waste collection and reduced fuel consumption for waste collection vehicles.

- **"Arduino-Based IoT Applications for Smart Cities"**

The paper discusses the versatility of Arduino in developing smart city solutions, including waste management. It explores how Arduino can be interfaced with various sensors and communication modules, such as GSM, to create efficient systems. Case studies show the successful implementation of such systems in urban areas.

- **"A Comprehensive Review of Smart Waste Management Systems"**

This literature reviews various smart waste management solutions using technologies like RFID, Zigbee, and GSM. The review identifies GSM as a robust communication method for transmitting real-time data over long distances, making it suitable for applications in smart cities.

- **"Impact of Smart Dustbins on Urban Waste Management"**

This research highlights the potential impact of smart dustbins on urban cleanliness and hygiene. It evaluates systems where real-time waste level monitoring and SMS alerts reduce manual inspections and improve waste collection efficiency. The study also discusses how such systems align with sustainable development goals.

III. METHODOLOGY

3.1 Block Diagram

The basic operation of the system. The fullness status of the bin is determined by calculating the distance between the lid of the bin and the trash by using a sensor. A distance threshold will be set according to the bin dimensions. When the distance measuring sensor indicates that the bin is full, then a microcontroller board will control a GSM module to send SMS alert that contains bin ID and alert message to a predefined phone number. The location of the bin is predefined by a sanitary workerwho will identify the filled bin by its ID which received by the SMS alert. The system will return to default operation when the bin is emptied by the sanitary worker.

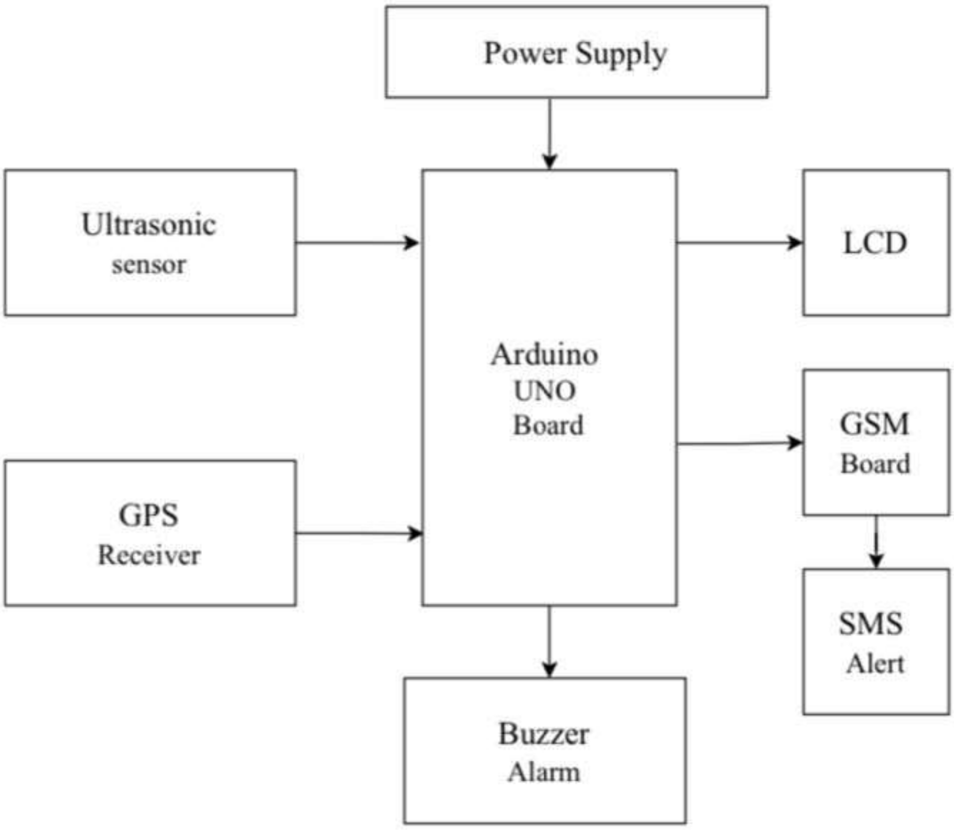

Figure 1 - Block Diagram of Project

IV. HARDWARE DESCRIPTION

4.1 Ultrasonic Sensor

Ultrasonic sensors measure distance by using ultrasonic waves. The sensor head emits an ultrasonic wave and receives the wave reflected back from the target. Ultrasonic Sensors measure the distance to the target by measuring the time between the emission and reception. An optical sensor has a transmitter and receiver, whereas an ultrasonic sensor uses a singleultrasonic element for both emission and reception.

Figure 2 - Ultrasonic Sensor

4.2 GSM SIM 800

GSM (Global System for Mobile communications) is an open, digital cellular technology usedfor transmitting mobile voice and data services. GSM differs from first generation wireless systems in that it uses digital technology and Time Division Multiple Access (TDMA) transmission methods. GSM is a circuit-switched system that divides each 200 KHz channel intoeight 25 KHz timeslots. GSM operates in the 900 MHz and 1.8 GHz bands in Europe and the 1.9 GHz and 850 MHz bands in the US. The 850 MHz band is also used for GSM and 3 GSM in Australia, Canada and many South American countries. GSM supports data transfer speeds of up to 9.6 kbit/s, allowing the transmission of basic data services such as SMS (Short Message Service). Another major benefit is its international roaming capability, allowing users to accessthe same services when traveling abroad as at home. This

gives consumers seamless and samenumber connectivity in more than 210 countries.

Figure 3 - Gsm Sim 800

4.3 Arduino Uno

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino programming language (based on Wiring), and the Arduino Software (IDE), based on Processing

Figure 4 - Arduino Uno

4.4 GPS NEO 6M

At the heart of the module is a GPS chip from U-blox – NEO-6M. The chip measures less than a postage stamp but packs a surprising amount of features into its tiny frame.It can track up to 22 satellites over 50 channels and achieve the industry’s highest level of tracking sensitivity i.e. -161 dB, while consuming only 45 mA current.Unlike other GPS modules, it can perform 5 location updates in a second with 2.5m horizontal position accuracy. The U-blox 6 positioning engine also has a Time-To-First-Fix (TTFF) of less than 1 second.

Figure 5 - Gps Sim 6M

V. WORKING

□1. After wiring and attaching all the devices and setting up to the Smart Dustbin, now observeall the important setup whether they are well connected or somethingmissed.

□

2.After connection set up now next step is to submit/upload code in Arduino and supply power to the circuit.

□

3.When system is powered ON, Arduino keeps monitoring for any things that come near the sensor at give range.

□

4.When Ultrasonic sensor detect any object for example like hand or others, here Arduino calculates its distance.

□

5. As soon as the thrash in the bin reaches a threshold value GSM will send a message to the concerned for immediate action.

VI. RESULT

The **IoT-Based Smart Dustbin Monitoring and Alert System using GSM** successfully automates waste management by providing real-time monitoring of dustbin fill levels. The system effectively detects waste levels using an **ultrasonic sensor**, processes data through a **microcontroller (Arduino/ESP8266)**, and sends **SMS alerts** via the **GSM module (SIM800/900A)** when the bin reaches a predefined threshold (e.g., 80% full).

Key Achievements:
✅**Accurate Monitoring:** The system continuously tracks waste levels with minimal error.
✅**Timely Alerts:** Municipal authorities receive instant notifications when bins need to be emptied.
✅**Cost & Time Efficiency:** Reduces unnecessary trips for waste collection, optimizing resources.
✅**Scalability:** Can be deployed across multiple locations for smart city waste management.
✅**Improved Hygiene:** Prevents overflow, reducing environmental pollution and health risks.

The system demonstrates a **successful real-world application** in improving urban waste management. Future enhancements like **GPS tracking, AI-based waste prediction, and mobile app integration** can further optimize its efficiency.

Figure 6 - dustbin indication

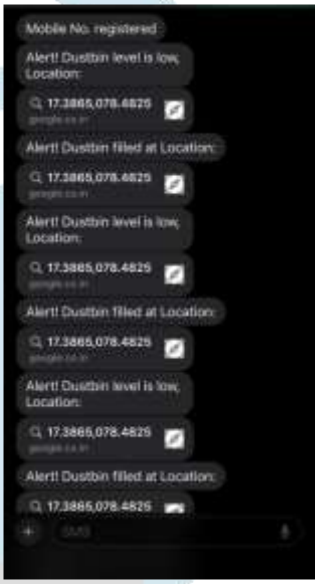

Figure 7 - location message

VII. CONCLUSI0N

Here we are going to make an evolution change toward cleanliness. The combination of intelligent waste monitoring and trash compaction technologies, smart dustbins are better and shoulders above traditional garbage dustbin. It is equipped with smart devices like sensor Arduino etc. Lid of the dustbinwill automatically open when an object comes near to the dustbin and after certain time period it will close the lid. For society, it will help towards health and hygiene so that normal people to rich people can take benefit from it.For correct maintenance and correct observation of the waste, an Arduino based wise alert system is devised. This method averts their regular cleanup of the garbage can by sending caution messages to the particular number periodically and it helps in the cleaning process in real time so this process can be considered as an outstanding performance for the surroundings. In this process it diminishes the number of human resources needed. Thus, the process of cleaning becomes faster compare to the manual process.

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