

SMART DUSTBIN WITH IOT NOTIFICATIONS

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ABSTRACT

In today's fast-paced world, efficient waste disposal is a critical need because maintaining a healthy and sustainable environment is becoming increasingly challenging. Busy lifestyles often result in overflowing dustbins that go unnoticed, leading to unhygienic conditions, foul odors, and the spread of infections. This emphasizes the urgent necessity for a systematic and automated approach to waste management. The Smart Dustbin with IoT Notifications is a modern solution that integrates advanced hardware components for real-time monitoring of waste. Equipped with ultrasonic sensors, the system detects and reports garbage levels and sends timely notifications to ensure it is disposed of on time. This smart system minimizes manual intervention, enhances cleanliness, and fosters a healthier environment through efficient management of waste. It addresses key hygiene challenges and contributes to sustainable living practices through the automation of the monitoring process.

1. INTRODUCTION

Proper waste disposal is fundamental to a healthy and sustainable environment. Open dumping and waste collection from exposed dumpsites have been a source of various health risks, such as skin infections and chronic illnesses. The Internet of Things, or IoT, refers to a network of interconnected physical devices embedded with sensors, software, and technologies that enable them to exchange data seamlessly. IoT enables the sensing, data collection, storage, and processing of physical objects by linking them to the internet, which drives innovation in various domains, including waste management.

This paper proposes a system that optimizes waste collection processes. The system uses IoT-enabled mechanisms to monitor and manage dustbins, ensuring timely disposal of garbage. It integrates an ultrasonic sensor to detect the real-time levels of waste and sends alerts when a bin approaches its maximum capacity. This mechanism ensures that if immediate disposal is not possible, it includes an extra mechanism by which bins can store waste for two more days. Thus, flexibility and reduction of overflow incidents are ensured. Overflowing bins are a common view in urban areas, with unpleasant odors and unsanitary conditions. Such areas breed germs and viruses and thus lead to diseases. As the population is increasing rapidly and so are the waste generations, the necessity to keep the surroundings clean and hygienic is more urgent than ever. With the help of this IoT-based solution, waste management will be much more efficient in reducing health risks and maintaining a cleaner environment. This system will thus align with the sustainable development goals and better quality of life by reducing one of the most pressing urban challenges.

2. LITERATURE SURVEY

SL.NO	TITLE OF THE PAPER & AUTHOR	JOURNAL & PUBLISHED DATE	REVIEW	RESEARCH GAP
1	Smart Garbage Monitoring System Using IOT Authors: Dr. Ihtiram Raza Khan Mehtab Alam Anuj Razdan	SSRN Electronic, February 2021	This research paper presents an IoT-based smartsystem designed for efficient waste management by monitoring the waste levels in dustbins using sensory technology. The system includes a microcontroller as the central component, which acts as a bridge between the sensors and the IoT network. Assessing waste levels in real-time, the proposed solution	The truck is called every time the garbage bin is full which can happen several times a day making the process time consuming and resource inefficient.

			ensures timely alerts and disposal.	
2	Smart Garbage Management System for a Sustainable Urban Life: An IoT Based Application Authors: Minhaz Uddin Sohag Amit Kumer Podder	ScienceDirect, June 2020	This system integrates an identification module for tracking usage; an automatic lid open- close mechanism for hands-free operation; a display interface for real-time status.	The system discussed in this report is extortionate and revolves around human intervention in the functioning where there is clear lack in automation without human intervention
3	Garbage Management using Internet of Things. Authors: Mrs. Pallavi Nehete Dhanshri Jangam Nandini Barne Prajakta Bhoite Shalaka Jadhav	International conference on Electronics, Communication and Aerospace Technology (ICECA), March 2018	The smart dustbin, integrated with a GSM module, uses an IR sensor to notify its levels of garbage. Water sensors are also included that identify wet waste, aiding in effective segregation and disposal of waste.	Uses GSM which is relatively old (can use GPRS
4	Garbage Monitoring System Using IOT Authors: Ashima Bajaj Sumanth Reddy	International Journal of Pure and Applied Mathematics, November 12, 2017	This system uses a microcontroller, an LCD screen, and Zigbee technology for efficient data transmission. Ultrasonic sensors monitor the garbage levels in the bins, while the LCD screen displays real-time status updates for effective waste management. level of garbage collected in the bins.	It suffers from the same drawbacks of being time consuming and resource inefficient as technology used is not practical with output and time parameters i.e., a garbage truck should only come in a periodical manner.

3. BLOCK DIAGRAM

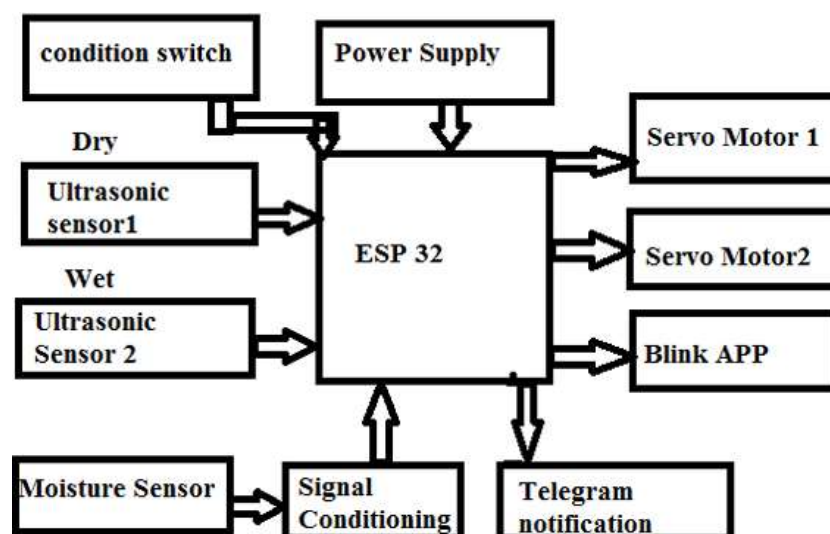


Figure 1: Block Diagram

4. WORKING

- The ESP32 is used to program and control the system. It is programmed to give instantaneous information about the percentage of dry and wet waste produced.
- There are two ultrasonic sensors that measure the garbage levels in the dustbin. One is for the dry side, and the other

is for the wet side.

- Two servo motors used to flip the lids or open the caps of the dry and wet compartments are controlled by a condition switch.
- A moisture sensor measures the moisture content in the garbage and sends data to the ESP32, which determines whether the garbage is dry or wet. The information is then displayed on the Blynk app and alerts users via Telegram.
- The Blynk app gives a graphical representation of the garbage levels.
- The real-time notifications about the exact amount of garbage left in the bin along with its location are sent through Telegram..

4.1 Hardware Requirements

- ESP 32
- Ultrasonic Sensor (HC-SR04)
- Moisture Sensor
- Servomotor
- Dustbin
- Cables and connectors
- Condition Switch

4.2 Software Requirements

- Arduino Compiler(IDE)
- Blynk App
- Telegram

4.3 Components Details

A. Ultrasonic Sensor (HC-SR04)

The Ultrasonic Sensor is a sensor that uses ultrasonic sound waves to measure the distance to an object, such as garbage. The sensor has a transducer which sends and receives ultrasonic pulses. The duration of the pulse depends on how close the object is. This sensor can detect objects as well as waste materials. The HC-SR04 ultrasonic sensor is applied in this application to measure the distance between the top of the dustbin lid and the top of the garbage.



Figure 2: Ultrasonic Sensor (HC-SR04)

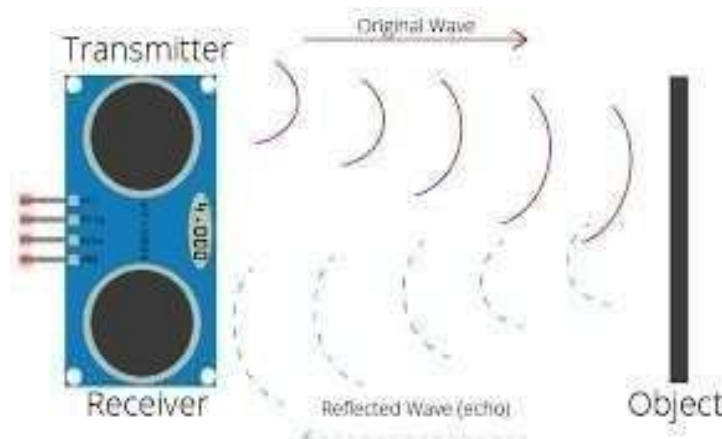


Figure 3: Working of Ultrasonic Sensor (HC-SR04)

- The ultrasound transmitter or trigger pin emits a high-frequency sound wave at 40 kHz.
- The sound travels through the air and bounces off an object back toward the module.
- The echo, or reflected sound, is then detected by the ultrasound receiver or echo pin, and used to calculate the distance from the sensor to the object.

B. ESP32

The ESP32 is a low-cost, low-power series of System-on-Chip (SoC) microcontrollers and modules from Espressif Systems. It offers Wi-Fi and Bluetooth connectivity,

making it perfect for IoT applications. The ESP32-D0WDQ6 chip is built on a Tensilica Xtensa LX6 dual-core microprocessor operating at frequencies of up to 240 MHz, thus ensuring robust performance and seamless communication with other systems. chip ESP32-D0WDQ6 is based on a Tensilica Xtensa LX6 dual core microprocessor with an operating frequency of up to 240 MHz.



Figure 4 ESP 32

C. Servo Motor

A servo motor is designed to precisely control its shaft position based on a control signal. It's used in applications like steering remote-controlled airplanes or drones, flow control systems, and robotic wheels.

A servo motor houses a DC motor, control circuit, and gearbox inside a plastic casing. The pulse width modulation (PWM) signal controls the position of the shaft such that the pulse width dictates the rotational direction. The positioning is achieved by a 1 ms pulse in a clockwise direction and 2 ms in counterclockwise. A pulse of 1.5 ms



Figure 5 Servo Motor

would usually position the shaft in the centre. This is particularly enabling applications that do need very accurate and continuous adjustment.

D. Capacitive Soil Moisture Sensor

For measuring soil moisture levels, a Soil Moisture Sensor is needed, and for this application, a capacitive type sensor is preferred. The analog capacitive soil moisture sensor works by measuring soil moisture through capacitive sensing, where the capacitance varies based on the water content in the soil. This capacitance is then converted into a voltage, typically ranging from 1.2V to 3.0V. One of the main advantages of capacitive soil moisture sensors is that the material used is corrosion-resistant, which helps increase the service life. Capacitive Soil Moisture Sensor v2.0 operates between a DC voltage of 3.3V and 5.5V and delivers an output voltage reaching as high as 3V in analog form..



Figure 6 Capacitive Soil Moisture Sensor

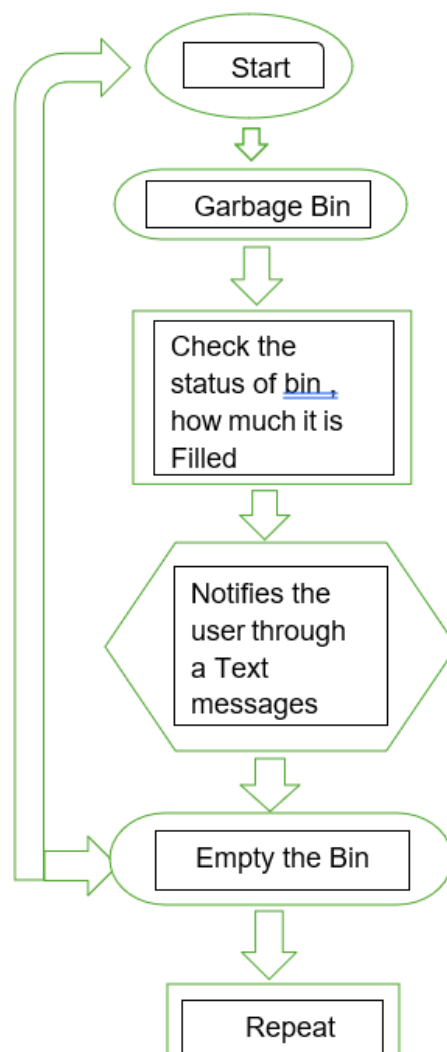
E. Jumper Wires



Figure 7 Jumper Wires

Jumper wires are flexible wires with connector pins at both ends, thus making easy connections between two points without soldering. Such wires are mostly used along with breadboards and other prototyping tools, providing an easy means of establishing temporary connections. The jumper wires make it easy to modify and reconfigure circuits in the prototyping and testing phases of a project.

4.4 Flow Chart



A flowchart is a graphical representation of a process or workflow. It outlines the steps involved in a task in a visual way, where each step is represented as a box of a particular type. The order of operations is depicted by drawing arrows between these boxes to indicate the sequence in which the steps are to be carried out. Flowcharts are used very often to represent algorithms and guide decision-making in solving problems by depicting each action in a clear, step-by-step manner.

Sequence Diagram A sequence diagram depicts the interaction between objects in terms of time to realize a specific result. It provides a view of the event sequence and message passing and thus is a useful tool for analysis, design, and documentation of system processes.

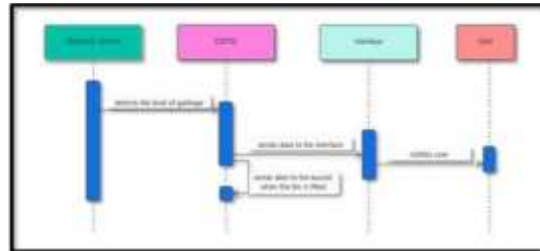


Figure 8 : Sequence Diagram

4.5 Data Flow Diagram

A data-flow diagram (DFD) is a graphical means of showing how data moves within a system or process. It uses a combination of symbols, including rectangles, circles, and arrows, together with short text descriptions for data inputs, outputs, storage points, and relationships between them. The diagram shows the interplay between various components in a system and how these components exchange information with one another. The primary components in a DFD are:

1. External Entity
2. Data Flow
3. Process
4. Data Store

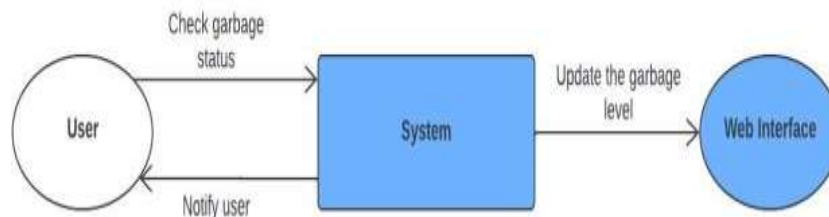


Figure 9 Level 0 data flow Diagram



Figure Level 10 Data Flow Diagram

5. RESULTS

The Smart Dustbin can be further developed with IoT notices wherein interconnectivity and communication could possibly be established between multiple dustbins using IoT technology. By way of example, using multi-compartment bins separating several types of waste, which included liquid, biodegradable waste, and nonbiodegradable waste, should overall improve the efficiency of waste management and the notification system for alerting updates across numerous different locations within the entire network.

This project involves Nextgen Dustbin IoT technology. It sends real-time notifications using Blynk and Telegram applications. The ultrasonic sensor is used to measure the level of waste in the dustbin, and a microcontroller is used to process the data that is transmitted over the internet to the respective applications.

The project shows the possible implementation of IoT by effectively linking devices with sensors, processors, and communication technologies. With the real-time exchange of data over the internet, this addresses common waste management problems often overlooked because of busier schedules of people, giving a more efficient solution for the disposal of wastes in this modern world.

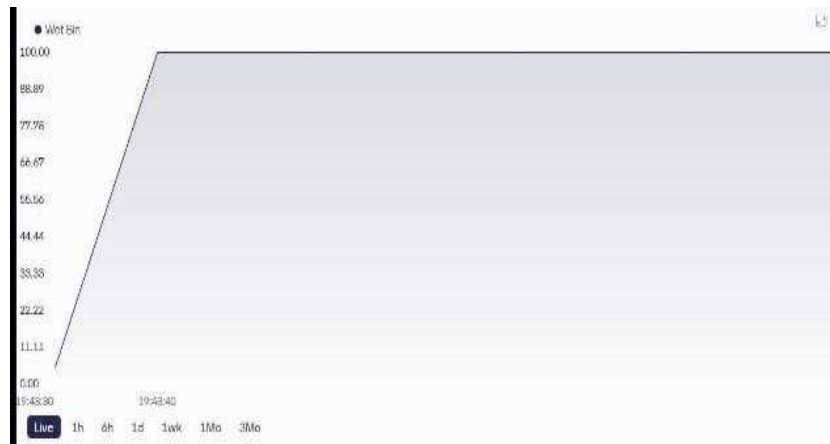


Figure: 11 Wet Bin Graph

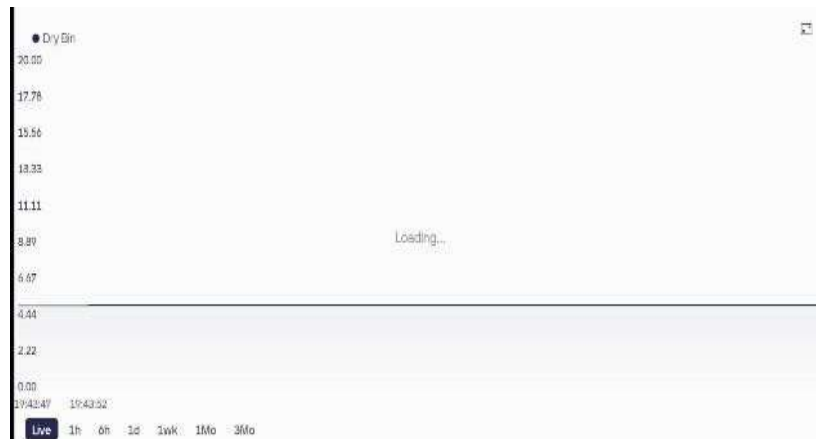


Figure 12: Dry Bin Graph

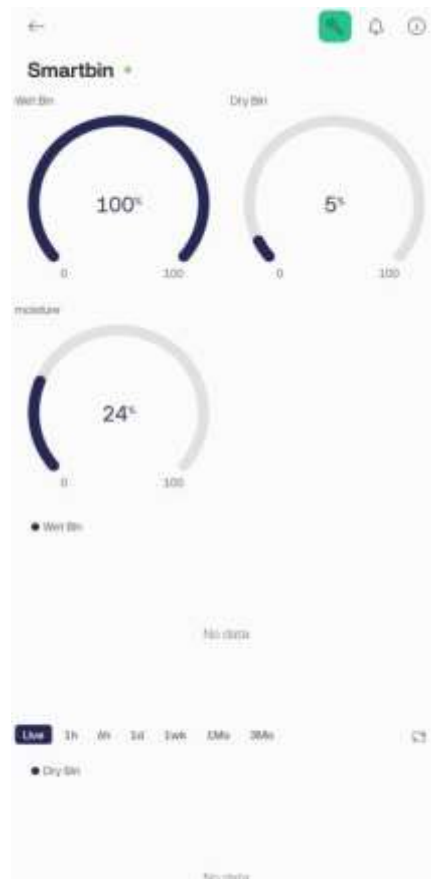


Figure 13: garbage status on blynk app

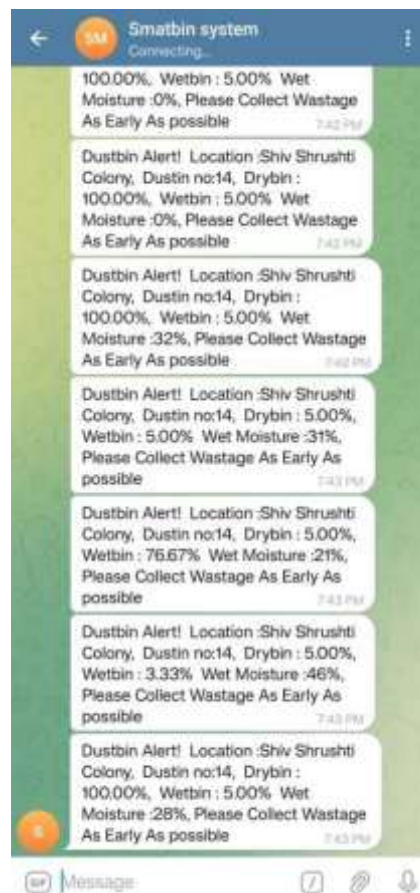


Figure 14: Test Notifications on Telegram

6. CONCLUSION

The proposed system, “Smart Dustbin with IOT Notifications” offers an effective solution to the challenges of waste management by addressing the issue of overflowing garbage bins. Utilizing IoT technology, this system provides real-time monitoring of waste levels and notifies users through the Blynk app and Telegram when the bin requires emptying. By automating the monitoring process, the system reduces manual intervention and ensures timely disposal, thereby contributing to cleaner and healthier environments.

This project demonstrates the potential of IoT in optimizing waste management systems, making them more efficient and user-friendly. The integration of sensors and communication technologies eliminates the need for frequent manual checks, reducing resource wastage and enhancing operational efficiency. With its scalable design, this system can be deployed in various settings, including public spaces, offices, and commercial areas, promoting overall environmental sustainability and hygiene.

7. FUTURE SCOPE

Furthermore, the automated waste management system developed would be one that will monitor the levels of the garbage in an accurate and timely manner and pick, classify, and put the respective wastes in their respective binning sites. A number of improvements could be made and lead towards greater improvements for keeping a place healthy, more so than cleaning it.

Possible enhancement would be having multiple connected bins, which could automatically determine the nature of waste and put it into its respective colored-coded bin for different categories. Other dynamic features may be added to the project in order to enhance its functionality, efficiency, and adaptability toward changing the revolution in the world of waste management.

8. REFERENCES

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