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Smart Garbage Monitoring System Using IoT

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ABSTRACT: In this paper we have discussed about smart garbage monitoring system using Iot to maintain cleanliness in our society and hygienic environment with the help of Iot based Technology. In this proposed system we have used Arduino Uno, Ultrasonic Sensor, Smoke Sensor, Moisture Sensor, Buzzer, Node mcu ESP8266, Lcd Display, and DC Motor, Garbage Bin. With the help of sensors we are able to detect the garbage and respective garbage level present in garbage bin. The overall collected data is notified to respective area's municipal corporation and bins should be emptied as soon as possible.

KEYWORDS: Ultrasonic Sensor, Time Efficient, Environment Friendly, Garbage waste, Iot Technology, Blynk, ESP8266

I. INTRODUCTION

IoT or Internet Things refers to the network of connected physical objects that can communicate and exchange data among themselves without the desideratum of any human Intervention In this project, we are going to propose a system for the immediate cleaning of the dustbins. As dustbin is considered as a basic need to maintain the level of cleanliness in the city, so it is very important to clean all the dustbins as soon as they get filled. We will use ultrasonic sensors for this system. The sensor will be placed on top of bin which will help in sending the information to the office that the level of garbage has reached its maximum level. After this the bin should be emptied as soon as possible. The concept of IoT when used in this field will result in a better environment for the people to live in. No more unsanitary conditions will be formed in the city. With the help of this system minimal number of smart bins can be used around the whole city and the city will still be much clean.

II. RELATED WORK

[1] Reference 1 presents a smart garbage monitoring system implemented by undergraduate students under the guidance of S. Satheesh Kumar. The system utilizes IoT technology for efficient monitoring of garbage levels. It was conducted at Kongunadu College of Engineering & Technology, Thottiam in 2018.[2] Reference 2 discusses an IoT-based garbage monitoring and street light control system developed by undergraduate students under the guidance of P. Jayabharathi. The system aims to integrate garbage monitoring with street light control for enhanced efficiency. The project was carried out in 2018 at the Department of Electronics and Communication Engineering.[3] Reference 3 provides a review of smart garbage monitoring systems conducted by undergraduate students under the guidance of P. Srinivas. The paper offers an overview of existing systems and their functionalities. The research was conducted at St. Martins Engineering College, Hyderabad in 2019.[4] Reference 4 describes a garbage monitoring system implemented by undergraduate students majoring in Computer Science and Engineering at SRM University, Chennai. The system utilizes IoT technology to improve garbage management. The project was conducted in 2017.[5] Reference 5 presents a LoRa-based garbage monitoring system developed by undergraduate students under the guidance of Dr. R. Prem Kumar. The system leverages the Internet of Things (IoT) and LoRa technology for efficient garbage monitoring. The project was carried out in 2022 at Siddharth Institute of Engineering & Technology, Puttur, Andhra Pradesh.[6] Reference 6 introduces the concept of a smart dustbin, which serves as an efficient garbage monitoring system. The paper highlights the implementation and benefits of the system. The research was published in the International Journal of Engineering Science and Computing in 2016.[7] Reference 7 presents an IoT-based smart garbage and waste collection bin. The paper discusses the design and implementation of the system, focusing on efficient waste management. The research was published in the International Journal of Advanced Research in Electronics and Communication Engineering (IJARECE) in 2016.[8] Reference 8 proposes a novel approach to garbage management using IoT technology for smart cities. The paper explores the application of IoT in garbage management systems to enhance efficiency. The research was published in the International Journal of Current Trends in Engineering & Research in 2016.[9] Reference 9 discusses waste management as an IoT-enabled service in smart cities. The research explores the use of IoT technology for efficient waste management in smart cities. The study was presented at the

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Conference on Smart Spaces in 2015. [10]This paper presents a waste bin monitoring system that utilizes integrated technology. The authors, Kanchan Mahajan and Prof. J.S. Chitode, propose a system that combines various technologies to monitor waste bins effectively. The research was published in Volume 3, Issue 7 of the International Journal of Innovative Research in Science Engineering and Technology.

III. PROPOSED ALGORITHM

The smart bin system is designed with three compartments, each serving a specific function. The first compartment is equipped with an IR sensor and a metal detector, the second compartment contains another IR sensor and a moisture sensor for detecting dry and wet waste, and the last compartment is subdivided into three bins for collecting segregated waste.The entire system is controlled by an Arduino Uno board, which acts as the central processing unit. All the components, including the dry/wet sensors, inductive proximity sensor, smoke sensor, IR sensor, DC motors, LCD, ESP8266, and electromagnet, are interfaced with the Arduino board.The working of the system begins when waste is dumped into the smart bin through a flap, which triggers the IR proximity sensor and wakes the microcontroller (Atmega328) from low power mode. The waste then slides over an incline, passing over the inductance coil to detect any metallic objects. The metal detection system measures the parallel resonant impedance of the circuit and determines if the waste contains metallic objects. If the waste is identified as metallic, the process continues accordingly.If the waste is not metallic, it proceeds towards the capacitive sensing module, where a decision is made whether it is wet or dry based on its relative permittivity. Two DC geared motors are utilized for the final segregation process. One motor moves a circular base to position the corresponding container under the collapsible base, which is controlled by the second motor.

This allows for the waste to be directed to the appropriate bin based on its identification.The proposed methodology involves an entry system and initialization phase, where the waste is detected and the sensor modules are initialized to ensure accurate sensing. The metal detection system utilizes the inductive coil and measures the parallel resonance impedance, while the capacitive sensing module determines the wet or dry nature of the waste.The system design is implemented using an Arduino Uno board, with each component interfaced to the board. The necessary code for controlling the sensors and motors is written in embedded-C language. A liquid crystal display (LCD) is used to display the decisions made by the Arduino processor. Additionally, a ESP8266 is incorporated to provide real-time updates by transmitting the device's status and decisions to a specific server.Overall, the proposed methodology outlines the design of a smart bin system that utilizes integrated technology and sensors to effectively monitor and segregate waste based on its properties.

IV. PSEUDO CODE

Step 1: Library and Pin Declarations:

The code begins by including the LiquidCrystal library and declaring the pins for the LCD (rs, en, d4, d5, d6, d7). Additionally, the code declares the pins for two ultrasonic sensors (trigPin1, echoPin1, trigPin2, echoPin2), an IR sensor (IR), dry/wet sensor (dry_wet_Sensor), two DC motors (M1, M2), and a buzzer (Buzz).

Step 2: Setup Function:

The setup() function is called once when the Arduino is powered on or reset.Serial communication is initiated with a baud rate of 9600 for debugging purposes.Pin modes are set for all the declared pins.The LCD is initialized, and a welcome message is displayed for 3 seconds.

Step 3: Ultrasonic Sensor Functions:

The ultra1() and ultra2() functions are defined to measure distances using the two ultrasonic sensors.These functions utilize the trigPin and echoPin of each sensor to generate ultrasonic waves, calculate the duration of the echo, and convert it into a distance value.The distance values are printed on the Serial Monitor for debugging purposes.

Step 4: Main Loop:

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The loop() function is where the main execution takes place and runs repeatedly.First, the ultra1() and ultra2() functions are called to measure the distances using the ultrasonic sensors.The LCD is cleared, and the distances are displayed on the first and second lines.If the distance from either sensor is less than 10 units, an alert message is displayed on the LCD and the buzzer is activated.If the IR sensor detects an object (waste) in the bin (digitalRead(IR) == 0), the program enters a while loop to perform waste segregation.The dry/wet sensor value is read multiple times within the loop to ensure accurate detection.If the sensor value is 1, indicating wet waste, the motors are controlled to rotate in a specific direction for wet waste segregation, and the LCD displays the corresponding message.If the sensor value is 0, indicating dry waste, the motors rotate in a different direction for dry waste segregation, and the LCD displays the corresponding message.If the sensor value is neither 0 nor 1, the motors are turned off.The program then repeats the loop, continuously monitoring the garbage status and performing waste segregation as required.

Step 5: End.

V. SIMULATION RESULTS

The simulation studies involve Distance Measurement:The distance1 value is 8 units and the distance2 value is 15 units.LCD Display:The LCD screen will show the following:"Distance1: 8" on the first line."Distance2: 15" on the second line.Alert Messages:Since distance1 (8 units) is less than 10 units, an alert message will be displayed on the LCD:"Aleart....." on the first line."Dustbin1 Full" on the second line.The buzzer will be activated.Waste Segregation:Assuming the IR sensor (IR) detects the presence of waste (digitalRead(IR) == 0).Assuming the dry_wet_Sensor value is 1, indicating wet waste.The motors (M1 and M2) will rotate to segregate the wet waste.The LCD screen will display the followin"Rotating...." on the first line."Wet Side" on the second line.Overall, in this simulation, the program detects that the first bin is full, displays an alert message on the LCD, and activates the buzzer. It also detects the type of waste in the second bin as wet and performs the necessary segregation action by rotating the motors accordingly. The LCD screen provides real-time information on the distances, alerts, and waste segregation process.

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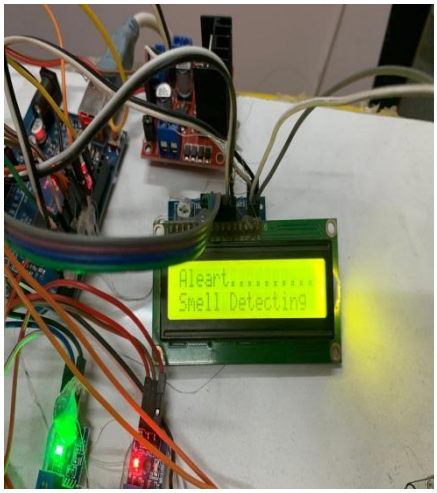

Fig.1. Smell Detector

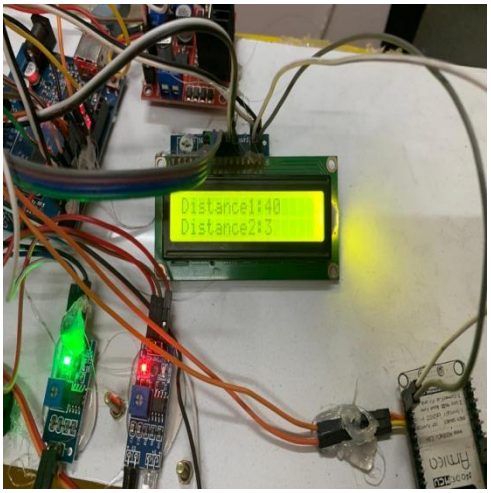

Fig. 2. Dustbin distance

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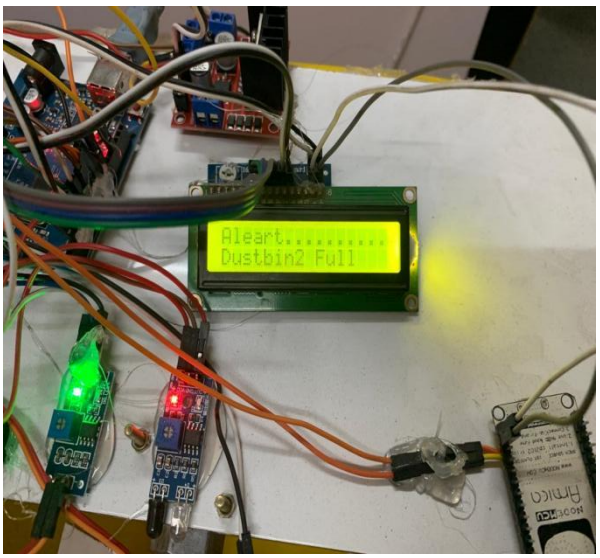

Fig 3. Dustbin Status

VI. CONCLUSION AND FUTURE WORK

The main objective is to maintain the level of cleanliness in the city and form an environment which is better for living. By using this system we can constantly check the level of the garbage in the dustbins which are placed in various parts of the city. If a particular dustbin has reached the maximum level then the employees can be informed and they can immediately take certain actions to empty it as soon as possible. The employees can check the status of these bins anytime on their mobile phones. This can prove to be a very useful system if used properly. The system can be used as a benchmark by the people who are willing to take one step further for increasing the cleanliness in their respected areas. Ultrasonic sensor is being used in this system to check the level of garbage in the dustbins but in future various other types of sensors can be used with the ultrasonic sensor to get more precise output and to take this system to another level. Now this system can be used in certain areas but as soon as it proves its credibility it can be used in all the big areas. As this system also reduces manual work certain changes can be done in the system to take it to another level and make it more useful for the employees and people who are using it. In future, a team can be made which will be in charge for handling and maintaining this system and also to take care of its maintenances.

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