IOT-BASED ADVANCED AUTOMATED WASTE MANAGEMENT AND SEGREGATION SYSTEM

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Abstract: The purpose of this system is to address the issues and limitations of current waste management and segregation practices, while also creating opportunities for improvement. It involves an automated waste management and segregation system that utilizes the Internet of Things (IoT) technology. The proposed system is installed throughout urban areas and equipped with embedded technology to separate and monitor the fill level of waste bins. Authorities are notified of bin status and locations via the Internet, reducing the need for human involvement, and cutting down on time and costs.

Keywords :IOT, Waste Management, Sensor, Segregation

I. INTRODUCTION

India is currently facing significant environmental challenges due to inadequate waste collection, treatment, transport, and disposal practices. The generation and disposal of waste is a complex issue that poses a threat to public health and the environment. With the increasing urban population, the current waste management system is unsustainable and poses a risk to public health and the environment. It is crucial to manage waste properly to maintain a healthy lifestyle and prevent the spread of diseases. The overfilling of dustbins on a daily basis creates an unhygienic environment, making waste segregation essential. Segregating waste into dry and wet waste reduces the amount of waste that is landfilled and also minimizes air and water pollution. This application assists in managing and segregating waste by deploying dustbins throughout the city with an embedded system that helps in tracking garbage bins at a minimal cost. An SMS text is sent to the municipal corporation once a bin is filled and reaches its maximum level, and the respective authorities take immediate action once the bin's status is notified via the Internet. This proposed system uses ultrasonic sensors, node MUC, and servo motor technology.

II. LITERATURE SURVEY

The following are summaries of various studies related to waste management using IoT technology.

Padmakshi Venkateshwara Rao and Pathan Mahammed Abdul Azeez, in 2020[1], developed an "IoT based Waste Management for Smart Cities" to address challenges such as inadequate waste collection and treatment. The system uses ultrasonic sensors, a node MCU, a Blynk app, and a servo motor to track garbage bin levels and notify authorities via SMS when the bin is full.

Nikolaos Baras and Dimitris Ziouzios, in 2020[2], developed a cloud-based smart recycling bin for in-house waste classification. The system uses artificial intelligence and neural networks to classify different types of waste with 93.4% accuracy.

Shashank Shetty and Sanket Salvi, in 2020[3], developed the SAF-Sutra, a prototype of a remote smart waste segregation and garbage level monitoring system. The system is designed for portability and ease of assembly and includes a mobile and web application for user interaction.

Claude-Noel Tamakloe and Dr. Elena v. Rosca [4]introduced a solar-powered, compact smart garbage bin for waste management. The bin can monitor internal garbage levels, compact waste,

and send information to a secure server-side application.

Rania RizkiArinta and DominikusBoliWatomakin, in 2020,[5] developed a waste management system integrated with smartphones and IoT technology. The system uses an ultrasonic sensor and Wi-Fi module to track garbage levels and send data to a smartphone.

Chethan Kaushal and Anshu Singha[6] proposed a novel waste management architecture that uses IoT and digital image processing for garbage monitoring. The system acts as a surveillance system to monitor garbage overflow and notify authorities to take necessary action.

III. METHODOLOGY

The two bins in this suggested system were used to store dry and wet garbage, and they can be swapped out for cleaner ones. On the dry-wet sensor, garbage is deposited. A threshold of moisture is selected for the dry-wet sensor. This detects the amount of moisture, and the relay enables the servo motor to rotate in both clockwise and anticlockwise directions, moving garbage into the appropriate bins. The IR sensors are used to inform the municipality and determine the level of waste in the bin. The MQ sensor is used to measure the concentration and smell of various gases. The node MCU is used to send all of the sensed data from the Arduino UNO's sensors to the cloud. Embedded C would be used to code the programme. As a result, users will see messages on the LCD, and the MQTT protocol will be used to send bin status notifications to those who have been given permission.

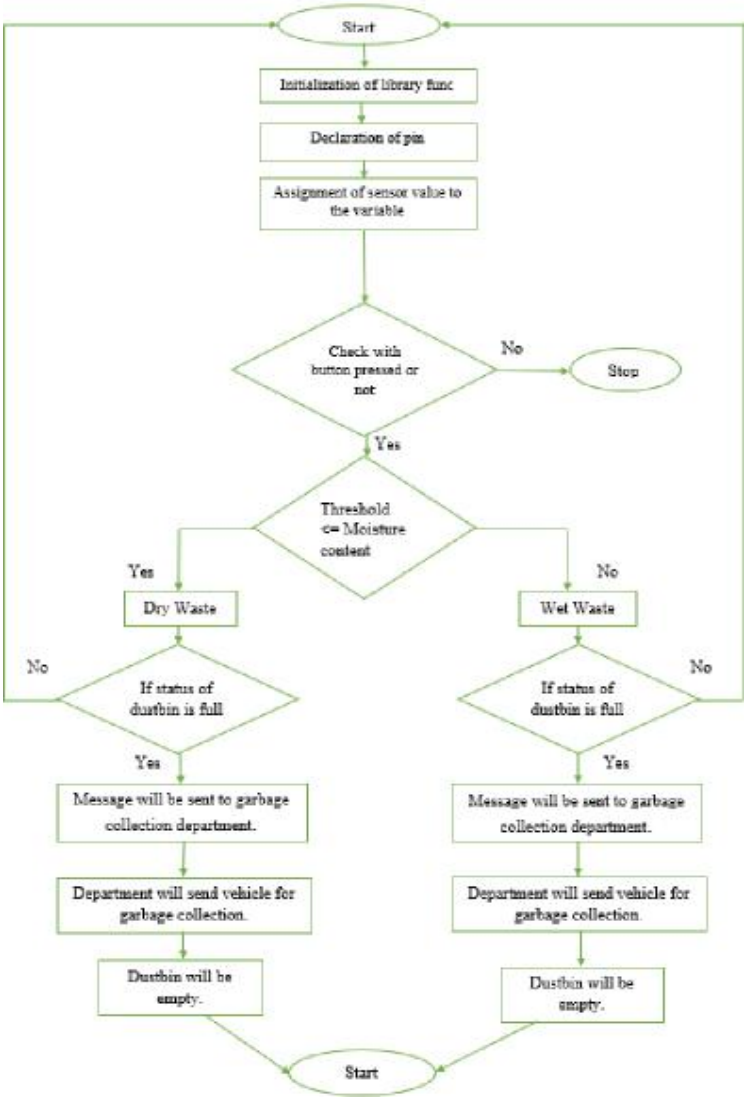

Fig.1. Flow chart of the proposed system

The project's flow is shown in Figure 1, where we first initialize the library functions, declare the pins, and assign the pre-set values to the sensors. The procedure will stop if the button is not touched, thus we must determine whether it is pressed before moving on.
The device will determine the amount of moisture in the trash before classifying it as either dry or wet based on previously defined parameters. When the trash can is full, a message notifying the department to collect the trash is sent, and the trash can is subsequently emptied. The method above repeats if not.

IV. IMPLEMENTATION

Our proposed waste management system includes two bins for waste storage. The system utilizes a dry-wet moisture sensor to determine the moisture content of the waste, which is displayed on an LCD screen for the user to see. Using a relay and Servo motor, the waste is then sorted into their respective bins. Infrared sensors are used to detect the level of garbage in each bin, and if the bins are full, messages are sent to the municipality to empty them, and the LCD displays a message to the user indicating that the bin is full. To check for odor and combustion, MQ and flame sensors are employed for the wet and dry bins respectively. If either of these sensors detects a problem, a message is sent to the municipality based on the concentration of gases present. All bin status information is transmitted to the cloud through MQTT protocol, allowing the municipality to access and monitor the system.

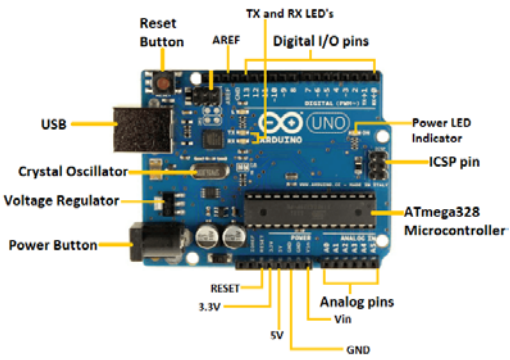

Fig. 2. Arduino UNO

A free and open-source microcontroller is the Arduino Uno. There are sets of digital and analogue I/O pins on the board. It has six PWM outputs, six analogue I/O pins, and fourteen digital I/O pins total. The Arduino Uno can be used to programme it. It can receive voltage ranging from 7 to 20 volts and can be powered by an external 9 volt battery or a USB connection.

Fig. 3. Infrared Sensor

In order to detect the environment, an infrared sensor emits. It is used to measure the volume of trash in each trash can. As a result, it aids in preventing bin overflow.

Fig. 4. MQ Sensor

The MQ sensor gas sensor is an extremely sensitive sensor used to identify toxic gases such as ammonia, smoke, and sulphur. It was originally used to measure gas concentration and detect explosive and dangerous gases. When there is a strong concentration of garbage scent, it uses this to detect it and sends an SMS to the municipal department. Having a healthy environment is therefore beneficial.

Fig. 5. Node MCU

An integrated chip called NodeMCU gives the embedded circuit it is part of full internet connectivity. Using the Arduino IDE, the USB port is used to map it. There are 30 pins total, 9 of which are digital pins and 1 analogue pin. It is a utility for wireless networking. It uses a small amount of power. Because of its built-in Wi-Fi connectivity, which can be used to communicate real-time monitored sensor data to web and mobile interfaces, it has been used as the primary microcontroller in this project.

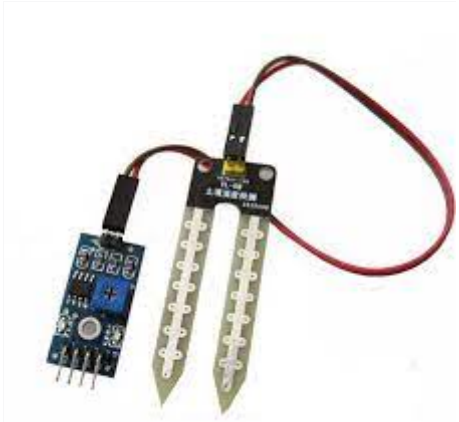

Fig. 6. Dry Wet Sensor

The sort of waste being placed on it has been determined using the moisture sensor. Based on the amount of moisture present, the sensor here divides the waste into dry and wet categories.The garbage is classified as wet waste if the moisture content exceeds a predetermined threshold value, otherwise, it is classified as dry waste.

V. RESULTS AND DISCUSSION

This proposed system can be used in daily life and will be able to separate dry and wet waste. It also monitors bin status and notifies the municipality. It prevents bin overflow, which lowers environmental pollution and health risks. It allows wireless data transmission and allows data to be accessed from anywhere at any time.The suggested system is applicable to all urban areas, including those that are polluted-free and have a friendly environment that supports healthy, risk-free living. By preventing the overflow of bins, it preserves human life without endangering it.

This approach promotes healthy environmental conditions, maintains towns more attractive, and keeps our surroundings free, clean, and green from the smell of waste.The traffic flow on the roads is reduced as a result of the direct message transformation between the smart segregation system and the municipal department. The automatic waste segregation process also helps to lessen the health problems and work stress experienced by employees who manually segregate the waste.It contributes significantly to the decrease in environmental pollutants.

VI. CONCLUSION

Because of the growing population and practical application of "Automatic waste management," this study improves the cleanliness of smart cities. "IOT-based segregation system." With urbanization and This suggested technology, garbage may be effectively separated into dry and wet materials without the need for human interaction or interference. It offers prompt collection and elimination. The suggested approach can be used domestically in a home or extensively in public areas.

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