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SMART DUSTBIN MONITORING USING NODEMCU

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***Abstract* – In the present day, efforts are being made to enhance cleanliness in the country, and the government has initiated various movements for the same. Smart garbage bins have the ability to alert organizations to empty them at the appropriate time. This Project is dedicated to Swachh Bharat Abhiyan. These dustbins feature automatic lid opening and closing, and an alert email is sent to a registered email ID when the garbage amount exceeds a predetermined value. The dustbin's full or empty status can be remotely checked via the internet. The dustbin updates its status every second, indicating the percentage of occupancy, and when it exceeds 70%, an email is sent to indicate that it is almost full. The dustbin incorporates an ultrasonic sensor and NodeMCU that detect the trash in the dustbin to calculate its occupancy, and the distance between the ultrasonic and trash is converted to a percentage to show the dustbin's status accurately. The IFTTT Web hooks system is employed to receive the status and alert emails.**

Keywords - Nodemcu, Ultrasonic sensor, Servo Motor Webhooks

I. INTRODUCTION

Internet of Things, refers to a network of physical objects that can communicate and share data with each other without the need for human intervention. It has been defined as an "Infrastructure of Information Society" as it allows us to gather information from various sources, such as humans, animals, vehicles, and appliances. Any physical object that can be assigned an IP address to transmit data over a network can be integrated into an IoT system by incorporating electronic hardware like sensors, networking gear, and software. Unlike the traditional internet, IoT goes beyond internet connectivity and enables objects that use embedded circuits to interact and communicate with each other. It can be found in various places, from homes and offices to public areas like shopping malls, theaters, railway stations, and parks. By connecting objects via the internet and operating them remotely, IoT offers a more convenient and efficient way of living. A project involving IoT-enabled smart dustbins has broad applications in railway stations, shopping malls, public parks, airports, and other similar locations. The dustbin's lid automatically opens and closes, and an alert email is sent to a registered email address when the garbage percentage surpasses a certain value.

II. LITERATURE SURVEY

Efficient and effective management of garbage in cities is crucial. Several proposals have been put forward and implemented, but they have not been entirely successful. To identify the most effective approach, a survey was conducted, which includes a comparison of different methods for smart garbage management in cities using IoT. One such proposal is the Smart Dustbin Management in Smart Cities Using IoT. This method employs ultrasonic sensors to detect the level of garbage in the dustbins, which is then communicated to an authorized control room. A smart waste collection system that addresses these concerns must be both efficient and effective. With the expansion of the Internet of Things (IoT), more effective solutions are becoming available. The proposed garbage collection system evaluates waste levels by gathering data from trash cans in metropolitan areas. Sensor data is transmitted to a server via the Internet, where it is processed and stored. Another proposed method involves waste segregation using bins of different colours. The smart dustbin method incorporates electronic components like NodeMCU, ultrasonic sensors, and servo motors. This approach is more efficient and effective than others as it uses WiFi technology to send messages, and the garbage lid opens and closes automatically when movement and garbage are detected. Moreover, hygiene is maintained because the lid or the dustbin does not need to be touched to dump waste into it.

III. PROPOSED HARDWARE

1. Nodemcu ESP8266

NodeMCU ESP8266 is a cost-effective and versatile Wi-Fi development board, which is specifically designed for IoT applications. It is powered by the ESP8266 chip, which integrates a microcontroller, Wi-Fi module, and necessary peripherals onto a single board. It also features multiple input and output interfaces such as UART, I2C, SPI, and GPIO, which makes it simple to interface with other hardware modules. Additionally, it has a built-in USB interface for power supply and programming, which makes it convenient to program and test. The module supports the 802.11b/g/n protocol and has a range of up to 100 meters.

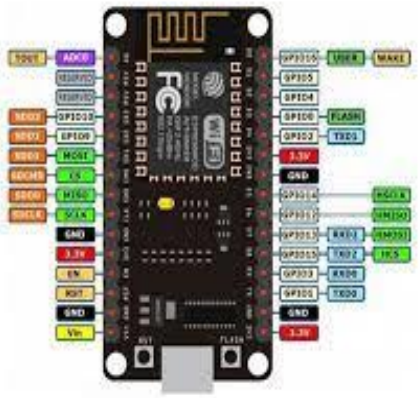


Fig.3.1.1 NodeMCU

2. Ultrasonic Sensor

The HC-SR04 ultrasonic sensor is a device that uses sound waves to determine the distance of an object. The sensor sends out high-frequency sound waves from its transmitter and measures the time it takes for the waves to bounce back to the receiver after hitting an object. This time difference is then calculated to determine the distance of the object using simple math.

One of the main advantages of the HC-SR04 sensor is its flexibility. Additionally, the sensor has a range of up to 4 meters and a high accuracy of up to 0.3 cm, making it suitable for a wide range of applications. The sensor is also easy to use, with a simple interface that requires only four pins to connect to a NodeMCU. The ultrasonic sensor in this project is used to continuously measure the level of garbage in the dustbin.

Fig.3.2.1 Ultrasonic Sensor

3. Servo Motor SG-90

It is a small, high-torque motor that is capable of precise control of angular or linear position, velocity, and acceleration. The motor works by receiving electrical signals from a controller, which adjusts the rotation angle of the motor shaft based on the signal's magnitude and duration. This precise control is achieved by using a closed-loop feedback system that continuously monitors the position of the motor and adjusts it accordingly. It operates on a voltage range of 4.8 to 6 volts and has a torque of 1.8 kg/cm. Its rotation angle is up to 180 degrees, and it has a response time of 0.1 seconds. The main function of Servo Motor SG-90 in this project is to open and close the lid of the dustbin.

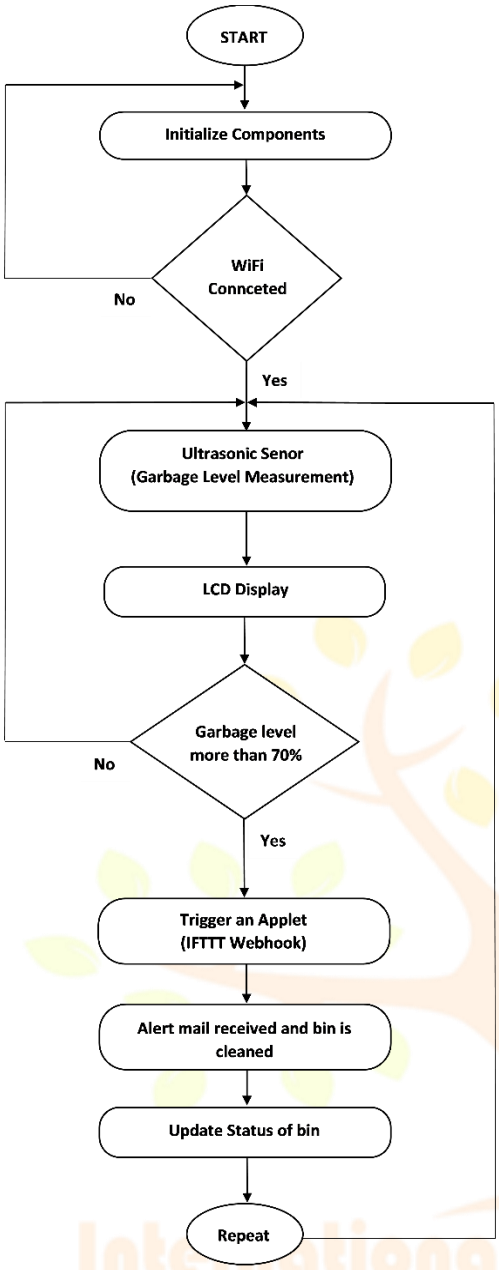
Fig.3.3.1 Servo Motor

IV. PROPOSED SYSTEM

1. IFTTT Webhooks

IFTTT webhooks is a platform that allows users to connect different apps and services together, and automate actions based on specific triggers. Webhooks can be used to send data from one application to another in real-time, without the need for manual intervention. IFTTT webhooks are essentially user-defined HTTP callbacks, which are triggered by an event in one application and cause a response in another.They can be used to automate a variety of tasks, such as sending notifications, updating data, and triggering events. In addition, webhooks can be easily customized and adapted to suit a variety of use cases.

2. Flowchart



3. *Operation*

When the system is switched on, the ultrasonic sensor starts to detect the presence of a person. If the calculated distance between the person and the sensor is less than a predetermined value, Nodemcu esp8266 is activated, which in turn activates the Servo Motor to lift the lid with the help of an extended arm. The lid remains open for a specific period of time (4 seconds) before closing automatically.

Moreover, the dustbin is equipped with another ultrasonic sensor that continuously measures the level of garbage in the bin and detects when it is about to reach its capacity. The smart circuitry in the dustbin transmits this information over the internet to alert the main garbage collector of the facility to empty the bin. This smart dustbin can be effectively utilized in households, offices, and public places for garbage management purposes. As a result, the smart dustbin provides a fully automated and efficient solution for garbage disposal.

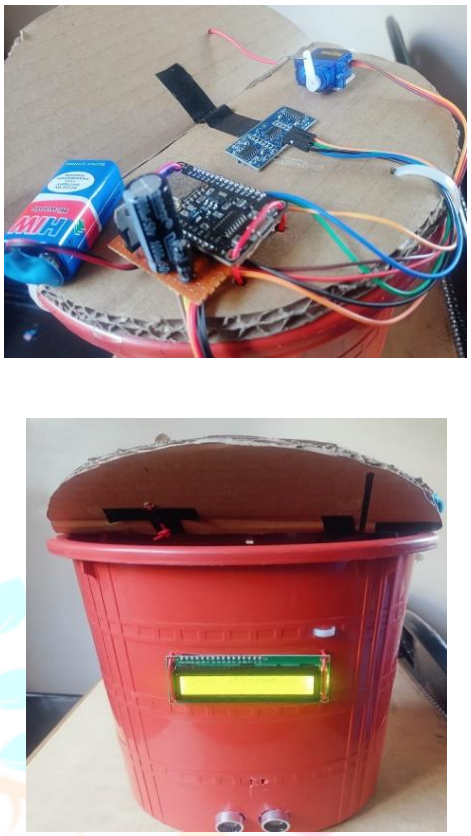


Fig.4.3.1 Smart Dustbin Model

CONCLUSION

The system is made to clean the dustbin when the dustbin volume reaches a specific level, taking into account the necessity to maintain cleanliness. The project is centred on "IoT technology" and "Smart City applications" (IoT). It contributes to maintaining a healthy environment free from disease.

Future Scope

This project can incorporate technologies such as real-time tracking of trashbin locations in the city and the detection of valuable items that are sometimes thrown by mistake into garbage bins. The main goal of this proposed system is to maintain cleanliness in public places and improve the vision of the smart city.

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