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A Removable Smart Garbage Can That Uses the Internet of Things (IoT)

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ABSTRACT:

Overflowing trash cans cause pollution, unsanitary conditions, and ineffective trash collection; hence, waste management is an important concern in contemporary urban areas. To improve sanitation and efficiency during garbage collection, this project presents an Internet of Things (IoT)-based portable smart trash can with an Ultrasonic Sensor, Internet of Things (IoT) technology, L293D motor driver, and buzzer.
A constant reading of the garbage can's capacity is provided by the ultrasonic sensor. The Blynk IoT app is notified by an Internet of Things (IoT) device that notifies consumers or municipal authorities when the bin exceeds a certain threshold. Particularly helpful for the elderly and others with mobility issues, the trash can's L293D motor drivers allow it to automatically travel to predetermined disposal sites. The inclusion of a buzzer ensures that the bin is never overflowing and that garbage collectors are promptly notified when the bin is full.
More effective and sanitary trash disposal is made possible by this system's real-time waste monitoring, automatic mobility, and alarm systems. By optimizing the garbage collection process via the integration of IoT connection and smart automation, sanitation standards are improved and human involvement is reduced. Autonomous route navigation for optimal collection, solar power operation, and garbage segregation based on artificial intelligence are all potential future upgrades.

INTRODUCTION

IoT refers to a network of interconnected computing devices that can be controlled and managed over the internet. We can get timely updates and utilize them according to our convenience by using IoT technology in the goods we use every day. Waste management is crucial to the progress of growing nations like India. Garbage management and disposal is rapidly becoming a problem in our nation. The original goal of developing Dustbin was to solve specific problems associated with trash management. The cleanliness of our immediate surroundings is the first step in meeting the basic need of the future generation. Many fatal infections, affecting both animals and people, spread as a result of incorrect garbage disposal. Lack of facility in bins is the main cause of inappropriate rubbish disposal. The animals who live by the roadside and feed on garbage, such cows and dogs, have also been impacted by the overflow of bins. Contaminating neighboring bodies of water, the overflow of the bin has also impacted water management systems. Out of India's total annual garbage production of 60 million tonnes, 10 million tonnes is accounted for by the country's largest urban centers. The authorities are taking this massive quantity of trash very seriously and are making great efforts to contain it. When formulating a strategy to regulate MSW, the majority of countries agree that the "waste management hierarchy" should serve as the starting point. People are often seen as being careless when they utilize normal trash cans, hence trash ends up outside of them. Dustbin position is another major issue due to the smart Dustbin's inertia. "Household waste" describes the garbage that most people's homes generate every day. Households use and dispose of hazardous items in the same way that any commercial setting does with potentially hazardous goods. Improper disposal of garbage makes our house unsafe due to the toxins in it. A corrosion, explosion, or fire might occur.

The worst way to dispose of the trash is to dump it on the ground, into storm drains, or into the toilet. Even while it may not be immediately obvious that some types of HHW, once disposed of, might be dangerous, they nevertheless constitute a threat to pets and young children if left unattended in the house. Animals and people alike would be in grave danger if exposed to the toxic waste, as the deadly microbes are multiplying at an alarming rate. Rarely does one see a mechanism in place to separate hazardous garbage from nonhazardous waste. Within

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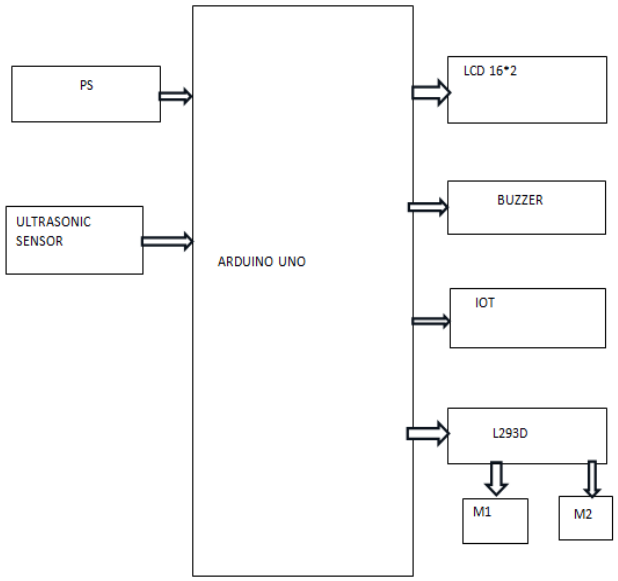
the OECD, nations generate over 540 million metric tons of MSW every year, with 67% of that quantity coming from residences. Since it isn't always clear what constitutes household waste as opposed to MSW, the estimated amount of HHW varies substantially. When human, animal, and plant waste is not properly disposed of, it releases harmful compounds into the environment that treatment facilities cannot remove and which eventually accumulate in living organisms' tissues. Throwing it away, letting it go down the drain, or even just leaving it outdoors are all examples of inadequate disposal methods. Consequently, regular garbage collection and disposal is essential for a sanitary environment.

Prior studies have concentrated on improving the following areas: finding the most efficient method of collecting Dustbins, developing a mobile app to show the current condition of the bin, delivering alarm messages to GSM, and compensating the user according to the amount of garbage they have disposed of. Finding shorter paths to bins and receiving fullness status alerts over GSM have been the primary areas of attention for the previously created models. While the Internet is more efficient, one kind of a commonly used bin may move in response to voice instructions sent by Bluetooth, which isn't ideal for home usage. It is imperative that we prioritize the inclusion of features into the bin to enhance its use for those with physical disabilities and the elderly. This paper's objective is to propose a smart trash can that can be personalized to the user's requirements and whose level can be tracked in real-time. In order to live a clean lifestyle, one must have a reliable method of disposing of trash. The efficiency of smart trash cans depends on their universal accessibility. Even those with physical disabilities or advanced age may use the paradigm proposed in this research.

Literature survey:

Everyone just tosses their trash in a trash can or some other random spot. The trash consists of both biodegradable and non-biodegradable polymers. Efforts are being made by everyone to dispose of trash in designated bins. The overflowing of trash cans and other public trash cans is a common sight in urban areas. As a result, the surrounding area becomes unsanitary. On top of that, it causes certain very dangerous illnesses. Simultaneously, a foul smell permeates the whole city, harming the ecosystem. Recycling bins are really a kind of waste management procedure; however, unlike regular trash cans, they do not need more waste. Waste disposal is an effective way to get rid of trash from public places including schools, universities, malls, and workplaces. We need to plan the project such that we can track when the garbage can is full and how much rubbish has been deposited inside. As far as hardware components go, the NodeMCU and ultrasonic sensor are everything you need to measure the trash can. The program element is a notification-receiving IFTTT Webhook. The basic idea behind this project is that when the trash can is 70% full, we will get an email message from the IFTTT Webhook.

Methodology



Block diagram.

Working

To improve the efficiency and automation of waste management, the suggested Internet of Things (IoT) smart trash can incorporates an Ultrasonic Sensor, Internet of Things (IoT) connection, L293D motor driver, and buzzer. The dustbin's fill level is constantly being monitored by the ultrasonic sensor, which transmits data to an Arduino-based microcontroller in real-time. When the bin fills up to a certain point, an Internet of Things (IoT) module sends a signal to a cloud service, such the Blynk IoT app, so that garbage collectors or city officials know when it's time to come get it.

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The L293D motor driver allows the trash can to move on its own, which is great for folks with mobility issues or the elderly who would have trouble reaching a stationary trash can. Reducing the need for human intervention and making the bin more accessible, the system makes sure it moves itself to a predetermined collecting spot. To further ensure timely disposal of garbage and avoid overflow, an inbuilt buzzer sounds an audible signal when the bin is full. The system is managed by an Arduino microcontroller, which does data processing on the sensors, activates the buzzer, and uses the L293D motor driver to control the dustbin's movement. By connecting to the internet of things, users can keep tabs on trash can levels from anywhere using a mobile or online app, which improves decision-making and makes trash pickup more efficient. Cleaner and smarter cities are possible thanks to an automated smart waste management system, which improves urban sanitation while reducing manual work.

Arduino uno

A microcontroller board based on the Atmega328, the Arduino Uno is described in the datasheet. A 16 MHz crystal oscillator, 6 analogue inputs, 14 digital input/output pins (including 6 PWM outputs), 1 USB port, 1 power connector, 1 ICSP header, and 1 reset button are all part of it. All you need is a USB cable, an AC-to-DC converter, or a battery to get it going; it comes with everything you need to support the microcontroller.

Because it forgoes the FTDI USB-to-serial driver chip, the Uno stands apart from all previous boards. In its place, you'll find the Atmega8U2 configured to convert USB to serial. "Uno" signifies "One" in Italian and is chosen to commemorate the impending release of Arduino 1.0. Going forward, the Uno and version 1.0 will serve as the reference versions of Arduino. See the index of Arduino boards for a comparison with earlier generations; the Uno is the newest in a series of USB Arduino boards and the platform's standard model.

The USB port or an external power source are both viable options for powering the Arduino Uno. It chooses the power source mechanically. You may use a battery or an AC-to-DC converter (wall-wart) to power it from the outside (not via USB). It is possible to attach the adapter by inserting a 2.1mm center-positive connector into the power port on the board. The POWER connector's Gnd and Vin pin headers are suitable for inserting battery leads. The board is compatible with power sources ranging from 6 to 20 volts. But if the voltage is lower than 7V, the 5V pin could not give 5V and the board might become unstable. The voltage regulator might become too hot and ruin the board if you use more than 12V. A voltage range of 7 to 12 volts is suggested.

LIQUID CRYSTAL DISPLAY

In front of a light source or reflector, a thin, flat display device called a liquid crystal display (LCD) arrays a large number of color or monochrome pixels. Pile of liquid crystal molecules held aloft by two transparent electrodes and two polarizing filters, whose polarity axes orthogonal to one another, make up each pixel. If there weren't liquid crystals interposed, one would block the other from light. Light that enters one filter is able to pass through the other because the liquid crystal bends its polarity.

A program's ability to communicate with the outside world depends on its input and output devices, which in turn rely on human communication. An LCD display is a typical accessory for controllers. The 16x1, 16x2, and 20x2 LCDs are among the most popular types of displays that are attached to the controllers. This equates to sixteen characters on a single line. The first set has 16 characters on each line while the second set has 20 characters on each line.

BUZZER

In a magnetic transducer, the circuitry includes an iron core, a yoke plate, a wound coil, a permanent magnet, and a vibrating diaphragm that can be moved. The magnet's field gently draws the diaphragm up nearer the core's surface. A positive alternating current (AC) signal causes the diaphragm to move up and down, which in turn vibrates the air. This is achieved by the current passing through the excitation coil, which forms a fluctuating magnetic field. A resonator, which is composed of a cavity and one or more sound holes, may amplify vibrations in order to generate a loud sound.

ESP8266 Wi-Fi Module

This project revolves on this. The module plays a crucial role in the project as it is centered on WIFI control of appliances. A low-cost Wi-Fi chip with full TCP/IP capability, the ESP8266 Arduino compatible module has an amazing built-in MCU (Micro Controller Unit) that allows you to control I/O digital

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pins using a simple programming language that is almost pseudo-code like. The Chinese company Es press if Systems is situated in Shanghai and makes this gadget. In August 2014, this chip made its debut in the ESP-01 version module manufactured by the third-party company AIThinker. The MCU can establish basic TCP/IP connections and connect to WiFi networks with the help of this little module. In his Many hackers and tech enthusiasts were interested in exploring and using it for a wide range of projects because to its tiny size and very inexpensive pricing (1.7$ to 3.5$). Since it has been so successful, Espressif has released other variants with varying proportions and technological specs. Among the following is the ESP32. Numerous projects and applications, such as home automation, may be found online.

RELAYS

Many household and commercial equipment, as well as industrial control systems, make use of electrically controlled switches called relays. By using a relay, two independent voltage sources may be isolated from one another; in other words, a little quantity of voltage or current on one side can manage a big amount of current or voltage on the other side, and vice versa.

Ultrasonic Sensor

One tool that may estimate the distance to an item using ultrasonic sound waves is an ultrasonic sensor. Simply put, an ultrasonic sensor is... A transducer allows the device to transmit and receive ultrasonic pulses, which in turn provide data on the proximity of an item. When high-frequency sound waves travel over different surfaces, they create unique patterns of reflection called echos.

To operate, ultrasonic sensors emit a sound wave at a frequency that is audible to humans but not to other creatures. The sensor's transducer takes the role of a microphone, transmitting and receiving ultrasonic waves. A single transducer is used to transmit a pulse and receive the echo by our sensors, as is common with many others. By timing how long it takes for an ultrasonic pulse to travel from source to receiver, the sensor may calculate the distance to an object. An ultrasonic sensor relies on this procedure.

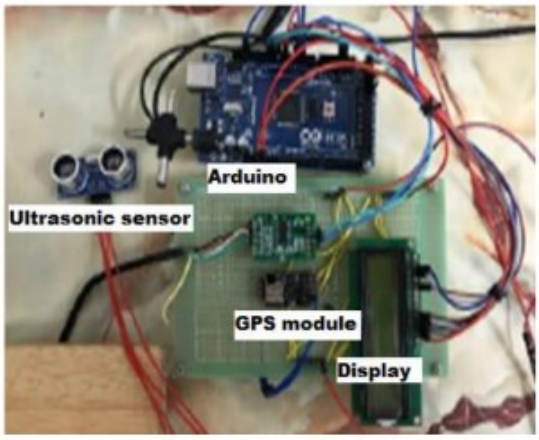
SOFTWARES

The Arduino platform is an open-source, user-friendly hardware and software environment for prototyping. It is comprised of a programmable circuit board (also called a microcontroller) and an Integrated Development Environment (IDE) called Arduino that is pre-made for writing and uploading code to the physical board.The main characteristics are:

• Many sensors can send signals in digital or analog formats to Arduino boards, which may then be used to activate motors, control LEDs, establish connections to the cloud, and much more.
• The Arduino IDE (also called "uploading software") allows you to command your board's operations by communicating with the microcontroller on the board. • A separate device, known as a programmer, is not required to load fresh code into an Arduino board, in contrast to most prior programmable circuit boards. The usage of a USB connection is all that is required. • The Arduino IDE employs a streamlined version of C++, which facilitates programming learning. Last but not least, Arduino offers a standardized form factor that simplifies the microcontroller's tasks.

Now that we know what the Arduino UNO board is and how it works, we can go on to setting up the Arduino IDE. As soon as we figure this out, we can upload our software to the Arduino board.

RESULTS



Output

CONCLUSION

An affordable, intelligent, and easily accessible trash management solution is the Internet of Things (IoT)-based portable smart trash can. This system efficiently avoids overflowing bins, increases trash

disposal efficiency, and uses real-time monitoring from ultrasonic sensors, movement from L293D motor drivers, remote tracking via the internet of things, and notifications through buzzer alarms. Users with mobility issues will find this system's automatic movement and real-time monitoring to be more accommodating than conventional trash cans. Authorities may improve garbage collection schedules and routes with the help of Blynk's Internet of Things integration, which offers remote access. Solar charging systems that use less energy, autonomous navigation systems that rely on GPS, and garbage sorting systems powered by artificial intelligence are all possibilities for the future. Incorporating this technology into smart city projects and better sanitation practices helps to create a greener and more sustainable city.

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