

ARDUINO BASED SMART DUSTBIN

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Abstract- Overflowing waste dumps and the resulting unhygienic conditions and offensive odours lead to the development of potentially fatal illnesses in today's society. The primary aim is to generate a clever garbage tin that will help in upholding a hygienic and sustainable environment. The Swachh Bharat Mission serves as a motivating factor. By adding a sensor and a GSM module, the conventional trash can is transformed into a "smart dustbin". Ultrasonic sensors are used to measure distance for intelligent garbage cans. The waste level may be monitored with a GSM module in a smart trash can, which then notifies the user via text message. Because of the waste that gets dumped into the smart trash can and the antibacterial spray used to try to keep germs at bay, the environment around the trash can is unsanitary. Unkempt garbage cans contribute to air pollution, which has negative effects on human health. Using an Arduino UNO, an ultrasonic sensor, a servo motor, and a battery jumper wire, we built a smart garbage can. Instead of waiting for the user to place trash in the can and close the lid, the dustbin will open as soon as they get within range. Business-wise, we aim to make it accessible to as many people as possible by keeping prices low. So, that everyone, from the poor to the wealthy, can profit.

Index Terms- Arduino, microcontroller, garbage disposal, ultrasonic sensor, smart dustbin, waste management.

I. INTRODUCTION

According to a Worldometer study of the most recent United Nations data, there are 1,418,237,140 people living in India as of 2023. In addition, if everyone did their part and cleaned up their area, we'd have a cleaner and healthier nation in less than two minutes. The issue of waste management affects people emotionally as well as ecologically. As a consequence of this study, a new benchmark has been set in this area. The Swachh Bharat Unnat Bharat Abhiyan was supported by the introduction of waste materials control, plastic rubbish control, and electronic waste management rules in 2016. In addition to fostering honesty and helpful regulatory frameworks with cutting-edge gear like a robotic waste sorting system, technological innovation is a factor that might assist the nation's ideal trash control. The primary objective is to promote the concept of a smart city while making smaller demands on human resources and labour. The persistent issue of trash cans spilling onto the roadway needs quick attention. Based on the proverb, "A clean city is like a temple dedicated to the Almighty," our paper's focus is on the need to keep urban spaces clean. A garbage can, or dustbin, is a container for trash that can't be recycled or composted. People are always close by to pick them up if there happens to be an overabundance, despite their pervasiveness in homes, workplaces, and communities. Trash cans frequently overflow, attracting a wide variety of unwanted visitors, such as dogs, rats, and cats. In addition, certain animals are known to rummage into garbage cans, but this innovative bin will put an end to that practise. The municipal administration can deliver the notification directly to the cleaning van. Being close to a garbage can also causes increased pollution. Air pollution from a garbage can may be conducive to the growth of germs and viruses, which might be fatal to humans. As a result, we designed a can with an Arduino UNO ultrasonic sensor that detects the can's latch and automatically deposits trash inside. The general public is more likely to adopt technologies that help consumers save time and energy. Green and smart cities benefit from the use of smart garbage cans.

II. LITERATURE REVIEW

Author	Year	Workdone
Gaikwad Prajakta and Jadhav Snehal	July 2021	Each trash can has a camera attached along with an accumulation cell sensor. Next, the camera readings and load sensor data are compared to the predetermined limit.
Abhishek Ayush et.al.	November 2021	Automatic trash can that listens for your voice commands
Abeesh A. I., et.al.	June 2019	An Arduino Mega board is used to build a "smart bin," as described in the paper "SMART BIN: Internet of Things-Based Waste Management, Evaluation, and Surveillance."
Ms. Nisha Bhagchandani et.al.	May, 2018	A smart waste management system for urban areas that makes use of the internet of things (IOT)
L.J.N. Sree Lakshmi et.al.	February 2018	With the use of GPS and the Internet of Things, we have developed a sophisticated warning system to keep tabs on garbage authorization by sounding an alarm through the municipal computer network.
Chaitanya Jambotkar et.al.	December, 2017	IoT Based Smart Trash Bins – A Step To-ward Smart City.
K.Harika, Muneerunnisa et.al.	February, 2017	IOT Based Smart Garbage Monitoring and Alert System Using Arduino UNO.
K. Vidyasagar et.al.	November, 2016	Eco - friendly Environment with RFID Communication Imparted Waste Collecting Robot.

III. SYSTEM DEVELOPMENT

Flowchart

The sensor will detect a human approaching the trash can. When motion is detected, the servo motor unlocks the lid of the trash can, and the GSM connection notifies the user that the trash can is full. In a garbage can in public, people toss trash into it, and a sensor goes on top of the can to detect when it's full. The process of the intelligent trash can is shown in the flowchart below

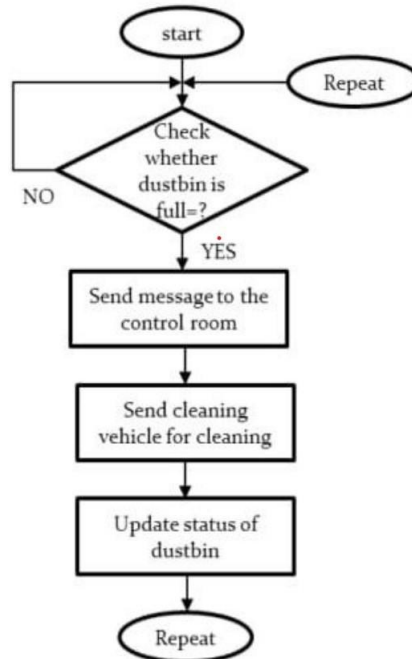


Figure 1.Flowchart

Components

1. Ultrasonic sensor
2. Arduino UNO
3. GSM Module
4. Connecting wires
5. Servo Motor
6. Battery
7. Adapter

1. Ultrasonic Sensor: This sensor is used to determine how far away a hand or other item is from the intelligent trash can. Sonar waves are the basis for determining the distance to an obstacle. The trigger pin only works to detect obstructions when it receives a strong pulse for more than 10 seconds. This sensor starts sending a 40 KHz ultrasonic burst of eight cycles when it detects a hand (an obstruction), and then it waits for the reflected ultrasonic signal.

Technical Specifications:

- Control supply : +5v dc
- Operating current : <15 mA
- Working current :15 mA
- Effectual angle : <15°
- Ranging distance : 2cm – 400cm/1” – 13 ft
- Resolution : 0.3 cm
- Measuring angle : 30 °
- Operating frequency : 40Hz

Table 1: Pin Number and Function of Ultrasonic sensor

Pin Number	Pin Name	Description
1	VCC	The VCC pin controls the sensor, typically with +5 V
2	Trigger	An input pin is Trigger pin, which has to keep high for 10 microsecond to initialize measurement by sending micro wave
3	ECHO	An output pin is echo pin which goes high for a period of time which will be equal to the time taken for the US wave to return back to the sensor.
4	GND	This pin is connected to the Ground of the system.

Working of Ultrasonic Sensor: The HC-SR04 US sensor is a 4-pin module with Vcc, trigger echo, and ground pins labeled accordingly for use with ultrasonic detection. This ubiquitous sensor is employed in a plethora of contexts requiring either distance measuring or object detection. Distance = Velocity x Time is the formula on which the sensor relies. The sensor works by sending out an ultrasonic pulse, which then travels through the air and is reflected back to the sensor by whatever it comes into contact with. The echo pin on the module will be set high for however long it predicts the US wave will take to return, allowing us to keep tabs on it.

2. **Arduino UNO:** An Integrated Development Environment (IDE) is a computer program used to write and upload programs to the Arduino board, which is a programmable circuit board based on a microcontroller. The Arduino is a microcontroller board that uses the ATmega8. It has 14 digital I/O pins (six of which can be used as PWM outputs), a USB connector, a power jack, an ICSP header, a reset button, and a power jack. The Arduino Uno is an open-source microcontroller board that is based on the ATmega328P. Including the reset button, power connector, ICSP header, and USB port, the board features a total of 14 input/output pins (8 of which can be utilized as PWM outputs). The microcontroller now has all of its components in place. You may power it on by connecting it to a wall outlet or a computer's USB port. The AVR board, which operates at 5V, and the Arduino Due, which operates at 3.3V, will eventually share compatible shields. The second is a sleeping pin with potential future usage.

3. **GSM Module:** A GSM modem or GSM module uses GSM mobile telephone technology to create a wireless data connection to a network. GSM modems are used in mobile phones and other devices that communicate with cellular networks. Users are identified on the network via their SIM card. Your computer can communicate with a GSM/GPRS network through the GSM/GPRS module. The components of a GSM/GPRS module include the modem itself, a power supply circuit, and a number of different types of computer interfaces (RS-232, USB, etc.). A GSM/GPRS MODEM is capable of the following tasks:

You may use a SIM to receive, send, and delete SMS messages.

Ability to access, edit, and search the SIM's phonebook.

Manage your incoming and outgoing voice calls.

4. **Servo Motor:** One example of a tiny device with an output shaft is a servo motor. Sending a coded signal to the servo allows for precise angular positioning of this shaft. As long as the encoded signal is present on the input line, the servo will keep the shaft at the programmed angle. If the encoded signal changes, so does the shaft's angular location. The Futaba S-148 is an example of a conventional servo, and its 42 oz/in of torque makes it rather powerful. It uses energy in accordance with the mechanical stress applied to it. Therefore, the power needed to run a servo that is not heavily loaded is minimal. A servo motor consists of a control circuit, the motor itself, a gear set, and a housing. Additionally, it includes three cables that go to the exterior. One is the control wire (white), another is the power (+5 volts), and the third is ground.

5. **Software Arduino IDE:** The Arduino IDE is the necessary software for this. With the free and open-source Arduino Software (IDE), creating and transferring code to the board is a breeze. Windows, Mac OS X, and Linux are all supported. The environment is built in Java, with Processing and other free tools serving as its foundation. The programme is compatible with all Arduino boards. The Arduino IDE has a code editor, a chat window, a text console, a toolbar with frequently used buttons, and a menu system. It communicates with Arduino boards so that code can be uploaded and run. Arduino software is referred to as sketches. These draughts are created using the text editor. Files containing sketches have the ".ino" extension. It allows you to copy and paste, search and replace text, and more. While exporting or saving, you may check for updates or issues in the message box. The Arduino environment's text output, such as error warnings and other data, is shown via the console. The active board and serial port are shown in the lower-right corner of the window. The buttons on the toolbar provide access to the serial monitor, programme verification, programme uploading, sketch creation, and sketch saving.

6.

IV. RESULTS

Incorporating garbage bins with indication lights is one way to improve sanitation in urban areas. This system utilises a garbage can, an infrared sensor, and a Raspberry Pi to collect garbage remotely. When the trash cans are overflowing, the system will send an email and update the bins' dashboard to let you know. If the trash can isn't emptied within a certain time frame, a report is sent up the chain of command so that action can be taken against the responsible contractor. Additionally, this approach aids in keeping an eye on phoney reports, which helps to cut down on managerial corruption. As a result, the cost of waste collection as a whole is reduced as fewer rubbish collection truck trips are required. Cleanliness in public places is aided as a result. This means that the inclusion of solar panels in a smart waste management system might help cut down on the system's overall energy usage while also making rubbish pickup more efficient. Such systems require improvement since they are susceptible to component theft in a variety of ways. Any of the world's smart cities can use this dustbin model. A waste collecting and monitoring crew sent into the city can be effectively directed in their collection efforts.

Table 2: Testing Results

Testcase Notation	Input	Remarks	Testcase Validation
T-1	Null	No trash can contents present.	Pass
T-2	Garbage filling	The rubbish can is almost overflowing.	Pass
T-3	Garbage filling	There's more trash than fit in the rubbish can.	Pass
T-4	Filled	The trash can is overflowing with trash.	Pass
T-5	Spillover	Overflowing waste has caused the bin to reach its maximum capacity.	Pass

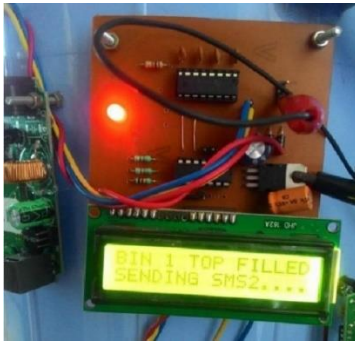


Figure 2: Result 1 showing Garbage level is Top filled

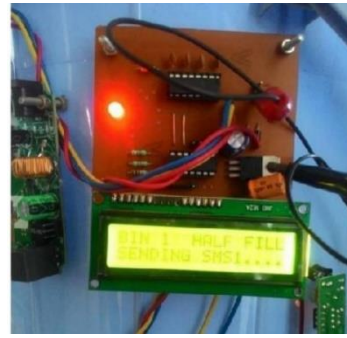


Figure 3: Result 2 showing Garbage level is Half filled



Figure 4: Final Model

V. CONCLUSION

Intelligent trash cans are better than regular garbage cans since they are compactible and can be monitored in real time using this cutting-edge system. The Arduino sensor and other high-tech gadgets are already built in. The trash can will open when something comes close to it and close when a set amount of time has passed.

Increasing the number of individuals who can afford it will stimulate the economy. And improve people's health and sanitation an afford it will stimulate the economy and improve people's health and sanitation. So that both the wealthy and the needy might share in its benefits. We predict that this will lead to improvements in sanitation and technology.

REFERENCES:

1. Mr. Kunal Dalvi et.al. "Solar Powered Dustbin for Efficient Waste Management", International Journal of Advanced Research in Science, Communication and Technology (IJARSCT), Volume 4, Issue 2, April 2021, ISSN (Online) 2581-9429, pp 124-128
2. N.S. Kumar, B. Vuayalakshmi, R.J. Prarthana, and A. Shankar, "An Internet of Things (IoT) and Arduino UNO-powered garbage can alert" 2016 IEEE Region 10 Conference (TENCON). IEEE, pp 1028–1034.
3. PS Reddy, R.N. Naik, A.A. Kumar, and S.N. Kishor, "An Arduino-based wireless trash can surveillance and alarm system" (2017), the Electrical, Computer, and Communication Technologies 2017 (ICECCT) conference, IEEE, pp. 1-5.
4. Thirdly, CJ Baby, H Singh, A Srivastava, R Dhawan, and P Mahalakshmi, "An intelligent trash can with alert and foresight capabilities based on machine learning", 2017 WiSPNET (International Conference on Wireless Communications, Signal Processing, and Networking), pp. 771-774 IEEE
5. R. Manikandan, S. Jamunadevi, A. Ajeyanthi, M. Divya, D. Keerthana, "An Analysis of the Grabage Mechanism for Smart Cities", International Research Journal of Engineering and Technology (IRJET), Volume: 06 Issue: 01, 2019, pp 1709-1713
6. Zade, R.; Khadgi, N.; Kasbe, M.; and Mujawar, T, "Online Garbage Monitoring System Using Arduino and LabVIEW", International Journal of Scientific Research in Network Security and Communication 2018;6(6):5-9.
7. L. Wang, Y. Ali, S. Nazir, and M. Niazi, "Isa evaluation framework for security of Internet of health things system using the-topics methods," IEEE Access, volume 8, pages 152316-152332, 2020
8. Public Space Hands-Free Garbage Compactor by Ramji DR, Shinde J.R., and Venkateswarlu R.2019;1(2):52-8 International Journal of Digital Electronics.