

# Autonomous Garbage Cleaning Robot

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*Abstract—India, the second-most populous nation in the world, has a serious waste management issue. Currently, there are established trash management practises include routine and periodic clearing by several civic organisations like the local government corporation. However, despite the fact that these routine maintenance tasks are completed, we frequently encounter garbage cans that are overflowing and letting their contents pour out onto the streets. Now that there will be many smart cities, there are also many obligations that must be carried out. Cleanliness is the first requirement of a wise lifestyle, and cleanliness starts with a trash can. Only if dustbins are strategically positioned and properly collected will a community have its trash transported in an efficient manner*

*Keywords—cleanliness, robot, automated, waste management*

## I. INTRODUCTION

Today's population has a busy lifestyle. As a result, their working hours will be inconsistent and longer. People always find a way to save time for relaxation in situations like this. Cleaning a room or specific area will therefore be perceived as a monotonous and laborious task. Not only in Indian cities, but also in the country's rural areas, garbage is a serious issue. It is a significant pollutant source. Each year, Indian cities produce more than 100 million tonnes of solid trash. In 2000, the Supreme Court of India ordered that a complete waste-management strategy, including household collection of segregated trash,

recycling, and composting, be implemented in all Indian cities. Simply put, these directives have been disregarded. Automated indoor waste management system employing wavefront algorithm and received signal strength indicator values-based mobile robot. To live is to help each other, to serve humanity, as a whole. But, in retrospect, the way waste management is being done clearly defies this. Waste management, both indoor and outdoor, is almost done manually. This is not only unhygienic, but also requires significant amount of valuable human resource to get it done. The unresolved problem of waste management is more of a hindrance in indoor environments like shopping malls, hospitals, schools, offices and homes; since, at least outdoor waste management is automated to an extent. Therefore a proposal to fully automate indoor waste management, by making the existing disposal outlets more intelligent and using a movable waste collecting robot, is discussed in this paper. The filling of the dustbin is monitored by ultrasonic sensors and if it is filled to the brim, the Arduino Nano controller transmits the data to the robot with the aid of wireless Zigbee 802.15.4 protocol. The robot is designed in such a way that it effectively tracks the location of the filled dustbin and collects the waste in its storage part. The RSSI (Received Signal Strength Indicator) value from the message received is used to identify which dustbin is full and its location based on Wave Front Algorithm

II.HARDWAREREQUIREMENTS:

- MICROCONTROLLER
- BATTERY
- ULTRASONICSENSORS
- RFIDREADER
- WSNMODULE
- DRIVERCIRCUIT
- DCMOTORS
- BUZZER
- LIMITSWITCHES

III.HARDWAREDESCRIPTION:

**ESP32:**

ESP32 is a low-cost System on Chip (SoC) Microcontroller from Espressif Systems, the developers of the famous ESP8266 SoC. It is a successor to ESP8266 SoC and comes in both single-core and dual-core variations of the Tensilica’s 32-bit Xtensa LX6 Microprocessor with integrated Wi-Fi and Bluetooth. The good thing about ESP32, like ESP8266 is its integrated RF components like Power Amplifier, Low-Noise Receive Amplifier, Antenna Switch, Filters and RF Balun. This makes designing hardware around ESP32 very easy as you require very few external components.



Fig 1 ESP32

**Sensor Ultrasonic:**

Ultrasonic sensor is that it generates ultrasonic pulses and determines the distance travelled by the pulse before returning to the transducer. The transducer emits sound waves, which are reflected by an object and returned to the transducer. The ultrasonic sensor will switch to receiving mode after it has finished emitting the sound waves. The distance of the item from the sensor determines how long it takes for an emission to be followed by a reception.



fig 2 Sensor Ultrasonic

**RFID READER:**

The transmitter consists of an oscillator to create the carrier frequency; a modulator to impinge data commands upon this carrier signal and an amplifier to boost the signal enough to awaken the tag. The receiver has a demodulator to extract the returned data and also contains an amplifier to strengthen the signal for processing. A microprocessor forms the control unit, which employs an operating system and memory to filter and store the data. The data is now ready to be sent to the network.



RFID Reader

Fig 3 RFID READER

**BUZZER:**

A buzzer or beeper is a mechanical, electromechanical, or piezoelectric audio signalling device. Buzzers and beepers are frequently used as alarm clocks, timers, and to validate human input such as a mouse click or keystroke. In computers, printers, copiers, alarms, electronic toys, automotive electronics, telephones, timers, and other electronic products for sound devices, buzzers are a common integrated structure of electronic transducers and DC power supplies. This part is dedicated to the sensor expansion module and the active buzzer 5V Rated power, which can be connected directly to a continuous sound.

**Features:**

- Input supply: 5VDC
- Current consumption: 9.0mA max.
- Oscillating frequency: 3.0±0.5KHz
- Sound Pressure Level: 85dB min.

**16×2 LCD:**

This LCD display was created with E-blocks in mind. It has a single 9-way D-type connector and a 16 character, 2-line alphanumeric LCD display. As a result, the gadget can be attached to the majority of E-Block I/O ports. The user guide that follows provides more information on the serial format of data that the LCD display demands. A 5V power source is also necessary for the display. Please be careful not to surpass 5V because doing so will harm the gadget. The E-blocks Multi programmer or a 5V fixed regulated power supply work best for producing 5V. The 224 various characters and symbols that can be displayed on the 16 x 2 intelligent alphanumeric dot matrix displays.



Fig 416x2 LCD

**ZIGBEE:**

The IEEE 802.15.4-2003 Low Rate Wireless Personal Area Network (LR-WPAN) standard must be followed by ZigBee devices. According to the standard, the physical layer (PHY) and the Media Access Control section of the data link layer (DLL) are the lower protocol levels. The ZigBee specification outlines a technology that is meant to be easier to use and less expensive than other wireless personal area networks (WPANs), such Bluetooth or Wi-Fi. Transmission distances are limited by its low power consumption to 10-100 metres line-of-sight, depending on power output and ambient factors. By sending information over a mesh network of intermediary ZigBee devices to more distant ones, ZigBee devices are able to transport data over vast distances. ZigBee is generally utilised in applications requiring slow data rates and extended battery lives.



Fig 5 ZIGBEE

**Features:**

- Supply voltage: 5v DC
- Detection range: (10-30) m
- RS232 Output
- TTL UART also provided
- Frequency: 2.4GHz
- Tx and Rx Status LEDs
- Low power

In order to provide real-time monitoring and alerting, the software component of the system is essential for gathering and processing data from the sensors and RFID technology. The programme is made to function on an embedded module with RFID and Internet of Things support that is connected to an Arduino UNO board. A suitable programming language, like C++, is used in the software's programming code, which controls how the sensors and RFID technology operate and how they interact with the city's web server. The software analyses the information when the software receives it from the ultrasonic sensor and calculates whether there is enough waste in the bin to trigger an alarm on the municipal web server. The software validates the RFID tag to certify that the trash has been picked up and the bin emptied, using RFID technology for verification purposes. The programme also comes with an Android app that connects to the web server and gets alerts from the embedded module. The application enables remote cleaning process monitoring, eliminating the requirement for human cleaning process monitoring and verification. In order to ensure efficient and effective waste management in public spaces, the software component of our project is essential for providing real-time monitoring, alerting, and remote management of the smart garbage alarm system.

**V.TECHNICAL INFORMATION**

Every time the boot loader is run, the Arduino boot loader resets the "erase Address" to zero. To specify the address in which we want to write or verify when downloading a programme, ROBOTC created the "Load Address" command. The Arduino boot loader will wipe the previous page and write a brand-new page when writing a page of memory to the Arduino. Everything works perfectly while downloading firmware because the Erase Address and the Loaded Address both begin at 0. When developing a user programme, we begin writing at memory location 0x7000, however the Boot loader deletes data beginning at location zero since the "Load Address" instruction fails to update where to delete data. In order to prevent the firmware from being unintentionally erased during the writing of a user programme, our update sets both the Load Address and the Erase Address.

**VI.TECHNICAL DETAILS**

Microcontroller	aduino UNO
Operating Voltage	5V Input Voltage
Input Voltage	6-20V
Digital I/O Pins	54
Analog Input Pins	16
DC Current per I/O	40mA
DC Current 3.3V	50mA
Flash Memory	256 KB
SRAM	8KB
EEPROM	4KB
Lock Speed	16MHz

VII. SYSTEM WORKING

The smart garbage alert system, which is designed to work with the help of a robot, is a highly efficient and effective solution for waste management in public spaces. The robot uses ultrasonic sensors to measure the level of garbage in the bin and sends an automatic alert to the municipal web server when the bin reaches a certain threshold. The RFID technology is used for verification purposes, ensuring that the garbage is collected and the bin is emptied. The system can be customized to cater to specific market segments and can be scaled up or down depending on the needs of the organization. The remote monitoring capabilities offered through the android application make it easier to manage the cleaning process and track progress. Overall, the robot working model provides a Sustainable and efficient solution for managing waste in public spaces, promoting public health and hygiene.

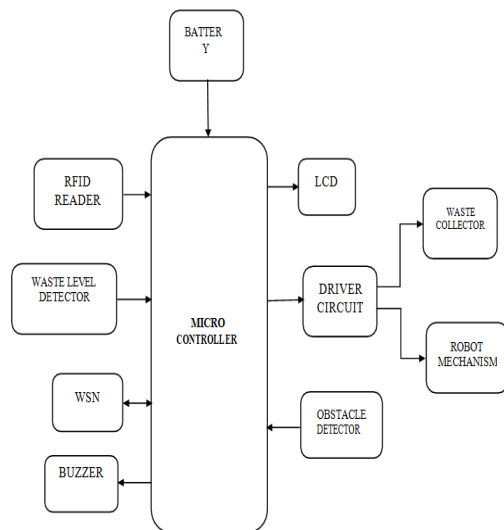


Fig 7 autonomous garbage cleaning robot

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