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Design and development of smart dustbin

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ABSTRACT

The biggest pollution concern today is the overflow of garbage. This creates unhygienic conditions for individuals and creates a bad smell in the environment which in turn leads to the spreading of deadly viruses and human diseases. In order to avoid such issues, smart dustbin control is carried out and implemented with the help of various sensors. Various sensors are used in this system to monitor the level and specific IDs will be given for each dustbin in the cities so that it is easy to recognize which waste bin is complete. The GSM module is used to send a message for updating the status of the bin to the respective authorities. When the bin level exceeds the threshold limit; the system transmits the reading with the given unique ID. After that, the dustbin will automatically close the door. Once the bins are complete, the user will not be able to access the bins. The status of the bin will be indicated on the LCD display and it will send a message with the help of GSM to the concerned authorities from their venues. So in order to clean the overflowing bins, the concern authority will take immediate action. The rain sensor is used to track rain. The door will automatically get closed when the rain is detected in order to prevent the water entering inside the bin.

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1. Introduction

Cities with emerging economies have exhausted services in waste management, badly maintained and unregulated waste disposal sites and issues escalate. In these countries, garbage collection methods are a constant challenge; due to poor institutions and rapid urbanisation, many struggles have been faced. Major diseases propagate because of human contamination. We have to track and manage the waste in open spaces. Cities in which intelligent cities around the world are becoming intelligent are currently evolving rapidly, but because of this, the quantity of waste & garbage is increasing each day. Waste management is turning into a worldwide epidemic. Since the authorities are not diligent and careful, the waste tanks tend to be mostly overflowing. This proposed framework provides us with one of the best ways to pre-

serve the clean atmosphere, control disease spread and free pollution. (See Table 1).

2. Proposed system

Fig. 1 shows the Block Diagram of Proposed System.

2.1. Power supply

An Arduino comes with a secure 5 V DC that can be supplied either through the USB power lines or through shield connectivity, or an uncontrolled 6–20 V DC (recommended 7–12 V), which can be supplied with a positive barrel connector via a 2.1 mm centre.

2.2. Arduino

Arduino is a company, a company that develops and produces microcontroller kits for the production of digital devices and inter-

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Table 1
Technical Specification of Arduino.

Arduino	ATmega328P
Operating Voltage	5 V
Input Voltage (recommended)	7–12 V
Input Voltage (limit)	6–20 V
Digital I/O Pins	14 (of which 6 provide PWM output)
PWM Digital I/O Pins	6
Analog Input Pins	6
DC Current per I/O Pin	20 Ma
DC Current for 3.3 V	Pin 50 Ma
Flash Memory	32 KB (ATmega328P)

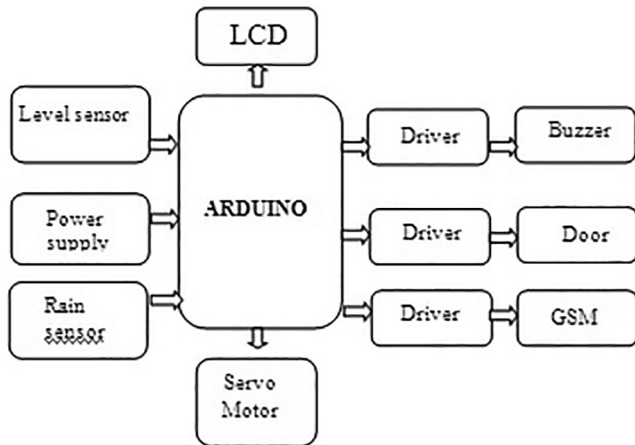


Fig. 1. Block diagram of proposed system.

active objects that can feel and manipulate objects in the real world.

2.3. Level sensor

A Level sensor is used to assess fluid, liquids or other substances in an open or closed system at levels or volumes of fluids. Two types of measurements are continuous and measurements of the point stage. For calculating levels to a certain level, the continuous level sensor is used but provides accurate results. On the other side, only the fluid level is calculated to be low or high. For the continuous level measurement of the bucket we use an ultrasonic level sensor. The sensor emits high frequency acoustic waves (20kHz to 200kHz) which are reinforced by the transducer.

2.4. Rain sensor

A weather sensor or a rain switch is a rainfall switch. Two rain sensor applications are available. Second, it is a water conservation unit that is attached to an automated irrigation system that stops the system in case of precipitation. The second is an instrument used to shield the inside of the car from the rain and to assist the windscreen cleaning system automatically.

2.5. GSM

The ETSI standard was originally created as a global framework of mobile communications, the mobile community special. GSM is the wireless network that binds mobile phones in the immediate vicinity by looking for cells. With most of the 2G GSM networks

running on the 900MHZ band or 1800MHZ band, the GSM network has a number of carrier frequencies.

2.6. LCD

Liquid Crystal display screen is an electronic display module that is used in many different systems and circuits for a broad variety of applications. A 16*2 LCD display allows 16 characters to be displayed per line and 2 such lines are displayed.

2.7. Buzzer

A Buzzer is an audio signalling device that is mechanical, electrical or piezo electrical, typically used to mean a click, a ring or a beep is pressed.

2.8. Driver

Driver circuits are most widely used to amplify signals in the semiconductor system from controllers or microcontrollers to monitor power switches.

2.9. DC motor

A DC motor is one type of electric rotary machinery that converts direct power to mechanical energy.

3. Working methodology of smart dustbin

The ultrasonic sensor is used in this proposed device to find the waste filled height on the floor. As a microcontroller platform, Arduino nano board is used. The GSM modem and the Arduino board can communicate with the RX modem pin connection to the TX board pin and vice versa. The sensor pins Echo and Cause are linked with the Arduino board's digital pins 5 and 13. Arduino is a 5 V power supply board with GSM modem 2A on. The height of the threshold is 10 cm. The distance between the sensor and the garbage-filling stage is the difference in height. During waste collection the modem is enabled to send an alarm signal to the authority concerned through the SMS if the difference falls below the threshold value. The GSM 900A modem used to send messages is included in this article. It includes a GSM/GPRS modem that has standard RS-232 (Serial Port), USB interfaces for fast connectivity to other devices. The LCD monitor and buzzer is included in the device too. A 12 V transformer is supplied to the device. The LCD monitor displays the status of the waste collected in the containers. The LCD displays the garbage level status. When the collected waste level reaches the set limit, the device sets the buzzer. This device thus helps preserve the urban environment by telling the city authorities about the waste levels of the bins. The rain sensor is also included to avoid water saturation in the bin. It is a conductivity sensor that senses the rain and automatically closes the dustbin lid. This ensures that diseases are not spreading in our society and that waste is free and safe. The intelligent dustbin management system also makes cities functional and intelligent.

4. Conclusion

The collection of waste in the cities is made simpler by using this process. It contributes to air pollution control, human energy, time and resources. Using proper technology, we can direct trucks on the shortest route for the waste collection by selecting the GPS & SOFTWAREAPPLICATIONS. This system will give cities an advantage in order for them to be intelligent and human-friendly. With

the aid of the servo engine and ultrasonic sensor, the dustbin will open the deck when movement is detected. Details about waste in the waste bin are provided by the ultrasonic sensor. If the threshold value is met, waste status is passed to the competent authority. The work proposed is to incorporate an intelligent dustbin management device using an ultrasonic sensor, Arduino Nano, a buzzer and a GSM modules. It also detects precipitation to prevent water storage stagnation within the bin. This device will ensure that dustbins are cleaned soon when the waste level hits the highest possible level. It uses a piezoelectric device to control supplies. If the dust bins are not washed for a certain period of time the status is forwarded to the sweeper or the authority that is willing to take adequate action on the contractor. This method also helps to track false reports and can also eliminate corruption in the management system in its entirety. In the end it helps to keep society clean. This makes the intelligent dustbin management system more effective waste collection and intelligent organisations.

CRedit authorship contribution statement

G. Revathy: Conceptualization, Data curation, Writing - original draft, Writing - review & editing. **K.V. Malini:** Investigation, Methodology. **Manoj Ashok Wakchaure:** Investigation, Methodology. **Dinesh Sheshrao Kharate:** Investigation, Methodology. **Jaishree Murugesan:** Conceptualization, Data curation, Writing - original draft, Writing - review & editing. **M. Jemimah Carmichael:** Conceptualization, Data curation, Writing - original draft, Writing - review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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