Smart Dustbin Monitoring System using LAN Server and Arduino

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Abstract: *The main objective of this paper is to monitor the dustbin and maintain the environment smart and clean. Nowadays people are using more products including food items, industrial products, medicines and, plastic materials. After expiry of these items they are put it into a dustbin for disposal. Without proper maintenance of dustbins, these expiry items can create epidemic diseases among people and pollution to the ambience. So the dustbins at cities, home, industries and hospitals have to be maintained properly to ensure cleanliness. This paper presents an Arduino based smart dustbin monitoring system which can be operated using a local area network (LAN) server. The Arduino Uno controller is used to read the dustbin levels with the help of Ultrasonic sensor. After 100% filling of dust and waste items, vehicle is sent to that area to collect the garbage deposited. Arduino Uno contains Atmega328p-pu IC. Arduino Ethernet shield is used to send the data to server in order to monitor the dustbin level. Embedded C is used to program the controller and html is employed for creating the web page.*

Keyword: *Dustbin Monitor; Arduino; LAN; Ultrasonic Sensor; Smart cities;*

1. INTRODUCTION

This article presents a Smart Solid Waste Monitoring and collecting system. It is a common sight to witness garbage spilled out in and around the dust bins. The area around an improperly maintained dust bins can house disease spreading insects like mosquitoes, flies, bees and driver ants. The environment around a dustbin is also conducive for increasing the pollution level in air. Air pollution due to a dustbin can produce bacteria and virus which can produce life threatening diseases in human beings. Additional care must be taken in a densely populated area where the waste deposits in the bins are sufficiently high [1][2].

Dustbin level is transmitted through server with the help of Ultrasonic sensor [3]. At a time we can monitor the dustbin throughout the network. It means we can access the data from dustbin where all the computer terminals are connected to the same network. Every 5 seconds the data about the level of garbage in the dustbin is updated. After the dustbin is filled completely it is transported by a vehicle to the dump yard to keep the city clean. This design is independent of Global System for Mobile Communication (GSM) and hence can be employed in apartments, industries and hospitals.

The rest of the article is organized as follows: Section 2 presents a brief survey on existing dust moni-toring systems. Section 3 introduces the block repre-sentation of the smart dust bin monitoring system; Section 4 focuses on the hardware implementation, while conclusion and scope for future work are given in Section 5 and 6 respectively.

2. LITERATURE SURVEY

This Section provides a brief survey on the existing dust monitoring systems proposed in the literature by the researchers in the past. For instance Ruhin Mary Saji has presented a smart garbage management system using IR sensor and web browser [1]. While Hassan et al. have developed a smart solid waste monitoring and collection system using radio frequency (RF) Communication [2] and GSM Communication [3]. Moreover a Novel approach to Home Automation system using Bluetooth and Arduino is suggested for Arduino Uno board [4].

A novel approach to Garbage management using Internet of things (IoT) and GSM Communication with GUI representation using MATlab is also suggested [5]. Moreover an IoT based intelligent bin for smart cities using IR sensor, GSM, and Internet is developed [6]. Other methodologies used for Waste bin monitoring system are based on Zixbee and GSM communication [7], PIC controller and GSM [8], Wi-Fi module [9] and IoT assisted RF module and web browser [10].

3. BLOCK REPRSENTATION

The block representation of the proposed Smart Dustbin Monitor using LAN Server and Arduino in given in Fig. 1. An ultrasonic sensor is used to sense the dust level distance and passes it to the Arduino Controller which reads the distance and gives the percentage of garbage level filled in the dustbin. The percentage of dust is given to Arduino Ethernet shield which transmits the data to LAN server. In the computer/laptop connected to that network, the dustbin level with the help of IP address of Ethernet shield. Dustbin levels are updated for every 5 seconds.
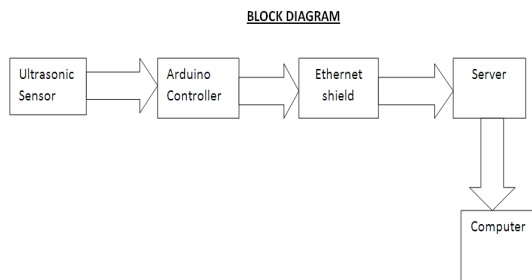

Figure 1: Block representation of the proposed system

4. HARDWARE IMPLEMENTATION

The hardware realization of the proposed Smart Dustbin Monitoring system using LAN Server and Arduino is detailed below

4.1. Arduino Controller

An Arduino is an open source microcontroller board which is shown in Fig. 2 [4]. There are so many Arduino boards are available in market like UNO, MEGA, Mico, Nano, Yun, Esplora, Pro mini, and Lilly pad. In this paper, we are use an Arduino Uno Board which consists of 14 digital input/output pins, 6 analog input/output pins and one serial port [5] [6]. USB power Supply and external power supply.

Figure 2: Arduino Uno Controller

The Arduino Ethernet shield W5100 which is compatible to Arduino Uno Board is used to transfer the dust bin level to the LAN server. This Shield consists of memory card slot, reset switch, RJ45 jack. Embedded C is used to program the controller. The board operates between 5-10 Volts and it draws small current. We are operated this setup using PC/Laptop

The programming software for this board is Arduino 1.6.11 or higher version. Programming is done using the USB serial cable [7]. Programming cable is shown in Fig. 3.The dust distance is viewed in serial monitor of Arduino software as shown in Fig. 4.
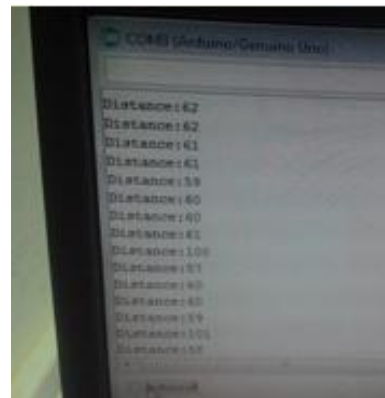

Figure 3: Programming Cable

Figure 4: Serial Monitor

4.2. Arduino Ethernet Shield

Arduino Ethernet Shield consist of W5100 IC, in-built SD card slot, reset switch and RJ45 jack. The Mac address of board is randomly assigned. The Mac address is represented in Hexa decimal form. If more than one Ethernet shield is used, then use different Mac address. IP address of board is assigned based on LAN. Arduino Ethernet Shield is shown in Fig. 5.

Figure 5: Arduino Ethernet Shield

4.3. Flow chart

A basic flow diagram of smart dustbin monitor using LAN server and Arduino is shown in Fig. 6.
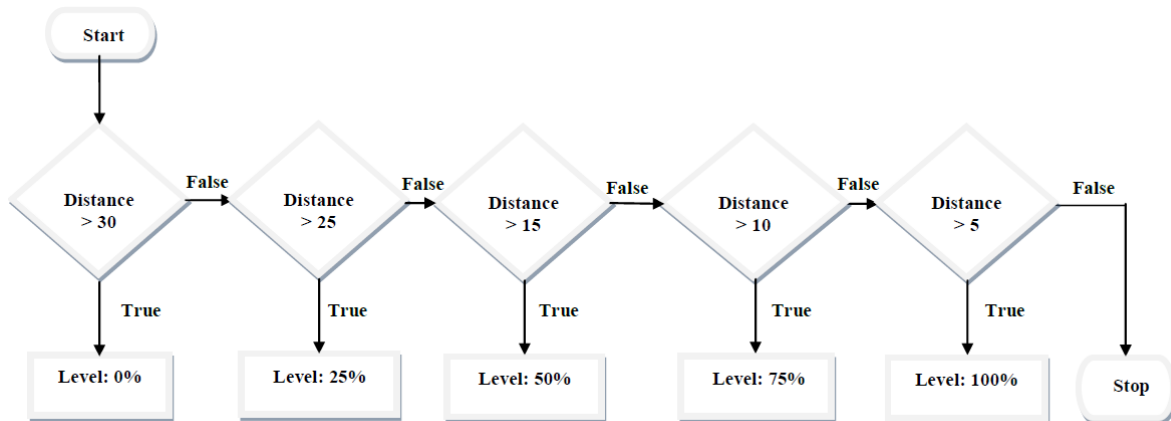
Figure 6: Flow chart for smart dustbin monitor using LAN server and Arduino

4.4. Ultrasonic Sensor

In this paper, a HC-SR04 ultrasonic sensor is used for measuring dust level [8] [9]. It consists of VCC, Ground, Trigger and Echo pins. This sensor detects the obstacle with help of radio waves. This module sends 40 kHz signals and detects reflected signal from obstacle. Ultrasonic Sensor is shown in Fig. 7. Equation 1 expresses the level of dust and garbage contained in the dustbin where the velocity of sound is 343 m/s. Its effectual angle is 15 degree.

$$\text{distance} = \frac{\text{high level time} \times \text{velocity of sound}}{2} \quad (1)$$

Figure 7: Ultrasonic Sensor

4.5. LAN Server

In this paper, a LAN server is used to serve the dustbin level data to the workstations connected to the LAN. The Internet Protocol (IP) address of Ethernet shield is typed in Uniform Resource Locator (URL) address for getting Dustbin level [10]. The Hypertext Markup Language (HTML) coding is used for creating webpage. The dustbin levels are displayed in all the computers connected the LAN Server. Even Without internet connectivity we can get the detail regarding the dustbin level. LAN Server connection is shown in Fig. 8.

Figure 8: LAN Server Connections

The proposed dustbin monitoring system uses ultrasonic sensor and Arduino controller for monitor the dustbin levels and sends the data to local area network server. This setup needs local area network connections to monitor the garbage level in dustbins continuously. Overall setup is used to maintain the smart and clean cities and reduce pollution and diseases.

3. CONCLUSION

The article proposes a cost effective and user friendly Smart Dustbin Monitoring system using LAN Server and Arduino. The significant advantage of the method is that the garbage level in the dustbin is centralized and monitored using the LAN Server. It saves the time to locate each and every dustbin in a remote area. This concept avoids over flow of dustbin and prevents diseases produced from the garbage spilled around the bin. The proposed system is robust, reliable and requires less maintenance. The idea proposed in this article can be used in hospitals, apartments and restaurant.

6. FUTURE WORK

In future the proposed idea can be extended to monitor more than one Dustbin through LAN server and Internet.

7. ACKNOWLEDGEMENTS

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