

Smart Bin: IoT Based Waste Alert System

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Abstract— As India is a developing nation; the important challenge is making the country as a smart city. The important concept of smart cities is the waste management which is very much trending and helpful these days. In the earlier existing systems, it gives prior information of the filling of the garbage bin that alerts and sends warning message to the municipality so that they can clean the garbage bin on time and safeguard the country.

Key words: Ultrasonic Sensor, Arduino, Microcontroller, IoT, Garbage System, Dashboard, Garbage Container, IoT

I. INTRODUCTION

IoT is improved by sensors and actuators; the technology becomes an illustration of the added widespread group of cyber-physical systems, which also encompasses technologies such as smart grids, virtual power plants, smart houses, intelligent transportation and smart cities. The smart dust bins are connected to the internet to get the information of the smart dustbins. In the recent years there was heavy pollution caused to the environment. When the garbage is spread in the city the animals eat that wastes and they are affected by the avoidable diseases. Due to lack of resources, ineffective groundwork, some waste is not collected which poses serious health hazard to the surrounding environment. Proper cleaning intervals may provide a solution to this problem. But keeping a track of the status of the bin manually is a very difficult job. There are multiple dustbins are located throughout the city. These dustbins are interfaced with IoT based system with Ultrasonic sensor. Where the Ultrasonic sensor detects the level of the garbage in the dustbin and sends the signals to GSM-module. Each thing is individually specific all the way through its embedded computing system but is able to inter-operate surrounded by the active Internet infrastructure. The IoT allows objects to be sensed or embarrassed remotely transversely active set of connections infrastructure, creating opportunity for added direct integration of the substantial planet into computer-based systems.

The data has been received, analyzed and processed in the database, which displays the status of the Garbage in the dustbin on the application of authorized person mobile. The concerned authority get alert about dustbin is full and informs person whoever is responsible for collecting garbage from the particular areas. The authority will check the garbage for every two hours and it will give the alert message the garbage is not cleaned. After cleaning the trash can the ultrasonic sensor checks the trash can whether it is empty or full and if the trash can is empty then it sends the information to the Arduino. Thus, any object in the physical world which can be provided with an IP address to enable data transmission over a network can be made part of IoT system by embedding them with electronic hardware such as sensors, software and networking gear. In this paper, we are going to propose a system for the immediate cleaning of the dustbins. As dustbin is considered as a basic need to maintain the level

of cleanliness in the city, so it is very important to clean all the dustbins as soon as they get filled. We will use ultrasonic sensors for this system. The sensor will be placed on top of bin which will help in sending the information to the office that the level of garbage has reached its maximum level. After this the bin should be emptied as soon as possible. The concept of IoT when used in this field will result in a better environment for the people to live in. With the help of this system minimal number of smart bins can be used around the whole city and the city will still be much cleaner. The IoT network consists of embedded electronics, sensors and software that allows these devices to send and receive data among each other. If the bin doesn't get emptied on time then the environment becomes unhygienic and illness could be spread. The proposed system will help in removing all these disadvantages.. The objectives of the project are to design a prototype of Internet-of-Thing (IoT) garbage monitoring system and alert the garbage collectors the fullness of the bin by identify the level of garbage based on the depth of the bin. Waste management is a big issue in today's world.

II. LITERATURE REVIEW

- 1) IoT Based Waste Management for Smart City by Parkash, Prabu V. Level of the dustbin is displayed when garbage is full. The drawback of this paper is time is not shown when the garbage is cleaned.
- 2) Waste Management System Using IoT by Mrs.D.Anuradha, A.Vanitha, S.PadmaPriya, S.Maheshwari. Unique ID of the dustbin is displayed when the level of the dustbin is full and is stored in the mobile application. The drawback of this paper is the time is not shown when the garbage is cleaned.
- 3) Smart Waste Management System using IoT by Prof. S.A.Mahajan, AkshayKokane, ApoorvaShewale, MrunayaShinde, ShivaniIngale. The load sensors will increase efficiency of data related to garbage level and moisture sensors is used to provide the data of waste segregation in a dust bin.
- 4) A Smart Waste Management and Monitoring System using Automatic Unloading Robot by Nithya.L, Mahesh.M. The robot is used to collect the garbage when it reaches high level. To move the robot from garbage area and unload the wastage by Using DC Motor. The overcome of this paper is that recycling the plastics automatically.

A Smart Dustbin proposed by [1], based on IoT in which the smart bin was built on a platform which was based on Arduino Due board which was interfaced with a GSM modem and an ultrasonic sensor. The sensor was placed on the top of the bin. A threshold level was set. As the garbage reaches the level of threshold, the sensor triggers the GSM modem which alerts the associated authority till the garbage in the bin is emptied.

The researchers [2] suggest the method for garbage management which is as follows. The bin was interfaced with

a system based on microcontroller which had Ultrasonic wireless systems with a central system that showed the current status of the garbage in the bin. The status was seen on a mobile based web browser with a html page by using GSM. Author proposed a method for areas

The researchers [3] in this system, the level of garbage in the bin were detected by the ultrasonic sensor which will send the data to the control room using the GSM module. A GUI was also developed to check the information that was related to the garbage for different locations, GUI was based on MATLAB so it was different. Two units were present in the system; Transmitter unit was in the bin whereas the Receiver unit was there in the control room. The sensor will check the level of garbage and send it to the Transmitter unit which will further send the data to Receiver unit which at last will inform the authorities to clean the bin.

The researcher's [4] a different ID was provided to each been so that it could be easier to detect that which is bin is full and ready to be emptied. The project is divided into two sections one being the transmitter section and other the receiver section. The transmitter section consists of a microcontroller and sensors which check the level of the garbage and the data is passed onto the system with the help of the GSM Transmitter, then GSM Receiver receives the data and sends it to the client associated so that the bin can be emptied quickly

III. PROBLEM DEFINITION

The existing system would be able to monitor the level of the dustbin and send the level of the dustbin to the authorized person. Pune city's current waste collection logistics is carried out by emptying containers according to predefined schedules and routes which are repeated at a set frequency. Such a System has major disadvantages:

- 1) Time consuming
- 2) High costs
- 3) Greater traffic and congestion.
- 4) Unnecessary fuel consumption.
- 5) Increased noise and air pollution as a result of more trucks on the road.

All the above disadvantages are a result of lack of real time information resulting in unsuccessful collection of waste.

IV. GARBAGE COLLECTION DUSTBIN MODULE

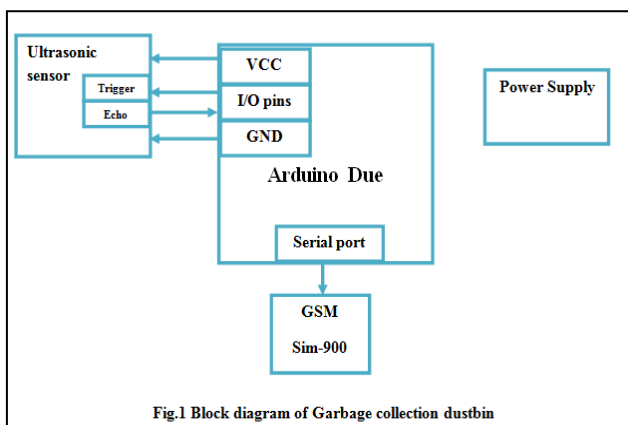


Fig. 1: Block Diagram of Garbage Collection Dustbin

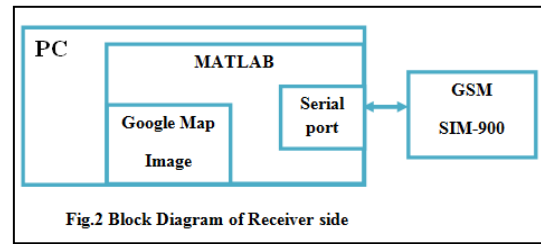


Fig. 2: Block Diagram of Receiver Side

A. Microcontroller

Proposed system block diagram is shown in figure 1 and 2. It consists of ATSAM3X8E microcontroller Board, Ultrasonic Sensor and GSM sim-90. Ultrasonic sensor detects level of the garbage collection dustbin whether it is full or not and sends signal to the microcontroller. Microcontroller gives indication to the server system through GSM sim-90. Suppose there are different dustbins which are placed at different locations then GSM send indications with respect to locations on Google map image. Whenever dustbin gets full above set threshold. This sensor data and location is send to microcontroller. Then it is send to PC with MATLAB through GSM. In PC, some operations will be performed on the received data and dustbin garbage level will be plotted in MATLAB.

The SAM3X8E also features a 12-bit ADC/DAC, temperature sensor, 32-bit timers, PWM timer and RTC. The 16-bit external bus interface supports SRAM, PSRAM, NOR and NAND Flash with error code correction. Based on the ARM® Cortex®-M3 processor, the Microchip's SAM3X8E runs at 84MHz and features 512KB of flash memory in 2 x 256KB banks and 100KB of SRAM in 64KB +32KB banks, with an additional 4KB as NFC (NAND Flash controller) SRAM. Its highly-integrated peripheral set for connectivity and communication includes Ethernet, dual CAN, High Speed USB Mini Host and device with on-chip PHY, high-speed SD/SDIO/MMC, and multiple USARTs, SPIs, TWIs (I²C), and one I²S.

B. Power Supply

In power supply firstly the DC socket is used to convert the 230v AC supply into DC supply. The output DC supply of DC socket is given to bridge rectifier as an input. We will get pulsating DC at the output of bridge rectifier. The LM7805 regulator is used to convert the pulsating dc to pure 5v DC output. The supply is given to the ATSAM3X8E-controller and GSM. In the schematic there are Port C, pin no 25 and 26 in the Microcontroller are used as transmitter and receiver respectively. Also in port A, pins from 2-7 are used as input pins. ATSAM3X8E a Controller is used. The GSM modem and Aurdino Ethernet shield are interfaced with controller. The DC socket, rectifier and regulator are used for power supply. The ultrasonic sensor is used to detect the level of garbage.

C. Ultrasonic Sensor

This is the HC-SR04 ultrasonic running sensor. This temperate sensor gives non-contact estimation usefulness with a going exactness that can reach up to 3mm. Each HC-SR04 module incorporates the ultrasonic transmitter, a recipient and a control circuit. There are just four sticks that

you have to stress over on the HC-SR04: VCC (Power), Trig (Trigger), Echo (Receive), and GND (Ground). You will discover this sensor simple to set up. Operating Voltage: 5V, DC Operating Current: 15mA, Measure Angle: 15°.

D. GSM

The GSM Module is used to send the message to the contractor for cleaning the dustbin. A GSM modem is a specialized type wireless modem that works with a GSM wireless network. It accepts SIM card, and operates over a subscription to a mobile operator, just like a mobile phone. A GSM modem can be an external device. An external GSM modem is connected to a computer through a serial cable or a USB cable. When a GSM modem is connected to a computer, this allows the computer to communicate over the mobile network. While these GSM modems are most frequently used to provide mobile internet connectivity, many of them can also be used for sending and receiving SMS. GSM Modem sends and receives data through radio waves. In this project GSM modem is used to send the messages.

1) Results

“Fig. 1,” The Arduino Board window of the serial monitor showing An alert is given in the Figure.

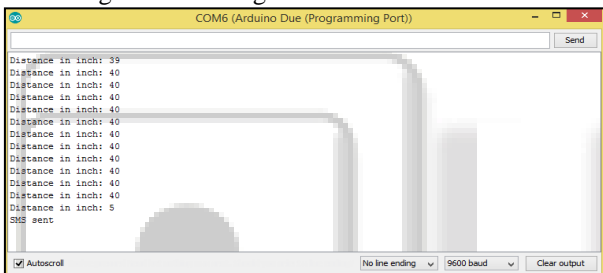
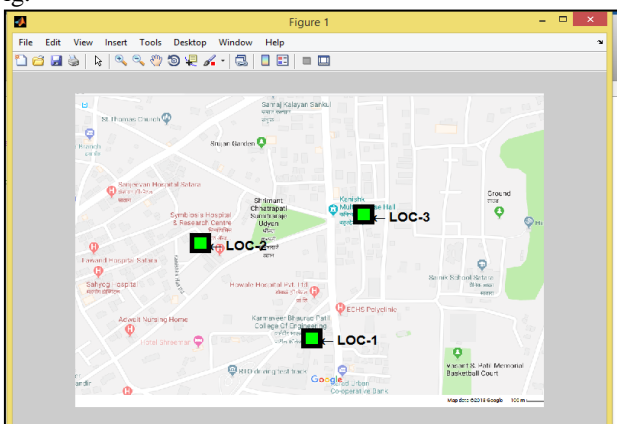


Fig. 1: Output for Alerts Message generated by the System “Fig. 2,” Location of the Bin Displayed on Google Map. Shows the dustbins with garbage. The sensor at the bin will detect the level of garbage. The sensor will connect to microcontroller that control system operation. Moreover, data for each bin will display on Matlab window. The data on the Thing Speak will shows the initial condition for each bins to make sure the waste management can monitor it as shown in Fig.



“Fig. 2:” Initial condition of Bin, Monitor on Matlab Window

“Fig. 3,” If the bin is full, the Message “Area 1 is full” is Displayed on Matlab Command Window.

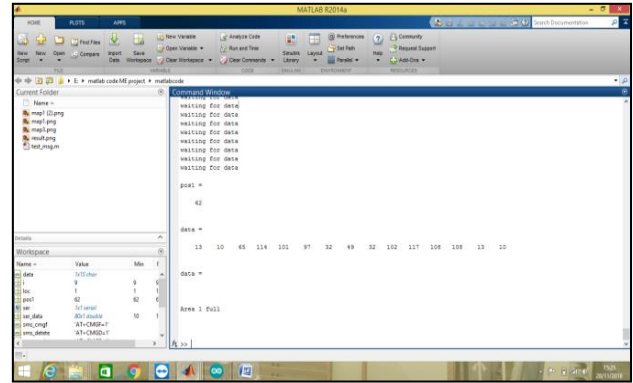


Fig. 3: The data on MATLAB Command Window, once the bin full with garbage

“Fig. 4,” Once the dustbin is filled, the red LED automatically lit up & is displayed on MATLAB Command Window.

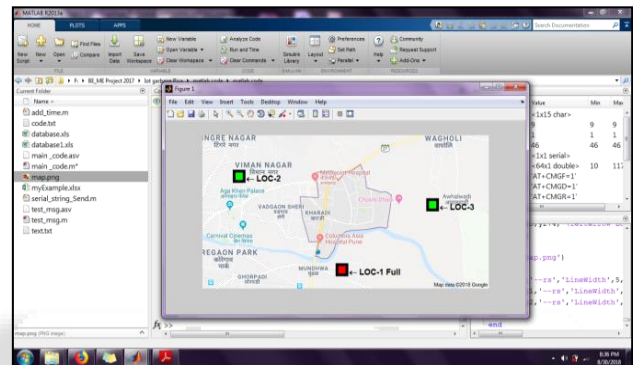


Fig. 4: Location of the bin when it filled with Garbage, displayed on Google maps

V. CONCLUSION

Waste management is a major challenging one. The system is based on IoT. We have used sensors to indicate if the bins are filled or empty. The smart garbage bin will automatically send a message when the bin is fill using GSM technology. In future, we would like to enhance the system for different kind of wastes, namely solid and liquid wastes. paper presents highly advanced and fully automatic system to collect and manage waste efficiently.

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