

Smart Garbage Monitoring System Using IOT

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Abstract— The ultimate aim for a developing nation is the “smart city”. Crucial effects on the health of living beings are being caused by the environmental pollution. Improper waste management and transports creates huge pollution in the atmosphere which are harmful to both living and non-livings creatures and to the layers of the atmosphere. The improper waste management has been continuing over years to disturb the environment and also has adverse effects on it. The detection and monitoring of wastes in the locality are such a difficult process being carried and faced by the corporation. Hence it is not possible with our ancient day’s technologies because of the need of more human effort, time and cost .The proposed system is an advanced method in which waste management is easy to handle. IOT is an emerging technology with an increasing range of applications leads to development of new advanced technologies and methods for the enhancement of IOT environment. In this system, objects are connected and controlled by the internet. Smart Garbage monitoring system using IOT is an effective design which will help the cities to keep the environment clean.

Index Terms— Internet of Things, Arduino Uno, Ultrasonic sensor, GSM/GPRS & GSM SIM908 Module and Potentiometer.

1 INTRODUCTION

Nowadays, trash bins are filled in the every corner of the society. To avoid this situation, we proposed a system which is fully related to “Smart City” and based upon “Internet of Things” (IOT). The objective of the system is to develop a smart alert system for the proper management of the garbage bins in the localities. Cleanliness is important for a smart lifestyle and hence it begins with the Garbage bin. The waste management is the cleaning of garbage bins at right time whenever it gets overflowed. To prevent the atmosphere from pollution, a smart system has to be implemented for the goodness of the society. The system works well by giving information to the corporation for the instant cleaning of the overflowed dustbins. Cleaning of the bins happens only through the proper verification of the level of wastages in the bin. For effective usage of the system, internet of things (IOT) concept has been used for data communication, processing, storing and retrieving. The proposed work helps to eradicate the everyday difficulty of managing the waste in the environment which is possible with the help of IOT.

2 PROBLEM DEFINITION

Several environmental problems and cost issues have been faced by the government because of the inefficient waste management. For the effective management, our system gives a solution to this problem for the welfare of the society. IOT technologies have been proposed

through our work for the easy communication between the bin and the admin office. The system consists of an Arduino Uno microcontroller, a garbage bin loaded with sensors and they are monitored continuously through a monitoring panel at the office with the help of GSM/GPRS & GPS module.

3 PROPOSED SYSTEM

The working of the proposed system is unpretentious. For the easy understanding, the system is divided into two units, slave unit and master unit. Slave unit is placed in the garbage bin and the master unit is placed at the control room. The working objects of the slave unit are Arduino Uno, ultrasonic sensor, Potentiometer, GSM/GPRS & GPS SIM908 module. The entire unit is kept at the top of the dustbin. The trigger pulse is sent from the ultrasonic sensor into the dustbin and as a result, the echo pulse will be received back by it. Thus the time lagging between the sent and received sound signal is used to determine the distance to the object. Through this it continuously checks the level in the dustbin. Once the wastages reach the specified threshold values, ultrasonic sensor gives indication to the Arduino uno.

Then a GSM module is connected with the Arduino Uno for passing the message. The distance measured by the ultrasonic sensor placed at top of dustbin gets reduced when the level of the wastages increased.

When the distance to the object becomes greater than the threshold value, a message is sent to the cleaner’s mobile indicating the overflow of the dustbin. SMS will be sent

before the cleaner’s regular interval of visit to pick up garbage. The alert message contains the longitude and latitude of the bin along with GPS location. The GPS location is determined by the GPS module fixed with GSM. Also, status of each dustbin is sent to the cloud server, every passing hour when it gets filled. The data are stored in the cloud by the http request from the GSM module that can store data periodically. A potentiometer has been used for setting the threshold values for the dust bins.

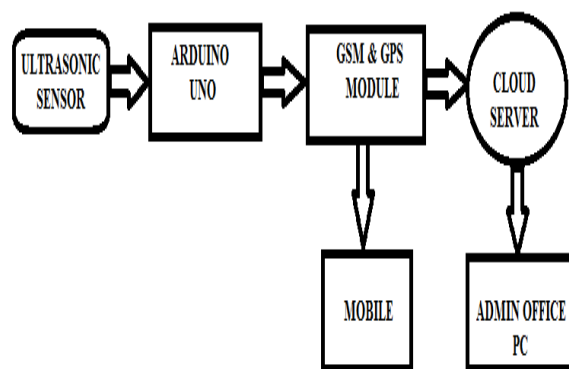


FIG 1: BLOCK DIAGRAM OF SMART GARBAGE MONITORING SYSTEM USING IOT

Then in the master unit i.e. control room, a monitoring panel was created for the Admin usage using Visual studio software through C# language. The panel will be used for getting the details about the level of the trash bins. The software has the indication for both the set level and trash level of the bin. The data are collected from the cloud server up-to-date. Once the panel is connected with the cloud server, level, latitude, longitude, time and date will be displayed in the data log panel. A warning log is provided in the system software if the trash level exceeds the bin level, it gives the warning. An email alert level has been set, once the set level exceeds the trash level, mail service has been activated that will be helpful for reporting about the non cleaning of the dustbins to the higher officials even after the alert message to the cleaner.

4 IMPLEMENTATION METHODOLOGY

4.1 HARDWARE DESCRIPTION

4.1.1 ULTRASONIC SENSOR



FIG 2: ULTRASONIC SENSOR HC-SR04

Ultrasonic sensor module HC-SR04 offers a 2cm-400cm non-contact measurement function, the accuracy range reaches up to 3mm. A high-frequency sound pulse is sent from the ultrasonic sensor and then it counts from the time of sending and receiving the pulse. There are two openings in the front of the sensor. The first opening transmits the sound signal and the other opening receives the echo signal. The speed of the signal is approximately 341 m/s in air. It uses electrical -mechanical energy transformation to measure the distance between the target object and the sensor. In the proposed system, ultrasonic sensor majorly helps to estimate the distance to the object.

4.1.2 ARDUINO UNO

It is a microcontroller board fixed on the ATmega328. It has 14 digital input/output pins in which 6 can be utilized as analog inputs, 6 PWM outputs, a power jack, a reset button, a 16 MHz ceramic resonator, ICSP header and a facilitation for USB connectivity. It operates on 16 MHz clock frequency.

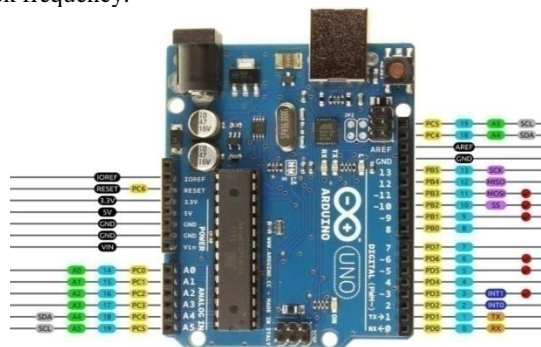


FIG 3: PIN DIAGRAM OF ARDUINO UNO

It has operating frequency of 5V and input voltage as 7-12V. It has the flash memory of 32 KB and out of which 0.5KB memory is used by boot loader. In this proposed system, Arduino Uno is connected with ultrasonic sensor, GSM/GPRS & GSM SIM908 module and potentiometer.

4.1.3 GSM/GPRS & GPS SIM908



FIG 4: GSM/GPRS & GPS SIM908 MODULE

SIM908 Module consists of Global System for Mobile communication, General Packet Radio Services Global

Positioning System. GSM is a digital, circuit switched network for telephony system and it is used for sending the SMS alert. GPS is a satellite based navigation system formed from at least 24 satellites. It works in any weather pattern all over the world, 24 hours a day without any charges. The GPS modem sends the latitude and longitude position with link pattern attached with the help of the SMS which helps to track the current position of the trash bin. SIM908 module is capable of using dual UART, only a single UART is used in this board. By connecting with the Arduino Uno, the GPS engine is switched ON through AT commands and similarly GSM is controlled through same UART by AT commands. Individual antennas are provided for both GSM and GPS. A STUB antenna is provided for GSM and an external Magnetic PATCH antenna is for GPS. The Modem has default bate rate as 9600. A sim card should be inserted in the slot of the module because the module needs the cellular network to send the location data to the server as well as for the purpose of sending the short messages.

4.1.4 POTENTIOMETER



FIG 5: ROTARY POTENTIOMETER

A potentiometer is a three-terminal resistor with a sliding or rotating contact that forms an adjustable voltage divider. It is a passive device and hence do not require a power supply or additional circuitry in order to perform their basic linear or rotary position function. Potentiometers are commonly used to control electrical devices. In this system, rotary potentiometer is used and it varies their resistive value as a result of an angular movement. In this proposed system, potentiometer is connected with the Arduino Uno for the purpose of changing the threshold values alternatively.

4.2 SOFTWARE DESCRIPTION

4.2.1 ARDUINO IDE

Writing new codes and uploading it to the board is simpler through this open-source software (IDE). It runs on Windows, Linux and Mac OS X. The platform is written using java and other open source-software depends upon processing. In fact, the Arduino Language is merely asset of c or c++ function. It provides expandables for software development. Programs are saved with the file extension.ino. These programs can be uploaded into the Arduino board using this software also have the facilities of compiling and uploading. This Arduino IDE can be used for any Arduino board. In this system, Arduino IDE helps to upload the program into

the board developed using embedded C language for the processing of the system.

4.2.2 VISUAL STUDIO

It is one of the Microsoft developed Integrated development environment. Visual studio is used to develop several computer applications, web servers and mobile applications. It uses different platforms such as Windows API, Windows Presentation Foundation, Window Store and Microsoft Silver light. It can produce both native code and managed code.

In this system, Visual studio is used to develop a web application for the purpose of office. A trash monitoring panel was developed using C# language that provides details of the trash level whether it exceeds the threshold value or stays in the set value by collecting from the cloud server. The cloud setting is developed using MySQL language. The panel also contains the Data log which includes the latitude, longitude, time, date and the level of the trash. Warning log is provided when the trash remains Unclean. An email alert setting is given for the purpose of sending the complaint about the non-cleaning of the bin.

5 EXPERIMENTAL SETUP



FIG 6: EXPERIMENTAL SETUP AT SLAVE UNIT

The experimental setup FIG 6 and FIG 7 shows the implementation of the smart garbage monitoring system using IOT. Fig 6 shows the entire setup has been built using the ultrasonic sensors, Arduino uno, GSM/GPRS & GSM sim908 module and a potentiometer and these are fixed on a board. The board is then placed on the top of the dustbin. Fig 7 shows the implementation at the master unit which brings the data about the set level and current level of the bins along with date, time, latitude and longitude.

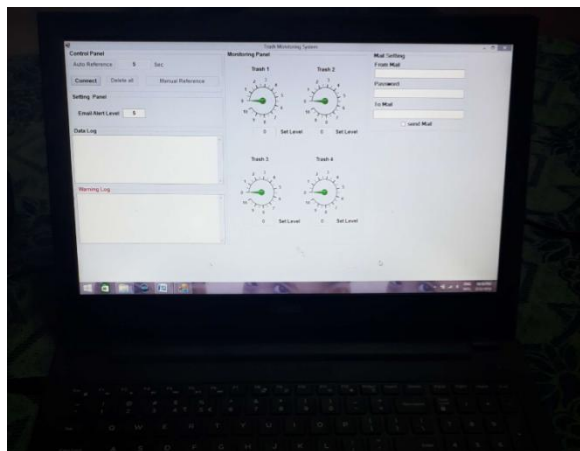


FIG 7: EXPERIMENTAL SETUP AT MASTER UNIT

6 CONCLUSION AND RESULTS

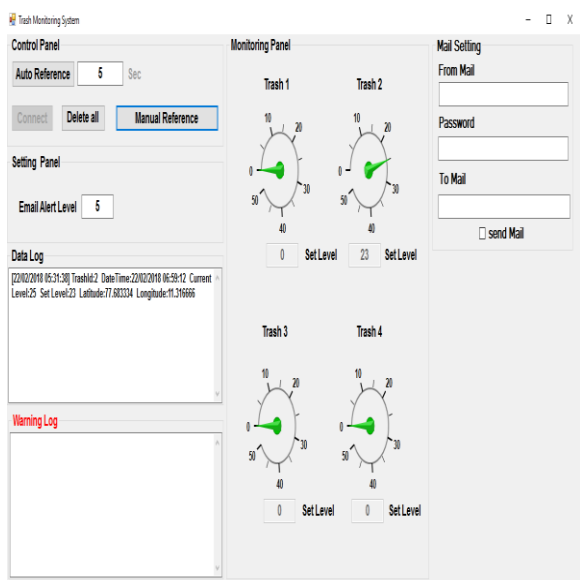


FIG 8: TRASH MONITORING PANEL

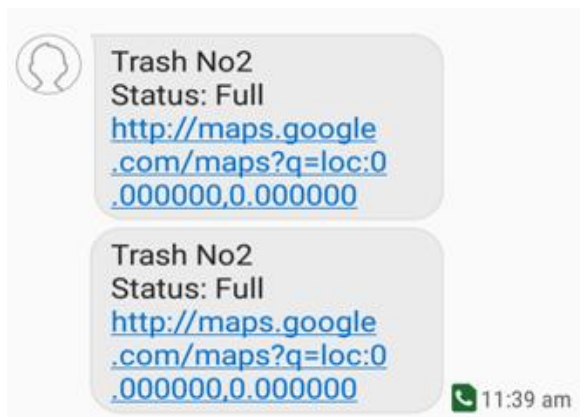


FIG 9: ALERT MESSAGE TO CLEANER'S MOBILE

The optimization of solution for the waste management is decided upon the results of the correct data obtained from the filling and the level of waste in the bins located at different places of the society. The proposed system is the optimum concept to implement and gives best solution for the major issue of managing waste properly in terms of indicating its level to the control room and an alert message to the cleaner's mobile. This system alerts the irregular cleaning of the dustbins by sending alerts to the concerned individual at regular intervals. In addition to this it also aids to contract the need for high human practices in the garbage maintenance of the municipality and pollution monitoring system.

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REFERENCES

- [1] Bharadwaj B, Kumudha M, Gowri Chandra N, Chaithra G (2017), "automation of smart waste management using IOT to support "swachh bhara abhiyan" – a practical approach", proceedings of the Second International Conference On Computing and Communications Technologies (ICCT'17), pp.318-320.
- [2] Dr.N.Sathish Kumar, B.Vijayalakshmi, R.Jenifer Prarthana, A.Shankar (2016), "IOT Based Smart Garbage alert system using Arduino UNO", Proceedings of the International Conference, pp.1028-1034.
- [3] Gopal Kirshna Shyam, Sunilkumar S. Manvi, Priyanka Bharti (2017), "Smart Waste Management using Internet-of-Things (IoT)", proceedings of the Second International Conference On Computing and Communications Technologies (ICCT'17), pp.1-4.
- [4] Trushali S. Vasagade, Shabanam S. Tamboli, Archana D. Shinde (2017), "Dynamic Solid Waste Collection and Management System Based on Sensors, Elevator and GSM", proceedings of the International Conference on Inventive Communication and Computational Technologies (ICICCT), pp.263-267.
- [5] Shubham Thakk, R.Narayanamoorthi (2015), "Smart and Wireless Waste Management", proceedings of IEEE Sponsored 2nd International Conference on Innovations in Information Embedded and Communication Systems, pp.1-4.
- [6] Keerthana B, Sonali M Raghavendran, Kalyani S, Suja P, V.K.G.Kalaiselvi (2017), "Internet Of Bins -Trash Management in India", proceedings of the Second International Conference On Computing and Communications Technologies (ICCT'17), pp.248-251.
- [7] Mohammad Aazam, Marc St-Hilaire, Chung-Hong Lung, Ioannis Lambadaris (2016), "Cloud based Smart Waste Management for Smart Cities", proceedings of the

Second International Conference on Smart Systems, Devices and Technologies, pp.188-193.

[8] Sauro Longhi, Davide Marzioniy, Emanuele Alidoriy, Gianluca Di Bu`o Mario Prist_, Massimo Grisostomi and Matteo Pirro (2012), “Solid Waste Management Architecture using Wireless Sensor Network technology”, proceedings of the fifth international Conference on New Technologies, Mobility and Security(NTMS), pp.1-5.

[9] Abhimanyu Singh, Pankhuri Aggarwal, Rahul Arora (2016), “IoT based Waste Collection System using Infrared Sensors” ,proceedings of the 5th International Conference on Reliability, Infocom Technologies and Optimization (ICRITO) , pp.505-509.

[10] Saurabh Dugdhe, Pooja Shelar, Sajuli Jire ,Anuja Apte (2016), “Efficient waste collection system”, proceedings of the International Conference on Internet of Things and Applications (IOTA), pp.143-147.