

Internet of Things [IoT]Based Smart Garbage Monitoring and Clearance System

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ABSTRACT

Swachh Bharat Abhiyan is a campaign by the government of India that aims to make it as a best and clean country of the world. With expansion of Internet of Things(IoT), devices such as Smartphones& sensors, we present a solution about the Smartbin is a network of dustbins which integrates the idea of IoT with wireless Sensor Network. It is possible to collect large amount of garbage. In the metropolitan cities it is not possible to check each and every place where the garbage dump yard is full or not. So these dustbins are interfaced with microcontroller based systems having sensors system. In this approach the sensors are placed in the dustbins that are located in the public areas, to sense the level of garbage in the dustbins. When the garbage reaches the threshold limit, the status of the dustbin is updated and this status is concerned by the authorities. Then the authority will give an indication to the concerned person by sending SMS using GSM technology. The webpage created shows the collection of waste and the particular date and arrival time of the vehicle. The main motto of the system is to avoid overflowing and stinking dustbins. The presented solution provides calculation of more efficient garbage truck routes. As an output, we manage the waste in different type of box using automation. The system detect the wet and dry waste and also separate it by automatically.

Index term- Internet of Things (IoT), Android application, Sensors, Raspberry Pi, Wireless Sensor Network.

1.Introduction

One of the main responsibility of us to our environment is managing solid waste which effects the health and environment of our society. The

management of wastes is one of the major problems of the present period of time. The conventional way of monitoring the wastes in garbage bins is a incommodious process and utilizes more man human effort, time and cost which can be easily avoided by our project. For example let consider street 1 as a busy street and the garbage fills up quickly whereas in street 2 even after three more days the garbage bins are not fully filled. This example is something that actually happens thus it leads us to the pollution. To avoid these, Internet of Things with Raspberry Pi is used. It is the network of devices embedded with software and sensors which makes these objects to exchange data."Internet of Things" concept became popular in the year of 1999. Kevin Ashton of Procter & Gamble, later MIT's Auto-ID Centre, in 1999 coined the term "Internet of Things". IoT vision introduces solutions for large amount of data collection and its analysis in many domains and to achieve an efficient output. A big challenge in the metropolitan cities is the Solid Waste Management, not only in our country but for most of the countries in the world. This project gives us the efficient ways to maintain a healthy environment and to support Swachh Bharat Abhiyan. Internet of Things and Raspberry Pi plays a major role. The Raspberry Pi is a low cost, credit-card sized computer. It enables people of all ages to compute and to learn languages like Python and Scratch. In this project, the sensors are placed on top of garbage bins located in the public places. When the garbage reaches the given threshold limit, then the status of the bin is updated. Then the indication will be given to the Raspberry Pi. Ultrasonic sensors are placed on the top of garbage bins to detect the garbage level and to compare it with the depth of the garbage bins. Then the information is collected by the authority and sends the information to the concerned persons by sending an SMS using GSM technology. Another important role of this project is to separate the collection of wet and dry wastes.

With the help of moisture sensor, separate the wet and dry wastes. Another important role is detecting the stinking smell with the help of gas sensors.

2.Literature Survey

In smart garbage monitoring system using Internet of Things, the IoT based smart waste clean management system which checks the waste level over the dustbins by using sensors systems. Once it detected immediately this system altered to concern authorized through GSM/GPRS. For this system used Microcontroller as an interface between the sensor system and GSM/GPRS[1].In method [2] the author describes the effective dry and wet collection by using embedded systems. The main motto of the application is collection of dry and wet waste separately which is placed in conveyor belt on which the dry waste collected dust bins are placed left side and wet collected bins on right side. The system will get input through the concerned person through switches and send signal to the Microcontroller unit using RF technology and that makes the H-bridge to rotate conveyor belt. The waste is dumped into the underground garbage container placed in the ground floor.In smart garbage collection system in residential area [3], for each bin a separate ID number is given. The camera is used to capture the level of the garbage in it. The load cell is used to sense the weight of the garbage that is interfaced with microcontroller through ADC. Then the microcontroller compares the set level with the input. If the input is crossed the threshold level then the microcontroller is interfaced with GSM module to send SMS to the concerned person to collect the waste with the help of Robot Mechanism.This method [4] describes a system in which garbage bins are interfaced with microcontroller based systems with IR sensors and RF modules. The function of the IR sensors is to indicate the level of the waste in the garbage bins then the same signals are encoded. Then these encoded signals sent through the RF transmitter and it is received and decoded by the RF receiver at the Raspberry Pi. Finally an internet connection is enabled through LAN cable. Once the data is received then it is analyzed and processed in the cloud which displays the current status of the wastes in the garbage bins.In the method [5], the dustbins are interfaced with the microcontroller based system with ultrasonic sensors and Wi-Fi modules. The role of the ultrasonic sensors is to detect the level of wastes in the dustbins and send the signals to the micro controller. Then the same signals are encoded and send through Wi-Fi module(ESP8266) and it is received by the end user. The data will be sent to the user by E-Mail so that the municipality van can come and empty the dustbin.

In this method [6], the status of the bin is continuously monitored at the control station and is presented in GUI to provide a user interface with the system. The values stored in the database helps

a user to have the updated data of the bin and also the previous values of the parameters of the bin. This collected data from the bin can be used in the optimizations of routes for the collection trucks for the use of resources in the waste management system.In Solid Waste Bin Monitoring and Collection System [7], the ultrasonic sensors were placed on the lid to sense the level of the garbage bin. When the mentioned level is reached then the signal was sent through ZigBee to the ARM board. Then the information about the place and area of the signal sent and the details were conveyed to the driver through SMS to collect the waste from the respective locations. The sensors would sense that and communicate to the ARM7 controller using ZigBeetechnology[8,9,10].

3.Proposed System

This paper proposes a system in which Smart bin is a network of dustbins which integrates the idea of IoT with wireless sensor network. IoT based smart waste clean management system which checks the waste level over the dustbin by using sensor systems. Once it detected immediately this system alert the concern authorized through GSM/GPRS. Manage the waste in different type of box by using automation. In this system we detect the wet and dry waste and separate this kind of waste by automatically. This project reduces lot of time and man power. The block diagram is shown on fig 1.

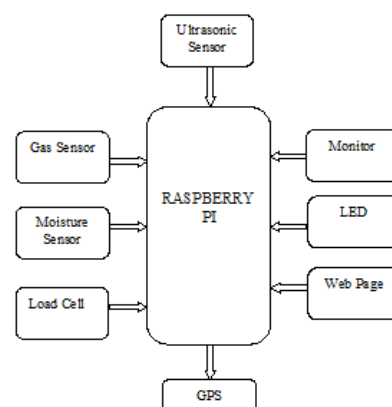


Fig 1. Block Diagram

4. System Architecture

4.1 Raspberry Pi

The Raspberry Pi is a credit-card sized and a low cost system. It enables people of all ages to compute and to learn languages like Python and Scratch. It has the chip of Broadcom BCM2837 SoC (System of Chip). Raspberry Pi has the core architecture of ARM 11. The module of Raspberry Pi is shown on fig 2. It provides an open GL ES 2.0, hardware-accelerated open VG, and 1080p30

H.264 high profile decode. It is capable of 1 Gpixel/s, 1.5Gtexel/s or 24GFLOPs with texture filtering and DMA infrastructure. The operating system boots from Micro SD card, running a version of the Linux operating system.



Fig 2. Raspberry Pi

4.2 Gas Sensor

The Gas sensor are used to detect and analyse gases. The MQ series Gas sensor uses a small heater inside with an electrochemical sensor. The output is an analog signal. It has the features of high sensitivity and fast response. It is a simple drive circuit. Because of fast response and sensitivity measurements can be taken as soon as possible. In this project it is mainly used for detecting the H₂, LPG, CH₄, CO, Alcohol, Smoke or Propane. The Gas sensor is shown on fig 3.



Fig 3. Gas Sensor

4.3 Ultrasonic Sensor

It is a device that can measure the distance to an object by using sound wave. The ultrasonic module is connected to the general purpose interface of a system. It has a main element, an analog unit for performing an analog signal processing, is

connected to another computer system. The ultrasonic waves generated by the oscillating body are radiated by funnel shaped resonator into the air and to effectively concentrate ultrasonic waves from air on the centre of the oscillator. The ultrasonic sensor is shown on fig 4. The sensor has two openings one is used to transmit the ultrasonic waves (like a tiny speaker) and the other is used to receive the ultrasonic waves (like a tiny microphone).



Fig 4. Ultrasonic Sensor

4.4 Load cell

A load cell is a transducer that is used to create an electric signal whose magnitude is directly proportional to the force being measured. Load cell are used to measure the weight. The load cell is shown on fig 5. It consists of a spring element on which screw gauge is placed. The various type of load cell are strain screw gauge load cell, hydraulic load cell, piezoelectric load cell, pneumatic load cell. Load cells are used in several types of measuring instruments.



Fig 5. Load Cell

4.5 Moisture Sensor

The purpose of Moisture Sensor is used to detect whether the substances are wet or dry. This sensor uses two probes to pass current through the substances, and then read the resistances to get the moisture level. The control board can get the moisture content or threshold value in the substance via analog or digital pins. The power supply is 3.3v or 5v. The ranges for values of dry(0-300), humid (300-700), and for water (700-950). It is easy to use and more compatible. The moisture sensor is shown on fig 6.



Fig 6. Moisture Sensor

4.6 LED

Light Emitting Diode is a semiconductor light source. It emits lights when the p-n junction diode is activated. LED will only work if the power is supplied correctly.

4.6 GSM/GPRS

GSM module is used to communicate with the network for messaging and calling purpose. A GSM modem requires a SIM card to be operated and operates over the network. The module of GPRS is shown on fig 7.

In this project the purpose of GSM is used to send message to the authority if the garbage bin exceeds the given threshold level. With the help of GSM module interfaced, we can easily send short text messages to the concern persons. It operates at either 900 MHz or 1800 MHz frequency band.

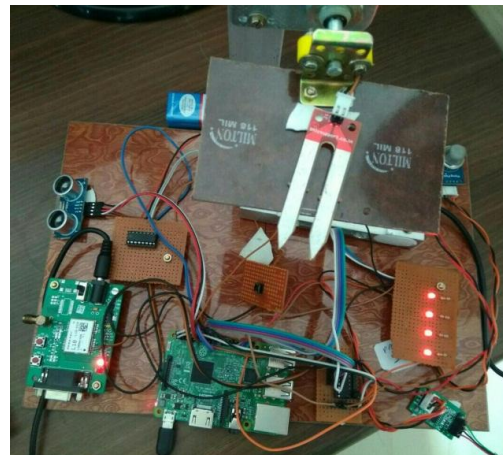


Fig 7.GPRS

6. Implementation Methodology and results

IoT is a very innovative system which will help to keep the environment clean. This system monitors the garbage bins and informs the level of the garbage bins to the authority via mobile

applications by the help of GSM/GPRS. The module of the smart garbage monitoring system is shown on fig 8. For this the system uses ultrasonic sensor placed over the garbage bins to detect the garbage level and compare it with the given



threshold level. The system makes the use of Raspberry Pi for sending data. The system is powered by a 12V power supply. The Gas sensor is used to detect gases like H₂, CH₄, CO, Alcohol, Smoke or Propane.

Fig 8.The module of the smart garbage monitoring system.

Load sensor indicates the weight of the dustbins. Four LEDs are used to indicate the status of the dustbins such as empty, low, medium and high by using separate LEDs. With the help of Moisture Sensor, the wet wastes are collected on the right side and the dry wastes are collected on the left side.

9881725272:
https://www.google.co.in/maps/place/@0,1,,,M,,*4B
 ,50zBin filled
 Sent via Way2Online. Download <http://bit.ly/WAY22>

Fig 9. SMS send to the concerned person when the bin is filled

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Bin empty
('GAS', 100)
('Ultrasonic Level', 196.9)
('Humidity', 949)
('weight', 4)
Bin empty
('GAS', 100)
('Ultrasonic Level', 197.33)
('Humidity', 948)
('weight', 4)
Bin empty
('GAS', 100)
('Ultrasonic Level', 196.45)
('Humidity', 949)
('weight', 5)
Bin empty
('GAS', 100)
('Ultrasonic Level', 196.88)
('Humidity', 949)
('weight', 4)

```

Fig 10. The status of the bin and the readings of the various sensors are displayed on the system.

If the wastes have reached above the threshold level then the authorized persons receive the indication of garbage bin is full through the GSM/GPRS. SMS send to the concerned persons is shown on Fig 9. Then inform to the concern person who is responsible to collect the wastes from the garbage bins in their respective areas. Fig 10 shows the status of the bin and the readings of the various sensors are displayed on the system.

7. Conclusion

By implementing this work will avoid the overflowing of garbage from the container in the metropolitan cities. This system indirectly reduces the traffic in the city. In metropolitan cities the municipal authority collect the wastes from the garbage bin in twice or thrice within a week depending upon the population and sometimes garbage bin may not full. This system will inform the current status of each and every garbage bins. Due to these the man power is completely reduced. Therefore this work makes the garbage collection more efficient and it will reduce the time as well as the fuel and saves the money. Hence it avoids the overflowing and stinking of wastes and maintains a clean and healthy environment.

8. References

- [1]. Prof Dr Sandeep, Akshay Joshi, Namrata Bajare, Rohini Korke M. Chaware, Shriram Dighe, "Smart Garbage Monitoring System using Internet of Things (IoT)". IJREEICE, Vol. 5 Issue 1, January 2017.
- [2]. Bharadwaj B, M Kumudha, Gowri Chandra, Chaithra G. "AUTOMATION OF SMART WASTE MANAGEMENT USING IoT TO SUPPORT "SWACHH BHARAT ABHIYAN" A PRACTICAL APPROACH", ICCCT' 17.
- [3]. Gaikwad Prajakt, ,Jadhav Kalyani, Hachale Snehal. "SMART GARBAGE COLLECTION SYSTEM IN RESIDENTIAL AREA" IJRET, Vol.4, Issue 03, March 2015.
- [4]. Vikrant Bhor, "Smart Garbage Management System", IJRET, Vol.4 Issue 03, March 2015.
- [5]. Minthu Ram Chiary, Sripathi Saicharan Abdul Bashath R, Dnikhi T, "DUSTBIN MANAGEMENT SYSTEM USING IoT", International Journal of Pure and Applied Mathematics, Volume 115 No.8, 2017.
- [6]. Mrs. Kanchan Mahajan, Prof J.S. Chitode, "Solid Waste Bin Monitoring Using Zig-Bee", International Journal of Engineering Research and Applications, Vol.4, Issue 6, June 2014.
- [7]. S. Vinothkumar, T. Senthil Kumar, A. Kishore Kumar, Mahantesh Mathapati. "Smart Garbage Monitoring and Clearance System using Internet of Things", ICSTM, August 2017.
- [8]. Dr. Anto Bennet, M, Sankaranarayanan S, Ashokram S, Dinesh Kumar T R, "Testing of Error Containment Capability in can Network", International Journal of Applied Engineering Research, Volume 9, Number 19 (2014) pp. 6045-6054.
- [9]. Dr. Anto Bennet, M, Sankar Babu G, Natarajan S, "Reverse Room Techniques for Irreversible Data Hiding", Journal of Chemical and Pharmaceutical Sciences 08(03): 469-475, September 2015.
- [10]. Dr. Anto Bennet, M, Sankaranarayanan S, Sankar Babu G, "Performance & Analysis of Effective Iris Recognition System Using Independent Component Analysis", Journal of Chemical and Pharmaceutical Sciences 08(03): 571-576, August 2015.

