

Efficient IoT based Smart Dustbin for Clean Environment

Mrs. M. Archana¹, Monolisa. G², Preethi. P³, Sangeetha. B⁴

^{1,2,3,4}Department of Computer Science and Engineering Adhiyamaan college of Engineering, Hosur.

Abstract - In the recent decades, Urbanization has increased tremendously. Has led to the inappropriate waste management in cities resulting in increased pests and spreading of diseases. Garbage collection management has been a critical issue to be considered. This paper is a way to attain this good cause. In this paper, smart bin is built on an IOT based platform AVR board which is interfaced with GSM modem and sonar sensor and IR sensor then Mq2 sensor. Sonar sensor is placed at the top of the dustbin which will measure the stature of the dustbin. The threshold stature is set as 10cm. AVR microcontroller will be programmed in such a way that when the dustbin is being filled, the remaining height from the threshold height will be displayed. Once the dust bin reaches the threshold level sonar sensor will trigger the GSM modem which will continuously alert the required authority until the garbage in the dustbin is dense. Once the dustbin is compressed, people can reuse the dustbin. At regular intervals dustbin will be squashed. Once these smart bins are implemented on a large scale, by replacing our traditional bins present today, waste can be managed efficiently as it avoids unnecessary lump of wastes on roadside. Unclean smell from these decayed wastes that remain untreated for a long time, due to negligence of authorities and carelessness of public may lead to long term problems. Reproduction of insects and mosquitoes can create nuisance around promote unclean environment.

Keyword: ultrasonic sensor, IOT, MQ2 sensor, clean environment.

1. INTRODUCTION

Smart garbage collection management is all the performance and accomplishment required to manage waste from its beginning to its final disposal. This include collection, transportation, treatment and disposal of waste together with monitoring and regulation. Waste collection methods vary extensively among different countries and regions. Domestic waste collection services are often provide by government authorities. Curbside collection is the as a rule common method of disposal in most countries, in which waste is collected at regular intervals by specialized trucks. Waste collected is then transported to an suitable disposal area.

Now days, cities with developing economies experience tired waste collection services, inadequately managed and uncontrolled dumpsites and the problems are deterioration. Waste collection method in such countries is an on-going challenge and many resist due to weak institutions and rapid urbanization.

2. LITERATURE SURVEY

Prakash in this paper they have design Internet of Things Base Waste Management for Smart City for solving the trash over flow which create insanitary condition and bad smell around the nearby. This paper has two part that are transmitter part and receiver. The MC controller, RF Transmitter module and sensors in the transmitter section that attached to the smart bin. The receiver part using RF Receiver module and Web page is used. This system can detect waste level in dustbin and avoid the overflow of dustbin.

- 1) Meanwhile the design a sustainability waste garbage data collection management. This dustbin design to the concept was design based on the interview to seven industry expert in both private and govt sector in Tamilnadu government.

3. EXISTING SYSTEM

- In this existing method they using RFID tag device and reader this device short distance coverage.
- When the truck reaches the RFID tag, it would be detected by the RFID receiver reader module.
- The RFID components are part of a heavy, highly integrated, vehicle mount system. Components of a basic system include an RF an RFID antenna and RFID tags attached on the bins.
- This process will be automatically initiate when the truck comes RFID system, the complete process will be fully automatic and requiring no action from the driver.
- Not only does the RFID system track and give trash bins but enhance the whole system. It is not possible to use GPS for indoor positioning.
- Even when outdoors, if the GPS receiver is too close to buildings where the trash bins are located, it is difficult to get accurate position information.

4. PROPOSED SYSTEM

- In Current existence the dustbins are getting over flowed, this proposed system helps to avoid the dustbin from overflowing dustbin.
- It will provide the authentic information about the dustbin level using WIFI.
- The proposed system of waste management is capable to solve the abovementioned problems solved and can save the time. It reduces the human effort and consequently the cost of the whole process is low.

- The implementation of this system can be done at any place with ease and within affordable amount of time reliable.
- The execution for the mechanization are further more in expensive. The overall method for the exposure and management of waste becomes efficient and intelligent. In our proposed method if any fire is occurred GSM module is send SMS
- Notification to authorized person. Then dirty smell are very harmful to human beings.
- This proposed system is not only for the purpose of collecting and updating data in voluntarily and timely, but also it could explore and use data intelligently.

5. System architecture

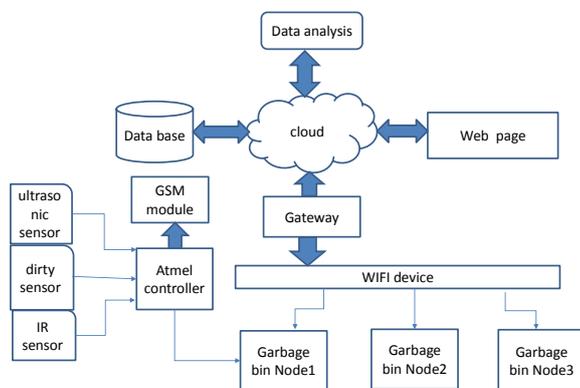


Fig 1 architecture design

In this system is combination of both hardware and software components. In this hardware consists of Atmega328 microcontroller is used to connect the different types of sensor to collect the analog information's. A rechargeable battery to save the power source. Microcontroller also detect the dust bin level monitor as well as smell monitor also measures the indicates in LCD. It's the fastest remote monitoring system. ESP 8266 its an WIFI access board it act as on router and coordinator its send collection of sensor data to cloud storage based on Application Program Interface (API) KEY. Every node haven separate MAC address so they are secured network MAC address.

a) Software used

1) keil software

AVR Simulation software IDE is influential application that supplies Atmel and atmega microcontroller users with user-friendly graphical development environment for Windows with integrated simulator (emulator), AVR basic compiler, assembler, disassemble and debug. AVR Simulation software IDE supports the extensive number of microcontrollers (MCUs) from the Atmel 328-bit mega2805

AVR and tiny8A AVR architecture product lines and mature 90S family (selected ATmega328, ATtiny8A, AT90S models).

2) Thingspeak

In the simplest terms, cloud computing means storing and accessing datas and programs over the Internet instead of the computer's hard drive cloud. The cloud is just a metaphor for the Internet protocol. Cloud servers are virtual servers which run on cloud computing environment IDE. That is why very often cloud servers are referred to as virtual network dedicated servers (vds). ThingSpeak cloud servers features. ThingSpeak is an IoT analytics platform service that provide enables aggregation, visualization and analysis of live data streams in the cloud with the ability to execute MATLAB code to Thingspeak, online analysis and processing of the data may be done as it comes in. The cloud may perform event detection and issue notifications is based on requirements to the clients / service providers.

b) Hardware used

Hardware implementation

The proposed cloud integrated wireless garbage management system composed of microcontrollers, sensors, LCD display module, GSM wireless transmission module at each smart bin and a central monitoring PC/server that receives information from each smart bin in the city.

A. Microcontroller

The smart bin monitoring system uses an atmega328 microcontroller based on the Atmega 328

The board is powered by 5V supply supplied either at VIN via an on-board regulator or USB or some other regulated 5V supply. It operates at CPU frequencies of up to 16 MHz. It atmega 328 includes up to 128 KB of flash memory, up to 8 KB of SRAM memory, USB Device interface, SPI interface, I2C-bus interfaces, UARTs, 54 digital input-output pins and 16 analog input pins.

B. Ultrasonic Sensors

The ultrasonic ranging module, HC-SR04 is used in this work for garbage volume sensing in bins due to its good accuracy. It comprises ultrasonic transmitters, receiver and a control circuit, powered by a 5V supply. A high-level voltage signal is applied for 10 microseconds at the input pin of sensor which generates eight 40 kHz burst pulses which hit the target object and return. The module detects the returned pulses. The fill volume is inversely related to the time delay elapsed between transmitted ultrasonic burst and received echo signal on sensor. The HCSR04 connections sensor and working principle. The sensor measurement range of the sensor is 2- 400 cm with an accuracy of 3 mm and 15° angle of coverage. Sketch of working principle of the Sensor.

C. Smell Sensor

MQ2 Gas Sensor module is used in this work for detecting flammable gases, CH₄, CO, Alcohol, Smell or Propane and more. This sensor uses SnO₂, which has lower conductivity in clean air checker. When the flammable gas is present, the sensor's conductivity gets higher as the gas concentration rises on the sensor. This change of conductivity may be converted to corresponding voltage output signal of gas concentration through a simple circuit lm358. The sensor has large measurement range (300-10,000 ppm), high sensitivity, fast response time accurate. The sensitivity of the sensor can be adjusted by potentiometer holder. The output can be an analog signal (AO) that can be read with an analog input of the Atmega or a digital output (DO) that can be read with a digital input of the Atmega328. Details of the interfacing circuit of MQ2 sensor gas sensor.

D. Temperature sensor

The DHT11 sensor used in this work detects water vapour by measuring the electrical resistance between two electrodes sensing. The sensing component consisting of a moisture holding substrate with electrodes is applied to the surface on dustbin. When water vapour is absorbed by the substrate, ions are released by the substrate sensor, which increases the conductivity between the electrodes sensing unit. The change in resistance between the two electrodes is proportional to the relative humidity on sensor. Higher relative humidity decreases the resistance between the electrodes sensing. The module measures temperature with a surface mounted NTC coefficient) temperature sensor (thermistor) built into the unit. The measurement ranges are 20-90% RH and 0-50°C temperature with sensitivities of +-5% RH and +-2°C temperature. The circuit diagram of DHT11 sensor interfacing with AVR.

E. LCD Display

A 16 x 2 alphanumeric dot matrix LCD printer displays is used in this work. The details of interfacing the LCD with AVR board. Interfacing LCD display and GSM shield with AVR board.

F. GSM shield and modem

The microcontroller is connected wirelessly to the remote cloud based server using an AVR compatible GSM shield. A Subscriber Identity Module (SIM) card provided mobile communication by a network provider is inserted in the shield for connecting to the cellular network.

G. WI FI module

The ESP8266 is a very user friendly and low cost device to provide internet connectivity to your projects and different types of sensors. The module can work both as a Access point (AP) can create hotspot and as a station they

can connect to the Wi-Fi, hence it can easily fetch data and upload it to the internet making Internet of Things (IOT) as easy as possible. It can also fetch data from internet using Application Program Interface (API) hence your project or devices could access any information that is available in the internet, thus making it smarter.

6. ADVANTAGES

- Less time and fuel consumption as the trucks go only to the filled containers and drivers alerted.
- Decreased noise, traffic flow and air pollution as a result of less trucks on the roads no traffic.
- Our smart operating system enables two way communication between the dustbin deployed in the city and service operator fast communication Therefore the focus is only on collection of route based fill level of the containers easy.
- The sensors installed in the bin provide real time information on the fill level.
- This information helps determine when and where to collection.
- In this way both service providers and citizens benefit from an optimized system which results in major cost savings and less urban pollution and time saving.
- Reduces the infrastructure (trucks, containers), (fuel) and maintenance costs of the service by up to 30%.
- Historical information on collections helps adapt the deployment of containers to the actual needs of the city, therefore reducing the number of containers that clutter up the road and increasing public using parking spaces.
- It keeps surroundings clean and green, free from bad odour of wastes, emphasizes on healthy environment and keep cities more beautiful.
- Reducing manpower required to handle the bin collection.

7. APPLICATION

- This can be best used by municipal corporation for their betterment of management regarding collection of wastes from bin.
- With the help of proper technology using (GPS & SOFTWARE APPLICATIONS) we can guide the trucks to choose the shortest path.

8. RESULT & DISCUSSION

The system with peripherals interfaced to bear out specific operation. Automation is done to send information in the format of topic to an mqtt application developed for raise up truck driver's to monitor the status of the bin. This is done by routinely subscribing and publishing for the corresponding topics. This module is connected with GSM and WIFI system to provide the current status about smart dust bin. If garbage is fill automatically Message send to authorized persons. Then live data update about dust bin.



Fig 2 shows the SMS information displayed on mobile updated information about the dirty smell more status of the bin



Fig 3 shows the SMS information displayed on mobile updated information about the fill status of the bin

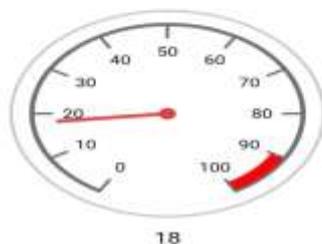


Fig 4 Live Data of dust bin fill data and smart analog gauge meter is display on Thing speak web page with live date and time also updated .

9. CONCLUSION

This project proposes work is the implementation of Automatic Garbage bin Fill Alerting system using Ultrasonic sensor, microcontroller, Buzzer and GSM module. This

system assures the cleaning of dustbins fast when the garbage level reaches its maximum. It will take power supply with the help of adapter and future battery. If the dustbin is not cleaned in specific times, then the record is sent to the Sweeper or higher authority who can take appropriate action against the concerned contractor regarding not cleanliness. This system also helps to monitor the fake reports and hence can reduce the corruption in the overall management system using IOT. It ultimately helps to keep cleanliness in the society good. Therefore, the Automatic Garbage bin Fill Alerting system makes the garbage collection more efficient and better.

REFERENCES

- [1] Shubham Thakker, R.Narayanamoorthi, "Smart and Wireless Waste Management", IEEE Sponsored 2nd International Conference on Innovations in Information Embedded and Communication Systems ICIIECS'15
- [2] Ahmed Imteaj, Mahfuzulhoq Chowdhury and Md. Arafin Mahamud, "Dissipation of Waste using Dynamic Perception and Alarming System: A Smart City Application", 2nd Int'l Conf on Electrical Engineering and Information & Communication Technology (ICEEICT) 2015 Jahangirnagar University, Dhaka-1342, Bangladesh, 21-23 May 2015
- [3] Jose M .Gutierrez, Michael Jensen, Morten Henius, Tahir Riaz, "Smart Waste Collection System Based on Location Intelligence", Procedia Computer Science , Volume 61, 2015, Pages 120-127
- [4] Mohd Helmy Abd Wahab, Aeslina Abdul Kadir, Mohd Razali Tomari, "Smart Recycle Bin: A Conceptual Approach of Smart Waste Management with Integrated Web Based System", IT Convergence and Security (ICITCS), 2014 International Conference Beijing, China. 14882217, 10.1109/ICITCS.2014.7021812, IEEE Xplore: 26 January 2015.
- [5] Md.Abdulla Al Mamun, M.A.Hannan,Aini Hussain, "Real Time Solid Waste Bin Monitoring System Framework Using Wireless Sensor Network", Electronics, Information and Communications (ICEIC), IEEE International Conference on 15-18 Jan. 2014 Page(s):1 – 2, INSPEC Accession Number:14649014
- [6] Sauro Longhi, Davide Marzioni, Emanuele Alidori, "Solid Waste Management Architecture using Wireless Sensor Network technology", New Technologies, Mobility and Security NTMS), 5th IEEE International Conference on 7-10 May 2012. INSPEC Accession Number:12770930
- [7] M. Faccio, A. Persona aste collection multi objective model with real time traceability data," Waste Management,vol. 31, no. 12, pp. 2391-2405,2011.