INTERNATIONAL JOURNAL OF ADVANCE RESEARCH, IDEAS AND INNOVATIONS IN TECHNOLOGY

ISSN: 2454-132X
Impact factor: 4.295
(Volume 5, Issue 5)
Available online at: www.ijariit.com

NodeMcu based smart garbage monitoring system

Suwetha I. G.
igsuwetha@gmail.com
SRM Institute of Science and Technology, Chennai, Tamil Nadu

ABSTRACT

Garbage monitoring is an essential issue for most of the cities in India. The current garbage monitoring and management system are highly ineffective contributing to high transportation and collection costs. Due to poor monitoring and collection, garbage bins are seen overflowing in certain areas which can lead to long-term problems such as bad odor and harmful diseases. On the contrary, in some places, garbage collection trucks end up collecting garbage from bins which have low garbage levels leading to high petrol consumption and increased air pollution. To overcome these problems "NodeMcu based smart garbage monitoring system" can be introduced as an effective solution. This smart garbage monitoring system employs NodeMcu as its main microcontroller. It uses the ultrasonic sensor as a level detector to detect the amount of garbage in the bin. It also employs an MQ-135 gas sensor and a DHT sensor to monitor the quality of air surrounding bin and temperature and humidity data respectively. This information is then transmitted via the NodeMcu to Blynk application and ThingSpeak channel. In the Blynk application, the live monitored information is displayed using a graphical interface. In the ThingSpeak channel, the real-time output data is represented as a line graph that can be interpreted easily. Thus, this system provides a web platform as well as a mobile platform for efficient garbage monitoring.

Keywords— *Smart garbage monitoring, Nodemcu, Ultrasonic Sensor, Mq-135, DHT Sensor, Thingspeak, Blynk*

1. INTRODUCTION

In the current garbage management and disposal system, the litter bins allotted for each locality or each street are emptied by cleaners at regular intervals of time. This system has several disadvantages such as:(1) In certain areas the garbage bins fill at a faster rate than the other and are thus seen overflowing in streets. Such garbage bins pollute the surrounding environment and also form breeding grounds for several harmful pathogens. The overflowing garbage bins also release the foul smell. (2) In certain other areas, the waste production rate is slow and bins are semi filled when the collectors arrive to empty the bin. This causes excess use of fuel and adds on to waste transportation and collection costs. Moreover, the production of household garbage and municipal solid waste is increasing at a rapid pace each passing day. According to research conducted, solid waste collection and disposal costs constitute 75-80% of a city's solid waste management budget. Therefore, even a small improvement in waste collection and transfer operations can lead to significant savings in costs [4]. In order to eliminate all these existing problems, proper garbage monitoring is essential. Thus, NodeMcu based smart garbage monitoring and disposal system has been proposed as a potential system to the existing problem.

2. LITERATURE SURVEY

The paper on Smart Garbage Monitoring and Clearance System using the Internet of Things by S. Vinoth Kumar, T. Senthil Kumaran, A. Krishna Kumar and Mahantesh Mathapati [1] proposed IOT based smart waste clean management system which checks the waste level over the dustbins by using Sensor systems. Once it detected immediately this system alerts concern authority through GSM/GPRS. Arduino-based Smart Garbage Monitoring System Analysis Requirement and Implementation by Namakambo Muyunda and Muhammad Ibrahim[2] proposed a system which can monitor the state of a garbage bin and relay the monitored state to a central database, collect Sensor data from each bin and display it on a webpage to alert the relevant authorities of the states of the various garbage bins in a given area, store sensor data for each of the garbage bins to provide analytical information for each of the garbage collection areas and provide route planning for the collection based on the selected fill level and priorities of each bin.

The paper "IoT based smart garbage alert system using Arduino UNO" by Dr. N. Sathish Kumar, B. Vijayalakshmi, R. Jenifer Prarthana, A. Shankar[3]proposes a smart alert system for garbage clearance aided by the ultrasonic sensor which is interfaced with Arduino Uno to check the level of garbage-filled in the dustbin and sends the alert to the municipal web server once if garbage is filled. After cleaning the dustbin, the driver confirms the task of emptying the garbage with the aid of the RFID tag. the whole process is upheld by an embedded module integrated with rf id and IoT facilitation. an android application is developed and linked to a web server and the notifications are sent to the android application using wi-fi module.

3. HARDWARE DESIGN

The sensors employed in the proposing system are ultrasonic sensor, MQ-135 gas sensor, DHT humidity sensor. The microcontroller board used is Nodemcu. Nodemcu has been used because of its inbuilt Wi-Fi connecting capability. The proposed system is capable of monitoring the percentage of garbage level in the bin. This is accomplished by using an ultrasonic sensor. The ultrasonic sensor senses the distance between the lid of the bin and the garbage present in the bin. This output of the ultrasonic sensor is the empty level of the bin. The fill level distance of the bin is then computed by subtracting empty level of the bin from the full length of the bin. The percentage of garbage in the bin is then determined by using the below formula:

*Garbage (%) = (fill level/total length of the bin) * 100*

The MQ-135 gas sensor has been used for sensing the pollution level surrounding the environment of the bin. The DHT sensor has been employed for monitoring the Temperature and Humidity surrounding the bin. The sensor outputs are then analyzed and interpreted by NodeMcu. It is then sent to ThingSpeak channel and Blynk application by accessing the inbuilt Wi-Fi connectivity of Nodemcu. In the Thingspeak channel, the output is shown in the form of line graph. In Blynk application the output is shown with the help of user-friendly graphics. Both ThingSpeak data and Blynk data are updated regularly on a real-time basis. The output displayed in Blynk application can aid the garbage collector to monitor the live status of the bin and plan garbage collection route accordingly. Optimized route planning thus helps to save cost spent on transportation of garbage. The web interface ThingSpeak can be used to monitor the bin fill-level data centrally by a main controlling authority. Thus with this proposing system a live bin status can be obtained which will help the garbage collection authorities to properly manage, monitor and collect garbage.

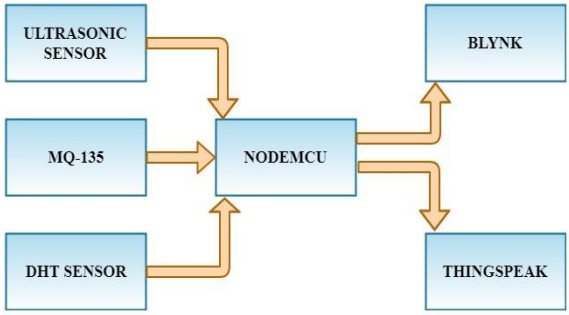

Fig. 1: Architecture of Nodemcu based smart garbage monitoring system

4. HARDWARE USED

4.1 NodeMcu

Fig. 2: NodeMcu board

The NodeMcu is an open-source Wi-Fi system on chip produced by Espressif Systems. It is an integrated chip that provides full internet connectivity to the embedded circuit in which it is present. It can be programmed through USB port using Arduino IDE. It has a total of 30 pins in which 9 pins are digital pins while 1 pin is analog pin. It is a tool that is employed for Wi-Fi networking. It has low power consumption. In this project it has been employed as the main microcontroller owing to its inbuilt Wi-Fi connecting capacity which can be exploited to transmit real-time monitored sensor data to web and mobile interfaces

4.2 Ultrasonic sensor

The ultrasonic sensor is employed for measuring distance between itself and the obstacle using ultrasonic waves. The head of the ultrasonic sensor emits a wave of ultrasonic wavelength and receives the reflected wave back from the object. The distance to the target is then calculated by measuring the time between the emission of the ultrasonic wave and reception of the same. It uses a single component for both sending and receiving the ultrasonic wave. The distance to the target is then calculated by using the formula:

*Distance = (Time * Velocity)/2*

In this project it has been employed for measuring the distance between the lid of the bin containing the sensor and the garbage level. The distance measured is then used for calculating the percentage of garbage level in the bin.

Fig. 3: Ultrasonic sensor

4.3 MQ-135 Gas Sensor

The MQ135 gas sensor is a highly sensitive sensor used to detect gases like ammonia, smoke, sulphur, and other harmful gases. It is a cheap sensor with several applications. In this project, it has been used for measuring the pollution surrounding the bin and the output of the sensor is monitored in ppm(parts per million).

Fig. 4: MQ-135 Gas sensor

4.4 DHT Sensor

Fig. 5: DHT Sensor

DHT Sensors have been employed for measuring the temperature and humidity surrounding the garbage bin. These are slow sensors with basic design. The two main components of DHT sensor are a capacitive humidity sensor and a thermistor. It also has an analog to digital converter that is used for analog to digital conversion of sensed data. The digital data is then read using a microcontroller, in this case, it is a NodeMcu.

5. SOFTWARE USED

5.1 ThingSpeak

ThingSpeak is a web-based Internet of Things platform which is used to analyze and visualize sensor data obtained from hardware module of a project. It is used to stream live data. It also provides accurate real-time visualization of monitored sensor output values. It has been employed as main web interface to display output of the ultrasonic sensor, gas sensor and DHT sensor in the form of line graph.

5.2 Blynk

Blynk is an android application that allows the user to build user-friendly mobile output interface for operating, monitoring and controlling hardware projects. It can be operated on both android and iOS platforms. Blynk supports different types of microcontrollers such as Arduino boards, Raspberry Pi models and ESP8266. Here Blynk has been employed as a mobile interface to monitor sensor output data obtained from hardware module of smart garbage monitoring system.

6. RESULTS AND OUTPUT

Fig. 6: Blynk output

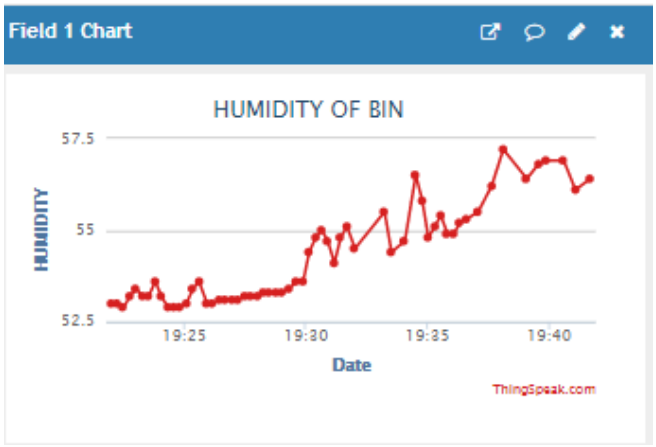

Fig. 7: Humidity data in Thingspeak

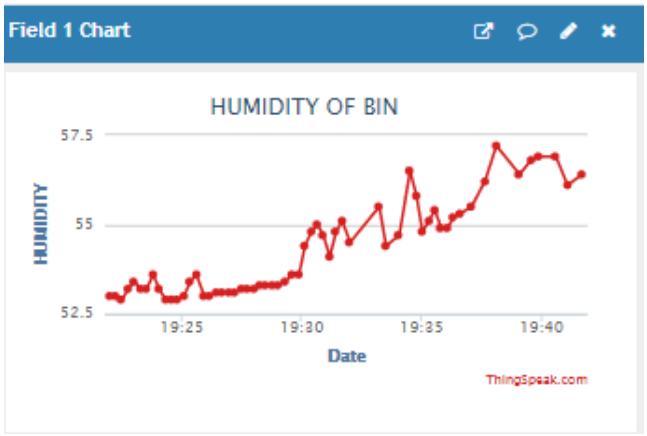

Fig. 8: Temperature data in Thingspeak

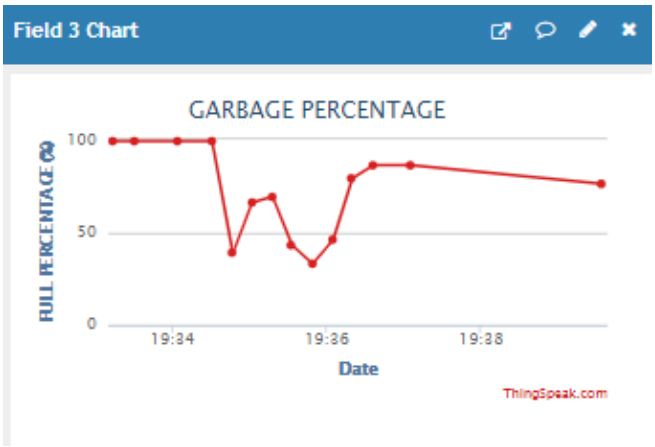

Fig. 9: Garbage percentage in Thingspeak

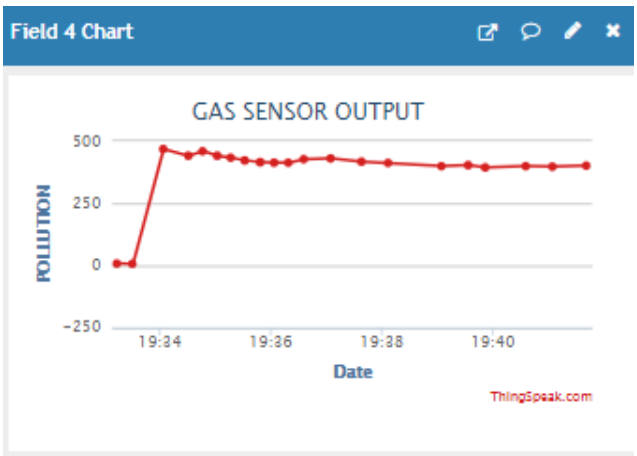

Fig. 10: Pollution surrounding the bin in ThingSpeak

7. ADVANTAGES

- Time consumption is less
- Fuel consumption is optimized
- Air pollution from garbage collection trucks and due to foul smell is reduced
- Fill level-based garbage collection route mapping is employed
- Real-time and live data from the garbage bin can be obtained
- Share of solid waste management cost spent on waste collection and transportation is reduced
- Introducing smart garbage system makes city 'SMART'
- Infrastructural needs such as garbage containers and trucks are reduced as the collection is based on fill level data and optimized route planning
- Manpower required for waste collection and transportation is reduced

8. CONCLUSION

The main aim of the project is to obtain real time data of percentage of garbage from garbage bins placed in various parts of the city. Along with the fill level data other important parameters such as pollution in ppm, humidity, and temperature of the bin are monitored and sent to ThingSpeak channel and Blynk interface. When the garbage level in particular dustbin has reached the maximum level then the employees can be informed and they can immediately take certain actions to empty it as soon as possible. It will reduce the wastage of time, cost and energy of the human. It will also prevent the occurrence of any disease. The truck drivers easily get information about the clearing process and do their work immediately. Thus this method of monitoring garbage level enhances the overall efficiency of the whole process.

9. REFERENCES

[1] S. Vinoth Kumar, T. Senthil Kumaran, A. Krishna Kumar and Mahantesh Mathapati "Smart Garbage Monitoring and Clearance System using Internet of Things'' in 2017 IEEE International Conference on Smart Technologies and Management for Computing, Communication, Controls, Energy and Materials (ICSTM), Veltech Dr.RR & Dr.SR University, Chennai, T.N., India. 2 - 4 August 2017. pp.184-189.

[2] Namakambo Muyunda, Muhammad Ibrahim "Arduino-based Smart Garbage Monitoring System Analysis Requirement and Implementation" in 978-1-5386-0765-7/17/$31.00 ©2017 IEEE

[3] Dr.N.Sathish Kumar, B.Vijayalakshmi, R. Jenifer Prarthana, A.Shankar "IOT Based Smart Garbage alert system using Arduino UNO" in 978-1-5090-2597-8/16/$31.00_c 2016 IEEE

[4] V. N. Bhat, "A Model for the optimal allocation of trucks for solid waste management," Waste Management & Research, vol. 14, (1), pp.87-96, 1996

