Garbage Monitoring System Using Internet of Things: Methods and Protocols

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Soft Computing and Signal Processing

Proceedings of ICSCSP 2018, Volume 1

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Preface

The International Conference on Soft Computing and Signal Processing (ICSCSP 2018) was successfully organized by Malla Reddy College of Engineering and Technology, an UGC autonomous institution, during June 22–23, 2018, at Hyderabad. The objective of this conference was to provide opportunities for the researchers, academicians, and industry persons to interact and exchange the ideas, experience, and gain expertise in the cutting-edge technologies pertaining to soft computing and signal processing. Research papers in the above-mentioned technology areas were received and subjected to a rigorous peer review process with the help of program committee members and external reviewers. ICSCSP 2018 received a total of 574 papers, each paper was reviewed by more than two reviewers, and finally, 156 papers were accepted for publication in two separate volumes in Springer AISC series.

We would like to express our sincere thanks to Chief Guest Dr. S. B. Gadgil, Outstanding Scientist, Associate Director, RCI, DRDO, and keynote speakers Mr. Aninda Bose, Senior Editor, Springer Nature; Dr. C. Suchismita, Professor, NIT Rourkela; and Dr. Rishu Gupta, Senior Application Engineer, MathWorks, India.

We would like to express our gratitude to all the session chairs, viz., Dr. Ram Murthy Garimella, IIIT Hyderabad; Dr. Chandra Sekhar, Osmania University; Dr. Mohammed Arifuddin Sohel, Muffakham Jah College of Engineering and Technology; Dr. Samrat Lagnajeet Sabat, HCU; Dr. Malla Rama Krishna Murty, ANITS, Visakhapatnam; Dr. Mohana Sundaram, VIT, Vellore; and Dr. Suresh Kumar Nagarajan, VIT, Vellore, for extending their support and cooperation.

We are indebted to the program committee members and external reviewers who have produced critical reviews in a short time. We would like to express our special gratitude to Publication Chair Dr. Suresh Chandra Satapathy, KIIT, Bhubaneswar, for his valuable support and encouragement till the successful conclusion of the conference.

We express our heartfelt thanks to our Chief Patron Sri. Ch. Malla Reddy, Founder Chairman, MRGI; Patrons Sri. Ch. Mahendar Reddy, Secretary, MRGI;

Sri. Ch. Bhadra Reddy, President, MRGI; Convener Prof. P. Sanjeeva Reddy, Director, ECE and EEE; and Organizing Chair Dr. M. Murali Krishna, Dean.

We would also like to thank the organizing secretaries, viz., Dr. S. Srinivasa Rao, HOD, ECE; Dr. D. Sujatha, HOD, CSE; and Dr. G. Sharada, HOD, IT, for their valuable contributions. Our thanks also to all the coordinators and the organizing committee as well as all the other committee members for their contributions in the successful conduct of the conference.

Last but not least, our special thanks to all the authors without whom the conference would not have taken place. Their technical contributions have made our proceedings rich and praiseworthy.

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Garbage Monitoring System Using Internet of Things

Arpan Patel and Nehal Patel

Contents

Abstract Garbage management is becoming the chief issue owing to escalate in population. In most of the metropolises, the overflowed garbage bins are producing an unsanitary atmosphere. Moreover, it leads to emerging of diverse varieties of anonymous illnesses. However, it damages the living standard. So, we need to take some responsible actions for garbage management. We have to improve garbage management level by decreasing the time for tacking garbage and finding the more efficient way. In this paper, we had done the literature survey and also proposed IoT-based garbage monitoring system which checks the level of garbage in bins and sends that information to authorized worker through SMS. Information contains level of garbage and Google map link of bin. Using the garbage bin link, worker reaches the garbage bin when it is full and saves the time which is unnecessarily used to go through for garbage bin even it is not full.

Keywords NodeMCU (Esp8266 12-E) · Ultrasonic sensor · Geolocation API IFTTT service · IoT

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1 Introduction

In current decade, people are migrating from rural to urban areas; therefore, garbage is increasing in urban areas rapidly, but technology is same in rural as well as urban areas to control the garbage. Hence, the technology used for controlling garbage is real-time monitoring using Internet of things (IoT) because communication through the Internet has evolved from user to user, and new technologies took a birth like IoT, cloud computing. IoT can link services with modern techniques and try to metamorphose urban centers into the smart cities by optimizing system.

In garbage monitoring system, sensor senses the information and sends to authorized worker in the form of message with the location of bin. After garbage is taken, they will send that garbage for disposal to organic, plastic, and metal [1, 2]. So it is getting easy to regenerate another thing using this garbage which is helping to make easy day-to-day life. We implement this system using embedded system with IoT. For that we need to take the information from ultrasonic sensor and check that information is above garbage limit or not; if it is above the limit, then send that information to authorized worker in the form of message with Google map location. Thus, worker can track that bin and easily collect the bin [3]. Ultimately it helps to retain cleanness in the society.

2 Literature Survey

See Table 1.

3 Proposed Work

As depicted in Fig. 1, first we start the NodeMCU. After starting NodeMCU, it will connect to router then it will request to ultrasonic sensor for information. Ultrasonic sensor collects the information and lends that information to NodeMCU [4]. Afterward, NodeMCU checks that information and figures out whether the information reaches the garbage limit or not. Nevertheless, if garbage level is less than 70% then NodeMCU will stop for some time and check again for newly arrived data from ultrasonic sensor. If garbage level is greater than 70% but less than 90%, then NodeMCU will get the longitude and latitude of that bin using geolocation API and send the message, “bin is 70% full,” with “Google map link” of that particular bin to authorized worker. If garbage level is greater than 90%, then it sends the message, “bin is full,” with “Google map link” of that particular bin to authorized worker.

Table 1 Comparison of diverse existing garbage monitoring system

S. No.	Title of papers	Year	Sensors used	Information transfer methods and technology used
1	Smart Garbage Monitoring System Using Internet of Things [6]	2017	Ultrasonic sensor	Microcontroller, Wi-Fi modem, IoT, GSM
2	Smart garbage monitoring and clearance system using Internet of things [3]	2017	Ultrasonic sensor, force sensor	Embedded, IoT, GSM, Microcontroller, Web server
3	Smart waste management using Internet of Thing [7]	2017	Ultrasonic ranging module HC-SR04	Wi-Fi, Embedded, IoT, MySql, AI
4	Smart Garbage Monitoring System for Waste Management [8]	2017	HC-SR04 ultrasonic sensor	SIM900A GSM Module, Arduino Uno board
5	Smart city technology based architecture for refuse disposal management [9]	2016	Proximity, light, odor, force sensitive sensor	Embedded, Arduino UNO microcontroller board, breadboard, GSM/GPRS, Wi-Fi
6	A Cloud-based Dynamic Waste Management System for Smart Cities [10]	2016	Load sensor SEN-10245, ultrasonic sensor	Cloud server, Microcontroller, and GPRS
7	Automatic Waste Segregator and Monitoring System [11]	2016	Ultrasonic sensor, proximity sensor	Arduino Uno board, Microcontroller, GSM
8	Cloud-based Smart Waste Management for Smart Cities [2]	2016	RFID, load cell sensor	Cloud, Big Data Analytics
9	Smart Dustbin-An Efficient Garbage Monitoring System [12]	2016	Ultrasonic sensor HC-SR04	GSM, Arduino Uno

(continued)

Table 1 (continued)

S. No.	Title of papers	Year	Sensors used	Information transfer methods and technology used
10	Real-time solid waste bin monitoring system framework using wireless sensor network [13]	2014	Accelerometer, hall effect, ultrasound, temperature, humidity, load cell sensor	Zigbee PRO, GPRS, central server database

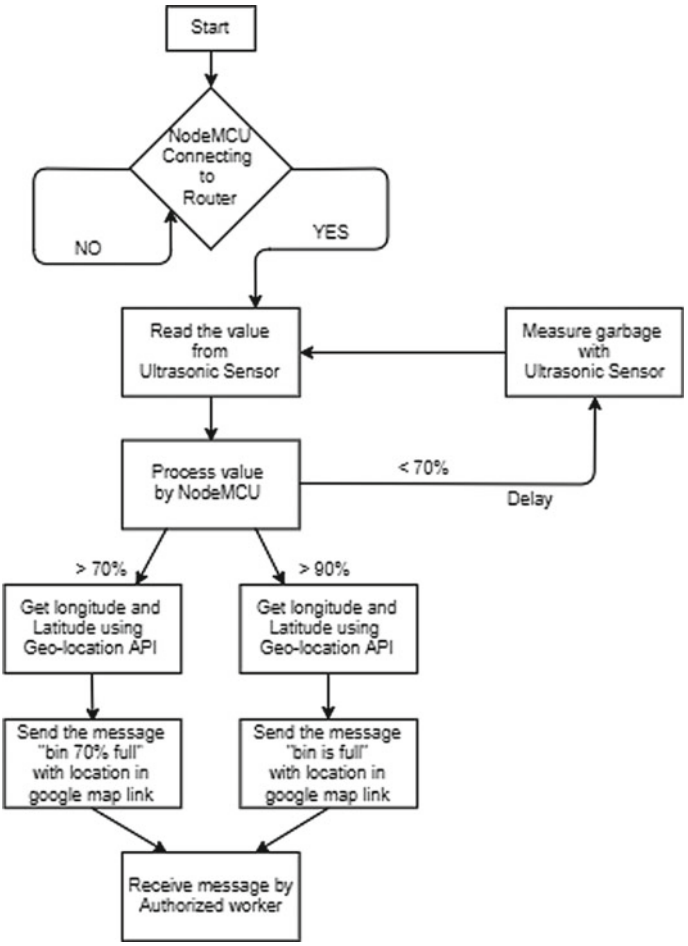

Fig. 1 System architecture

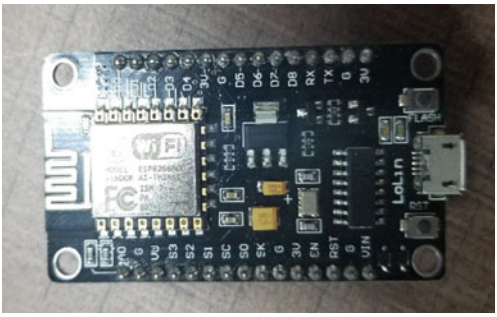

Fig. 2 NodeMCU (Esp8266 12-E)

4 Implementation

A. **Ultrasonic Sensor**
This module is connected to NodeMCU and waits for NodeMCU reply. When it gets a reply from NodeMCU, it sends the signal and waits for receiving that signal and calculates that amount of time and gives it to NodeMCU.

B. **NodeMCU**
This module gives the instruction to ultrasonic sensor to sense the time. After retrieving that time, it performs some operations and calculates distance. If distance is more than 70%, then this module is connected to geolocation API and gets the longitude and latitude of that location and sends the Google map link through IFTTT service.

C. **Geolocation API**
NodeMCU connects to geolocation API server and gives the information about nearby Wi-Fi network or cell tower. Geolocation API performs the calculation and gives the longitude and latitude with accuracy.

D. **IFTTT Service**
After getting longitude and latitude, NodeMCU connects to IFTTT service and triggers the message using Webhook service to assign number with value. Value contains percentage of garbage level and location of garbage bin.

5 Results and Discussion

The hardware mechanisms must be associated correctly. Moreover, ensure that the android phone and the server must be connected to the Internet.

In Fig. 2, this module is called NodeMCU which is used to load program and connect to the server. In Fig. 3, ultrasonic sensor is used to measure distance of garbage. It detects the range from 3 cm up to 3 m. Figure 4 shows the diagram of implemented system and Fig. 5 shows bin with garbage.

Fig. 3 Ultrasonic sensor

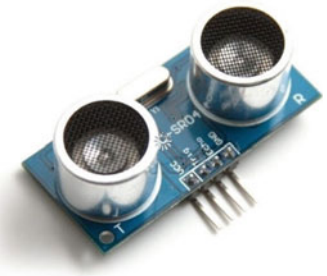

Fig. 4 Diagram of implemented system

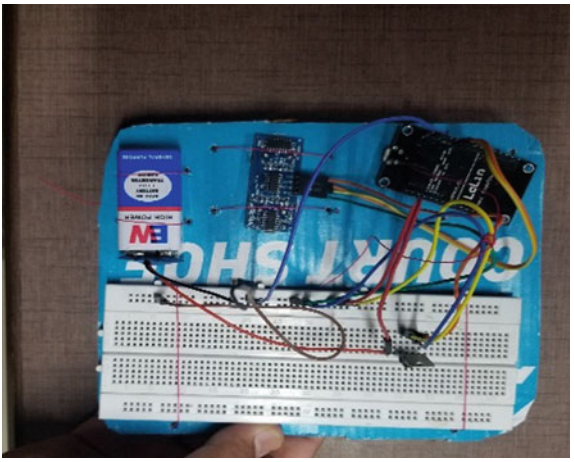

Fig. 5 Bin with garbage

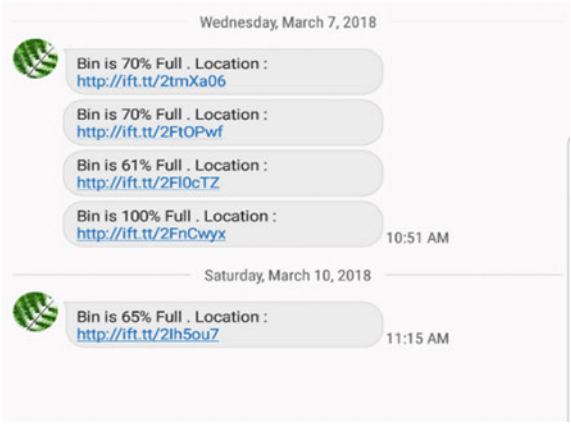

Fig. 6 Received message

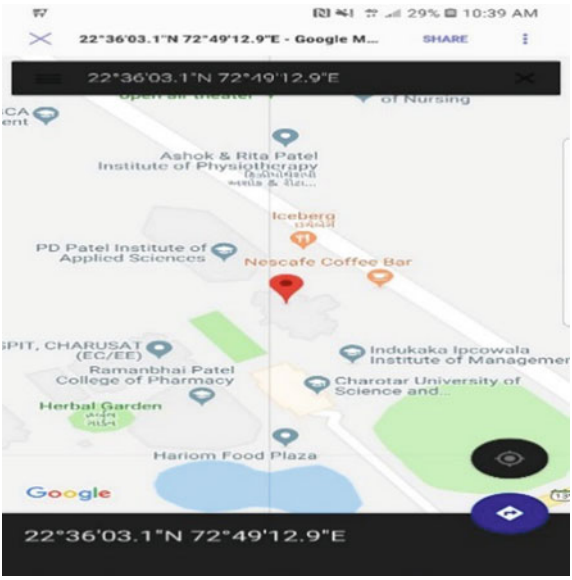

Fig. 7 Garbage bin location

In Fig. 6, when garbage reaches the threshold value, message will be received to phone via SMS with garbage bin location link [5]. In Fig. 7, we can see the garbage bin location using Google map link.

6 Conclusion

In this paper, we presented a smart garbage monitoring system for single bin using IoT. It is accountable for computing the waste level in the bins and later sends the information to authorized worker through SMS. This information helps to calculate

to optimized routes for the workers. Furthermore, we get the location without using GPS module and send the message deprived of using GSM component. In the future, we would like to elongate this system for different kinds of wastes such as metallic, organic, and dry waste segregator and monitoring system.

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