INTERNATIONAL JOURNAL OF ADVANCE RESEARCH, IDEAS AND INNOVATIONS IN TECHNOLOGY

ISSN: 2454-132X
Impact Factor: 6.078
(Volume 7, Issue 2 - V7I2-1229)
Available online at: https://www.ijariit.com

Smart sanitation system

Vaibhavsingh Rajput
2017.vaibhavsingh.rajput@ves.ac.in
Vivekanand Education Society's Institute of Technology, Mumbai, Maharashtra

Manisha Chottopadhyay
manisha.chattopadhyay@ves.ac.in
Vivekanand Education Society's Institute of Technology, Mumbai, Maharashtra

Mitali Jadhaw
2017.mitali.jadhaw@ves.ac.in
Vivekanand Education Society's Institute of Technology, Mumbai, Maharashtra

Devesh Sawant
2017.devesh.sawant@ves.ac.in
Vivekanand Education Society's Institute of Technology, Mumbai, Maharashtra

Atharva Gupte
2017.atharva.gupte@ves.ac.in
Vivekanand Education Society's Institute of Technology, Mumbai, Maharashtra

ABSTRACT

According to India Today, 80% of 1.5lakh metric tonne daily garbage remains exposed which can cause cholera, dysentery, typhoid etc. Unhygienic toilets can result in urinary tract infections, hepatitis, E.coli etc. Proper sanitation and timely maintenance is necessary to bring this number under control. While awareness is an important tool in India, we also need to start developing sustainable models of greener and smarter cities which use analytical solutions to solve problems faced by millions of people universally. When it comes to building smart cities for a greener tomorrow, proper sanitation, clean toilets, and efficient waste monitoring systems play an important role. Therefore to overcome the challenges faced in developing a better sanitation system, the proposed solution explores, primarily developing sensor-enabled solutions to improve waste monitoring and toilet sanitation across cities.

Keywords: *Microcontroller, Ultrasonic Sensor, Moisture Sensor, Turbidity Sensor, NRF Module, IR Sensor, ESP32, MQTT*

1. INTRODUCTION

Worldwide interest in Smart Cities has been rising, which also brings to concern the need to find effective remedies to major challenges foreseen for the next years. With the proliferation of population, a lack of public awareness and limited funding for programs, waste management and lack of hygienic public toilets is a formidable challenge faced by the public administrations. CPHEEO i.e The Central Public Health and Environmental Engineering Organization has estimated that the waste generation in India is as much as 1.3 pounds per person per day. Toilets in public areas like airports, universities, colleges, schools, offices etc. may also look clean and odourless but the bacteria level increases as people keep using it. As per the survey of national medical and science submit accounts for Urinary tract infections of about 8.3 million each year.

As part of 'Swachh Bharat Abhiyaan', nearly 6 million community and public toilets have been constructed in the urban areas. The city governments are also taking a step to monitor the overflowing garbage bins but with limited resources it can turn into a complex task. In this paper, the proposed solution aims to showcase the real time monitoring of the garbage level of respective garbage bins and to detect the level using a combination of sensors and Raspberry Pi.[4] Similarly, another model is presented to detect the rising foul smell and the presence of bacteria in public toilets using two main sensors, a smell sensor and a turbidity sensor.[1] These sensors are connected to an esp32 microcontroller which monitors the changes. The data from both these systems is fed to a raspberry-pi using the MQTT protocol and near radio frequency communication and then the live monitoring of data would be displayed using the map application.[4] The main objective of this system is to supersede the tedious existing system and to ensure that the garbage collecting vans or the toilet cleaning workers attend to the garbage bins and toilets with the utmost efficiency, depriving the fuel consumption, cost, time and labor.

2. RELATED WORK

This system uses an IR sensor, microcontroller, and GSM module.[2]. The data collected from the sensor is transferred to the GSM module via a microcontroller. This system ensures that the concerned cleaner receives the message about the filled dustbins and the status of the garbage bins are monitored on the GUI display in the control room.[2][4]

This system was developed using an ultrasonic sensor, humidity sensor, load cell, Raspberry Pi, WiFi module[4]. The data is collected from the sensors by Raspberry Pi-3.[4] The proposed

architecture has a master-slave configuration of dustbins. The master dustbins have a Raspberry pi and slave dustbins have IoT modules. The data collected by the dustbins are sent to the server by Raspberry Pi using WiFi[4][1]. The unique ids on the bins are matched with the server database and hence the data is analyzed[4] The message about the levels on the garbage bins is then sent to the garbage van on a GUI.[2][4].

The system is developed which employs a smell sensor[5][1] to detect foul smell and a turbidity sensor to detect presence of suspended solids in water.[3][1] The data collected by the microcontroller is sent to the firebase from where it is sent to the cleaning management with the help of WiFi. The concerned cleaner is notified through a message on the mobile.[1]

The authors have proposed a system which allows IR sensors to detect dirt in the wash basins by comparing the detected images with the sample images[5][3]. If the dirt is present then a beep sound is produced by the buzzer[3]. The gas sensor detects the presence of unwanted gases and a turbidity sensor is also used[1]. The microcontroller collects the data and is transferred to the GSM with the help of WiFi and the cleaner is notified about his services.[3]

The system has been proposed where IR sensor, smell sensor[1][5], ultrasonic sensor and RFID reader is used[5]. The RFID reader is used to monitor the activities of the cleaners. The ultrasonic sensor is useful for collecting data about the depth of the sewage in the septic tank[5]. The microcontroller collects data and it is sent to GSM on the mobile[5]. Hence the cleaner is notified and the authorities are informed about the activities of the cleaner.[5]

The authors have developed a system which employs IR sensors to test the presence of a person who has used the washroom so that the flush runs automatically. The ammonia sensor tests the foul odour so as to turn on the room freshener automatically[6]. It implements BLE Beacon technology (Bluetooth low energy device) for power.[6] The data collected by a microcontroller and sent to the hub station where it is analyzed. Then the message is sent to the cleaner for this service. The attendance of the cleaners is taken into account using the RFID reader installed in the washrooms[6]

3. PROPOSED WORK

The two important aspects of the project are Smart Garbage Bins and Smart Public Toilets.

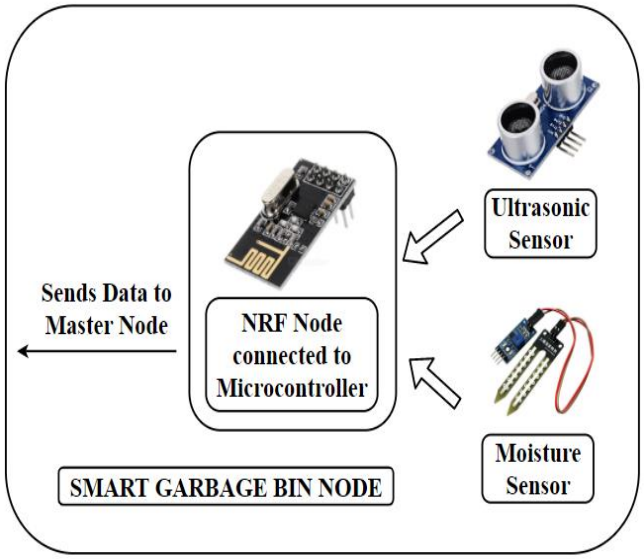

Fig. 1: Smart Garbage Bin

Smart Garbage Bins-The proposed solution explores, primarily developing sensor-enabled solutions to improve waste monitoring and toilet sanitation across cities. The system includes ultrasonic sensors and moisture sensors to collect the required data i.e the amount of garbage level in the bin is identified by the ultrasonic sensor and the moisture sensor is used to identify whether it is a wet or a dry waste.

Hence the data collected from the respective sensors is communicated using the NRF module i.e near radio frequency communication. It is a transceiver module (2.4-2.5GHz) that forms a tree network as shown below

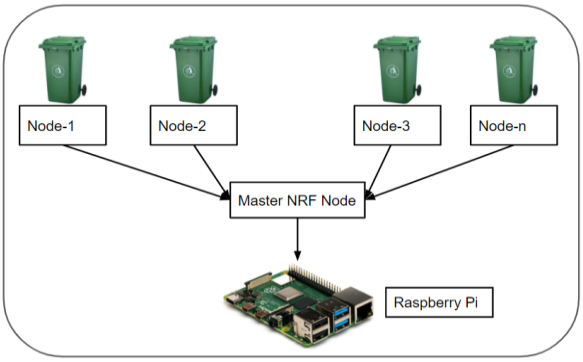

Fig. 2: Tree Network - NRF Module

In this network there are n-nodes and a single master node which would be connected to the raspberry-pi using the USB communication. Raspberry Pi is running a Map application that displays the live monitoring of dustbins and as Raspberry-pi has preconfigured dustbin's location, only the garbage level of the dustbins needs to be displayed.

Smart Public Toilets-In public toilets, gas sensors collect data regarding the presence of unwanted gases,in the gas sensor a reference point is set and if the value of the input surpasses the reference point then it indicates that the toilet is not clean enough and it needs to be cleaned.

The IR sensor consist of IR LED and Photodiode, the radiation emitted by IR LED is incident on the surface and the reflected emission is obtained by the photodiode based on the intensity of radiation obtained by photodiode we can derive the conclusion that whether the public urinals are clean or need to be cleaned.

Turbidity sensor imposes the light beam in the water, if the scattered particles are present in the water then light is reflected from the scattered particle.hence more the light is reflected more are the suspended particles present in the water. Hence the turbidity sensor can be used to track the cleanliness of commode in the public toilets.

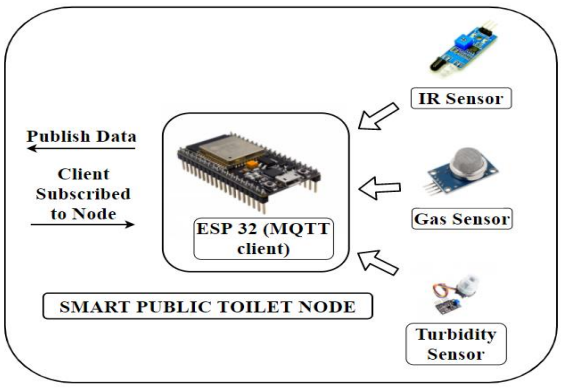

Fig. 3: Smart Public Toilet

Hence the data collected from the respective sensor is passed to the ESP32 microcontroller which then does the communication using the MQTT protocol.

Here MQTT protocol is used to send data from individual nodes to a master node. MQTT i.e (Message Queuing Telemetry Transport) is a lightweight, publish-subscribe network protocol that communicates with messages between different IOT nodes. A MQTT broker receives messages from clients and routes them to respective clients who have subscribed to that topic. Individual nodes then publish sensor data to respective topics.

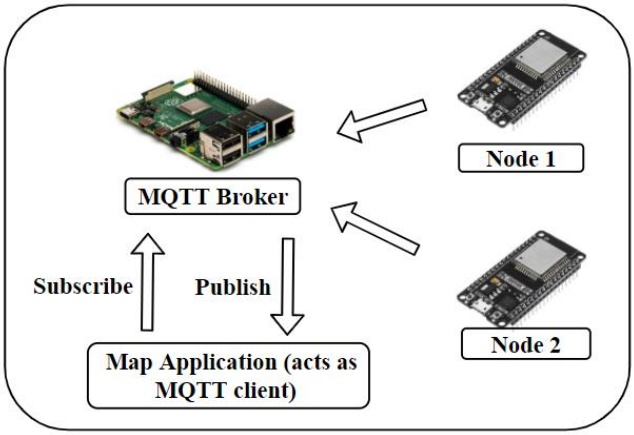

Fig. 4: MQTT

4. CONCLUSION

The initial part of the proposed solution explores the usage of the ultrasonic sensor, moisture sensor to detect the garbage level and type of garbage(wet/dry) and then the data collected from the respective sensors is communicated using the transceiver module i.e is the NRF module by forming the tree network which is further communicated to the Raspberry pi and hence it showcase the live monitoring of data of garbage bins using the map application. The second part of the proposed solution, that is the smart public toilets uses the turbidity sensor, IR sensor and the as sensor to detect the cleanliness of the public toilets and the data collected from the sensor is moved to ESP32 microcontroller which uses MQTT protocol to transfer the data to the Raspberry pi and which shows the live time monitoring of data of public toilets. Both the solutions can be performed on a single Raspberry pi hence rather than having two different access points we can have a single access point to perform the given function, which would aid in the proper garbage disposal and help in the proper sanitation of public toilets.

5. REFERENCES

[1] R. Sujeetha, Abhinav D, Rithik R, Abishek S, "Toilet Management System Using IOT", International Journal of Scientific & Technology Research, Volume-8 Issue-12 December 2019, ISSN 2277-8616.

[2] Vikrant Bhor, Pankaj Morajkar, Maheshwar Gurav, Dishant Pandya, Amol Deshpande, "Smart Garbage Management System", International Journal of Engineering Research & Technology (IJERT) ISSN: 2278-0181 Vol. 4 Issue 03, March-2015

[3] Mithya V, Divya Prabha.N, Sisma Samlein S, Madhumitha M, "Smart Toilets using Turbidity Sensor", International Journal of Innovative Technology and Exploring Engineering (IJITEE) ISSN: 2278-3075, Volume-8 Issue-5S March, 2019

[4] Prof. S.A.Mahajan, Akshay Kokane, Apoorva Shewale, Mrunaya Shinde , Shivani Ingale, "Smart Waste Management System using IoT", International Journal of Advanced Engineering Research and Science (IJAERS), [Vol-4, Issue-4, Apr- 2017] ISSN: 2349-6495(P) | 2456-1908(O)

[5] Mrs.K.Elavarasi,Mrs.V.Suganthi,Mrs.J.Jayachitra,"DEVELOPING SMART TOILETS USING IOT" International Journal of Pure and Applied Mathematics Volume 119 No. 15 2018, 3061-3068 ISSN: 1314-3395

[6] Ms. Nayana B. Chide, Mr. Nilesh P. Bobade, " IoT based Smart Washroom", International Research Journal of Engineering and Technology (IRJET), Volume: 07 Issue: 01 | Jan 2020, e-ISSN: 2395-0056 p-ISSN: 2395-0072

