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An Efficient IOT Model for Garbage Segregation at source level in Ahmedabad

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Abstract
The efficient accumulation, conveyance, segregation and disposal of garbage play a vital role in efficacious waste management. Segregation at source level itself impacts more truncation of landfills. According to a survey conducted in the city of Ahmedabad, due to infelicitous amassment and segregation of garbage at source level by the door-to-door van collector, there arises quandary of segregating them at different wards as well as increase in landfills. This paper suggests an architecture which will intimate the AMC ascendant entities about the incongruous amassment and segregation of garbage at source. Humidity sensor and MQ4 gas sensor is utilized in order to detect the level of the humidity and methane gas accumulated in the dry as well as wet container. Arduino Nano is utilized in order to detect that the dry garbage in accumulated in the dry container and wet garbage is accumulated in the wet container. Sim800L module will transmit the data to the server to be exhibited to the ascendant entities.

Keywords: *Waste, Door-to-Door Van, AMC, segregation, containers and sensors*

I. Introduction

Ahmedabad city is geographically spread over six zones i.e. north zone, south zone, east zone, west zone, central zone and new west zone [1]. There are overall 48 yards where the amassed garbage is distributed for further procedure of segregation and disposal. The conveyance of garbage from source to destination is executed by door-to-door van. This van consists of two containers i.e. wet waste and dry waste. As the segregation at source leads to decrement in landfill, the accommodation provider has to amass the garbage from society in segregated mode and dump the dry waste in dry container while wet waste in wet container. The door-to door van accumulates the garbage at source and conveys it to the yards twice a day [1]. It takes three to four hours for a service provider to visit different places of his area, amass and convey it to the yard.

II. Aims and objective

The objective of this paper is to improvise the process of segregation at source itself in the city in order to truncate the landfills. It will withal be very auxiliary in the swachch Bharath Abhiyan. This paper consists of the surveys conducted on waste management in the Ahmedabad city, proposed architecture and results ascertained of the calibration procedure.

III. Methods And Material

A survey conducted in 2016 on solid waste management in the city of Ahmedabad describing its accumulation, segregation, conveyance, processing and disposal process comparing with its budget concluded with the decentralization and segregation at source can lead to better standard of society and abbreviation of cost of overall waste management to INR 418 per ton from INR 1000 per ton [2].

Another survey was conducted in 2019 asking the denizens of Ahmedabad city regarding issues and challenges faced while managing the solid waste in the Ahmedabad city which expressed an issue of inopportune amassment of waste at source level by the service providers. The solution proposed for that issue was the Sensor-Predicated door-to-door van [3]. It was verbalized that the door-to-door van should be equipped with the moist sensors connected to the Internet. Sensors will detect the type of waste in the dry and wet container and notify the ascendant entities about equipollent.

3.1 Proposed architecture

The Internet of Things (IoT) is an emerging paradigm that enables the communication between electronic contrivances and sensors through the cyber world in order to facilitate our lives [4]. Internet of things comprises of various components like different types of sensors, data transmitters, and transceivers which helps to resolve real world problems by designing and implementing new models and architecture.

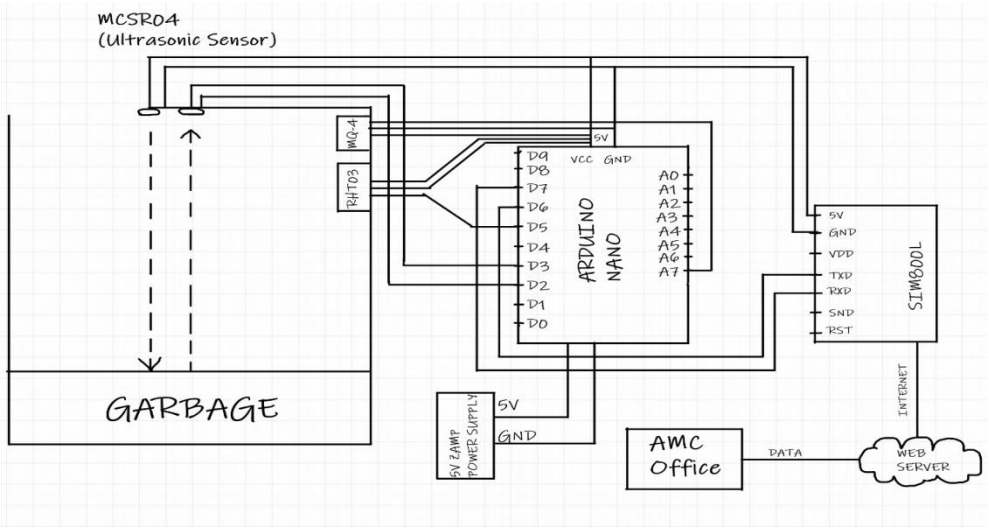

Fig.1 Proposed Architecture

The disposal of these wastes into landfills results in the emission of gases with a high ecumenical warming potential such as CH4, MQ-4 sensor is utilized to monitor or sense methane gas [5]. The municipal solid waste (MSW) engendered by households is considered the third most astronomically immense anthropogenic source of methane (CH4) emissions, constituting 11% of all ecumenical CH4 emissions [5]. It also gives a clearer picture of how moisture is distributed between the solid waste and the void spaces within a landfill. The size of the door-to door van container utilized for garbage amassment including dry and wet containers is 254*150*200 cm. Components used to engender this model include Humidity Sensor (RHT03), MQ-4 Sensor, Ultrasonic Sensor (HC-SR04), Arduino Nano and Sim800L GPRS Module. Two humidity sensors RHT03, two MQ4 sensors and two HC-SR04 sensors will be utilized in this model and one of each in dry container and another one of them in wet container.

Humidity Sensor (RHT03): Humidity is formed depending on the content of water in the air. Humidity sensing is important for industrial processes and human life control system [6]. This sensor is utilized to count the sultriness level (in percentage). The operating range of this sensor is up to 100 meters and it requires 3.3 to 5V DC to operate. As shown in the fig. 1, RHT03 sensor will generate the analog value and send it to Arduino Nano.

MQ-4 Sensor: Fig. 1 shows that the sensor senses the gas produced from wet garbage and sends the data to the micro-controller. The operating range of this sensor is very wide and it needs 5V DC to operate.

Ultrasonic Sensor: This sensor is used to find out the distance whether the garbage box is full or not. It will check the level of garbage in garbage box and check whether the garbage box can contain more garbage or not. The range of 2cm to 4m with a resolution of 0.3cm is measured using HC-SR04 ultrasonic transducer [7]. The operating range of this sensor is up to 4 meters and it needs 5V DC to operate.

Arduino Nano: Arduino Nano provides easy and cheap for interested people to construct electronic devices that can be programmed to interact with the external environment using sensors and actuators [8]. Fig. 1 depicts that the microcontroller receives the readings from the sensors especially MQ-4 and RHT03 sensors and then calculates amount of the moisture content generated. Depending upon methane level along with humidity percentage, it calculates the moisture level of garbage. It will then forward it to the sim800L GPRS module

Sim800L GPRS Module: Sim800L is a GPRS module in which we have to insert internet activated sim card and it sends all the required data to dedicated server i.e. to the AMC authorities as shown in Fig. 1. The vehicle number, the moisture status in the wet container and the moisture status in the dry container can be transmitted to the authorities so ass to improve the method of waste segregation at source

3.2 Calibrating with Moisture Sensor

The inadequate needle length of moisture sensor makes it arduous to conduct simple and expeditious moisture sensing content in deep soil [9]. Because of the variety of technologies used and the varying length of the monitoring period, calibration of any given sensor could vary depending on site concrete conditions. Calibration is very proximately aligned with evaluating system performance [10]. The procedure of calibration was followed in order to find how the RHT03 sensor and MQ-4 sensor behave in different scenarios as well as to measure and set the accuracy of the sensors. The moisture sensor was placed in the garbage in wet as well as dry containers and readings from the sensors were received and moisture content was calculated. In order to quantify and set the accuracy of humidity sensor, ultrasonic sensor and MQ-4 sensor, calibration procedure is undertaken. Visual examinations noted throughout this procedure are mentioned below.

For Dry containers: Sensors vary their readings when wet waste is inserted into dry containers. When small amount of wet waste is added up then the sensor readings observed are:

- RTH03 below 30% and MQ-4 value is > 100 & < 150 Analog Value
- RTH03 below 30% and MQ-4 value is > 150 Analog Value
- RTH03 above 30% to 50% and MQ-4 value is > 85 & < 100 Analog Value
- RTH03 between 50% to 60% and MQ-4 value is > 50 & < 65 Analog Value
- RTH03 above 60% and MQ-4 value is > 10 & < 40 Analog Value

When some more amount of wet waste is added up again then the sensor readings observed are:

- RTH03 above 30% to 50% and MQ-4 value is > 100 Analog Value
- RTH03 between 50% to 60% and MQ-4 value is > 65 Analog Value
- RTH03 above 60% and MQ-4 value is > 40 Analog Value

For Wet containers: Sensors vary their readings when dry waste is inserted into dry containers. When small amount of wet waste is added up then the sensor readings observed are:

- RTH03 below 30% and MQ-4 value is > 50 & < 100 Analog Value
- RTH03 between 30% to 50% and MQ-4 value is > 30 & < 85 Analog Value
- RTH03 between 50% to 60% and MQ-4 value is > 20 & < 50 Analog Value
- RTH03 above 60% and MQ-4 value is < 10 Analog Value

When huge amount of dry waste is added up again then the sensor readings observed are:

- RTH03 below 30% and MQ-4 value is < 50 Analog Value
- RTH03 between 30% and to 50% MQ-4 value is < 30 Analog Value
- RTH03 between 50% to 60% and MQ-4 value is < 20 Analog Value

IV. Experimental Result

Few of the scenarios are depicted here accumulating data during calibration process. Table-1 shows vehicle number, time, methane gas emitted in ppm as well as relative humidity in percentage of dry container. If the readings are checked as it is depicted in the Fig 2 the value read from RTH03 is above 60% and MQ-4 value is less than 40 which denotes that the presence of wet waste in it is in immensely colossal quantity. Table-2 additionally shows vehicle number, time, and methane gas emitted in ppm as well as relative humidity in percentage of dry container. If the readings are checked and it is depicted in the Fig 3 the value read from RTH03 is below 30% and MQ-4 value is more preponderant than 100 and less than 150 which denotes that the presence of wet waste in it is in minute quantity. Similarly Table-3 additionally shows vehicle number, time, and methane gas emitted in ppm as well as relative sultriness in percentage of wet container. If the readings are checked and it is depicted in the Fig 4 the value read from RTH03 is below 30% and MQ-4 value is less than 50 which designates that the presence of dry waste in it is in immensely colossal quantity

Vehicle No.	Time (s)	CH4(ppm)_ dry	Humidity (%r.h.)_dry
GJ01AZ5401	7695.282	82.134	59.67
GJ01AZ5401	7700.158	82.134	59.66
GJ01AZ5401	7705.035	82.134	59.66
GJ01AZ5401	7710.214	82.134	60.16
GJ01AZ5401	7715.091	82.134	60.16
GJ01AZ5401	7720.276	82.134	60.16
GJ01AZ5401	7725.157	82.134	60.16
GJ01AZ5401	7730.033	82.134	60.16
GJ01AZ5401	7735.218	82.134	60.16
GJ01AZ5401	7740.093	82.134	60.16
GJ01AZ5401	7745.275	82.134	60.16
GJ01AZ5401	7750.149	82.134	60.16

Table-1 Dry container with wet waste in huge Quantity

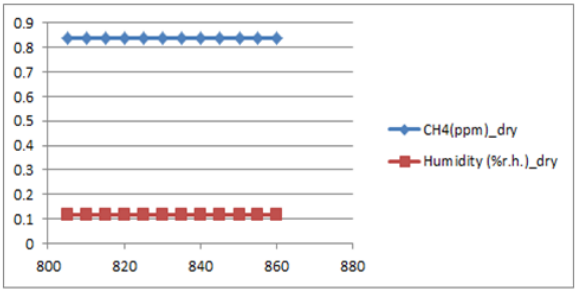

Fig-2 Dry container with wet waste in huge Quantity

Vehicle No.	Time (s)	CH4(ppm)_dry	Humidity (%r.h.)_dry
GJ01AZ5401	805.167	120	8
GJ01AZ5401	810.115	120	8
GJ01AZ5401	815.06	120	8
GJ01AZ5401	820.003	120	8
GJ01AZ5401	825.259	120	8
GJ01AZ5401	830.202	120	8
GJ01AZ5401	835.145	120	8
GJ01AZ5401	840.083	120	8
GJ01AZ5401	845.027	120	8
GJ01AZ5401	850.282	120	8
GJ01AZ5401	855.227	120	8
GJ01AZ5401	860.168	120	8

Table-2 Dry container with wet waste in small Quantity

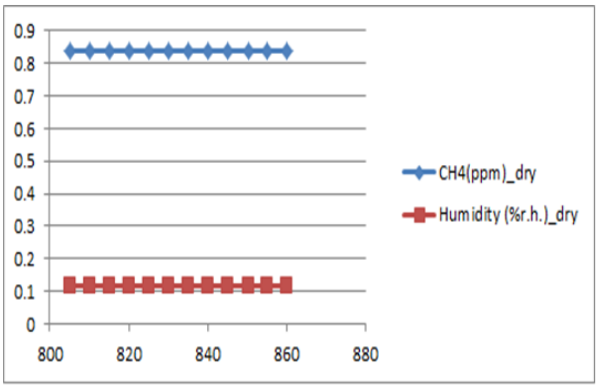

Fig-3 Dry container with small quantity wet waste

Vehicle No.	Time (s)	CH4(ppm) wet	Humidity (%r.h.)_ Wet
GJ01AZ5401	0	0	20
GJ01AZ5401	5.244	0	20
GJ01AZ5401	10.448	0	20
GJ01AZ5401	15.573	0	20
GJ01AZ5401	20.257	0	27
GJ01AZ5401	25.136	0	27
GJ01AZ5401	30.014	23	27
GJ01AZ5401	35.195	23	27
GJ01AZ5401	40.07	23	27
GJ01AZ5401	45.257	23	27
GJ01AZ5401	50.133	23	27
GJ01AZ5401	55.012	50	27
GJ01AZ5401	60.195	51	27
GJ01AZ5401	65.07	121	27

Table-3 Wet container with dry waste in huge Quantity

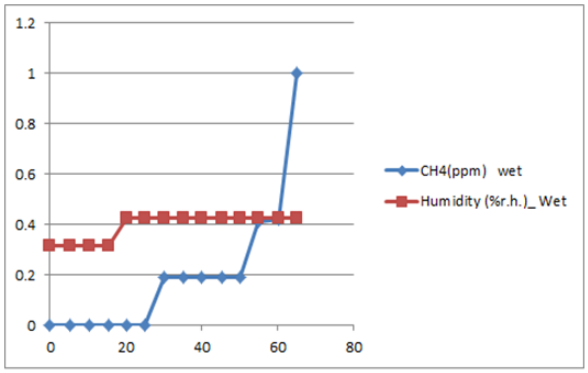

Fig-4 Wet container with dry waste in huge Quantity

V. Conclusion

Predicated on our analysis it can be concluded that the proposed architecture will enhance the efficacy of waste management system in Ahmedabad. It is very consequential to avert, reuse, recycle and disposal of waste in very efficacious way. Segregation efficiently done at source level will abbreviate the process of segregation at yards and directly can be moved towards next step of reuse and recycle. The concept of implementing astute sensors data accumulation and analysis makes the task of human being much more facile resolving genuine world quandaries.

References

[1]. Amdavad Muncipal Corporation, https://ahmedabadcity.gov.in/portal/jsp/Static_pages/solid_waste_mgmt.jsp
[2]. J.T sheth, K. patel, D. Shah A Case Study of Ahmedabad, IJSRD, "Habitat Conclave 2016", Paper presentation on "Smart & Sustainable City"|| ,February 2016.
[3]. Nithya. Nadar, S. Sonar, A Survey report on Waste Segregation in Ahmedabad City, International Journal of Scientific and Technology Research (IJSTR) ISSN 2277-8616 ,2019.
[4]. S.Kumar,P. Tyagi, M. Zymbler, Internet of Things is a revolutionary approach for future technology enhancement: a review, Kumar et al. J Big Data ,2019 ,6:111
[5]. C. K Singh , A. Kumar , S.S Roy, Quantitative analysis of the methane gas emissions from municipal solid waste in India, http://www.nature.com/scientificreports ,Feb 2018.
[6]. Dr. J. J. Amalraj, S. Banumathi, J. J John, IOT Sensors and Applications: A Survey, International Journal Of Scientific & Technology Research Volume 8, Issue 08, Issn 2277-8616 ,August 2019.
[7]. M. Kaur, J. Pal, Distance Measurement of Object by Ultrasonic Sensor HC-SR04, IJSRD - International Journal for Scientific Research & Development| Vol. 3, Issue 05, 2015 | ISSN (online): 2321-0613 ,2015.
[8]. H.Al-Mimi1, A Al-Dahoud, M. FEZARI, M.Sh. Daoud, A Study on New Arduino NANO Board for WSN and IoT Applications, International Journal of Advanced Science and Technology Vol. 29, No. 4, (2020), pp.10223–10230 ,2020.
[9]. Z .Gao, Y. Zhu, C. Liu, H. Qian, W.Cao, J. Ni, Design ,Test of a Soil Profile Moisture Sensor Based on Sensitive Soil Layers, Published online 2018 May 21. doi: 10.3390/s18051648 ,2018.
[10]. D. J. Sample, J. S. Owen, S.Barlow, Understanding Soil Moisture Sensors: A Fact Sheet for Irrigation Professionals in Virginia, Produced by Communications and Marketing, College of Agriculture and Life Sciences, Virginia Tech, 2016.