IJIRCCE

e-ISSN: 2320-9801 | p-ISSN: 2320-9798

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING

Volume 11, Issue 3, March 2023

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 8.379

International Journal of Innovative Research in Computer and Communication Engineering

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 |

|| Volume 11, Issue 3, March 2023 ||

| DOI: 10.15680/IJIRCCE.2023.1103054 |

Design and Implantation of IOT Based Garbage Collection and Monitoring System Using RaspberryPi

P.Jyothi[1], A.Nikhila Ghayathri[2], S.Lakshmi Prasanna[3], V.Himasri[4], KBL Phani Kumar[5]

Assistant Professor, Department of ECE, Sri Vasavi Institute of Engineering &Technology, Nandamuru, A.P, India[1]

U.G .Student, Department of ECE, Sri Vasavi Institute of Engineering &Technology, Nandamuru, A.P, India [2]

U.G .Student, Department of ECE, Sri Vasavi Institute of Engineering &Technology, Nandamuru, A.P, India [3]

U.G .Student, Department of ECE, Sri Vasavi Institute of Engineering &Technology, Nandamuru, A.P, India [4]

U.G .Student, Department of ECE, Sri Vasavi Institute of Engineering &Technology, Nandamuru, A.P, India [5]

ABSTRACT: As the population is increases with the growth of the cities, the waste produced alsoincreases. In today's scenario many cities are still lacking in the area of waste management, particularly,the collection of garbage within the cities. Because of this there is overspill of garbage bins.To provide a solution to this problem, a smart garbage monitoring system is therefore to proposed to tackle the issues faced. Now-a-days sanitariness & cleanliness are one of theagitated issues by any state all over the world. The main purpose of this project is to develop an IOT Based project which is cost-effective system that can monitor the everyday garbage in real time by using smart technology. The mechanism proposed accesses real-time information of any smart garbage bin deployed across the city and helps to resolve the problem of waste overflow from garbage bins and keep the smart cities clean.

KEYWORDS: Ultrasonic Sensors, IOT(Internet Of Things),Garbage monitoring system, Solid&liquid waste collection, RaspberryPi, GSM and GPS module

I. INTRODUCTION

In today's scenario many cities are still lacking in thearea of waste management, particularly, the collection of garbage within the cities.Because of this there is overspill of garbage bins. To provide a solution to this problem, a smart garbage monitoring system is therefore to proposed to tackle theissues faced. Now-a-days sanitariness &cleanliness are one of the agitated issues by any state all over the world. The main purpose of this project is to develop an IOT Based project which is cost-effective system that can monitor the everyday garbage in real time by using smart technology. In this we are using ultrasonic sensors positioned over the bins to detect the garbage level and relate it with the garbage bins depth and also using capacitive and inductive proximity sensors fordetection and separation of metallic and non metallic objects such as plastic, paper and more. We are also using GSM module for sending information about fill of garbage bin to municipal office and also it displays about filling of garbage bin information by using LCD display which was present on the garbage. The mechanism proposed accesses real-time information of any smart garbage bin deployed across the city and helps to resolve the problem of waste overflow from garbage bins and keep the smart cities clean. Waste management in cities has been a critical challenge to city engineers and urban planners for a long time. The significant causes of waste generation in the cities are industrialization, increased household incomes, changing consumer patterns due to taste and preferences, economic growth, development, and exponential population growth. Also, an increase in the human population has led to an increase in waste production, posing a challenge to waste management and control for smart cities. It is well known that there is a significant generation of waste from households as well as industries . The local authorities collect this generated waste and subsequently take it to the dumping sites for disposal or recycling. In order to keep the environment hygienic, clean, and green, the monitoring of waste and its disposal is vital. The improper disposal of waste can result in numerous health hazards. Over the last decade, many cities worldwide have faced significant challenges such as small parking slots for vehicles, overcrowding, waste management, unemployment, housing, traffic jams, and water andsewerage problems. These challenges have severely affected the livelihood of city residents. In the recent past, Internet of Things (IoT) has helped resolve some of these challenges. For example, in smart cities based on IoT, physical devices interact over the internet and provide ease to human beings based on their intelligence

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 |

|| Volume 11, Issue 3, March 2023 ||

| DOI: 10.15680/IJIRCCE.2023.1103054 |

The rapid growth in urban population and the voluminous generation of waste have made the cities unclean and dirty, which poses a health challenge to urban residents. The generated waste can be classified into solid and wet waste. The main focus of this paper is to suggest novel methods of solid waste management and the associated control mechanism for smart cities coherently making a Smart Garbage Bin Mechanism(SGBM). The control mechanism is aimed at cleaning and sanitizing the smart city environment more intelligently. The process of waste management and the associated control mechanism is broken down into five steps: garbage collection, transportation of garbage, analysing and processing garbage, recycling garbage, and the disposal of garbage. The proposed SGBM is novel in the aspectof real-time monitoring of solid waste deposited in garbage bins, and it employs fuzzy expert system in decision making that helps in strategic deployment of garbage bins across the smart city. Besides, the proposed mechanism will be of great benefit in the near future where all communication will be established through the internet without human interference.The proposed system is implemented using Net logo which provides a multi-agent modelling environment.

II. LITERATURE SURVEY

The paper "IOT based smart bin allocation and vehicle routing in solid waste management: A case study in South Korea" presents the design and implementation of an IoT-based Arduino Uno microcontroller working with the ultrasonic sensors that detect the level of waste in the waste bins placed in different locations. The sensors display the status information of the bins as "filled," "half filled," or "empty" on an LCD screen at regular intervals and send this information to the CMS. This operation is performed using a microcontroller, a Wi-Fi module, and ultrasonic sensors. The above process helps to automate waste bin monitoring and control. Experimental results demonstrate a promising solution to waste management. Several tests can be performed to evaluate the system's performance. The proposed IoT-based waste bin system will help to keep smart cities clean. To the best of our knowledge, there is no research which impose a time-dependent penalty for the delay to serve a filled bin. The concept of neighbouring bins is introduced to maintain the load constraint of a vehicle, and these are present under a certain radius from thelast visited filled bin of a tour plan. In our proposed model, we consider the IoT based smart waste bin system, which has the potential to detect the overflow of waste through an ultrasonic sensor. A time- dependent penalty is imposed on the waste management authority if filled bins are not emptied in time after becoming full. These smart waste bins can send messages to the CMS to avoid the penalty. After receiving the filled waste bins' status, the CMS sends an appropriate vehicle to collect the waste, following the optimum path using our developed hybrid VNSACO algorithm. After collecting the waste from all the filled bins, the vehicle finds the nearest neighbouring bins, which are not necessarily filled above a certain limit, and cleans those waste bins, too, if sufficient space is available for them to be emptied. By applying this idea to the vehicle routing technique, we can search for the shortest path to optimize the routing cost and clean the allocated bins as early and efficiently as possible. This model illustrates different scenarios, depending on different parameters, like vehicle types and driver availability under a budget limit.

In the last few years, there have been many proposals on smart systems by researchers to deal with numerous challenges faced by the cities globally. Some proposals have focused on smart waste collection process and smart waste management systems [2] According to a smart city is an advanced infrastructure that incorporates Information Communication Technologies(ICT) and in which, everything or every device is interconnected with one another and can interact without any interference. One fundamental requirement in a smart city environment is that everything is supposed to be intelligent and mart in making decisions. With advancements in technology, a smart city requires many applications for providing services to the residents. The major applications include: smart health, smart surveillance and security[3] smart traffic management and control [7] smart environment monitoring [11] and many other many applications [12]. From the smart cities applications and literature review, big data and data analysis is required in development of these applications [13,14]. In this section on literature review, research on solid waste collection and management mechanisms is reviewed [5] developed a real-time intelligent garbage bin level monitoring system coupled with rule-based decision algorithms used in solid waste collection and the management. The decision-based algorithms would sense the waste-data through a wireless sensor network (WSN). The architecture had three modules, namely the control station, smart garbage bin and gateway. The concept of this system was that the garbage bins can collect the status of solid waste in them. In an event where a small change occurs, they would transmit the status of the data collected to a central server through an intermediate coordinator [6]. An array of applications in the central server provided the updated garbage bin status in real-time. The advantage of the proposed system was its design and development, which resulted in an automated garbage bin status checking system that is novel in that it uses decision-based algorithms. However, the system also had several challenges, in that it lacked GPS for position detection, errors in the output data readings of the sensors, and lack of citizen interaction with the system[10] introduced optimal path finding in the transportation of solid waste for city municipalities, which involved using the Dijkstra's algorithm and Geographical Information System (GIS). The system aimed at reducing the distance travelled by waste trucks to reach

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 |

|| Volume 11, Issue 3, March 2023 ||

| DOI: 10.15680/IJIRCCE.2023.1103054 |

the garbage bins by 9.93%. This optimal path finding also reduced the time spent on the roads and fuel costs. Nevertheless, the authors did not expound on how all the stakeholders (the city residents and the garbage collectors) will be involved and how the proposed system could be used by municipal authorities to improve waste management and reduce the cost of waste collection[17]. developed an effective control mechanism to measure the filling levels of the solid waste garbage bins. The system was developed to use Infrared (IR) sensor, transmitter, microcontroller and Radio Frequency (RF) module to gather the information of any waste in the garbage bins right on time. The sensors have been employed sense the exact level of solid waste in the garbage bins and send any alert to the central controller. The microcontroller then encodes all these alerts and sends them to the Central Processing Unit (CPU). Lozano, [13]. Introduced a new method of checking the levels of SGB and subsequently determines an optimal path in the state of Philadelphia, USA based on genetic algorithm and logistic regression. However, the authors did not provide the technology to transmit the data from the SGB to other arrays of the devices in the system[18]. Introduced an innovative way of collecting waste information from the garbage bins. The authors suggested an integration of the GSM module and the ultrasonic sensors. The ultrasonic sensors were aimed at detecting the current level of waste in the garbage bins and compare it with the threshold limit provided. If the detected level exceeds the threshold, the sensor issues a notification of an update to the Arduino UNO responsible for the general communication of the system. Further, the Arduino UNO sends an alert signal to the GSM module.The GSM module is wirelessly linked to Personal Digital Assistant (PDA), and the information is shared with the municipal authorities. [20] proposed a system that would obtain information on solid and liquid waste from the smart garbage bins. The mechanism incorporated both IoT and WSN. An array of sensors was attached to the SGB, and the communication between the SGB and the central server was through WSN. The personnel involved in garbage collection played a significant role because they would receive all the alerts that are generated by the various sensors. The authors stated that, one of the cities in India, Asansol, has proposed using GIS in planning for the collection, transportation and storage of all the waste generated intelligently.The SGBM system proposed in this paper for solid waste management for smart cities is better compared to the existing systems in the terms of its flexibility and optimal route finding.

III. EXISTING SYSTEM

In the existing system, the garbage is collected by the municipality servants on the scheduled routine basis i.e., weekly or 2-3 times within the months. As we see many times that garbage bins are placed in the public places in the citiesare overflowing due to increase in the waste every day. Due to this, the garbage shrinks and produces the bad smell which will tends to cause the air pollution and spread diseases. That can cause the harm to human health. Thus, cleaning is the bigissue. Also finding the path of garbage bin is one of the tasks especially for new driver. Thus, to avoid such conditions we have designed the improved system

IV. PROPOSED SYSTEM

Our proposed project main purpose to develop an IOT Based project which is cost-effective system that can monitor the every day garbage in real time by using smart technology. In this we are using ultrasonic sensors positioned over the bins to detect the garbage level and relate it with the garbage bins depth and also using capacitive and inductive proximity sensors for detection and separation of metallic and non-metallic objects such as plastic, paper and more. We are also using GSM module for sending information about fill of garbage bin to municipal office and also it displays about filling of garbage bin information by using LCDdisplay which was present on the garbage. The mechanism proposed accesses real-time information of any smart garbage bin deployed across the city and helps to resolve the problem of waste overflow from garbage bins and keep the smart cities clean.

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 |

|| Volume 11, Issue 3, March 2023 ||

| DOI: 10.15680/IJIRCCE.2023.1103054 |

Block Diagram

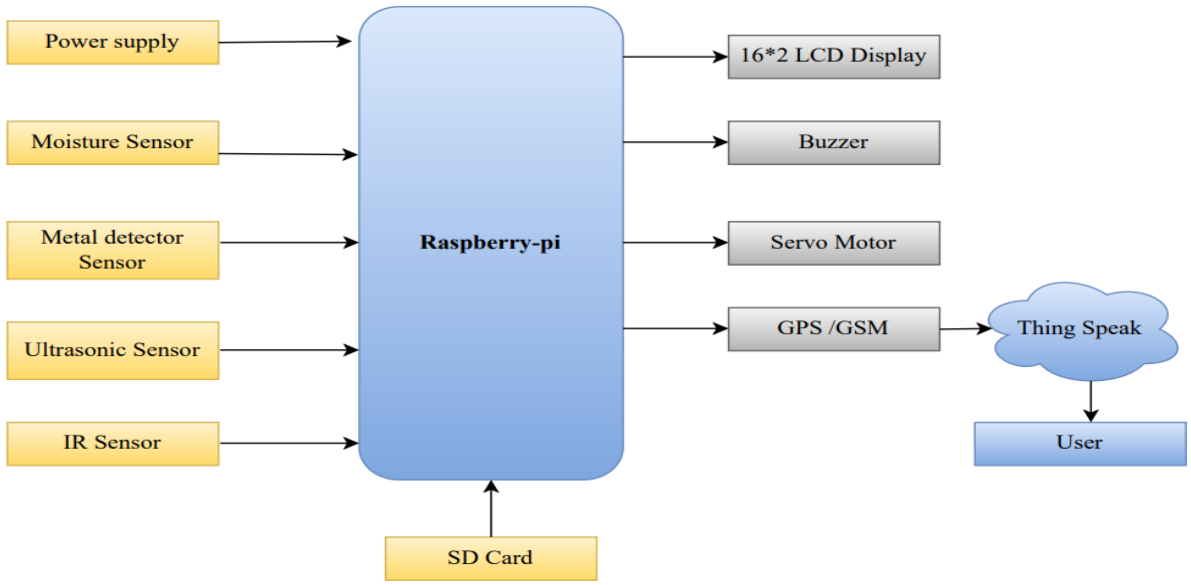
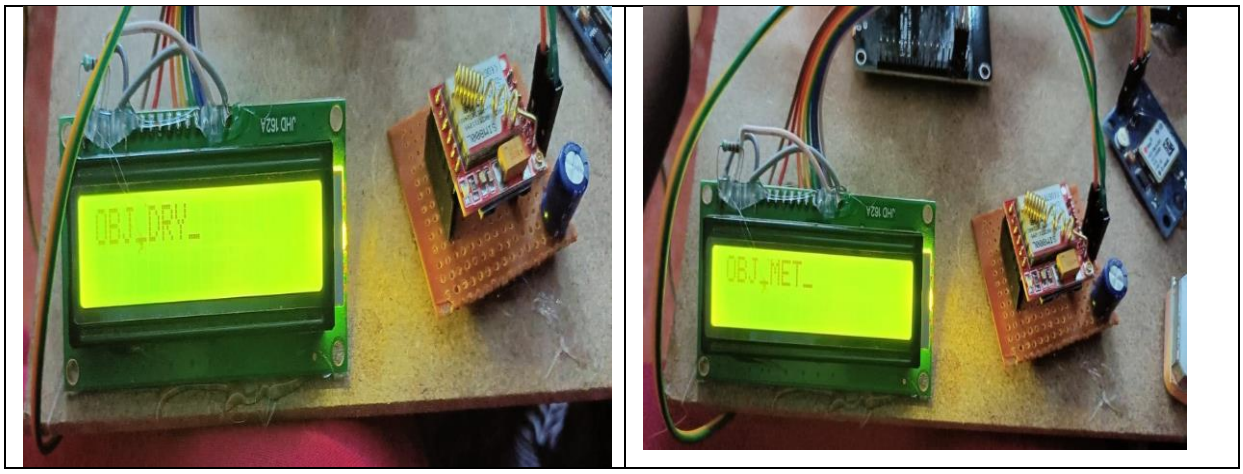


Figure 1 Block Diagram

The main motive to implement this project it is a cost-effective system that can monitor the everyday garbage in real time by using smart technology. In this we are using ultrasonic sensors positioned over the bins to detect the garbage level and relate it with the garbage bins depth and also usingcapacitive and inductive proximity sensors for detection and separation of metallicand non-metallic objects such as plastic, paper and more. We are also using GSM module for sending information about fill of garbage bin to municipal office and also it displays about filling of garbage bin information by using LCD display which was present on the garbage. The mechanism proposed accesses real-timeinformation of any smart garbage bin deployed across the city and helps to resolve the problem of waste overflow from garbage bins and keep the smart cities clean.

V. RESULTS



International Journal of Innovative Research in Computer and Communication Engineering

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 |

|| Volume 11, Issue 3, March 2023 ||

| DOI: 10.15680/IJIRCCE.2023.1103054 |

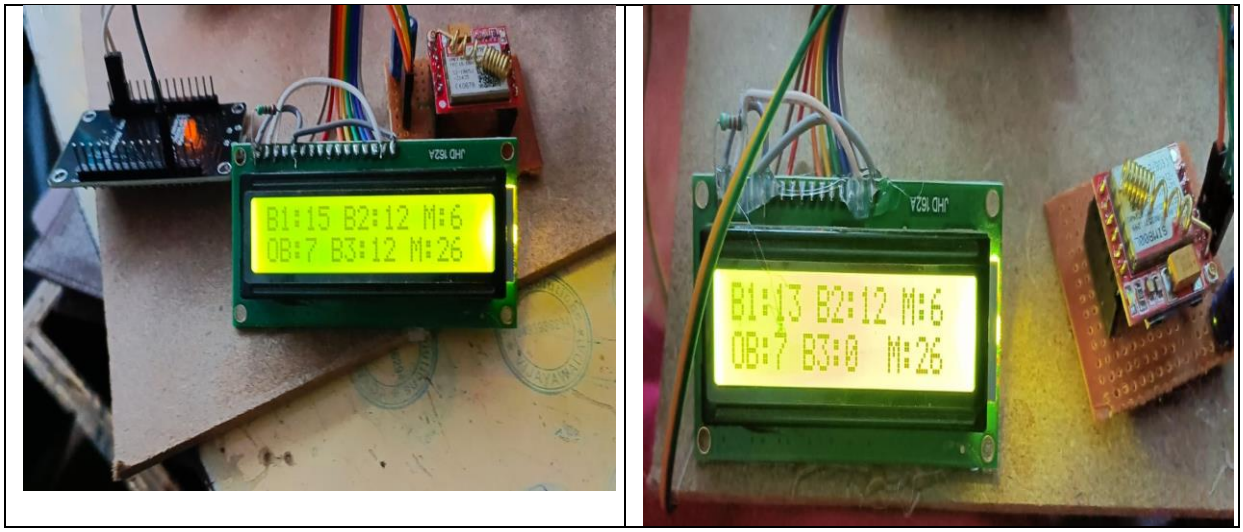


Figure 2 Dry waste detection output on lcd display

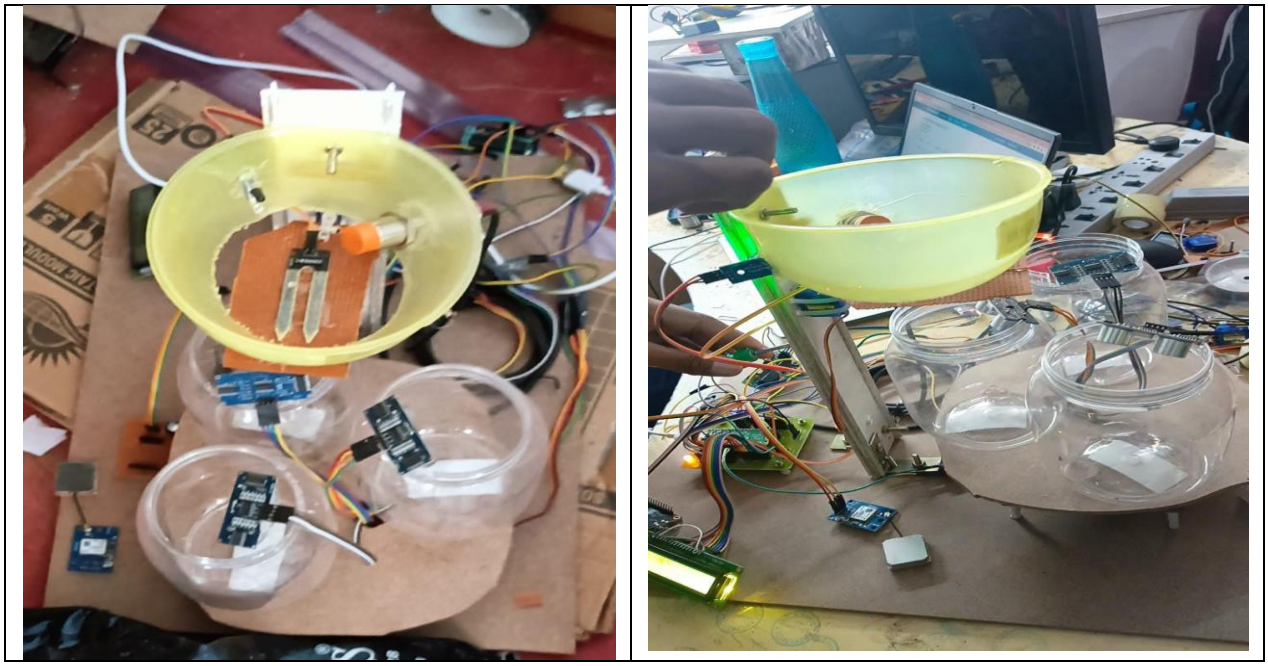
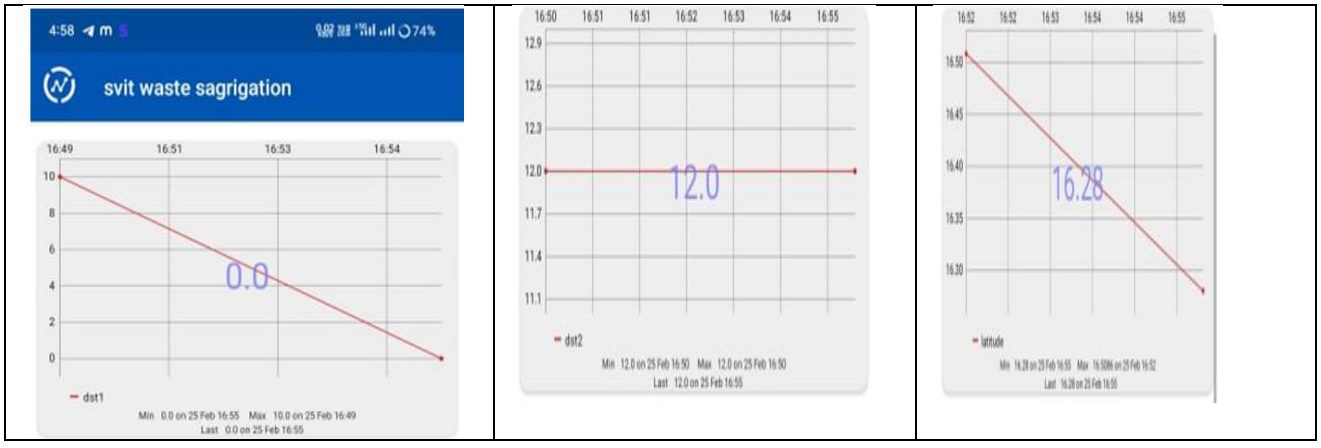


Figure 3 Kit arrangement of the IOT based garbage collection and monitoring system using Raspberry pi



| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 |

|| Volume 11, Issue 3, March 2023 ||

| DOI: 10.15680/IJIRCCE.2023.1103054 |

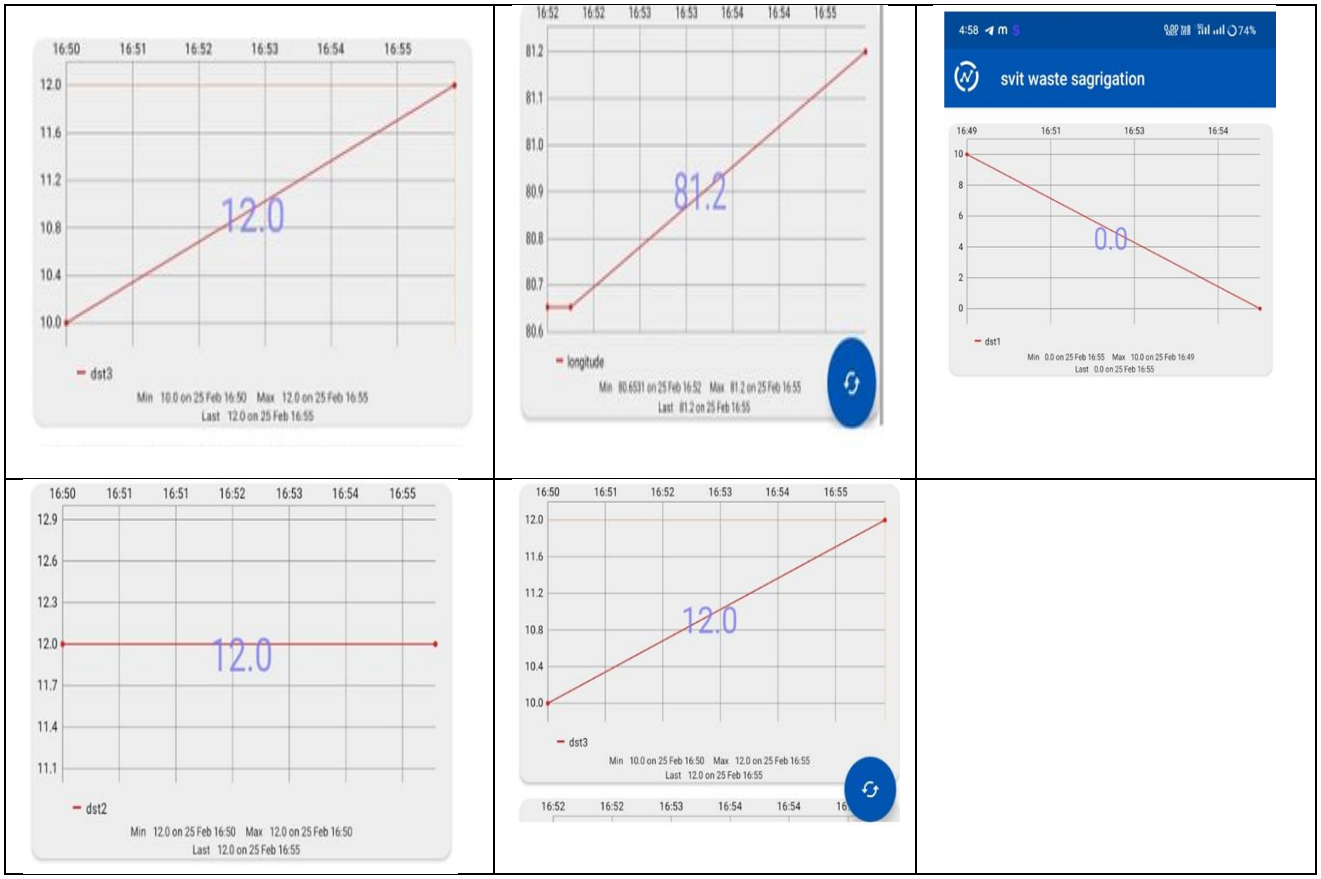


Figure 4.IoT based output on bin collection and location of bin

VI. CONCLUSION

The paper has presented real-time smart garbage bin mechanism for solid waste management in smart cities. The system is implemented using Raspberry-pi which provides a real-time multi agent modelling environment, and the SGBM results show that the mechanism is responsive, adaptable and effective to any smart city environment. Existing solid waste collection and management systems have several drawbacks: less accessibility to the actual data, late or delayed unloading of waste from the garbage bins, lack of throughput, and hindrance in embracing new techniques. Therefore, a more pragmatic and advanced approach must be designed and developed to overcome the existing systems challenges. In general, waste monitoring and collection takes a significant amount of money from the municipal budget. The method proposed in this paper can access real-time data from the smart garbage bins; hence, it can appropriately implement the waste collection procedure. The proposed waste monitoring and collection mechanism is achieved by using both architectural and theoretical models. Future work should consider using WSN in the real-time waste collection and management by integrating the GIS maps into the system for precise location identification of the nodes. In addition, the future work may consider applicability of IoT in the implementation of the proposed system. The output of this project it avoids the over flow of garbage bins by monitoring the bin every time and it transmit the data to local municipal office by this we can avoid the environmental pollution and diseases cause to humans due to garbage. In this project we had completed a partial result.

REFERENCES

[1] Angelelli, E., & Speranza, M. G. (2002a). The periodic vehicle routing problem with intermediate facilities. European Journal of Operational Research, 137(2),233–247.https://doi.org/10.1016/S0377-2217(01)00206-5

[2] Angelelli, E., & Speranza, M. G. (2002b). The application of a vehicle routing model to a waste-collection problem: Two case studies. Journal of the Operational Research Society,53(9),944–952. https://doi.org/10.1057/palgrave.jors.2601402

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 |

|| Volume 11, Issue 3, March 2023 ||

| DOI: 10.15680/IJIRCCE.2023.1103054 |

[3] Alves, C., Br´ as, P., Val´erio De Carvalho, J. M., & Pinto, T. (2019). A variable neighbourhood search algorithm for the leather nesting problem. Mathematical Problems in Engineering, 2012. https://doi.org/10.1155/2012/254346
[4] Akhtar,M.,Hannan,M.A.,Begum,R.A.,Basri,H.,&Scavino,E.(2019).Backtracking search algorithm in CVRP models for efficient solid waste collection and route optimization. Waste Management,61,117–128.https://doi.org/10.1016/j.wasman.2017.01.022
[5] Beltrami, E. J., &Bodin, L. D. (1974). Networks and vehicle routing for municipal waste collection. Networks,4(1),65–94.https://doi.org/10.1002/net.3230040106
[6] Benjamin, A. M., & Beasley, J. E. (2019). Metaheuristics for the waste collection vehicle routing problem with time windows, driver rest period and multiple disposal facilities. Computers&Operations Research,37(12),2270–2280.https://doi.org/
[7] Armas, J. D., Lalla-Ruiz, E., Exposito-Izquierdo, ´ C., Landa-Silva, D., & Melian-Batista, ´ B. (2019). A hybrid GRASP-VNS for ship routing and scheduling problem with discretized time windows. Engineering Applications of Artificial Intelligence,45,350–360. https://doi.org/10.1016/j.engappai.2015.07.013
[8] Delgado-Antequera, L., Caballero, R., Sanchez-Oro, ´ J., Colmenar, J. M., & Martí, R.(2020). Iterated greedy with variable neighborhood search for a multi-objective waste collection problem. Expert Systems with Applications,145.
[9] Lozano, A., ´ Caridad, J., De Paz, J. F., Villarrubia Gonzalez, G., & Bajo, J. (2019). Smart waste collection system with low consumption LoRaWAN nodes and route optimization. Sensors, 18(5), 1465. https://doi.org/10.3390/s18051465 Mahajan,
[10] S. A., Kokane, A., Shewale, A., Shinde, M., &Ingale, S. (2019). Smart waste management system using IoT. International Journal of Advanced Engineering Research and Science, 4(4), Article 237122. https://doi.org/10.22161/ijaers.4.4.12 Al
[11] Mamun, M. A. A. M., Hannan, M. A., Hussain, A., &Basri, H. (2020). Theoretical model and implementation of a real time intelligent bin status monitoring system using rule based decision algorithms. Expert Systems with Applications, 48, 76–88. https://doi.org/10.1016/j.eswa.2015.11.025
[12] Mehmood, Y., Ahmad, F., Yaqoob, I., Adnane, A., Imran, M., &Guizani, S. (2019). Internet-of-things-based smart cities: Recent advances and challenges. IEEE Communications Magazine, 55(9), 16–24. https://doi.org/10.1109/MCOM.2017.1600514
[13] Melakessou, F., Kugener, P., Alnaffakh, N., Faye, S., &Khadraoui, D. (2020). Heterogeneous sensing data analysis for commercial waste collection. Sensors, 20(4), 978. https://doi.org/10.3390/s20040978 Monzon, A. (2015, May). Smart cities concept and challenges: Bases for the assessment of smart city projects. In 2015 International conference on smart cities and green ICT systems (SMARTGREENS) (pp. 1–11). IEEE.
[14] Pant, M. B. A., Saurkar, M. A. R., &Sarvaiya, S. B.. (2019). On-demand security configuration for iot devices in present and future challenges. Research Journey, 111.
[15] Pardini, K., Rodrigues, J. J.., Diallo, O., Das, A. K.., de Albuquerque, V. H. C., & Kozlov, S. A.. (2020). A smart waste management solution geared towards citizens. Sensors, 20(8), 2380. https://doi.org/10.3390/s20082380
[16] M. I.., Lau, R. Y.., Demirkan, H., & Azad, M. A. K. (2019). Smart health: Big data enabled health paradigm within smart cities. Expert Systems with Applications, 87, 370–383. https://doi.org/10.1016/j.eswa.2017.06.027

INNO SPACE
SJIF Scientific Journal Impact Factor

Impact Factor: 8.165

doi cross ref

ISSN INTERNATIONAL STANDARD SERIAL NUMBER INDIA

निस्केयर NISCAIR

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING

9940 572 462 6381 907 438 ijircce@gmail.com

www.ijircce.com

Scan to save the contact details