International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 05 Issue: 11 | Nov - 2021 ISSN: 2582-3930

SMART WASTE MANAGEMENT USING IoT

Swati Mishra
Department of Instrumentation & Control Engineering
JSS Academy of Technical Education, Noida

Prachi Yadav
Department of Instrumentation & Control Engineering
JSS Academy of Technical Education, Noida

Gaurav Dubey
Department of Instrumentation & Control Engineering
JSS Academy of Technical Education, Noida

Abstract-The uncollected waste material when the waste bin is full is a common problem nowadays. Thus, an efficient waste management for the waste material is essential in ensuring a clean and green surrounding environment. This paper presents an Internet of Things (IoT) based Smart Waste Collection Monitoring and Alert System to monitor the waste material at the selected site of the garbage collection area. The garbage bins are deployed with sensors and networked together using WSN.The sensors deployed in the garbage bins collect the data for every determined interval.Once the threshold is reached,it raises a request to GCA(Garbage Collector Agent). This agent collects the request of all the filled vehicles and communicates using IoT framework.The experimental simulation is done in a proteus tool. A hardware prototype is developed for the proposed framework.Analysis of proposed scheme provides better results in waste management

Keywords—Wireless Sensor Network(WSN); Internet of Things(IoT);Smart Waste Management(SWM)

To make the cities more greener,safer,and more efficient,the Internet of Things can play an important.Improvement in safety and quality of life can be achieved by connecting devices,vehicles and infrastructure in all around the city.Best technological solutions can be achieved in smart cities by making different stakeholders to work together.System integrators,network operators and technology providers have a role to play in working with governments to enable smart solutions.But building such solutions on an open,standards based communication platform that can be continuously used in a challenge. We present a waste collection management solution based on providing intelligence to waste bins,using an IoT prototype with sensors.It can read,collect and transmit a huge volume of data over the internet..

1. Introduction-

It is visible that the garbage bins are mostly overloaded, many bins were not attended by municipal persons at the right time, this leads to spill over of waste on the streets. Due to which the environment is polluted with bad odor and untidy to the public.Solid waste is a general term that encloses all waste materials except unsafe waste, liquid waste and region emissions.Solid wastes are often additionally divided into two general groups: residential and business. The residential cluster refers to the waste that's labeled as ‘garbage’. The rubbish category is often represented because of the

waste that's collected by the community services.The business cluster contains industrial and agricultural customers. These purchasers are far more spread and manufacture higher amounts of waste. The foremost necessary distinction between urban routes and business routes is that the waste management company serves locations i.e. business rather than streets or quarters i.e. residential.

Disposing of perishable waste product creates odor nuisance. User inconvenience caused by the advanced discharge method needs a lot of maintenance value than the present system. Fuel connected issues, energy constraint over The detector node limits the period of time of the WSN.Improvement of routes should be followed by the truck once it involves collect wastage, wherever business waste assortment issues square measure established, the situation of the selling facilities square measure a lot of necessary than within the case of urban waste assortment, due to the upper range of disposal journeys that ought to be integrated. The employment of multiple disposal locations will improve assortment efficiency traditionally, as a result of associate degree unloading trips needing to be created to a disposal location when every client.

By proposing the new method of waste management, a message will be sent to authorities once the bin is about to be filled, so that they can act quickly and clear the bin to provide a hygienic environment to the public.The proposed solution is to monitor the garbage bin and automatically send the message to municipal authorities if the garbage bin is about to fill, so that they can act quickly and clear the bin to provide hygienic environment to the public. While drizzling the level sensor will sense the rain and close the garbage bin automatically.

Using Wireless Sensor Network (WSN) the information is provided to local authorities and to the control center immediately once garbage bin status is sensed. This system consists of spatially dispersed and dedicated low powered devices and sensors for monitoring and recording the physical condition of the environment and organizing the collected data at a centralized location. The maximum performance is obtained by linking the sensors in different configurations. The communication process between sensors is done using transceivers. The sensor nodes range in WSN are in the order of hundreds and may be thousands in the network. These networks will not have any infrastructure. Wireless network is one of the best services that is applied in automating the accessibility of home appliances, Industrial equipment and machineries, it is because of the rapid technical growth in embedded computing devices, processor and communication. The Sensor nodes are predominantly used to monitor the environmental conditions such as, pressure, temperature, humidity, sound, position, vibration, etc.,

Literature Survey

There have been IoT based trash cans that have been deployed and used in the past. One type of system employed use of sensors that detected if the bin was full or not. If it was full, an automated message was delivered to the system's server end via the Arduino SIM module, which used the Arduino board's application. When the server got the message, it transmitted it to the worker in charge, who, if available, would announce his or her presence by accepting the assignment and arriving at the specified location. The work would be shifted to another worker if the worker was unavailable. Real-time synchronisation was also used by several authors.

Multiple writers have also demonstrated real time waste detection and management systems by incorporating the use of smart dustbins with the ability to check the levels. In this system, the status of the family of dustbins can be gathered over the internet by the concerned or designated authority and then a decisive action can be taken accordingly. By By implementing this on a larger scale, optimisation of resources, reduction in cost and effective and advanced usage of dustbins was achieved. This design of waste collection and management also had some indirect advantages like reducing traffic in the city during the waste collection hours. In more populated cities, the waste collectors earlier had to visit the household twice. This system enabled the authorities to manage the collection of wastes more effectively and thus reducing the number of trips and usage of fuel.

Advantages of proposed system over the existing:
- Low implementation cost
- Simple module
- Easy functionality

II. Methodology

One of the difficult operational problems municipal and local authorities are facing is the collection of

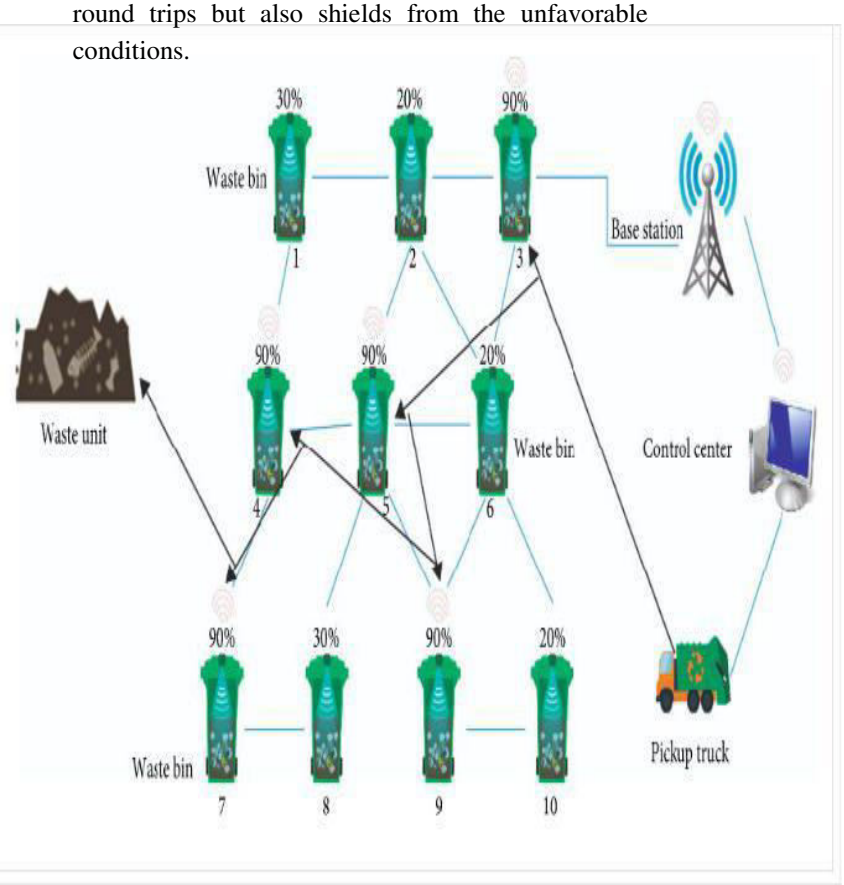
municipal solid waste. In recent years, due to environmental concerns and number of costs, most of the municipalities have been forced for assess their solid waste management and examine their cost-effectiveness and environmental impact, for example, designing the collection of routes. During the past 15 years, numerous technological advancements, new acquisitions, and developments were provided in the industries. Consequently, both municipal and private haulers are giving serious considerations to use advanced technologies such as computerized vehicles that take the decision of route planning and schedule of collection of waste . This proposed system describes a study of planned and computerized vehicle routes for the collection of municipal solid waste in the different regions. The proposed system contains all the stages from the collection of our waste material, load to the truck, and recycling it in the recycling unit.

For this purpose, it includes the following list of activities:

- Controlling and monitoring the collection of wastes;efficient and speedy transportation to the recycling units/point.
- Preventing the waste from spilling from the waste bins during transportation to the recycling units.
- Speedy transportation to recycling units so that the traffic condition will not be bothered in peak hours.
- Proper storage and maintenance in the storage units.

We have used smart bins in which waste-detecting sensors are fixed. These sensors are capable of sending signals to the nearest sensor referenced to the base station.When the sensors detect the volume of the garbage, they communicate to the respective centers, indicating the volume of the garbage. The garbage centers will have the garbage pickup truck sent to collect garbage from the garbage bin and recycle it in the recycle unit.the garbage pickup goes on the routes which are the most optimized routes, both cost-wise and hygiene-wise.

In Figure, it can be easily noticed that the pickup truck is directed to those waste bins which are more than 90% full or about to be 100% full and not selecting the path which is partially filled. In this case, the pickup truck selects the most optimized route that not only reduces its costs in the collection round trips but also shields from the unfavorable conditions.



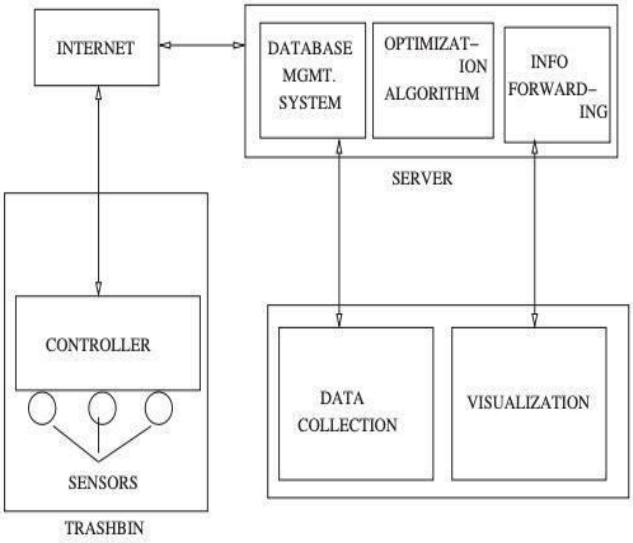


Fig. 2. System Architecture

III. Implementation

In this scenario, garbage bins will be classified as master dustbins and slave dustbins. Master dustbins will be equipped with Raspberry Pi and slaves with IoT modules. Every dustbin whether a master or a slave will have to be given a unique id. A database will be maintained containing the information about which dustbin to be placed in which area by their corresponding ids. The dustbin has UV sensor and load sensor for level detection, and humidity sensor for wet and dry garbage detection. Every dustbin, slave or master will have to communicate with Raspberry-pi 3, where Raspberry-pi 3 will act as a broker. The work of Raspberry-pi 3 will be to collect the data from sensors attached to master and slave dustbins, apply noise removal algorithm and send data to server using Wi-Fi. The message has to be sent to server by raspberry-pi 3 about levels of garbage in a bin, wet and dry waste segregation levels along with dustbin id.Server matches ids with database of dustbins, and will find levels of dustbins located in different areas of the city. Different IoT protocols can be used for data transmission like MQTT or COaP.

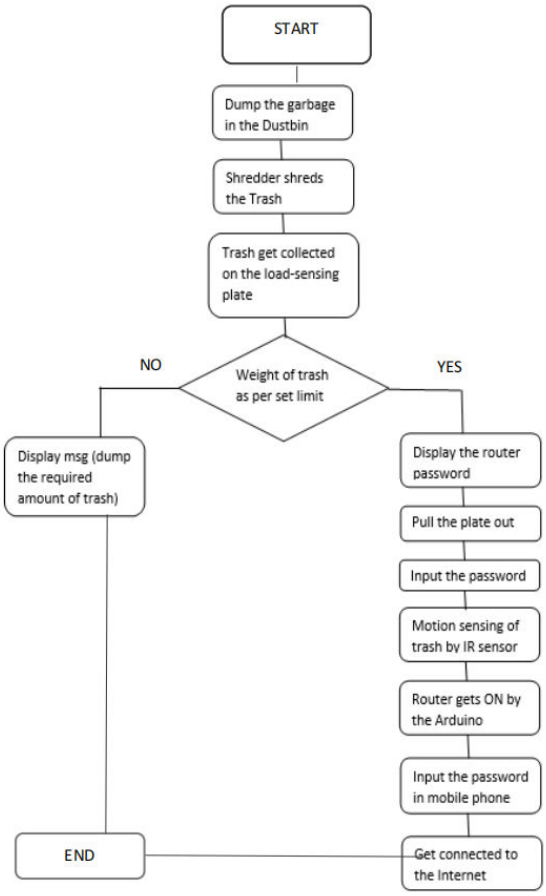
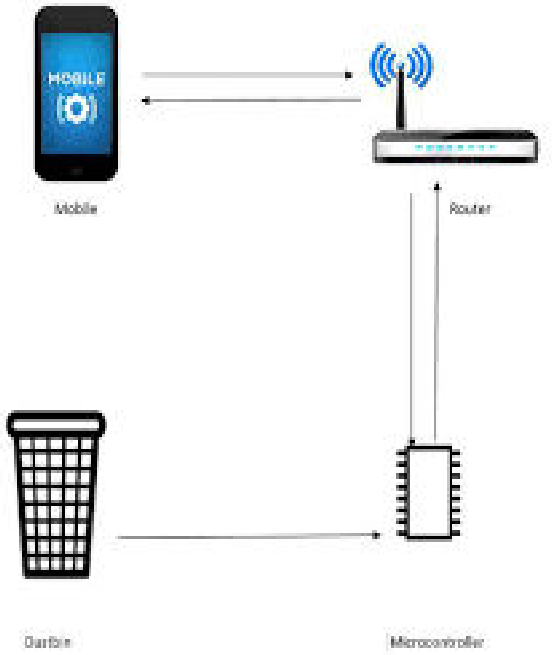


Fig 3: Flow Diagram

The collected data in the cloud will be analyzed by using analytic tools like Hadoop or Storm, and useful information regarding waste management will be extracted. From the collected data, the user will get to know about real-time garbage level, and the garbage collection van can find an optimized route for collection of garbage. Whenever the garbage level crosses threshold level, the alert will be generated for urgent collection of garbage. The data of wet and dry segregation level will help in evaluating the current garbage management plans and also to refine the plans for increasing the efficiency. The simple Web GUI will help the user to use this system efficiently.



Advantages

Besides providing many advantages, the proposed system is also practical enough to be implemented in every street in any developing nation. These advantages are related to its easy and viable functionality. This not only improves the quality of life on the streets, but also provides on smoother surface for better systems on the streets.

- Eliminates cost of unnecessary collection
- Seeing data in real time, 24/7
- Identifying cost-effective routes
- Improving process efficiency
- Clean environment

- Low health issues.
- Improve street sanitation

IV. Conclusion

This paper shows how smart waste management using IoT can be implemented. This proposed system assures the collection of garbage soon when the garbage level reaches its maximum level. The system will thus provide accurate reports, increasing the efficiency of the system. The real-time monitoring of the garbage level with the help of sensors and wireless communication will reduce the total number of trips required of GCV and thus, will reduce the total expenditure associated with the garbage collection. Thus, the dustbins will be cleared as and when filled, giving way to cleaner cities, better infrastructure and increased hygiene.

REFERENCES:

[1] S.S.Navghane, M.S.Killedar, Dr.V.M.Rohokale, "IoT based smart garbage and waste collection bin", international journal of advance research in electronics and communication engineering, volume 5, Issue 5, May 201

[2] Andrea Zanella, Nicola But, Angelo Castellani,Lorenzo Vangelista,Michele Zorzi, "Internet of Things for Smart Cities", IEEE Internet of Things Journal (Volume: 1, Issue: 1, Feb. 2014)

[3] L. Anthopoulos, M. Janssen, and V. Weerakkody, "A unified smart city model (USCM) for smart city conceptualization and benchmarking," in *Smart Cities and Smart Spaces: Concepts, Methodologies, Tools, and Applications*, pp. 247–264, IGI Global, Hershey, PA, USA, 2019.

[4] P. Suresh, Vijay. Daniel, R.H. Aswathy, Dr. V. Parthasarathy, "A State-of-the-Art review on Internet of Things" International Conference on Science Engineering and Management Research (ICSEMR), IEEE, DOI: 10.1109/ICSEMR.2014.7043637 19 February 2015.

[5]Parkash, Prabu V "IoT Based Waste Management for Smart City"
International Journal of Innovative Research in Computer and Communication Engineering, Vol. 4,
Issue 2, DOI:
10.15680/IJIRCCE.2016. 0402029, February 2016.

[6] S. Longhi, D. Marzioni, E. Alidori, G. Di Buo, M. Prist, M.
Grisostomi, et al., "Solid Waste Management Architecture Using
Wireless Sensor Network Technology", The 5th International
Conference on New Technologies, Mobility and Security (NTMS),
7-10 May 2012, Istanbul, pp. 1-5, 2012. 147

[7] Waikhom Reshmi, RamKumar Sundaram, M. Rajeev Kumar,
"Sensor Unit for Waste Management: A Better Method,",
International conference on Science, Engineering and Management
Research, ©2014 IEEE