SMART WASTE MANAGEMENT SYSTEM USING IOT AND BLOCKCHAIN

Dr.K.Karunambiga

Professor, Dept of CSE, Karpagam Institute of Technology, Coimbatore, India- 641105

Nusrat Jahan S, Keerthana S, Pavithra D, Umakarthikeyan C

Students, Dept of CSE, Karpagam Institute of Technology, Coimbatore, India- 641105

ABSTRACT

In our day to day life we face environmental challenges associated with waste generation and inadequate waste collection, transport, treatment and disposal. The waste treatment process takes crucial procedures to segregate waste materials into reusable material. To separate reusable particles from E-waste, wet waste, plastic waste, metal waste are monitored and segregated using this System. In this paper, we propose a method where the waste particles are moving in the conveyor belt and they are detected using sensors. This System enables an IoT based waste monitoring system using Thing speak,which is an open IoT platform. This system consists of an Arduino microcontroller, a set of sensors and a Wi-Fi module. The Arduino microcontroller receives data from the sensors like IR sensor, proximity sensor, ultrasonic sensor and load cell. The wastes are detected and pulled to the respective dustbins. The depth of the garbage in the bin is measured using an ultrasonic sensor and the weight of the bin with garbage is measured from the load cell. The LCD screen is used to display the data. The Wi-Fi module transmits the above data to the internet. An open IoT platform Thingspeak is used to monitor the garbage system. IOT combined with smart dustin helps the administrator to monitor and schedule garbage collection more efficiently. Finally, the blockchain technology supports sharing the information among stakeholders to analyze and take action appropriately.

Keywords : Sensors, Internet of Things, Smart Waste Container.

INTRODUCTION

The increasing number of world population and the rapidly expanding globalization of the world, waste is one of the main issues that concerns many parties. The World Bank estimates that in 2025, the world's urban population will reach 4.3 billion and the rate of waste production is about 1.42 kg per day for every resident. Based on World Bank reports, there is a positive relationship in which waste generated is directly proportional to the level of economic prosperity and the level of industrial growth achieved. But it is also reported that 33% of the generated solid waste in cities does not manage in an environmentally friendly and safer way. Today a smart solid waste management system uses Internet-of-Things (IoT) technology in order to automate several traditional waste management processes. IoT technology is being used to make waste management more efficient, cost-effective and environment friendly.There are many ways where IoT is used in waste management. Firstly the smart waste bins, equipped with sensors which give a signal when it gets filled.

It can also be used in vehicles to monitor and optimize routes which reduces fuel consumption and improves efficiency. Also it saves more time and identifies areas where recycling efforts need to be improved. However, these systems had a drawback which was a lack of means to adequately share waste-related data among involved stakeholders in the waste management process. Blockchain technology presents a single and unified platform that can be used by the involved stakeholders in waste management of cities to share data in an effective, secure, transparent, and verifiable manner. Since blockchain follows a decentralized architecture, it is a highly trusted technology.

LITERATURE SURVEY

ARTICLE	PROBLEM	SOLUTION
IoT-Based Smart Solid Waste Management System.[1]	In today's world, typical solid waste management includes large outdoor waste bins, waste pickup trucks, and scheduled pickup routines by the related party.	In a smart solid waste management system, the smart waste bins are integrated with several sensors (e.g., proximity sensor, IR sensor etc…) These sensors then collect related real-time data regarding the solid waste inside the bin before the microcontroller embedded on each bin transfers the data to Cloud servers.
The Design and Implementation of Smart Trash Bin.[2]	Require cost-effective design of an intelligent waste container for small-scale cases.	It Can be done by Arduino Nano board and an ultrasonic sensor to monitor the fullness level of the container and give SMS alerts using a GSM module. The system is powered by a lithium battery power bank supported by a solar cell panel. System will also store usage events on a memory card, which is also used to play audio messages using a speaker, when the bin is being used.
Smart Waste Bin with Real-Time Monitoring System.[3]	Lack of monitoring in waste management treatment leads to loss of reusable waste materials.	To enable remote monitoring of solid waste bins in real-time via Wi-Fi connection, to assist the waste management activity.
Internet of things (IoT) based Smart Garbage monitoring system.[4]	The usual way of manually monitoring and collecting the garbage is a cumbersome and inefficient process as it requires considerable human effort and time leading to higher cost.	Here an IoT based garbage monitoring system using, "Thing speak" is an open IoT presentation. The system consists of an Arduino microcontroller, an ultrasonic sensor, a load cell and a Wi-Fi module. The Arduino microcontroller receives data from the ultrasonic sensor and load cell. The depth of the garbage in the bin is measured using an ultrasonic sensor and the weight of the bin with garbage is measured from the load cell. The LCD screen is used to display the data.

Automation of smart waste management using IoT.[5]	The detection, monitoring and management of waste is one of the primary problems of the present era. The process of making things automatic is being exploited in almost all the major fields of life.	The dustbins are interfaced with microcontroller based systems having ultrasonic sensor systems along with central system showing current status of garbage, on mobile web browser with html page by Wi-Fi. Hence the status will be updated on to the html page. It depends upon the working of the Wi-Fi module essential for its implementation.
Smart garbage management system.[6]	The situation is that some countries are having inadequate waste infrastructure, the informal sector and waste dumping. There are major issues associated with public participation in waste management and there is generally a lack of responsibility towards waste in the community	IoT based garbage management system which is cost effective and helps the authority to efficiently manage the problem of increasing waste generation in a city. This system includes a network of smart bins which monitor and analyze data collected. An android app is provided through which citizens can track the nearest bin and drivers can get the shortest path while collecting garbage.
Monitoring the smart garbage bin filling status: An IoT Application towards Waste Management.[7]	The collected waste in the garbage bins must regularly be monitored, and from there it must be delivered to processing plants. But the process of monitoring garbage bins would become difficult for the ones placed at inaccessible and remotely located sites.	Smart Garbage Bin (SGB) enabled with Internet of Things (IoT) is developed. SGB's generally embedded with the ultrasonic sensors used for sensing the garbage levels, information and communication devices that help in networking, interconnection, and data transfer. The developed bin allows us to monitor the amount of waste filling in it by sending information about its filling status as applicable among these defined test cases 0% or Empty, 50% or Medium, 90% or Nearly Full, 100% or Full, and Threshold Crossed or Spill Over. The test cases were chosen based on the realistic possibilities of offering the waste collection service.
Smart trash bin for waste management using odor sensor based on IoT technology [8]	If the vehicle comes to collect too early it would lead to unnecessary trips. And when it comes to collect too late will result in an overflow of waste. Even though the level is moderate, the odor produced by the waste can cause air pollution. These problems stated can be resolved using IoT technology used by this project.	An app is designed to monitor the levels which the user can view. The workers need not want to approach the bin to know whether a waste is ready to be removed. Also, it is used to monitor whether the bin is not full and if not checks the smell of waste and then the bin can be removed.

PROPOSED METHODOLOGY

First, waste was collected from various places via trucks. These waste include organic waste, Metal waste, plastic, E-waste and so on. Then the collected waste moves to a place called segregation house where the separation process is done. The waste segregation is done using a conveyor belt. Where, the conveyor belt is attached with many devices like Infrared sensors, Thermal sensors, Ultrasonic sensor, proximity sensor and Moisture sensor. This system also includes Arduino uno along with robotic hands or pistons to separate waste. There are several dustbins each for storing a particular waste, one for plastics, one for metals, one for organic, and so on. And also a blower to segregate small things at the start of the segregation process. Tiny particles were removed by blower and by sensors each waste gets separated. Then the details get stored by dustbins attached with a load cell or ultrasonic sensor. Then using Thingspeak the data is further visualized and the information gets stored in the cloud.

MODULES IN WASTE MANAGEMENT

This methodology includes 3 various modules

- Garbage Collection.
- Segregation of Waste.
- Analyzing and Visualization.

GARBAGE COLLECTION

In *figure 1*, the garbage from each individual house and industries were collected by truck. This waste consists of organic waste, metal waste, E-waste and so on. Next these waste were taken by the truck to a specific place called segregator house.
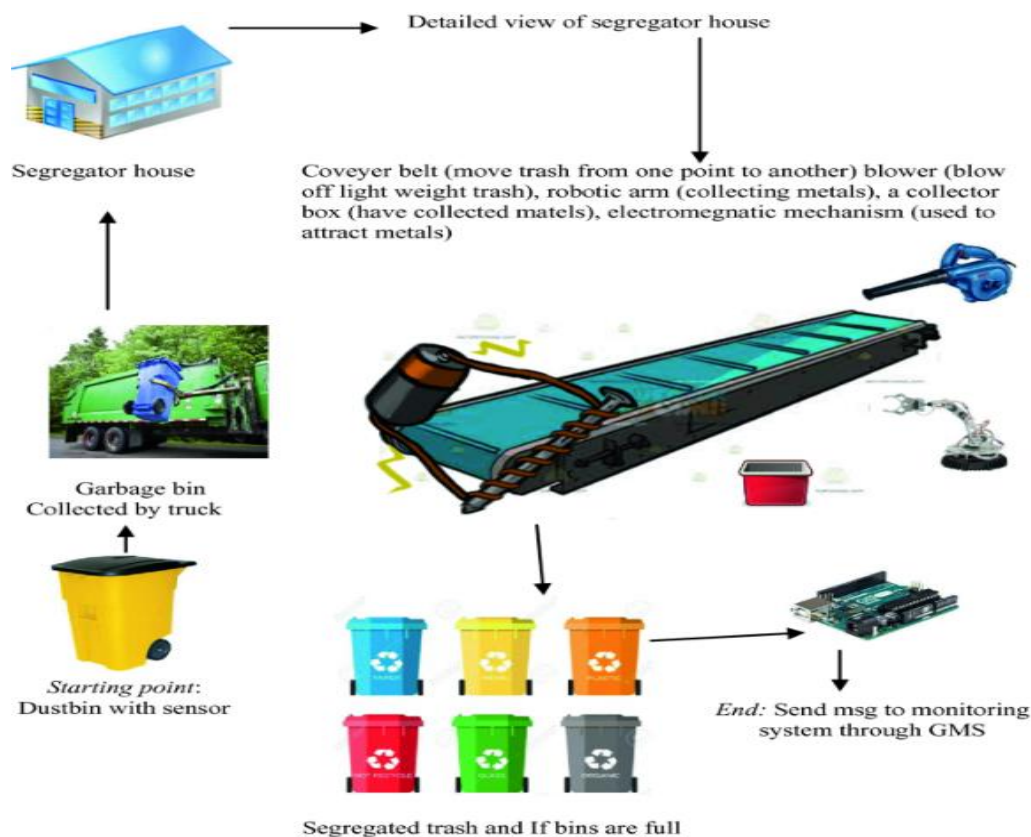

FIGURE 1: **PROCEDURE OF WASTE SEGREGATION**

SEGREGATION OF WASTE

In *figure 2,* the collected waste was dumped into a conveyor belt. Initially the light weight particles were removed by the blower. Then the waste moves into the section where the sensor is fixed. Each sensor has its own functions and detects specific kinds of waste like IRsensor for organic wastes, Moisture sensor to detect dry waste, inductive proximity sensor to detect metal waste and so on. Then there exist some pistons which push the waste, in particular the dustbin by receiving the signal from the respective sensor. And finally, the ultrasonic sensor which is fixed in dustbins or using the load cell we can monitor the level of bin's capacity and communicate the data to the computer.
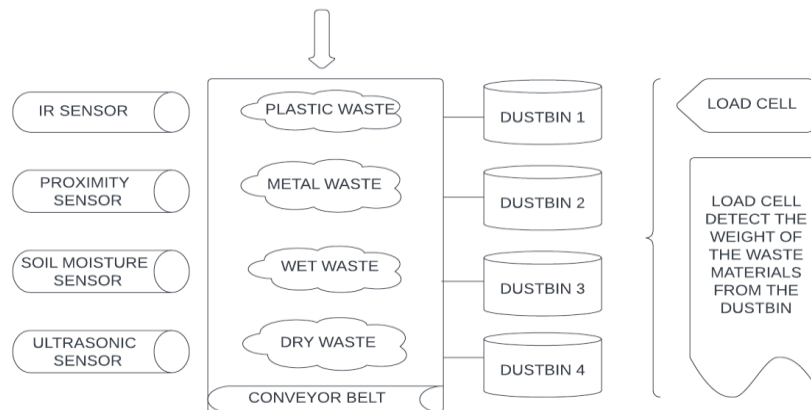
FIGURE 2: SENSOR DETECTION OF WASTE MATERIALS

ANALYZING AND VISUALIZATION

Finally, Thingspeak, an IoT platform is used to get the details collected by the load cell or the sensors and further we can visualize that information. And the details processed by this platform gets stored in a database like a cloud to perform further operations. The authentication of data and its consistency is ensured using the blockchain technology among the stakeholders involved in swart waste management system.

CONCLUSION

This proposed smart waste management system with smart bin, IoT and blockchain technology provides the hygienic environment. IoT allows the creation of smart bins in different locations of the city, collecting bins usage information and storing it in the cloud. Since blockchain is a very secure and trustworthy technology, where data will not get lost and provides privacy to users. The authentication and privacy of the bin information is achieved with the help of blockchain technology.

REFERENCES

[1]. Nor Azman Isamil, Nurul Aiman Ab Majid, Shukur Abu Hassan , "IoT-Based Smart Solid Waste Management System A Systematic Literature Review" (IJITEE) ISSN:2278-3075, Volume-8 Issue-8 June 2019.

[2]. Fady E.F Saman "The Design and Implementation of Smart Trash Bin".

[3]. Norfadzila Mohd Yusof, Mohd Faizal Zulkifli, Nor Yusma Amira Mohd Yusof, Azzina Afifie Azman "Smart Waste Bin with Real-Time Monitoring System" International Journal of Engineering and Technology, 7 [2.29] [2018] 725-729.

[4]. Thangavel Bhuvaneswari, J.Hossen, Nur Asyiqinbt, Amir Hamzah, P.Velrajkumar, Oo Hong Jack, "Internet of things (IoT) based Smart Garbage monitoring system" Indonesia Journal of Electrical Engineering and Computer Science Vol.20, No.2, Nov 2020.

[5]. Prof. S.I.Shrike, Shubhangi Ithape, Sandhya Lungase, Madhuri Mohare, "Automation of smart waste management using IoT" (IRJET) Vol:6 Issue:6 June 2019.

[6]. Ms.Akhila Joseph, Ms.Anjali, Ms.Suhaila B.M, Mr.Mahesh B.L, "Smart garbage management system", (IRJET) Vol:7 Isuue:6 June 2020.

[7]. Sirisha Meesala, Sugathi Parimala, Nallapaneni Manoj Kumar, N.Arun Jyothi, "Monitoring the smart garbage bin filling status: An IoT Application towards Waste Management.", International Journal of civil Engineering and Technology June 2018.

[8]. Steffy Thankam Wilson, Tophia K.Sebastine, Merin Daniel, Vineeth Martin, Neenu R , "Smart trash bin for waste management using odor sensor based on IoT technology" (IJARIIT) ISSN:2454-132X Vol:5 Issue:2