

A Survey Paper on Automated Waste Sorting

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Abstract— Waste management is essential in today's society. Due to an increase in population, the generation of waste is getting doubled day by day. Waste management is that the tactic of treating solid wastes and offers reasonably solutions for usage things that don't belong to trash. It's regarding but trash bin be used as a valuable resource. Waste management disposes of the merchandise and substances that we simply have use throughout a secure and economical manner. Researchers are finding out waste management for over a century, and for over forty years waste utilization analysis. There are eight major ways of waste management strategies, every of them divided into various classes. Those are- reduction and employ, animal feeding, recycling, composting, fermentation, landfills, burning and land application. Fortunately, IoT has the answer to assist the utilization method at each stage of the waste management.

Keywords— Internet of things, Waste Management, Smart bin, sensors

I. INTRODUCTION

In today's world, garbage is a thing that can be seen everywhere in our surroundings, we are producing waste all the time 24/7 hours & and it is continuously growing over time. Meanwhile, many diseases are created through this waste.

Although people are aware of environmental issues, they are not doing anything to solve these problems. Very few people are trying to reduce the wastage of the planet by applying the structure of the waste segregation process in their homes, societies, urban areas, etc.

To make the environment clean is the responsibility of all individuals who live on this planet. But we think people forget the importance of environment & protection & that's why producing & spreading waste everywhere.

According to stats, India produces around 62 million tonnes of waste per year, which is a considerable number & to decrease the number of wastages, we have to follow and understand the importance of the waste segregation process to recycle maximum waste into valuable products.

As technology continues to advance, we can expect to see more

widespread adoption of automated waste sorting systems.

II. EXISTING METHODS

A. IoT based waste management for smart cities

In this paper [1] it introduces the IoT based Waste Management for Smart Cities to overcome the challenges in the environment such as inadequate waste collection, treatment, disposal. Due to flooding of the dustbin causes unhygienic conditions are created, the dustbin is placed in the entire city; it is delivered with minimum cost embedded method to assist in tracking of the garbage, therefore the Blynk app is used to get the immediate SMS as early as garbage bin reaches its peak level. Therefore, instant action will be taken by the alarmed authorities once the status of a bin is notified through the internet. Ultrasonic sensor, node MCU, blynk app, a servo motor is used to develop the proposed system.

B. A prototype of Remote Smart Waste Segregation and Garbage Level Monitoring System

This paper [2] is a Prototype of Remote Smart waste segregation and garbage level monitoring system, which can remotely monitor and is built at a very minimal cost. The design of the presented system considers the portability and ease of assembly of components as the essential factors during implementations. The demonstration shows the implemented system; its interaction with the user using the mobile along with the web application.

C. Smart System and the Internet of Things (IoT) For Waste Management

In paper [3] it explains about the Smart System and the Internet of Things (IoT) for waste management to provide an efficient and effective manner for waste disposal, improving the city's waste management. The proposed system is drawn and makeup a prototype of a solar powered, compact smart garbage bin whose monitoring is done with server-side applications. The smart garbage bin is capable

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of monitoring internal garbage levels, compact them, and also free 25% of the space with each compactness. The bin detects and monitors the total weight and is capable of sending all the information to a secure server-side application.

D. Improve Smart Waste Management to Preserve Tourist Attractions Yogyakarta in IoT Environment

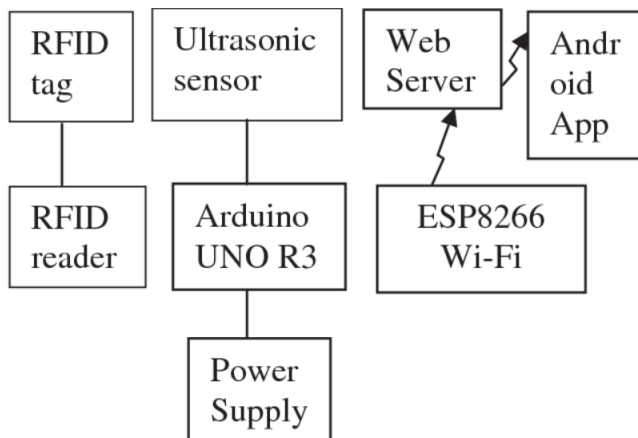
In paper [4] it introduces the Improves smart waste management to preserve tourist's attractions Yogyakarta in IoT environment, the main agenda is to make waste recycled, if it is not recycled, it will make the decomposition process more tedious. Therefore, the dustbin is integrated with the smartphone to find out information about the capacity of the garbage by using the ultrasonic sensor. The wi-fi module combined with the dustbin allows the sensor to send the data through the wi-fi module via smartphone.

E. Architecture for garbage monitoring systems using integrated technology

In this paper [5] it introduces the Architecture for garbage monitoring systems using integrated technology, proposed the novel architecture of waste management that utilizes the concept of IoT and digital image processing, the architecture acts as a surveillance system to monitor the over the flow of the garbage and delivers the message to the concerned authorities to take the necessary and instant action.

F. IoT smart garbage alert system using Arduino UNO.

In paper [6], The paper proposes a smart alert system for garbage clearance by giving an alert signal to the municipal web server for instant cleaning of dustbin with proper verification based on level of garbage filling. This process is aided by the ultrasonic sensor which is interfaced with Arduino UNO to check the level of garbage filled in the dustbin and sends the alert to the municipal web server once if garbage is filled. After cleaning the dustbin, the driver confirms the task of emptying the garbage with the aid of RFID Tag, he real time status of how waste collection is being done could be monitored and followed up by the municipality authority with the aid of this system. An Android application is developed and linked to a web server to intimate the alerts from the microcontroller to the urban office and to perform the remote monitoring of the cleaning process, done by the workers, thereby reducing the manual process of monitoring and verification.



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G. Smart garbage management system.

In paper [7], The system detects the level of garbage in the dustbin with the help of sensor systems, and communicates to the authorized control room through the GSM system. Microcontroller is used to interface the sensor system with the GSM system. A GUI is also developed to monitor the desired information related to the garbage for different selected locations. For garbage detection, a weight sensor is used which gives the weight of garbage in the dustbin. This paper shows the implementation of a smart garbage management system using IR sensor, microcontroller and GSM module. This system ensures the cleaning of dustbins soon when the garbage level reaches its maximum. If the dustbin is not cleaned in a specific time, then the record is sent to the higher authority who can take appropriate action against the concerned contractor.

H. Waste management using Internet of Things

Currently we are managing lot of wastes such as municipal wastes, industrial waste which is both hazardous and non-hazardous. Poorly managed wastes have direct implications on the environment leading to various pollution. Hence waste management has become the need of the hour. To manage the waste this system uses a smart bin which is a solar powered waste compacting bin. Its sensor monitors how much waste has been accumulated and automatically compacts the waste so that it can hold up to 10 times of the normal bins. It also wirelessly transmits fill level information to cloud server. The smart bin can be used with wheelie bins act as a Wi-Fi hotspot and the clean cap is a pin fill level sensor powered by either battery or solar energy. It can be used with all types of containers such as wheelie bins, large waste containers and even underground bins. It senses how much waste is inside the container and wirelessly transmits fill level information to cloud server. Users can log on to the server networks to access data analytics and to monitor the fill levels of the smart bins in real time. The server networks even notify users when collections are required and generates optimized routes for each collection. So instead of blindly collecting waste using static routes and schedules users can play in smart waste collection routes and schedules based on where collection is actually needed. It's the smart solution designed to save money and to keep streets cleaner

I. Smart solid waste management.

This system mainly focuses on managing solid wastes by using efficient waste management techniques such as minimizing the wastes, recycling and composting. this system also highlights about different sensors and recent technologies that can be integrated into these existing waste management techniques to make it smarter and highly efficient. The different sensors that can be used in waste management techniques are ultrasonic sensors, Moisture Sensor, Integration of GPS, GPRS and RFID, Motion Detection Sensor. It tells us about different waste management techniques along with recent technologies and using different sensors to reuse and recycle the waste efficiently.

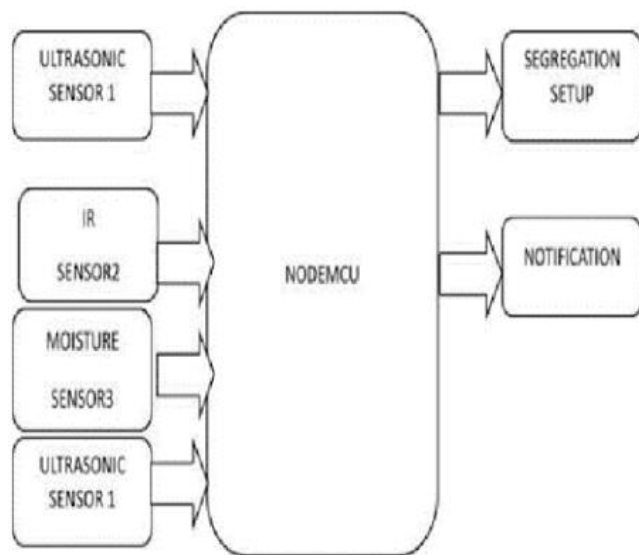
J. Automated waste segregation system

In paper [10], The system aims on making a cost-effective and compact automatic waste segregator. The waste segregator is designed to segregate waste explicitly in a step-by-step process using blowers to separate dry waste, wet waste and magnets are used along with a scrapper arrangement to separate metallic waste. Ultrasonic sensors are used to detect the level of bins. The paper proposed here is to increase the efficiency of waste segregation by implementing the blower mechanism and using magnetic strips, while keeping it cost

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effective and sustainable to use.

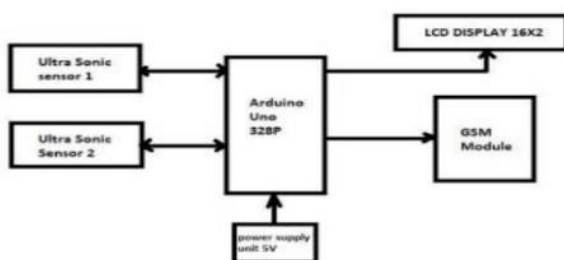
K. An IoT Based Waste Management System using Node MCU

In paper [11], The system detects the waste on board and classifies them based on the moisture content as dry or wet waste. It is then being placed in the appropriate bins and the levels of the bins are continuously monitored. In case the level on the bins exceeds 80 or 90% fill stage, there is an automatic notification sent to the civil authorities, intimating that the bin would be 100% filled soon, thus enabling the possibilities of them clearing the bin. The system comprises three sections viz a viz, Waste Segregation System, Cloud Server System, and the Data Process System.



L. Automatic Waste Segregation System

In paper [12], The system is controlled by an Arduino Uno board. All other parts like ultrasonic sensors, inductive proximity sensor, DC motors, blower and electromagnet are interfaced to the Arduino board. The system comprises different parts and mechanisms such as Conveyor Belt, DC Motor, Ultrasonic Sensor, GSM Module, Monitoring System, and working software.



M. A cloud based smart recycling bin

In paper [13], System introduces A cloud-based smart recycling bin for in-house waste classification urban waste increases as long as modern lifestyle increases. Recycling is the best way to create a sustainable environment and also it needs the segregation of waste materials which is a tedious time-consuming task. It is the minimal cost and effective smart recycling bin that uses the power of the cloud in order with waste classification in personal in-house usage. A centralized Information System collects measurements in smart

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dustbins, the waste in each bin can be classified using Artificial Intelligence and also neural networks. And it is capable of classifying different types of waste with an accuracy of 93.4%.

N. Semi-Automated Metallic Waste Segregation System

In paper [14], The system includes a partition that separates the bin into two parts. The major inclusion is a mechanical magnetic arm which separates key metals from the other non-degradable wastes. The magnetic arm gets into the dustbin as soon as one side of the bin opens and picks up the key metals and then puts it separately into the bin which is in the next partition of the bin. The next inclusion is a load cell which would weigh the amount of the key metals and then the amount corresponding to the weight of the metals is credited to the account of the particular person accessing the dustbin.

O. Implementation of Automated Waste Segregator at Household Level

In paper [15], The paper proposes implementation of an automated Waste segregator at household level using PIC16F877 microcontroller, to control the entire process with ease and simplicity. The sensing unit consists of an IR (Infrared) sensor, a moisture sensor and a metal sensor used to detect and identify various types of waste respectively. The main architecture of the segregator comprises three prominent stages consisting of an IR sensor, a metal sensor, a moisture sensor and the segregation bins. The IR sensor detects the arrival of waste. Identification and separation of waste is done by sensors. The microcontroller controls all the activity of sensors. Results have presented segregation of waste into metal, wet and dry waste. An Automation of Waste material Segregation in the scrap industry. This method is an easy and simple solution of segregation of three types of wastes: glass, metal and plastic. It is designed to sort the trash into metallic waste, plastic waste and glass waste ready to be processed separately for the next process of operation. The Method uses inductive sensors, metallic items, and capacitive sensors to distinguish between and dry waste.

P. Automated Waste Segregator

In paper [16], system is used to detect metallic waste. After this the object falls into the capacitive sensing module. This module distinguishes between wet and dry waste. After this the object falls into LDR+LASER for sensing plastic waste. After the identification of waste, a circular base holds containers for drying. Wet and metallic waste is rotated. The waste falls into the container and the flap is raised.

Q. Smart Garbage Segregation & Management System Using Internet of Things (IoT) & Machine Learning (ML)

This paper mainly concentrated on home automation systems. This paper proposes IOT based smart waste segregation management device which detects the wastes in the dustbins with the help of sensors and after detection the waste substances will get segregated with the help of sensors and the information is transferred to cloud database via iot. Microcontroller is also used in this system to combine the sensors and the iot module. Ultrasonic sensor and moisture sensor is also used in this system. Metal sensor is used to separate the metal items and is separated to a section. In this module, the metal sensor is connected to the board along with power supply to the sensor since it allows only limited voltage. Metal Sensor is used to detect

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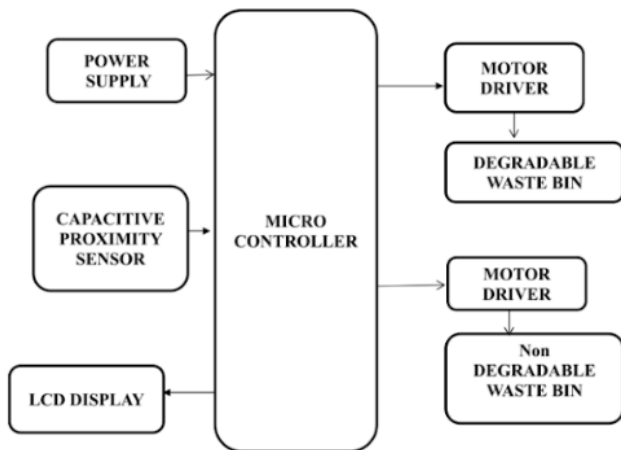
the waste whether it is metallic or non-metallic waste and separate them accordingly.

R. Waste Segregation using CNN & IoT

This paper describes a waste management system to segregate waste into dry waste and wet waste through automation. This system includes a camera module, which captures the image of the waste based on input from a sensor. The image, that is stored on Raspberry Pi, is then classified using the deep learning classification model. This system is designed using a Laptop and a microcomputer to interface the deep learning model with IoT sensors and devices like Raspberry Pi 3.

S. Smart Waste Management using AI-ML

The paper proposes a smart mechanism for improving the management of wastes in cities. In this system, the smart bin is connected with the internet to display the exact information about the dustbin level and to which area it belongs. The system would be able to monitor the solid waste collection process and management of the overall collection process. In order to differentiate between wet and dry waste a moisture sensor is used instead of a capacitive sensor which increases the complexity by making it difficult to differentiate between dry and wet waste by making use of dielectric values of waste substances.



T. Smart Waste Segregation with Crusher Using Arduino

In this project material will be separated based on their type then crushed and stored in respective storage box. It would also help in reducing the volume of the material and will thus help in effective waste management. Several types of sensors are used in this project to detect the type of materials.

III. IOT BASE SMART SOLUTION

Waste collection today is inefficiently performed using static routes and schedules. Some bins are overflowing with waste causing unnecessary clean-up costs. This type of inefficiency wastes both time and money and is harmful for the environment but what if there is a better way. Integrated hardware and software solution optimizes waste collection, saving time, money and the environment.

The project has been implemented as an IoT system which captures images through the Pi and sends it to a server for processing. On

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the server, we use CNNs for the Machine learning/Image processing algorithms, which are used to identify type of waste that was dumped. The server communicates back to the Pi and the Pi actuates accordingly by turning the servo motor and thus dumping the garbage to either the recyclable or non-recyclable side. We use an ultrasonic sensor to detect the level of garbage accumulated in the bin.

IV. CONCLUSION

In this paper, during literature survey various works carried out globally/locally on smart waste management using Internet of Things has been discussed. The literature review has given solutions to the problems such as sensing the data, analyzing the data, collecting data, processing the collected data and getting output result for effective handling of solid waste. Advancements in innovation in different parts of life has made ways of sophisticated delivery of service. With the expanding population and changes in the way of life, waste administration is another area where current innovative collection can be connected in a more efficient way. Diverse environmental elements and partners are included in the waste management system.

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[20] Smart Waste Segregation with Crusher Using Arduino. S. Manimaran, Dr. Azha. Periasamy, T. Karuppiyah PG Student, Dept. of E&I, Bharathiar University, Coimbatore, Tamil Nadu, India Assistant Professor, Dept. of E&I, Bharathiar University, Coimbatore, Tamil Nadu, India Ph.D., Research Scholar, Dept. of E&I, Bharathiar University, Coimbatore, Tamil Nadu, Indian this project waste segregation is done using crusher with Arduino.