A Review on Smart Waste Collection and Disposal System

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Abstract. The main cause for land pollution is overflow of garbage. It makes insanitary condition for the encompassing individuals and cause ailment. This paper focuses on the review of various existing techniques available for garbage monitoring. In this article, survey about the waste monitoring methods, garbage disposal techniques and technologies utilized for developing a system to deal with waste management are presented. Finally, an efficient system is proposed along with waste disposal method that can be used in future for achieving better performance and cost effectiveness.

Keywords. Waste management, Waste disposal, Waste segregation, Alert system

1. Introduction

Increased complexity of waste is generated because of urbanization and industrialization. We decided to solve the problem involving how to improve our environmental cleanliness by using only a simple IoT arrangement. The problem that we identified about the ordinary dustbins is that even when the dustbin is full of trash inside it, there are people who still try to put their trash into the bin until there are some trashes that have come off from the dustbin because there is no more space that can fit the trash. This kind of problem also can make the environment around the dustbin to look dirty. The paper focuses the collection and disposal of waste for the healthy environment. This framework distinguishes the appearance of trash by utilizing an IR sensor and checks the substance of metal in the loss by utilizing metallic sensor. Moreover, the waste is ordered into dry and wet waste build-up with the assistance of capacitive finder. It comprises of ultrasonic sensors which quantifies the degree of trash, and shows the level in LCD screen just as message to clean in the event that it is full by the utilization of GSM and Arduino. Additionally there is a microcontroller in wet waste trash, when waste reaches it desired level in trash, microcontroller will start the relay. The relay will make the heating coil to work and heat the wastes. Later the heated waste is used as fertilizer or biogas. It is expected that this framework brings about establishing greener climate by observing and arranging the assortment of waste intelligently through IoT.
2. Survey on smart waste management system

2.1. Waste segregation

S Lopes and S Machado proposed IoT in segregating the waste what's more, the framework identifies the appearance of waste and isolates them as dry, wet and metallic waste at the family unit level and furthermore helps continuously observing of trash level in dustbins. Moreover it likewise shows the trash level of the dustbins on LCD screen and sends message to clean when it is full by utilizing GSM and Arduino [1]. Bharadwaj B et.al proposed the simple way of waste monitoring system which supports the Swachh Bharat Abhiyan. The fundamental proverb of the work is to gather the same type of trash independently which is set in a transport line on which the dry waste gathered residue receptacles are put in one place and wet waste gathered containers on the other side. The information will be sent the normal individual. By using this application we can view the date and easier to track the vehicle [2]. Yann Glouche et.al implemented the smart waste management with self describing objects. The principle objective of the framework is to diminish, reuse constantly the waste. It uses the RFID technology to access the information regarding the arrival of each product. It also uses the QR code technology which is cost efficient. The collected information’s are used for segregating the waste as glass, plastic and paper/cardboard. The information regarding the waste in each bin is highly supportive during the process of recycling [3].

Gaurav K et al. address the rapid increase in Municipal Solid Waste. Handpicking methodology is used for separating the municipal solid waste. It separates only the bulk materials. Then trammel screens separates the inorganic materials, magnetic and electromechanical systems separate ferrous and nonferrous metals. The separated waste is reduced by incineration to recover energy. The classified solid wastes can be made into pieces that are suitable for thermal conversion process [4].

2.2. Waste collection

The authors are involved in identifying issues in the waste collection process and provide solution to optimize the process to achieve higher efficiency. The model consists of three framework parts which is data gathering layer, waste disposal method and waste disposing areas. The final outcome is a complete framework which compromises the Inputs, Outputs, Guide and Enables. The data’s are stored in cloud server which is managed by the local authorities [5]. In the proposed system the author integrated the RFID, GPRS, GPS and camera for the identification of the waste. The system reads the RFID waste tag and transmits the information about the trash content in bin. The transmitted information is stored in central monitoring station for controlling the waste disposal process. The images of the bin are collected using the MATLAB image processing tools and MySQL data server [6]. The creator made IOT based clean organization system which checks the waste level over the dustbins by using Sensor structures. At the point when it perceived rapidly this system acclimated to concern affirmed through GSM/GPRS. Then output is viewed in an android application through which the user can get the information regarding the location of bin. The model additionally considers factors identified with fuel utilization, toxin outflows, truck speed and limit shipped as a component of the improvement interaction [7].

2.3. Waste collection using solar methods

The author MD Humaun Kabir et.al proposed IOT based sunlight based controlled shrewd waste
administration framework. Five receptacles are situated nearby and associated with Arduino Mega. Sun oriented force gives the controlled DC ability to each waste. When the canisters have extreme measure of waste filled the alarm is sent by both electronic and SMS based warnings [8]

![Figure 1: SMS notification system](image)

### 2.4. Waste collection using machine learning

Elsa Estrada et.al developed a smart city visualization tool using machine learning. The author worked on three frameworks like smart tracking-which detects the regular events in cities, smart citizen tool-to monitor the regular participation of citizens, smart visualization-to monitor the environment, energy and transport [9]

Vincenzo Catania et.al developed the Smart-M3 platform which is used to share the data between devices for accomplish a serious level of adaptability. The shrewd framework depicted spotlights on two structures: above all else, it is routed to governments and privately owned businesses to design a superior administration of assets and an ideal arranging of waste assortment; also, it is pointed toward giving the chance for the resident to know the condition and area of the closest canisters and urge them to reusing [10]

### 2.5. Waste management using cloud

Norfadzlia Mohd Yusof et.al proposed the system for waste management in residential areas. Ultrasonic sensor quantifies the degree of rubbish in each canister and sends data to Arduino Uno. In addition, to indicate the threshold level of bin, different colour of LEDs is placed in sensing platform of the bin. The created framework is extremely valuable in improving the proficiency of strong waste administration in local locations [11]. The creator explores a novel methodology for squander isolation for its compelling reusing and removal by using a profound learning procedure. The YOLOv3 calculation has been used in the Darknet neural organization system to prepare an independent set of data. YOLOv3 also struggles in classifying the object which is made up of more than two materials [12]

### 2.6. Waste collection using IoT

There are expanding activities by legislative and public experts corresponding to squander the board to productively improve the assortment and canny removal of waste created by a city. The receptacle is partitioned into three sub canisters which gather three distinct sorts of waste. IR sensor is used sense the trash in the bin. Moisture and metal sensor is used to separate wet and metal waste. GSM is used to fetch the location of bins. The data collected about the waste is sent through the wifi module ESP8266. The count of the waste is updated in Thinkspeak server [13]

Chitluri Sai Srikanth et.al provided a solution for waste assortment using the smart waste managing system using IoT. The system shows the responsible for contemplating the waste evaluation in dustbins
and sends the response to a specialist. So we can keep up the essential separation from the contamination acknowledged by the dustbin and moreover the smell of the trash is diminished [14]. According to the author the issues related to garbage management are degrading immensely. The temperature and humidity sensors are utilized to recognize the wet and dry waste. The information regarding the waste is processed by microcontroller using Raspberry pi. The systems have the master slave configuration, which reduces the connectivity issues in remote areas [15].

![Diagram](image)

**Figure 2** Waste collection [13]

### 2.7. Waste monitoring

S S Navghane et al. assures that their proposed system results in cleaning the dustbin soon when the trash level arrives at its greatest. In the event that the dustbin isn’t cleaned the message is shipped off the higher specialists who can make the suitable move. The system reduces the overall expenditure and corruption in the management system [16]. The details regarding the quantity and type of wastes are stored in the cloud. So it is not difficult to get to the information from the cloud. Besides the specialists can choose the way for assortment as per the situation with squander receptacle. It helps in time effectiveness [17].

Shraddha Zavare et al. provided the solution for waste management by providing smart bin with a novel ID. In some cases, when the compartment is filled, the (GSM) cautioning signal will be sent the holder ID and region to the waste administration organization. After the collection of waste, the status about the empty bin also sent to the concerned authorities [18].

The paper is about making a shrewd waste-container that makes the specialists aware of assemble the waste once it arrived at the limit level of receptacle. It manages the trash trucks drivers to gather the trash just from those zones where the container arrived at 90%. The ‘AI’ idea has been utilized to
assemble data about the waste age propensities in that specific territory and henceforth foresee the measure of waste that will be created sooner rather than later. The persistent information is also analysed and sent over the cloud as diagrams. The email prepared and the text has moreover been sent therefore to the concerned city subject matter experts [19].

3. Proposed waste disposal method

Isolation of waste at the family unit level is the need of great importance and implemented successfully by adopting different techniques. The paper suggests lessening the human mediation during the time spent isolation of trash while guaranteeing legitimate isolation of waste with negligible endeavours. An IoT based brilliant waste assortment and removal framework is proposed to distinguish and isolate the loss as dry, wet and metallic waste at the family unit level. The framework identifies the appearance of flotsam and jetsam utilizing an ultrasonic sensor and after that checks for any metal substance in the loss by utilizing metallic sensor. When the rubbish is identified and isolated, the wipers help to move the refuse over the individual canisters, and afterward the stage flips. Furthermore, the framework shown in Fig.3 can be used to the trash level of the dustbins on the LCD screen just as makes an impression on clean it if it's full by the utilization of ESP32. Here, IoT module is utilized to control and screen the waste and the data will be shipped off the specific association and the individual man. Moreover, this system can provide a substantial support required to improve the productivity of the strong garbage removal and disposal the board. The versatile application of the waste assortment and disposal can evidence in improve and enhanced system.

![Waste Disposing Module Diagram](image)

**Figure.3** Proposed method of smart waste disposal
4. Overall Inferences

The system used for segregation of waste are handpicking, GSM and Arduino. The techniques utilized for collection of waste are IoT, solar and cloud. The wide area of research focuses on the waste collection methods. Then modules used for monitoring the wastes are Bigdata and Node MCU. In addition the concepts of IGOE IoT framework using machine learning and deep learning for the precise monitoring of waste are employed in each of the bin using web application. Thus applications of GSM and GPRS module helps in spotting the location of bin and information are shared to the waste collector.

The proposed system is suggested to focus on the next level of waste disposal implementation. Thus, when the waste reaches the threshold level microcontroller command is given to the relay and heating of coil makes the conversion of biodegradable waste into useful products like fertilizer and biogas.

The available and implemented waste monitoring systems is lag in sending information to the collectors regarding the overflow of the bins. The various monitoring systems are reviewed in this article and finally a conclusion is proposed to overcome the drawbacks available in the existing methods. Thus the proposed smart waste management systems will substantially provide an alternative and enhanced solution to deal with waste collection and disposal.

5. Conclusion

The system is used for monitoring the waste in different location by using the IoT and web application. The work focus on classify the waste into dry, wet and metal waste. Alert message is send to the collectors at the point when the trash level arrives at the greatest amount. If the dustbin isn't cleaned the message ship off the higher city authorities. By using an android application one can view then bin location surrounded by his area. This will save both the time and effort of the human for tracking the location of the bin. It will lead to the cleaner environment by disposing the waste without affecting the surrounding environment. The proposed system can reduce the total amount of waste in India for SwachhBharath Mission.

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