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Review on Automatic Methods for Segregation and Monitoring of Waste

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Abstract: *This paper presents a review on various automatic methods for segregation of waste. Segregating the waste into categories is done using various sensors and state of the art technologies. Internet of things, wireless communication between modules and cloud computing, aids real time monitoring of the process. Automation in collection of waste have made this process easy, effective and safe.*

Keywords*: Waste Management, Automatic Segregation, Real Time Monitoring.*

I. Introduction

Waste management and segregation is a much-needed process in metro cities and urban areas due to spreading of diseases. It is estimated that India produces 42.0 million tons of municipal solid waste annually at present. Waste lying littered in the surrounding, dumped on open lands, becomes a major problem for various types of disease-causing bacteria and viruses. Hence, segregation, transport, handling and disposal of waste must be managed properly to minimize the risks to the public and environment.

When mixed dry and wet waste breaks down in lowland, it creates nasty greenhouse gases. Unorganized waste collection leads to improper recycling. Segregation makes it attainable to utilize and recycle the waste effectively. For maintaining the cleanliness in the cities, litter bins were placed at a particular location and emptied after certain period of time traditionally. It is possible that the bins would be overflowing between the intervals in whichthey were emptied [4]. Also segregation of waste was not done at domestic level, the wet and dry waste wouldmix and recycling of non-biodegradable waste becomes complicated and ineffective. Segregation of waste at junk yards is hazardous and time consuming process.

Automatic segregation of waste will help in effective recycling process. It will reduce the sorting time and energy. Environmental pollution will lessen with proper segregation and management of waste. Landfill problems can be solved and optimal utilization of resources can be achieved.

II. Literature Survey

Rajkamal R et al. [1] have implemented 'GREENBIN' an automatic waste segregator. The segregation is done in 5 categories that are metal/glass waste, paper/plastic, food waste, bio-waste and inert material. Using inductive sensor, capacitive sensor, methane sensor and odor sensors respectively in different bins which are arranged in circular manner. Both dry and wet waste needs to be in a plastic bag, it is carried by conveyer belt to a bag opening module which contains a spike barrel arrangement on a motor. Bags are opened by rotational movement of the barrel in opposite direction of conveyer belt. The system also has an air treatment for separating paper and light weight trash by blower fans and is collected in mesh like arrangements.

Aazam,Mohammadet al. [2] have designed a cloud based waste management mechanism 'CloudSWAM'. Which helps in city administration by analyzing the optimal route to collect waste. Hence saving the fuel and other resources. It notifies of the trash levels. It makes use of cloud computing to let the users and waste collectors know which bins can still accommodate the trash and which bins needs to be cleared. It is a robust and an effective method.

F.Folianto,Yet al. [3] have employed 'SMART BIN' which uses wireless sensor network (WSN) to identify fullness of litterbins. The system has 3 tiers architecture – outdoor nodes, analytics and work station. Every smart bin will have a sensor node powered by a small battery. Ultrasonic sensors are used to detect the level of trash. Sensor data is transmitted to gateway node by 2.4GHz lower power radio. The analytics parts consist of processing the incoming data from sensors, interfacing with the external system. The bin sub system uses GUI (graphical user interface) to push information in workstation. Each bin placed on the physical location are visualized as an icon with the help of GIS (geographical information system). The system used a duty cycle technique, the sensor send data after every 5 minutes so between the intervals sleep mode is activated to reduce power consumption.

BalajiMasanamuthuet al. [4] have implemented a 'RECYCLEBOT' which makes uses of image processing for segregation into biodegradable and non-biodegradable waste. It creates an offline database using raspberry Pi and a Linux machine. The recyclebot have 4 modules, drive train, image acquisition, image processing and human machine interface. The drive train uses motors for locomotion. The image is acquired by the camera of the raspberry Pi. The image processing is done remotely on a Linux machine to avoid bulkiness of the structure and easy motion. The image is reconstructed and analyzed by MATLAB software. Python programming language is used and content based image retrieval technique is applied to match the image with already stored database. That is used to distinguish the waste as biodegradable and non-biodegradable. After the processing the signal is wirelessly communicated to the recyclebot and the platform moves so the trash falls in the assigned bins.

Neetha, Sanjana Sharma et al. [5] have an IOT (Internet of Things) approach so that the details of dustbins located in different areas can be accessed by the concerned faculties anytime. So that the dustbins can be cleaned on time in cities to prevent bad odor from spreading. Cloud computing aids in accessing the data in real time. The system uses ultrasonic sensors for detecting the level of garbage collected. If the level exceeds the set threshold value, the status is uploaded on the cloud using Wi-Fi module. The authorities can access this data and maintain the cleanliness of the city.

SubhasiniDwivediet al. [6] separates waste into metallic, dry and wet, the garbage level is displayed on a LCD and GSM module is used to send alert message when the cans get full. The setup has limitations that only one item can be detected at a time. Error is used in detection when wet waste passes on the conveyer belt making it wet and miscalculate the dielectric constant of dry waste by the capacitive sensor.

JebersonRetna Raj et al. [7] the proposed system separates the waste into metal, non-biodegradable and wet waste. The system has two conveyer belts for smooth running. The first conveyer belt has magnets attached to attract metals. The detected metal is put in a bin with a metal sensor. The remaining waste is passed to second conveyer where a medium speed blower is present to remove light waste such as papers and plastics. This low density waste is collected in a bin with IR sensor. The waste without the disturbance of blower collects on the second conveyer collects wet waste in a bin with moisture sensor. The sensor outputs are displayed on a LCD. The data is uploaded on server for further action. The system detects the metal with 95 percent accuracy. paper wastes are detected with an accuracy of 85 percent. wet waste is collected with an accuracy of 82 percent. Rust iron and a combination of oil soaked or wet papers are the hindrance in proper segregation.

K. Jaikumaret al. [8] have utilized moisture sensor to differentiate between dry and wet waste. If the moisture content is above the threshold value it is a wet waste. Servo motor is tosses the waste in respective bin after wet and dry waste is detected. Arduino UNO board is used as a controller and Arduino IDE platform is used to code the required program. Node MCU is the wireless communication model to monitor the process. The published data on the server can be subscribed by any MQTT (Message Queuing Telemetry Transport) client from anywhere.

Santhosh Kumar et al. [9] provides chemical treatment to the biodegradable waste. It consists of gas sensor as well as bacteria sensor. Microbial activities are sensed by bacteria sensors. To reduce the unpleasant odor, odor controller sprays chemicals. The segregation is done on domestic level. Waste is separated into biodegradable, metal, plastic. Each segment has a level detecting sensor. Acrylic coating is provided for the segment which collects metals. It prevents the reactivity of metals. It is possible to detach each segment separately after it is filled for disposal of waste. IOT is used for continuous monitoring of physical devices. SMT-32 controller is used for integrating and processing the data.

III. Conclusion

Proper collection and management of waste will lead us one step closer to cleaner and sustainable cities. The traditional schemes used were inefficient and unhygienic. The proposed systems as discussed above proves to timely collection, separation and management of waste. Future improvements like installation of a mechanism to reduce the size of garbage, self-cleaning mechanisms for the system and usage of renewable energy for the operation of system can be made. This will ensure that the process becomes smooth and efficient.

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