

AUTOMATIC WASTE SEGREGATION AND MANAGEMENT

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ABSTRACT;

As the population increases, waste management has become difficult in today's world. It is estimated that, until now in India in the year 2022, the total amount of waste generated is 62million tons, wherein nearly 43 million tons of waste is collected in which about 12million tons is treated and 31million tons is dumped in landfill. Moreover, segregation of waste also is a tough task for the workers. Since the waste may be hazardous and infectious for the human life, the segregation must be carried out without labor. This problem is majorly being faced in developing cities. To overcome this, a smart waste segregation system using CNN is proposed in this paper. Segregation of waste from building itself brings about a large change in waste management. As the waste gets collected in a dumping area, it is identified using Open CV with the help of Pi camera. The captured image of waste is compared with default images using CNN algorithm, and segregation is done using robotic arm. Furthermore, the ultrasonic sensor present within the bin monitors the level of waste; when the waste level reaches the maximum, it alerts the authorized person with the help of GSM module. As the result, this keeps the buildings clean and supports the swatch Bharath mission. Existing waste segregation system use moisture sensor to differentiate between wet and dry waste ,even with small water droplets present on dry or metal waste detects it as wet which is a wrong identification.



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1. INTRODUCTION ;

As the population is increasing at a disturbing rate, the country is heading towards the most terrible time for contamination which is toxic for living beings. Pollution or contamination can happen in any source like water, air, and soil. The current population of India is 145 crores; may be by 2030 many parts of the universe will be gigantically populated [1] including India because of which the amount of waste generated will also increase terribly. During covid19 lockdown, there were huge amount of waste generated from every house in the locality, due to the improper manner of waste disposal and different types of health issues were observed [2]. To avoid this, the proposed model informs the authorized person to collect the waste from the specific area like home, building and campus. To focus on waste management our honorable Prime Minister of India had launched the swatch Bharath mission on 2nd October 2014, which aims to keep villages districts, states, and union territories in India clean. In this regard 2 different dustbins are used to segregate wet and dry waste [3]. But people in this modern generation with busy schedule forget to separate in the flowing manner. Therefore, to overcome this problem, this proposed model segregates the waste into wet, dry, and metal automatically without human intervention. The waste collection may be door to door or indirect [4]. In both cases, the plan is to develop a system that would collect and segregate in a smart way. The system is designed by reducing unnecessary cost, and it provides good quality of service to the citizens. The proposed smart waste segregation system is developed to reduce the existing problems in the urban environment. Nowadays there are many hardware and software resources available, and this has led to the increased enthusiasm in researchers and hobbyists to perform experiments using Machine learning Algorithm. Currently the waste management practice includes more human resources which is time consuming and results in health issues of workers. Dumping the waste materials everywhere can be injurious to plants and animals lives also; when the waste is segregated as wet, dry, and metallic in the initial stage, it will be helpful [5]. Waste is a big problem throughout the countries. Municipal authorities are facing problem in collecting huge amount of waste from different location and segregation in large scale. In the proposed system, CNN is used to segregate the waste without manpower with less time consumption. Machine learning is a function of intelligence where the system gets the ability to make decisions automatically without any help. CNN is neural network algorithm which is useful to classify the images. Input image is converted to matrix form, then extracts the features in the image by applying filters; when it is applied to whole image, there will be an activation of that feature to detect. In the proposed model, the waste is discovered by using open CV. The waste is further segregated using robotic arm into respective section in the bin.

2. Related Work Few recent papers are referred to identify the existing techniques of waste segregation system. Some new technologies have proved to be the best in this field. So, there is a need for public to implement this type of system which is significantly less in the current scenario [6].

2.1 Literature Survey Shamin.N et al., [7] proposed the implementation of KNN and surf algorithm for waste segregation. The system was based on IoT waste segregation which segregates the waste to the dustbin by the usage of sensor and when detected right away, the information goes to cloud via IoT which segregates the wastes into metal, biodegradable and nonbiodegradable wastes. Shinini Ray et al., [8] described the model of smart bin which manages the collection of waste in buildings. The system optimized the routine to clean up the bins regularly. They have derived only three timings to clean up the bins. The 3 cleanups showed a standard deviation of 37minutes, which showed that particular dustbin might be left unclean for maximum 37minutes. And also new dustbins were installed that reduced the standard deviation and range. Krishangi Deka et al., [4] used IoT Platform RL78 series of micro controllers interfaced with other component, and low-cost sensor attached to it which

made dustbins handy all the times. The usage of force restive sensor measured the weight in dustbin. They have given a approach to contribute to the smart city which address the government and private sector to utilize the resources in an efficient manner, and also address the public to make them understand the environment and the steps included in 'recycle, reuse, reduce' near them. Himadri Nath Saha et al., [1] attached the ultrasonic sensor and DHT11 sensor to the dustbin. When the dustbin is full, the alert is sent to the user using GSM model. The main source of power supply was solar panels. RGB led lights were used to indicate the level of waste in the dustbin. They have mainly concentrated to reduce the amount of petrol cost by detecting the shortest required route for the truck drivers when collecting waste. Kishan Ps et al., [9] performed classification of garbage by using deep learning and CNN. It had different folders created having different images like glass, plastic, metal, and cardboard. Nearly 2500 default images were used, wherein 800 images of garbage and 300 images non garbage were trained using faster CNN. Robotic intervention was used to classify without human intervention and the accuracy attained was 85.52%.

2.2 Existing System The previous existing system detects the level of the waste and sends message via GSM to the authorities. Separation is done only for metallic and non-metallic substances. Moisture sensor detects the waste as wet. Whereas the proposed system monitors, segregates the waste into wet, dry, and metal, into specific sections of dustbin using robotic arm. From the previous existing models, it is observed that KNN algorithm can only classify and do not segregate into different categories, and SURF algorithm has a low rate of efficiency (70- 75%). Therefore the idea of implementing the model with the help of CNN algorithm has been implemented.

2.3. Proposed Work This system focuses on developing a smart waste segregator that segregates waste into wet, dry, and metal. It begins with the detection of waste by using open CV. Then the Pi camera captures the image of the present waste and compares with the default trained images by using CNN algorithm. Later, the robotic arm that is present segregates the waste into different compartments of the smart bin according to its category (wet, dry, and metal). The level of the dustbin is measured by using level sensor i.e., ultrasonic sensor. When the dustbin is filled and less than 10mm space is available, immediately the information is sent in the form of message to the authorized person through GSM module. Existing waste segregation system use moisture sensor to differentiate between wet and dry waste, even with small water droplets present on dry or metal waste detects it as wet which is not a proper consideration. Initially the proposed model consists of a dumping area where the waste materials are dumped. The waste detection happens by using the Open CV. The Pi camera module is connected to raspberry pi which captures the images of the waste present. The captured images are sent to the raspberry pi which is the main part of the proposed model

CNN Algorithm CNN is convolutional neural network, which is used for classification of image, and widely used in image recognition and object detection. This process goes through several layers like convolution layer, max pooling, and fully connected layers. Convolution layers consist of many filters that extract the features which are applied to the whole image.

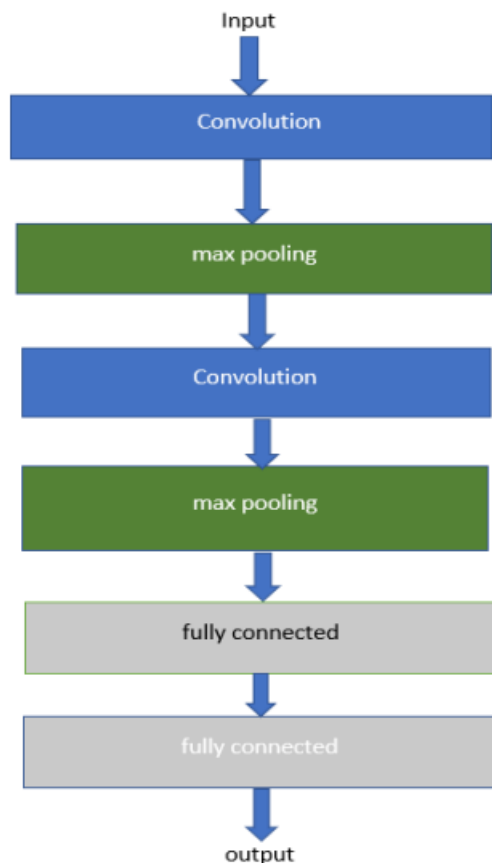


Fig: CNN algorithm

The purpose of filter is to extract the specific feature from the input image [11]. The max pooling layer reduces the size of the image compared to the convolution layer; this process continues until all the features are extracted. At last, it goes to the fully connected layer which consists of weights and bias. Then the sum of dot products of input goes to the activation function that is ReLU activation which decides the neuron for the specific situation. This results in comparison of images of waste in the proposed model.

CONCLUSION This paper proposes an automatic waste segregation model. The present images of the waste materials are compared with the stored images by using CNN, and by the usage of robotic arm, the wastes are segregated to different categories into the sections of smart bin. This proposed system works with the image identification by image comparison using CNN algorithm rather than using moisture sensor as in the existing methods, the exact waste material is identified by the image even with the presence of moisture on it. After extensive working with the present system, it is found to achieve more than 90-95% success rate in segregating wet, dry, and metal wastes in different forms. This system will defiantly contribute to a larger extent in managing waste, thus supporting the Swachh Bharath mission

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