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Efficient Garbage Management System Using Machine Learning

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Abstract: ***Garbage management is essential in today's society. Due to the increase in population, the waste generation is getting doubled day by day. Therefore, it is imperative that we examine the process of garbage collection, segregation, and automation for better management of the garbage materials. This project provides a solution that can detect, identify and segregate waste objects into Bio-Degradable and Non-Biodegradable garbage classification. This work is an integration of machine learning concepts using. Numbers of ways have been proposed to solve this challenge; a new concept uses a conveyor belt and a camera module that can sort garbage objects at the initial stage of segregation. The segregating module is DC geared motors sorts these garbage objects into two different categories, namely Bio-Degradable and Non-Biodegradable garbage. Our main aim is to segregate the collected garbage objects into two categories of bio-degradable wastes and non-biodegradable wastes. So, when the unwanted garbage is discarded in two different dustbins at the source itself which in turn allows effective treatment and disposal. So, Efficient garbage management administration makes the garbage collection productive.***

Keywords: Biodegradable waste; Non-Biodegradable waste; Arduino Uno; USB Camera; Garbage Segregator; Conveyor belt

I. INTRODUCTION

The dynamic increase in the amount of garbage and despicable disposing of the waste has become a matter of concern because of the threat it causes to the environment. This increase in waste has harmful effects on the lives of many people. Waste management is essential in today's society. Waste management refers to managing waste by proper disposal methods and recycling it. Proper techniques are needed in the segregation of waste keeping in mind the environmental situations.

The recent issues with garbage disposal have made people realize the importance of waste management and segregation. The challenge is that people are not knowledgeable of how to start separating the waste into basic categories. This lack of knowledge is becoming a blockage to find the remedy for waste management. Through this project, we want to spread awareness among people, regarding how to segregate the garbage correctly.

It is important to segregate waste on a daily basis. Segregation of garbage means separating biodegradable wastes from non-biodegradable wastes. By this means, the wastes can be sorted accordingly. As an individual simplest way, we can contribute is by having two waste bins at home one for biodegradable wastes another for non-biodegradable wastes.

But because of our ignorance, a lot of waste gets dumped in landfills and sites as a result pollution hits the planet.

We should start creating awareness and take self-responsibility then only we can keep our environment clean. For this, we have to segregate our wastes on a daily basis. It is quite important to separate non-biodegradable wastes from biodegradable wastes. Non- biodegradable

wastes should be separated from natural wastes. Non – biodegradable wastes do not decay like biodegradable wastes. Instead, they take many years to break down and are dangerous even after that.

II. PROBLEM DEFINITION

Segregation is the most necessary step for garbage management. Diverse garbage materials require new ways of treatment; assorted garbage cannot be treated. As a consequence, if garbage management is to be accomplished in an efficient and orderly manner, the fundamental aspects and relationships involved must be identified, adjusted for uniformity of data, and understood clearly. A mechanism will be used to differentiate among different types of waste materials namely paper, dry leaves, and fruit waste. So efficient segregation of garbage management plays a very important role. As garbage is segregated, it can be treated accordingly. Biodegradable garbage can be deposited in unfilled land for composting or can be sent to dumping ground. Non-biodegradable garbage can further be reprocessed or can be treated distinctly. Segregation makes there cycling of the garbage easier.

III. OBJECTIVE

The main purpose of the project is to develop a garbage segregation model using a conveyor belt and camera module that will detect, classify and segregate garbage and drop the garbage into the respective bins attached to either side. The system will be capable to sort different types of garbage into different dustbins based on their type. The objective is to demonstrate that the sustainability and efficiency of garbage segregation practices can be achieved by introducing an innovative, economically viable system that completely reduces manual work. The objective is to efficiently segregate garbage into Biodegradable and Non- Biodegradable into their respective bins.

IV. SYSTEM DESIGN

The system consists of a Conveyor belt, Camera Module, Arduino Uno, L293D Motor Driver, two DC Motors, and Rotating Disc. On top of the conveyor belt, USB Camera is fitted which captures the objects placed on the conveyor belt. The conveyor belt which runs with the help of DC Motor is in turn connected to the L293D Motor Driver. The motor driver is connected with the Arduino UNO with the help of a wired connection through which communication establishes with the system. The rotating disc rotates with the help of a DC Motor which is also connected with the L293D Motor Driver.

V. IMPLEMENTATION

The system consists of a conveyor belt, Arduino Uno, DC motor, L239D motor driver and USB camera, and a rotating disk. Initially, the garbage material is placed on the conveyor belt where the camera module placed near the conveyor system captures the image.

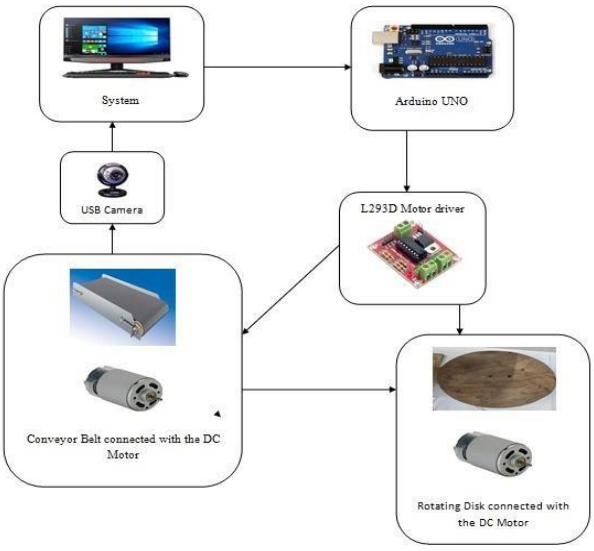

Fig 1. System Design

Fig 2. Flow of Methodology

Data Augmentation takes place in order to increase the performance and outcomes of machine learning models and to improve the amount of data by adding slightly modified copies of already existing data or newly created data from existing data.

Creating the environment with the necessary package is the first step of programming in python. A convolutional

neural network (CNN) is a class most commonly applied to analyzing visual imagery.

In order to train the network, we require a huge amount of data only then the network can be trained efficiently. The greater the number of inputs, the greater is the accuracy and the way round. Using Python IDLE 3.7.4, virtual environments can be created, exported, listed, removed, and updated that have different versions and packages like NumPy, Sklearn, Keras, with tensor flow backend installed in them. Switching between domains is called activating the environment.

This captured image is fed into the CNN model which is trained with the dataset. The prototype is trained on the training dataset using a supervised learning method. The training dataset usually comprises pair of the input vector and the corresponding output vector, which is commonly denoted as the target.

The current model is running with the training dataset and generates a result, which is then matched with the target, for each input vector in the training dataset. Based on the result of the observation and the specific learning algorithm being used, the parameters of the model are modified. The fitted model is used to envision the acknowledgment for the observations in a dataset. The validation dataset provides an evaluation of a model fit on the training dataset.

Testing information is employed to check the system. The captured image undergoes histogram equalization to normalize the intensity value throughout the image. Next, the image undergoes a Gaussian filter to remove any noise in the image. It is the set of data that is used to verify whether the system is generating the accurate output after being trained or not. Testing data is used to compute the correctness of the system.

The CNN model currently classifies the image as Biodegradable or Non-biodegradable waste. The conveyor belt is currently turned ON and therefore the garbage kept on the belt starts moving. Based on the classification of garbage, serial communication is sent to the Arduino Uno which rotates the rotating disk clockwise if the classified garbage is biodegradable waste and the garbage material falls into the bin and rotates back to its initial position. Otherwise, if non-biodegradable the rotating disk stays in the initial position and the garbage material falls into the respective bin.

VI. RESULT AND SNAPSHOTS

The proposed model "Efficient Garbage Segregation Using Machine Learning" segregates garbage into two different categories, namely Biodegradable garbage and Non-Biodegradable garbage. Segregating garbage is indispensable as the quantity of garbage being set up today causes massive complications. Here, we have tested the common garbage materials which are generated in every house today in our daily lifestyle and we have concluded with the following result.

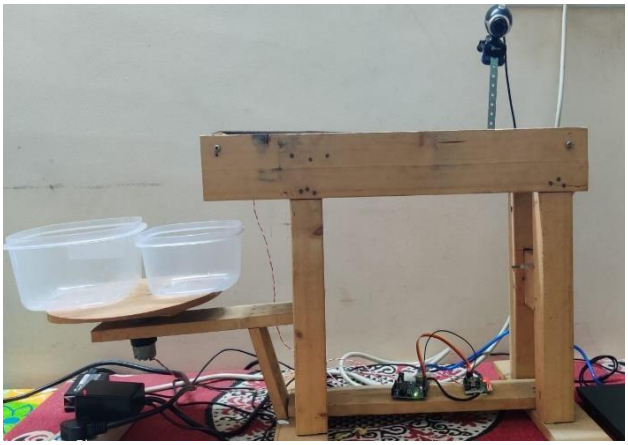

Fig 3. Model Design

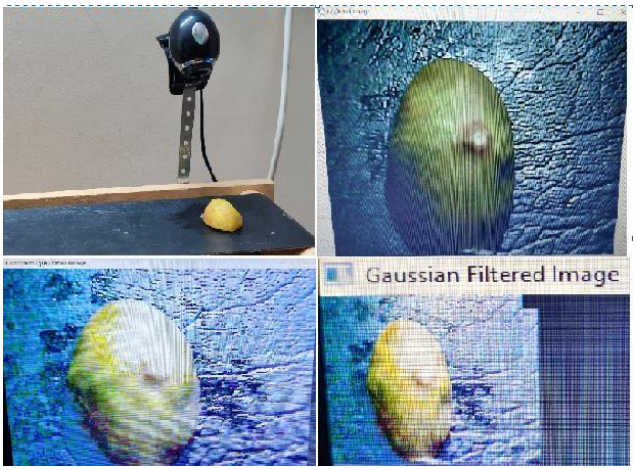

Fig 4. Image processing of Biodegradable Garbage

After running the test code image gets captured. The captured image undergoes histogram equalization and gaussian filtration thereby classifying the object as Biodegradable.

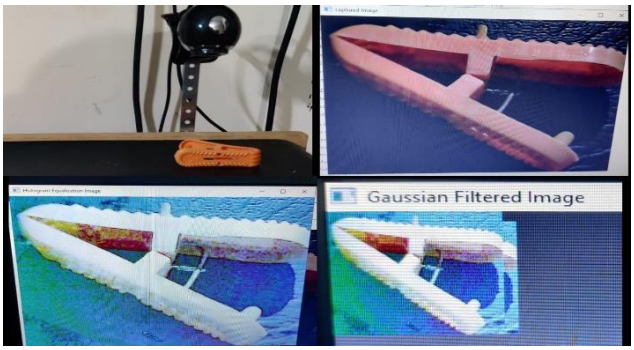

Fig 5. Image processing of Non-Biodegradable Garbage

After running the test code image gets captured. The captured image undergoes histogram equalization and gaussian filtration thereby classifying the object as Non-Biodegradable.

VII. CONCLUSION AND FUTURE WORK

The proposed system is an integration of Machine learning algorithms and Image Processing techniques that uses Convolutional neural networks to pre-train and test the images. After working with the dataset containing the bio-degradable and non-biodegradable waste materials. However, these results are mandated for optimization and improving the accuracies when it comes to being employed in real-time. The system concentrates on an efficient garbage management system this can be done on large scale in the future. The proposed model can efficiently classify and segregate biodegradable and non-biodegradable waste with an accuracy of approx. 95 percent, with the help of the data set. The model can be made more precise by adding different categories of images presently it is able to classify among general plastic, cardboard, leaves, paper. The proposed system can take one item at a time which can be taken care of with the help of further advancements so that multiple items can be segregated in real-time which will help to reduce both human efforts and overall time. The model can be trained further to detect hidden items in waste Furthermore, advanced electronic sensors can be used to reduce the time lapse between communications among different parts of the model. The proposed model gives more priority to low cost, maintainability, and accuracy which can be enhanced with the help of future advancements using electronic sensors.

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