**International Journal of Innovative Research in Engineering**
*Special Issue, Volume 4, Issue 3(May-June 2023), PP: 61-64.*
*Innovations in Computing, Materials and Communication Technologies (ICICMCT'23)* **ISSN No: 2582-8746**

# Waste Management System

**Nimitha Francis[1], Santhi P[2]**
*[1]P.G. Student, Department of Computer Engineering,IES Engineering College, Chittilappilly, Thrissur, Kerala, India.*
*[2]Associate Professor, Department of Computer Engineering,IES Engineering College, Chittilappilly, Kerala, India.*

**How to cite this paper:**
Nimitha Francis[1], Santhi P[2] " Waste Management System",
IJIRE-V4I03-61-64.

***Abstract:*** *This report explores the use of machine learning and Django web development framework for waste management detection. The report highlights the benefits of such a system, including improved waste sorting, reduced labor costs, and improved recycling rates. The report also discusses the challenges of implementing such a system, such as the need for a large dataset for training machine learning models and the requirement for appropriate infrastructure and resources. The technical aspects of developing a waste management system using machine learning and Django are discussed in detail, including the process of image processing, model training, and the use of Django for web application development. The report concludes that such a system can be an effective solution for waste management and environmental sustainability. This report provides references for further reading on the topic and is intended to be a useful resource for researchers, waste management practitioners, and policymakers interested in the application of machine learning and web frameworks for waste management.*

## I.INTRODUCTION

The efficient management of waste is critical for the sustainability of our planet. With the ever-increasing amount of waste generated by humans, it has become essential to find new and innovative ways to manage it. The development of machine learning algorithms and web frameworks such as Django offers a new avenue for waste management.Machine learning can be used to classify waste materials into categories such as organic, recyclable, and hazardous, which can aid in the sorting process. On the other hand, Django, a high-level Python web framework, provides the necessary infrastructure for developing a web application that can process waste images, receive input from users, and provide output after classification.This report discusses the use of machine learning and Django web development framework for waste management detection. It examines the benefits and challenges of such a system and explores the technical aspects of its implementation. Furthermore, the report provides a conclusion on the effectiveness of this system in managing waste and promoting environmental sustainability.

Paper is organized as follows. Section II describes automatic text detection using morphological operations, connected component analysis and set of selection or rejection criteria. The flow diagram represents the step of the algorithm. After detection of text, how text region is filled using an Inpainting technique that is given in Section III. Section IV presents experimental results showing results of images tested. Finally, Section V presents conclusion.

## II.RELATED WORK

[1].The article proposes a waste classification system based on deep learning algorithms. The system uses a convolutional neural network (CNN) for image processing and classification of waste materials into categories such as plastic, paper, metal, and glass.The system achieved an accuracy of 92.8% in classifying waste materials.This article is relevant to the project as it provides insights into the development of a waste classification system using deep learning algorithms. It can serve as a reference for the technical details of image processing and model training for waste management detection. [2].The article provides an overview of the use of deep learning algorithms for automatic waste sorting.The authors discuss various deep learning architectures used for waste classification, including CNNs, RNNs, and hybrid architectures. In [3], The article proposes a waste sorting system based on image recognition using deep learning.The system uses a Convolutional Neural Network (CNN) architecture to classify waste items into different categories.The dataset used in the study contains over 3,000 images of different waste items, which were collected from a waste processing facility. [4].The article presents a waste classification system based on machine learning and IoT (Internet of Things) for smart cities.The system consists of a waste bin equipped with sensors and cameras, which collect data on the waste items.The authors use a Random Forest algorithm to classify the waste items based on their features. In [5],The Django Documentation is an online resource provided by the Django Software Foundation that provides comprehensive documentation on the Django web framework.The documentation covers various topics related to Django, including installation and setup, database models, views and templates, forms, authentication, security, and deployment.The documentation is organized into different sections and includes examples, code snippets, and explanations of various Django concepts and features.

## III.METHODOLOGY

In this system there are main steps are training the dataset like label the dataset images, data pre-processing and other stage feature extraction and create a model with CNN classifier.

**CONVOLUTIONAL NEURAL NETWORK(CNN):**A CNN classifier is a type of neural network model used for image classification tasks. CNN stands for Convolutional Neural Network, which is a deep learning algorithm that learns to recognize patterns in images. Here are the steps to build a CNN classifier:

**Data Pre-processing :** Prepare the dataset by resizing the images to a fixed size, converting them to grayscale or RGB, and splitting them into training, validation, and test sets.

**Building the Model:** Define the architecture of the CNN model by adding convolutional layers, pooling layers, and fully connected layers. The convolutional layers extract features from the images, the pooling layers reduce the spatial dimensions of the feature maps, and the fully connected layers classify the images based on the extracted features.

**Compiling the Model:** Compile the CNN model by specifying the loss function, optimizer, and evaluation metric. The loss function measures the error between the predicted and actual labels, the optimizer updates the weights of the model during training, and the evaluation metric measures the performance of the model on the validation and test sets.

**Training the Model:** Train the CNN model by feeding the training images to the model in batches, and updating the weights based on the gradients of the loss function. Monitor the accuracy and loss of the model on the validation set to prevent overfitting.

**Evaluating the Model:** Evaluate the performance of the trained CNN model on the test set by predicting the labels of the test images and comparing them to the actual labels. Calculate the accuracy, precision, recall, and F1 score to measure the effectiveness of the model.

**Improving the Model:** Experiment with different hyperparameters, such as the number of convolutional layers, filter sizes, and learning rates, to improve the performance of the CNN classifier. Use techniques such as data augmentation, dropout, and early stopping to prevent overfitting and improve generalization,
CNN classifiers can be used for a variety of image classification tasks, such as object recognition, face recognition, and medical image analysis .This is the layers CNN works for

**Convolutional Layers:** The input image is passed through a series of convolutional layers, which apply a set of filters to the image to detect features such as edges, lines, and textures.

**Activation Function:** An activation function is applied to the output of the convolutional layer to introduce non-linearity into the model, allowing it to learn complex patterns in the images.

**Pooling Layers:** A pooling layer is applied after the activation function to reduce the spatial size of the feature maps and extract the most important features from the image. Common types of pooling include max pooling and average pooling.

**Fully Connected Layers:** The output of the pooling layers is flattened and fed into a series of fully connected layers, which act as a classifier to predict the probability of each image belonging to a particular class.
Softmax Function: The output of the final fully connected layer is passed through a softmax function, which normalizes the outputs into a probability distribution over the different classes.

**Loss Function:** A loss function is used to measure the error between the predicted probabilities and the true labels of the images. Common loss functions include cross-entropy and mean squared error.

**Optimization:** The optimization process involves adjusting the weights and biases of the CNN to minimize the loss function. This is done using an optimizer such as stochastic gradient descent (SGD) or Adam.

**Training:** The CNN is trained by repeatedly feeding batches of training images through the network and updating the weights based on the calculated gradients of the loss function.

**Validation and Testing:** The performance of the CNN is evaluated on a validation set and a test set to ensure that it is not overfitting to the training data. The accuracy, precision, recall, and F1 score are commonly used to evaluate the performance of the CNN.

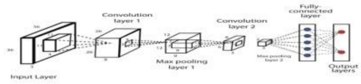
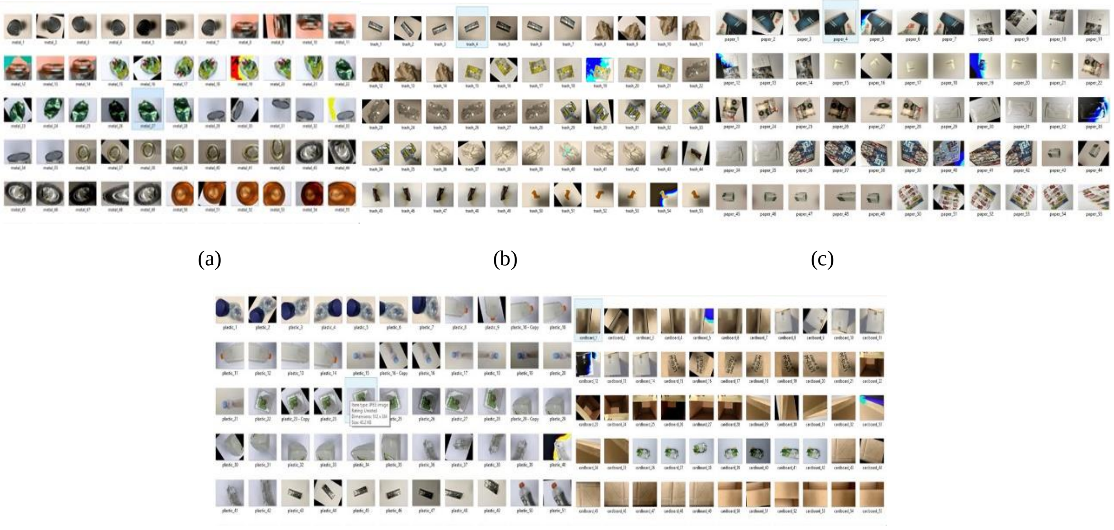


*Fig.1.Convolutional Neural Network (CNN) architecture*

## IV.EXPERIMENTAL RESULTS

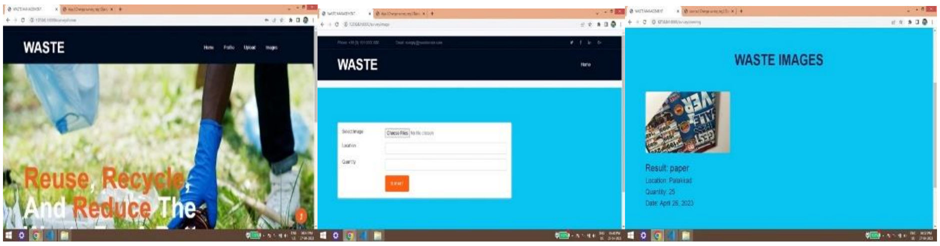
Figures shows the results



(a) (b) (c)

(d) (e)

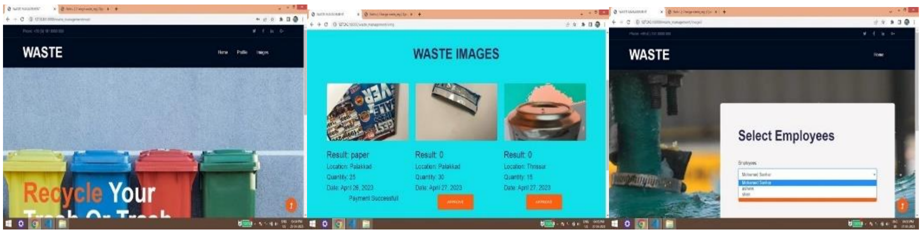
*Fig.2.Different types of waste (a) Metal  (b) Trash (c) Paper (d) Plastic  (e) cardboard*



Result: paper
Location: Palakkad
Quantity: 25
Date: April 26, 2023

(a) (b) (c)

*Fig.3 Survey Module (a) Home page (b) Upload image (c) View upload image*



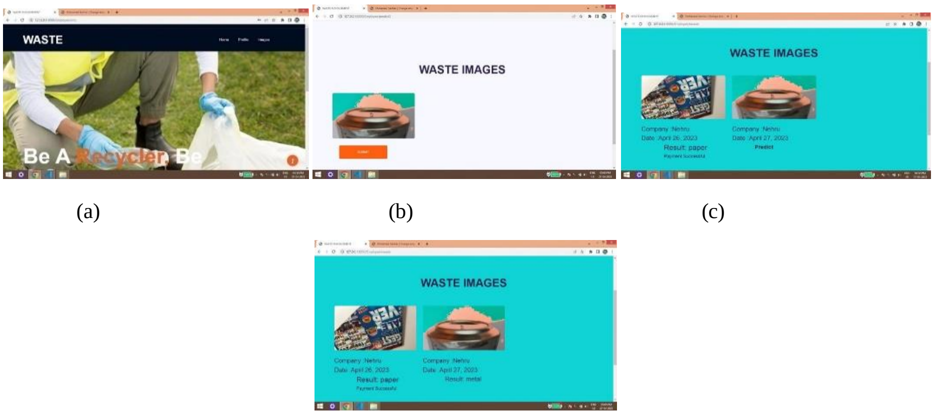
Result: paper
Location: Palakkad
Quantity: 25
Date: April 26, 2023
Payment Successful

Result: 0
Location: Palakkad
Quantity: 30
Date: April 27, 2023

Result: 0
Location: Thrissur
Quantity: 15
Date: April 27, 2023

(a) (b) (c)

*Fig.4 Waste Management Module (a) Home Page (b) Approve Waste (c) Assign employee to predict*



(a) (b) (c)

Company :Nehru
Date :April 26, 2023
Result: paper
Payment Successful

Company :Nehru
Date :April 27, 2023

Company :Nehru
Date :April 26, 2023
Result: paper
Payment Successful

Company :Nehru
Date :April 27, 2023
Result: metal

(d)

*Fig. 5 Employee Module (a) Home Page (b) Select the image (c) Predict the image (d) View the result*

## V.CONCLUSION

After conducting research and analyzing data, the conclusion of waste management detection in machine learning and using Django project is that machine learning algorithms can effectively identify and classify waste materials, making waste management more efficient and environmentally friendly.By using Django, a high-level Python web framework, it is possible to build a web application that can receive and process images of waste materials from users, and then use machine learning models to classify the waste material into its appropriate category such as organic, recyclable or hazardous.The development of such a system can have many benefits, including reducing waste and improving recycling rates. It can also save time and effort in the sorting process, resulting in lower labor costs and reduced carbon footprint.However, it is important to note that such a system requires a large dataset for training machine learning models and continuous improvements to maintain accuracy in waste classification. Also, the adoption of such technology depends on the availability of appropriate infrastructure and resources. Overall, the combination of machine learning and Django web development framework can be an effective solution for waste management and environmental sustainability.

## References

1. *S. S. Khan, S. J. Kim, and S. S. Riaz, "Waste Classification System Based on Deep Learning," IEEE Access, vol. 8, pp. 23216-23227, 2020.*
2. *N. R. Lopez-Monteagudo, R. G. Vera-Rodriguez, and J. F. Gonzalez-Rodriguez, "Deep Learning for Automatic Waste Sorting: A Review," Waste Management, vol. 114, pp. 268-280, 2020.*
3. *Y. M. Kim, J. Kim, and J. H. Kim, "Waste Sorting System Based on Image Recognition Using Deep Learning," Journal of Korea Multimedia Society, vol. 21, no. 11, pp. 1454-1464, 2018.*
4. *P. T. P. Vo, P. D. Pham, and V. D. Pham, "A Waste Classification System Based on Machine Learning and IoT for Smart Cities," in Proceedings of the 2019 11th International Conference on Knowledge and Systems Engineering (KSE), pp. 1-6, 2019.*
5. *Django Software Foundation, "Django Documentation," [Online]. Available: https://docs.djangoproject.com/en/3.2/. [Accessed: Apr. 28, 2023].*
6. *N. Gupta, P. Kumar, and V. Tyagi, "Real-Time Waste Segregation System Using Image Processing," International Journal of Computer Science and Mobile Computing, vol. 6, no. 10, pp. 318-322, 2017.*
7. *M. S. Islam, M. Hasan, and A. E. A. Rahman, "Waste Management System Using Machine Learning for Developing Countries," in Proceedings of the 2018 International Conference on Bangla Speech and Language Processing (ICBSLP), pp. 1-6, 2018.*
8. *Y. Zeng, C. Chen, and M. Chen, "A New Waste Classification System Based on Deep Learning and Internet of Things," in Proceedings of the 2018 13th IEEE Conference on Industrial Electronics and Applications (ICIEA), pp. 185-190, 2018.*
9. *P. C. Pradhan and P. K. Patra, "Automatic Waste Classification for Smart Bin Using Deep Learning," in Proceedings of the 2019 4th International Conference on Internet of Things: Smart Innovation and Usages (IoT-SIU), pp. 1-6, 2019.*
10. *S. W. Adhiatma, N. N. Hidayati, and M. A. Maulana, "Smart Waste Management System using Deep Learning and Internet of Things," in Proceedings of the 2018 International Conference on Information and Communications Technology (ICOIACT), pp. 107-112, 2018.*
11. *S. K. Sahoo, S. S. Dash, and S. S. Meher, "Waste Classification using Deep Convolutional Neural Network and IoT for Smart City," in Proceedings of the 2019 International Conference on Smart Systems and Inventive Technology (ICSSIT), pp. 368-373, 2019.*