BE MAJOR PROJECT REPORT

ON

Waste Management System”

BY

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Under the guidance of

Internal Guide
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University of Mumbai

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MANJARA CHARITABLE TRUST

RAJIV GANDHI INSTITUTE OF TECHNOLOGY

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C E R T I F I C A T E

Department of Computer Engineering

This is to certify that

1. A840-Aryan Jain
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Have satisfactorily completed this project entitled

"Waste Management System"

Towards the partial fulfilment of the

BACHELOR OF ENGINEERING
IN
(COMPUTER ENGINEERING)

as laid by University of Mumbai.

Guide

Prof. S. P. Khachane

H.O.D.

Prof. S. P. Khachane

Principal

Dr. Sanjay Bokade

Project Report Approval for B. E.

This project report entitled ***"Waste Management System"*** by ***Aryan Jain, Dhruv Jain and Naitik Jain*** is approved for the degree of ***Bachelor of Computer Engineering***.

Examiners:

1----------

2.----------

Date: 16-02-2022
Place

Declaration

We wish to state that the work embodied in this project titled ***"Waste Management System"*** forms our own contribution to the work carried out under the guidance of" Prof. S. P. Khachane" at the Rajiv Gandhi Institute of Technology.

I declare that this written submission represents my ideas in my own words and where others' ideas or words have been included, I have adequately cited and referenced the original sources. I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in my submission. I understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

(Students Signatures)

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Naitik Jain (A-842)

Acknowledgement

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This project bears on imprint of many peoples. We sincerely thank our project guide **Prof. S.P. Khachane** for his guidance and encouragement in carrying out this synopsis work.

Finally, we would like to thank our colleagues and friends who helped us in completing project work successfully

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ABSTRACT

Solid waste management is an important task that needs to be carried out on a day-to-day basis. Waste Sorting is a task that is of utmost importance in today's scenario, as waste production is increasing at an immense rate. Today, a lot of waste can be recycled, but there is a chance of incorrect disposal, like plastics mixed with paper waste, or contaminated waste thrown out along with recyclable waste. For this task, we have decided to implement a digital solution, an Image Classifier to Classify Different waste. It can be used for identification of different wastes for Waste Management purposes. This will be done using a Convolutional Neural Network (CNN), that is a pillar of image processing for Deep Learning. The Classifier will use Deep Learning algorithms to sort waste shown to it into biodegradable and non-biodegradable forms of waste. The Classifier will use Computer Vision to detect and prompt to the user about the detected waste.

This proposed architecture is aimed to create a useful waste management system with B2C,B2B services which can be used with the combination of software and hardware tools so as to manage waste efficiently.

Group Members:

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CHAPTER 1

Introduction

1.1 Introduction Description

Waste Management is a fundamental issue in all parts of the world. As the population is on the rise, waste and in turn pollution rises in both urban and rural settings. Most of the waste collected is dumped into landfills, which is rising, and is predicted to increase by 70 percent by 2025. With the emerging urban areas, there has been a steady increase in waste that is being dumped.

Improper disposal of waste harms the environment around us, leading to pollution, and many more hazards to air, water, soil and diseases. This is a dangerous task, as it poses hazardous to the waste sorters, and is a slow and time-consuming method, and thus the efficiency is also low. There has been a push for digitization of this, as technology is rapidly growing. To tackle this, we have proposed a system which will automate the work of distinguishing between different types of wastes, such as metals, plastics, paper and many more. Using Deep Learning, we plan on training a data set, which can then be used to identify the waste. This will be helpful is recycling of waste, as well as proper disposal of waste which is biodegradable, and thus help the environment, while being efficient.

1.2 Organization of report

- Ch.1 Introduction: Introduces the topic
- Ch.2 Literature Review: Includes the survey of existing system, limitation, objectives and scope of the topic
- Ch.3 Proposed System: Analyses the proposed system, the algorithms required, and the requirements of hardware and software.
- Ch.4 Results & Discussion:

CHAPTER 2

Literature Review

2.1 Survey existing system

- The accumulation of solid waste in the urban area is becoming a great concern, and it would result in environmental pollution and may be hazardous to human health if it is not properly managed. It is important to have an intelligent/advanced waste management system to manage and separate variety of waste materials. So as to simplify the process, an advanced classification system is developed using Convolutional Neural Network (CNN) model that is using deep learning which is used to classify variety of waste materials into different groups/types such as glass, metal, paper, and plastic, etc.
- The designed system sorts waste into six different categories, namely, metal, plastics, paper, textile, wood and glass. An OpenCV, which acts as the heart of the system, is then used to observe the wastes and timing of all the subsections so as to sort the waste into the three primary categories.
- The idea behind all the projects was to classify all the waste material into different categories and minimize the human effort and develop an automated system which will classify waste accurately and efficiency.
- Different types of wastes from the Internet are collected. To remove all the redundancies from those images, pre-processing will be done followed by training those datasets and finally developing a model and classifying the waste as biodegradable (textile, paper, glass, wood, waste, agricultural waste, food waste) and non-biodegradable (plastics, steel, metal cans). Few images of waste datasets were collected by us and the rest are taken from the Internet.
- Many different algorithms have been developed for the classification of images, such has RNNs, SVMs, ANN etc, but Convolutional Neural Network which is a Machine Learning algorithm has really performed better than them all.
- CNNs hit the spot when the algorithm was used to win the 2012 image-Net large-scale visual recognition challenge (ILSVRC) which was proposed earlier. Since 2012 many different CNN architectures have been developed which has solved many image classification problems.
- Lulea University of technology in 1999 undertook a project, and a system was developed to recycle metal scraps using mechanical shape identifier used the features from SIFT and outline shape on the Bayesian computational framework and their system was based on the Flickr material database.

- A convolution Neural Network (CNN) is one of the most popular algorithms for deep learning, a type of machine learning where a model learns to perform the task of classification directly from text, images, videos or sound. CNNs are specifically useful for finding the patterns in images to detect and recognize objects, faces and poses.

- Thus, efficient segregation of solid wastes helps to reduce the amount of waste buried in the ground, thereby improving the recycling rate, and safeguards the soil from pollution.

No.	TITLE	YEAR	AUTHOR	METHODOLOGY	FINDINGS	LIMITATIONS
1)	Automatic classification of solid waste using deep learning	Springer, 2020	V. PBrintha, R. Rekha, J. Nandhini, N. Sreekaarthick, B. Ishwaryaa, et al.	The proposed idea mainly concentrates on the classification and identification of the waste that is being dumped into the garbage.	The developed system could identify different types of wastes when shown individually with different accuracies.	The system is not able to classify waste accurately when the image contain more than one waste category.
2)	An automatic classification method for environment	IEEE,2016	S.Sudha M.Vidhyalakshmi K.Pavithra K.Sangeetha	The implementation part is done using Caffe which is a deep learning framework as software. Deep learning and deep features have only recently achieved strong results in many tasks.	The developed system would pioneer the work for solid waste management process in the field of Artificial Intelligence. When properly trained, the system is highly efficient	It has very less accurate due to use of caffe.
3)	Intelligent waste classification system using deep learning CNN	SMPM,2019	Olugboja Adedeji, ZenghuiWang	The proposed method is developed based on the ResNet-50 pre-trained model, SVM.	The proposed system is able to classify waste with 87%accuracy.	The model is trained using small dataset and thus accuracy was not optimal.
4)	Automation of Waste Sorting with Deep Learning	IEEE WVC,2019	Joao Sousa , Ana Rebelo, Jaime S. Cardoso	Basic R-CNN, Hierarchical Approachsused using multi-labeled datasets and traininf for shape and materials	The direct R-CNN used gave a mAP of 74.1%, using a hierarchical approach gave a mAP of 80.9% for materials, and 86% for shapes showing improvement on R CNN methods	It uses a non controlled data set which makes training difficult and the model is specifically trained for food trays.

Table 1.1: Survey of reference papers

2.2 Limitation existing system or Research gap

Paper name	Problem solved	Demerits
An automatic classification method for environment: Friendly waste segregation using deep learning	A proposition for a system that automatically classifies waste using deep learning	Cannot classify medical waste and e-waste due to government restrictions
Comparing deep learning and support vector machines for autonomous waste sorting	To use SVM model to classify waste into plastic, paper and metal	Small amount of images is used in the training set
Automatic waste classification using computer vision as an application in Colombian high schools	Integrating computer vision into developing an application to classify waste automatically into the IEAB	The wrong classifications, the reduced waste and the images in the database indicate that this technique is not enough to carry out the classification in a system of the real scale
Municipal solid waste classification using microwave non-destructive testing technique	This paper presents basic researches of the variation of microwave signal propagation characterization to verify microwave is suitable for MSW classification	Resolution of microwave non-destructive detection of MSW is not always high enough and can be improved only by using stronger microwaves
Smart recycle bin: A conceptual approach of smart waste management with integrated web- based system	A smart recycle bin that caters for recycling glass, paper, aluminium cans and plastic products that automatically evaluate the value of the wastes thrown and accordingly provide 3R card	It is not a very energy-efficient process when the scale of the project is increased

Table 2.2: Literature Survey

2.3 Problem Statement and Objectives

The increasing population poses serious threats like limitation of living space, education and employment. But a major serious problem is the enormous amount of waste generation each minute. Waste management is a big challenge in urban areas for most of the countries throughout the world. An astounding ton of waste is generated on a daily basis, but only 5% of this large amount of waste is recycled.

A possible solution for this could be segregating the waste at the starting stage itself. The identification of the waste is to be properly managed so as to minimize the risks to the health and safety of patients, the public, and the environment. Currently there is no effective system for identification of various types of wastes at a household level. The purpose of our project is to make a simple, low cost and user-friendly waste management system for urban households to introduce waste management process more effective in India.

2.3.1 Objectives

The existing garbage disposal system does not include segregation of its waste at early stages. Our objective is to bring about an automated process to the existing classification method, where the process is faster, cleaner and does not affect the ecosystem. The biodegradable products must be put to decompose and the rest, recycled. Resources must be saved and they must not be extinguished.

The main objective of this project is to develop a useful waste management system with various services provided to solve B2B, B2C problems such as to classify garbage in an efficient manner into recycling categories to process waste, disposal-recycle system, Garbage Truck Monitoring System and Garbage Level Monitoring System.

2.4 Scope

As our topic is based upon Waste Management System, the Scope of the project falls into the Domain of Environment and Ecology.

CHAPTER 3

Proposed System

The proposed methodology mainly focuses on the identification and classification of the waste service provided for waste management.

The proposed idea of the project is to provide with an efficient and digital solution to this, so as to waste management through services provided by us.

This project all while being user friendly for the basic users of the system, allowing them to manage waste properly and efficiently through different services.

The waste management website consists information regarding waste management techniques and has following four services of waste management as follows:

1) Classification of waste article through ML model. (ResNet-50 Model)

2) Disposal and Recycle System.

3) Garbage Truck Monitoring System.

4) Garbage Level Monitoring System.

1) Classification of waste article through ML model. (ResNet-50 Model)

3.1 Analysis/Framework/Algorithm

Points: -

- *How's data collected*
- *How's data is preprocessing*
- *Implementation*

Data collection:

- Here data is referring to data set of images which were used for training models. Data should be clean and refined to get accurate result for classification of waste. We have classified waste into six categories such as metal, paper, glass, trash, plastic, cardboard. The data-set contains images of solid waste objects across 6 classes with about 100–500 images in each type of waste, totaling about around 2497 images.
- The data-set collection process involved using a white paper as a background (even normal background is supported) and taking pictures of waste. The intensity of light and position for each image is not the same, which introduces variation in the data-set.

Data pre-processing:

- Whatever the image is collected is re-sized or transform to suitable type which the algorithm can use for proper training.

- For the pre-processing stage, data augmentation method was performed on the images, because of the small size.
- This technique was chosen because of the different orientations of the waste materials. Some of the technique includes, random of the image, translating the image, randomly scaling the image, image shearing, randomly scaling of the image.
- With this technique it maximizes the data-set size. The proposed method was developed based on the ResNet-50 pre-trained model.

Implementation:

✓ **Algorithm Used:**

1.) **CNN**: -

A Convolution Neural Network (ConvNet or CNN) is one of the most popular algorithms for deep learning, a type of machine learning where a model learns to perform the task of classification directly from text, images, videos or sound. CNNs are specifically useful for finding the patterns in images to detect and recognize objects, faces and poses.

2.) **ResNet-50**: -

- Due to the fact that the trash image dataset is small, we used a pre-trained ResNet-50 model which is a type of Convolutional Neural Network architecture. When the depth is increased, the recognition accuracy of the convolutional neural network can be increased, but due to the increase in depth, the signal that is supposed to modify the weight is reduced at the earlier layer of the CNN.
- This will make learning at the earlier layers inconsequentially and this is called vanishing gradient. Adding more and more layers to the network always leads to training error.
- Residual Network (ResNet-50) is different from the normal convolutional Neural network in that, it is able to go around this problem of vanishing gradient by designing the Convolutional neural network using modules which are called residual models, the ResNet model.

The proposed methodology mainly focuses on the identification and classification of the waste that is being dumped. Commonly, waste is unsegregated when dumped into landfills, which can cause nonbiodegradable waste thousands of years to decompose. The proposed idea of the project is to provide with an efficient and digital solution to this, where a computer system is able to detect and classify the waste item irrespective of shape, size and other factors. The project will also be able to learn by itself and hence be constantly updating itself, all while being user friendly for the basic users of the system, allowing them to classify and better dispose of the waste. The advantages of a system like this are that it would provide easy classification to a user and will reduce unsegregated waste being dumped, all while being fast and user friendly to the user or consumer

3.2 Details of hardware and software

3.2.1 Hardware requirements

Hardware Requirements: -

Platform	Hardware	Operating System	Supported Versions
Windows/Linux	Intel/AMD 64-bit	Windows	Windows 10/Ubuntu -18.04

Deep learning is a very CPU intensive thing to be running. Here are some system requirements to adhere to:

- Quad core Intel Core i5 8th Generation or higher (Dual core is not the best for this kind of work, but manageable)
- 8GB of RAM or higher.
- Minimum of 50GB of storage free
- Premium graphics cards, with Nvidia GTX 980 or higher

3.2.2 Software requirements

- ✓ Python 3.7 or higher versions
- ✓ Jupyter Notebook/Google-Colab
- ✓ TensorFlow
- ✓ PyTorch
- ✓ OpenCV
- ✓ IDE/Text-Editors
- ✓ Other Python Libraries

3.3 Design Details

3.3.1 System Flow/ System Architecture

System flow or architecture diagram with description or working of every module in diagram.

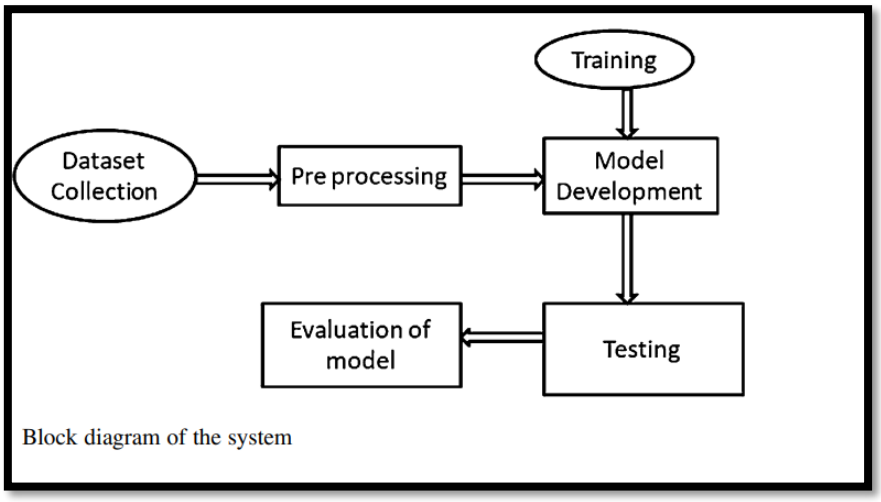


Fig. 3.1 System Architecture

3.3.2 Design

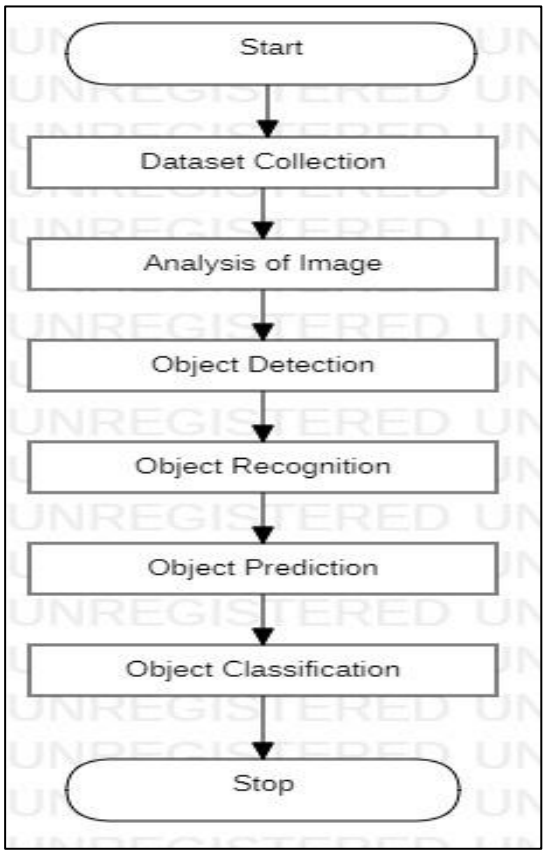


Fig. 3.2 Basic Flow of System

3.4 Methodology/Procedure (Approach to solve the problem)

Deep Learning:

Deep learning is an arising field of Machine learning which is still in its research and mainly aims in bringing machine learning even more nearer to one of its focuses: Artificial Intelligence. Machine learning concentrates on tasks such as recognizing the images, converting speech to text, recognition of speech and visual object, drug discovery, face detection and recognition, weather forecast etc. Deep learning techniques are used more in these applications where adaptive learning is done. Deep learning can do cognitive learning such as learning the features, characteristics and attributes with the help of good algorithms which can learn by itself and deep architecture. The family of deep learning has been increasing which includes neural networks, various unsupervised and supervised learning algorithms for recognizing feature such as Deep Belief Network, Deep convolutional Neural Network and Recurrent Neural Network and models which represent the probability of the hierarchy.

Model and Training:

1.) Deep Neural Network Model:

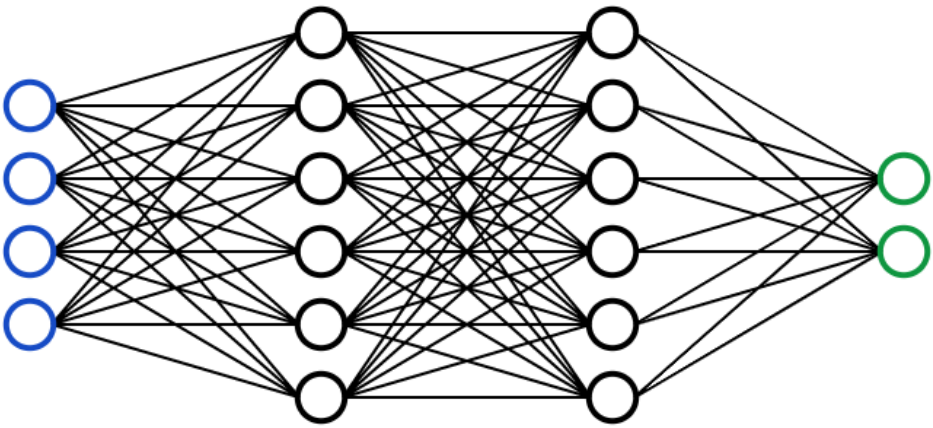


Fig. 3.3 Neural Network

A Neural Network is essentially a network of mathematical equations. It takes one or more input variables, and by going through a network of equations, results in one or more output variables. You can also say that a neural network takes in a vector of inputs and returns a vector of outputs, but I won't get into matrices in this article.

The blue circles represent the input layer, the black circles represent the hidden layers, and the green circles represent the output layer. Each node in the hidden layers represents both a linear function and an activation function that the nodes in the previous layer go through, ultimately leading to an output in the green circles.

2.) Training Deep Neural Network:

To achieve high level of accuracy, huge amount of data and henceforth computing power is needed to train these networks. However, despite the computational complexity involved, there are certain guidelines to reduce the time for training and improve model accuracy.

A.) Data Pre-Processing:

The importance of data pre-processing can only be emphasized by the fact that your neural network is only as good as the input data used to train it. If important data inputs are missing, neural network may not be able to achieve desired level of accuracy. On the other side, if data is not processed beforehand, it could affect the accuracy as well as performance of the network down the lane.

B.) Mean subtraction (Zero centering)

It's the process of subtracting mean from each of the data point to make it zero-centered. Consider a case where inputs to neuron (unit) are all positive or all negative. In that case the gradient calculated during back propagation will either be positive or negative (same as sign of inputs). And hence parameter updates are only restricted to specific directions which in turn will make it inefficient to converge.

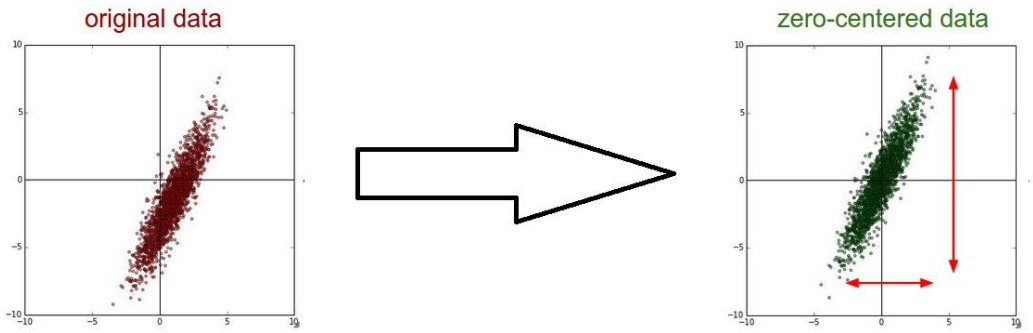


Fig. 3.4 Zero centering

C.) Data Normalization

Normalization refers to normalizing the data to make it of same scale across all dimensions. Common way to do that is to divide the data across each dimension by its standard deviation. However, it only makes sense if you have a reason to believe that different input features have different scales but they have equal importance to the learning algorithm.

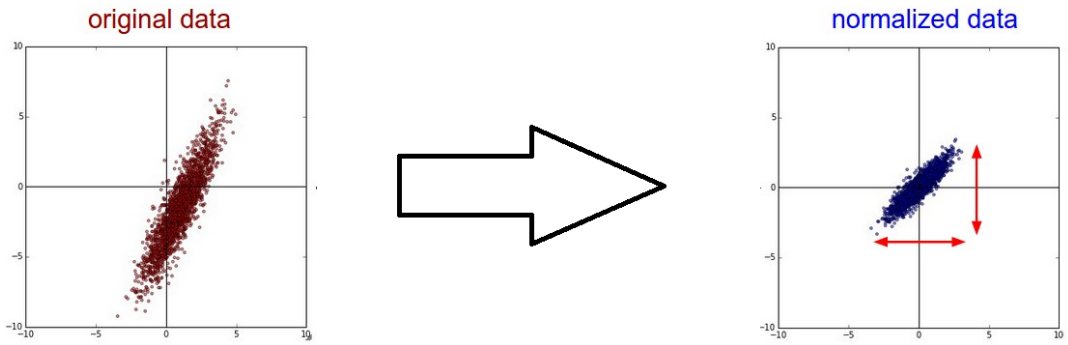


Fig. 3.5 Data Normalization

Algorithms:

- **Residual Networks (ResNet) – Deep Learning:**

After the first CNN-based architecture (AlexNet) that win the ImageNet 2012 competition, Every subsequent winning architecture uses more layers in a deep neural network to reduce the error rate. This works for a smaller number of layers, but when we increase the number of layers, there is a common problem in deep learning associated with that called Vanishing/Exploding gradient. This causes the gradient to become 0 or too large. Thus, when we increases number of layers, the training and test error rate also increases.

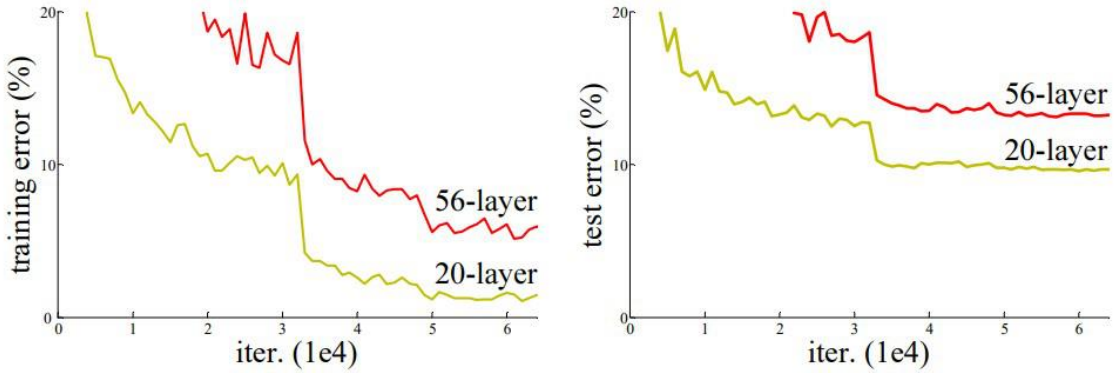


Fig. 3.6 Error between 56 and 2 layer

In the above plot, we can observe that a 56-layer CNN gives more error rate on both training and testing dataset than a 20-layer CNN architecture, if this was the result of over fitting, then we should have lower training error in 56-layer CNN but then it also has higher training error. After analyzing more on error rate, the authors were able to reach conclusion that it is caused by vanishing/exploding gradient.
ResNet, which was proposed in 2015 by researchers at Microsoft Research introduced a new architecture called Residual Network.

Residual Block:
In order to solve the problem of the vanishing/exploding gradient, this architecture introduced the concept called Residual Network. In this network we use a technique called

skip connections. The skip connection skips training from a few layers and connects directly to the output.

The approach behind this network is instead of layers learn the underlying mapping, we allow network fit the residual mapping. So, instead of say H(x), initial mapping, let the network fit, F(x): = H(x) – x which gives H(x): = F(x) + x.

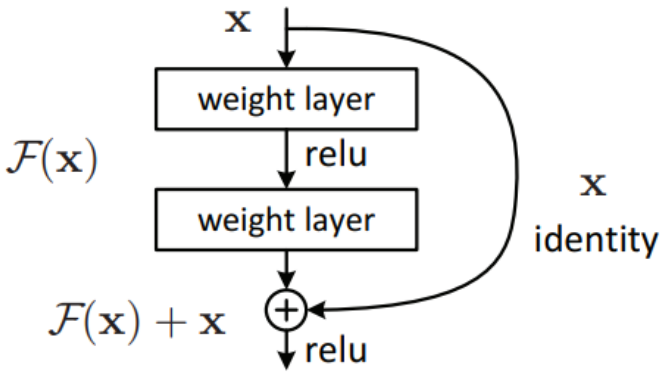


Fig. 3.7 Residual Block

Network Architecture:
This network uses a 34-layer plain network architecture inspired by VGG-19 in which then the shortcut connection is added. These shortcut connections then convert the architecture into residual network.

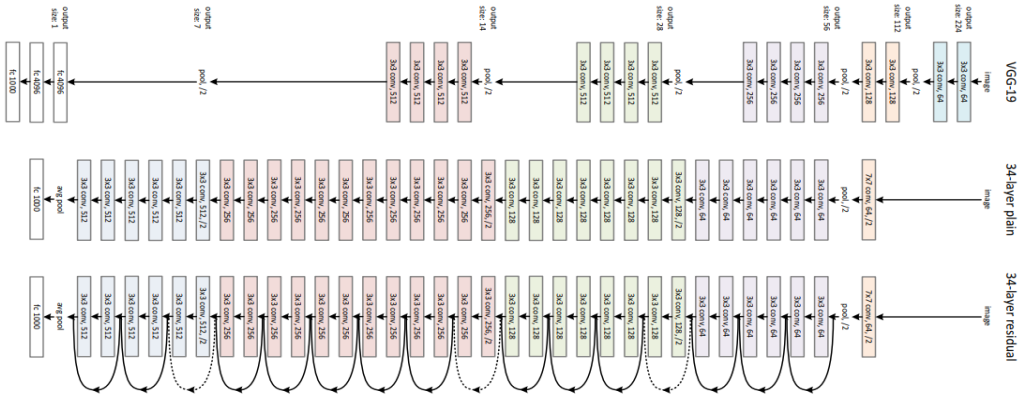


Fig. 3.8 ResNet Architecture

Inputs:

Here we have used labeled inputs to train over neural network model (ResNet). Input is data set of images which are refined and proper to get maximum accuracy of model. We have used ResNet50 which need image of the size 256×256. So, we used Torch Vision to resize image. There are six type of waste material classified.

DATASET TAKEN FOR TRAINING:

Our dataset includes images of different categories of waste such as cardboard images, paper, plastic, metal, glass, other trash images,etc

This includes:

Cardboard:- 403 images

Glass :- 501 images

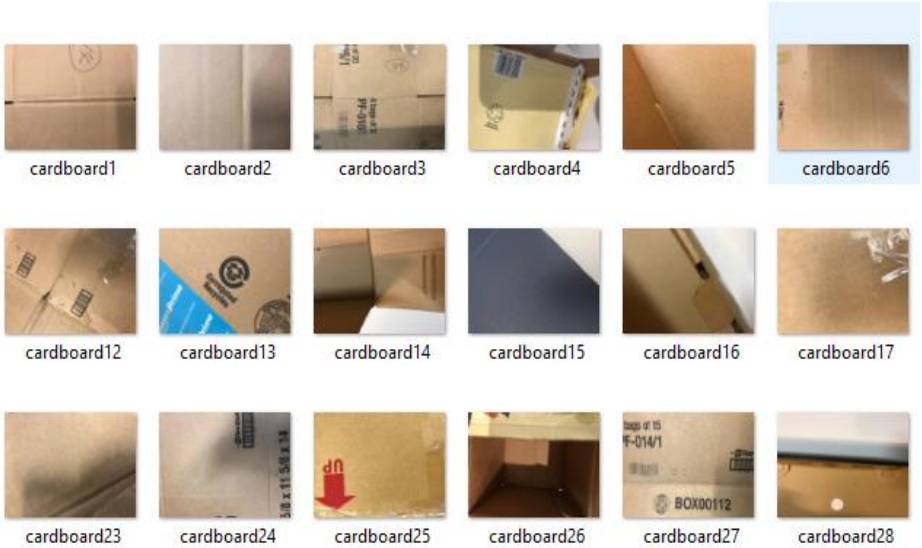
Metal:- 410 images

Paper:- 594 images

Plastic :- 492 images

Other Trash:- 137 images

Total around:- approximately 2500 images

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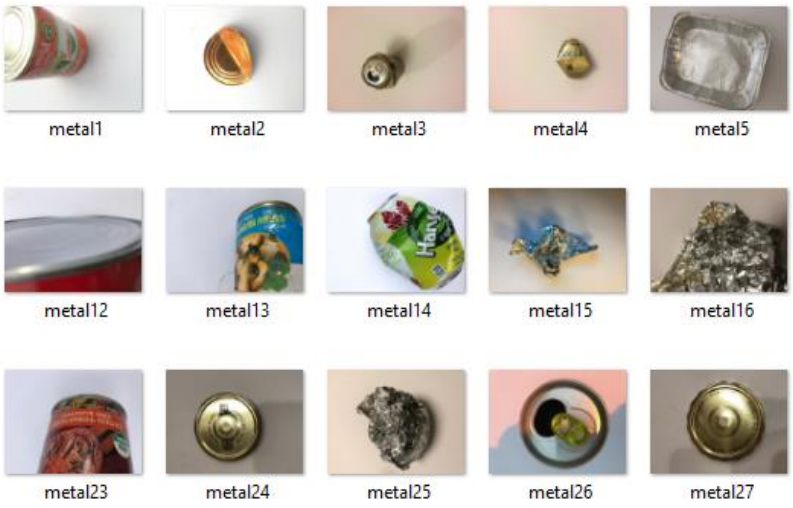
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CHAPTER 4

Results and Discussion

4.1 Results

```
[ ] def plot_accuracies(history):
        accuracies = [x['val_acc'] for x in history]
        plt.plot(accuracies, '-x')
        plt.xlabel('epoch')
        plt.ylabel('accuracy')
        plt.title('Accuracy vs. No. of epochs');

    plot_accuracies(history)
```

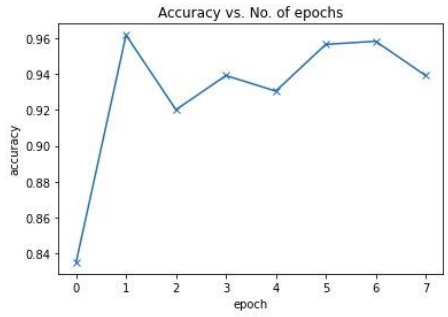


Fig. 4.1 Accuracy Vs Epochs

```
[ ] def plot_losses(history):
        train_losses = [x.get('train_loss') for x in history]
        val_losses = [x['val_loss'] for x in history]
        plt.plot(train_losses, '-bx')
        plt.plot(val_losses, '-rx')
        plt.xlabel('epoch')
        plt.ylabel('loss')
        plt.legend(['Training', 'Validation'])
        plt.title('Loss vs. No. of epochs');

    plot_losses(history)
```

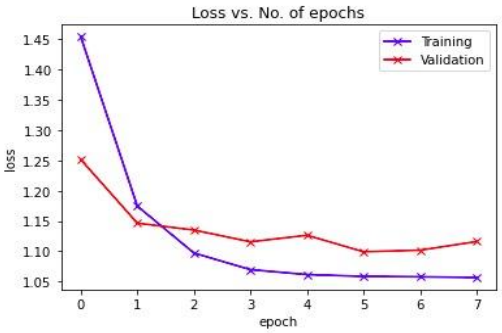


Fig. 4.2 Loss Vs No. of Epochs

Let's start training the model:

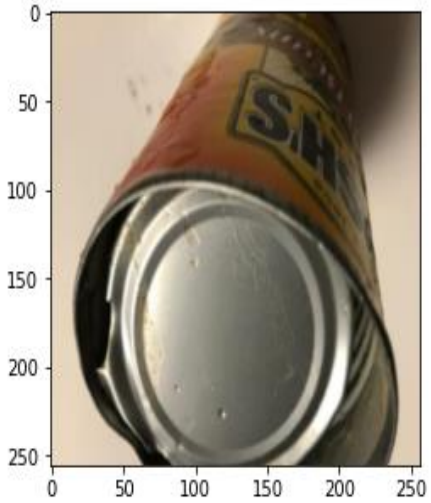
```
[ ] num_epochs = 8
    opt_func = torch.optim.Adam
    lr = 5.5e-5

    history = fit(num_epochs, lr, model, train_dl, val_dl, opt_func)
```

```
Epoch 1: train_loss: 1.4542, val_loss: 1.2516, val_acc: 0.8351
Epoch 2: train_loss: 1.1746, val_loss: 1.1465, val_acc: 0.9618
Epoch 3: train_loss: 1.0972, val_loss: 1.1351, val_acc: 0.9201
Epoch 4: train_loss: 1.0697, val_loss: 1.1157, val_acc: 0.9392
Epoch 5: train_loss: 1.0616, val_loss: 1.1265, val_acc: 0.9306
Epoch 6: train_loss: 1.0586, val_loss: 1.0992, val_acc: 0.9566
Epoch 7: train_loss: 1.0579, val_loss: 1.1019, val_acc: 0.9583
Epoch 8: train_loss: 1.0569, val_loss: 1.1161, val_acc: 0.9392
```

Fig. 4.3 Training

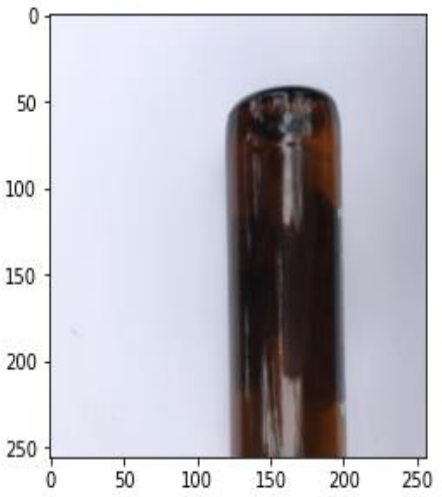
```
[ ] img, label = test_ds[17]
    plt.imshow(img.permute(1, 2, 0))
    print('Label:', dataset.classes[label], ', Predicted:', predict_image(img, model))
```

```
Label: metal , Predicted: metal
```



```
img, label = test_ds[23]
plt.imshow(img.permute(1, 2, 0))
print('Label:', dataset.classes[label], ', Predicted:', predict_image(img, model))
```

```
Label: glass , Predicted: glass
```



4.2 Discussions

We have learned about convolutional neural network in machine learning and we have also learned about how training a machine learning algorithm takes place. We have also learned about the requirements needed for training a deep learning algorithm along with languages like python and its libraries. We have also learned about multiple frameworks which are used or may be used in training and implementation of algorithms.

PROGRESS SO FAR….

So, after successfully creating our classification model using deep learning algorithm called CNN and using ResNet50 model to classify different waste articles, now we are trying to improve our classification model or classifier by collecting more images of waste articles so that it can predict the waste category more accurately.

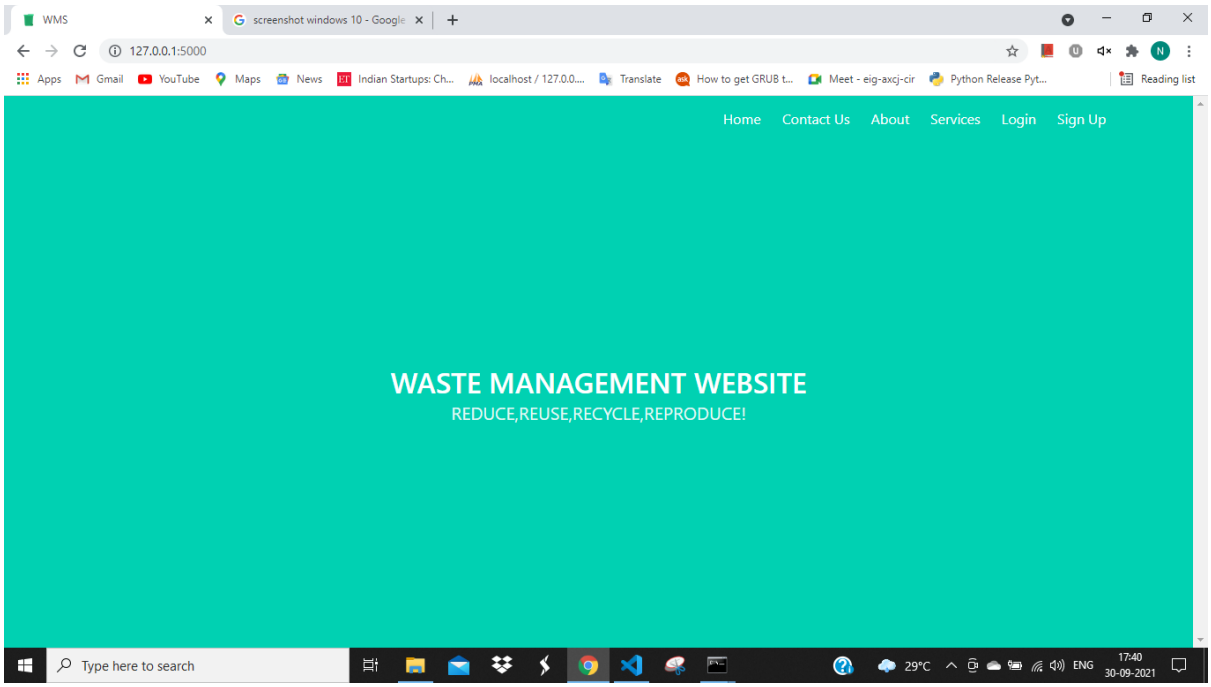
Besides collecting images, we have started to deploy our classification model on a web-based application using python framework called Flask which is full stack framework for web development.

We have successfully created an authentication system for our website so that the user can register and login/logout in into our site to use our classifier for waste classification.

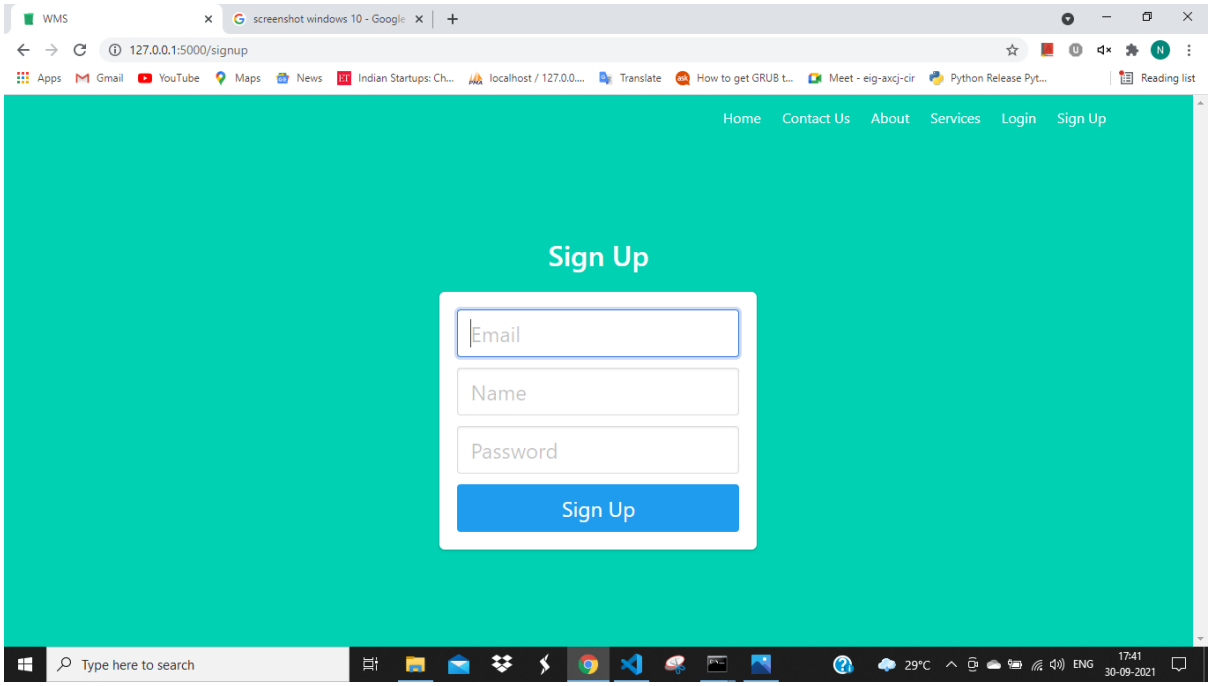
Also, we have created a web page for our classifier and in that we have started writing down the backend code to use our feature to upload an image by the user and to predict the result based on the waste category. The following slides contain screenshots of our site.

IMPLEMENTATION SCREENSHOTS: (WEB APP)

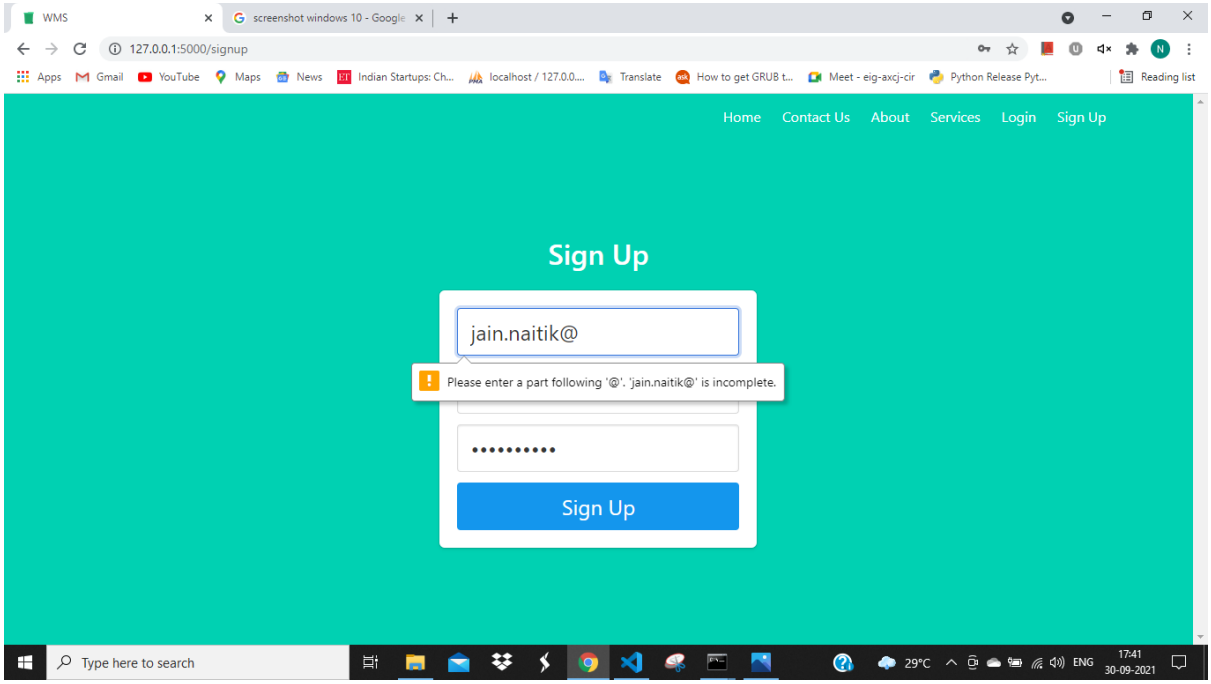
Home/Index page



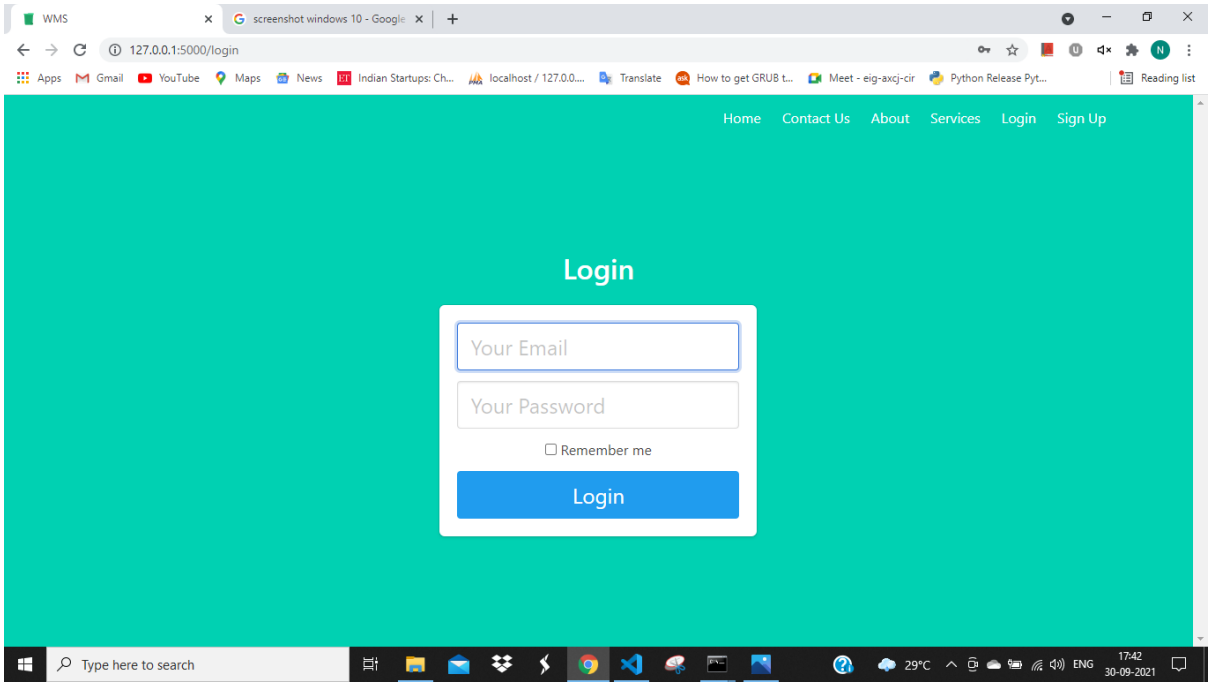
Sign-up/Register Page



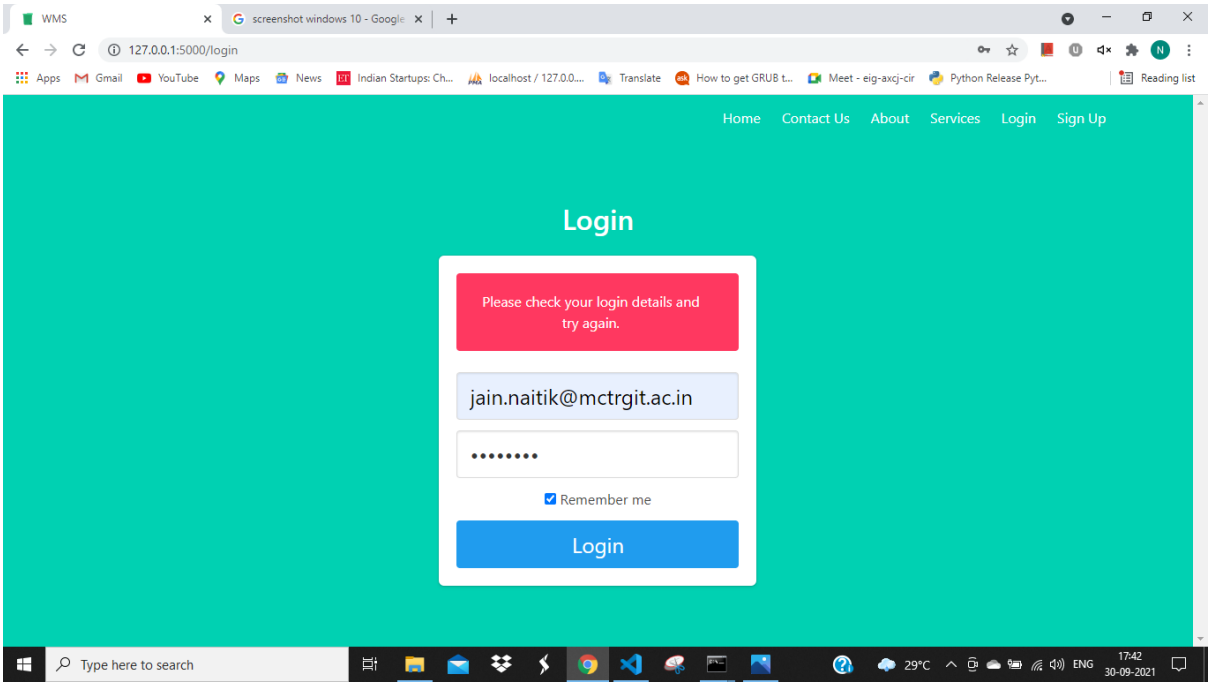
Invalid Details

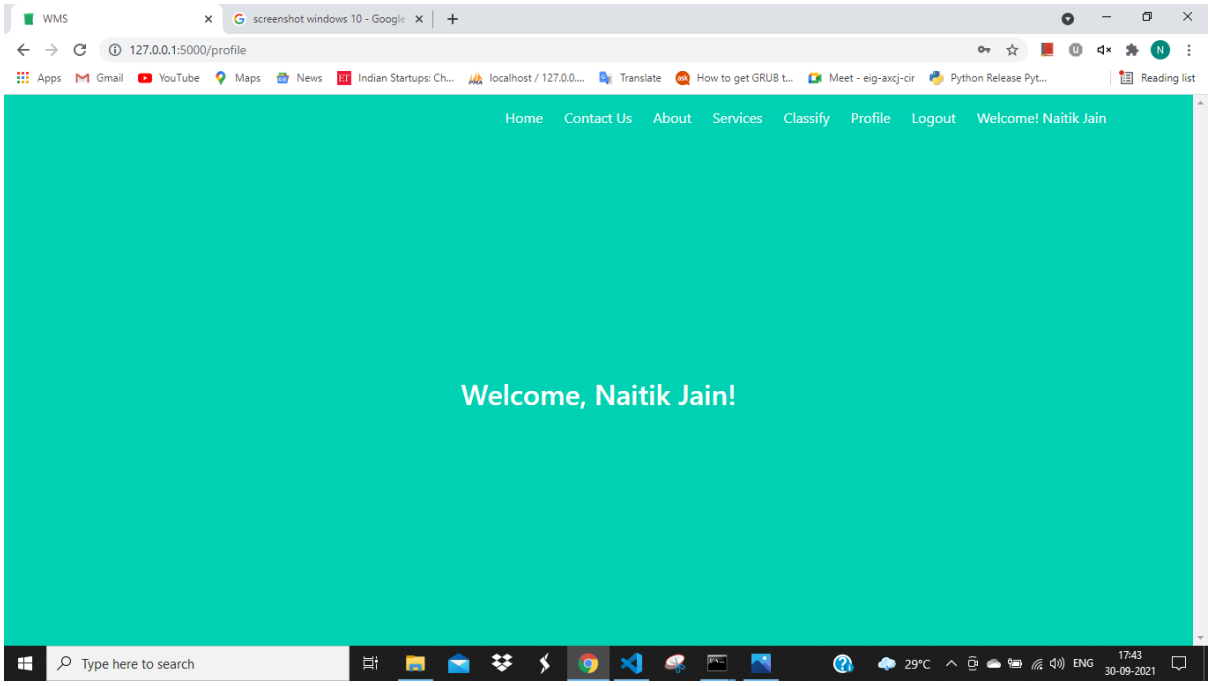


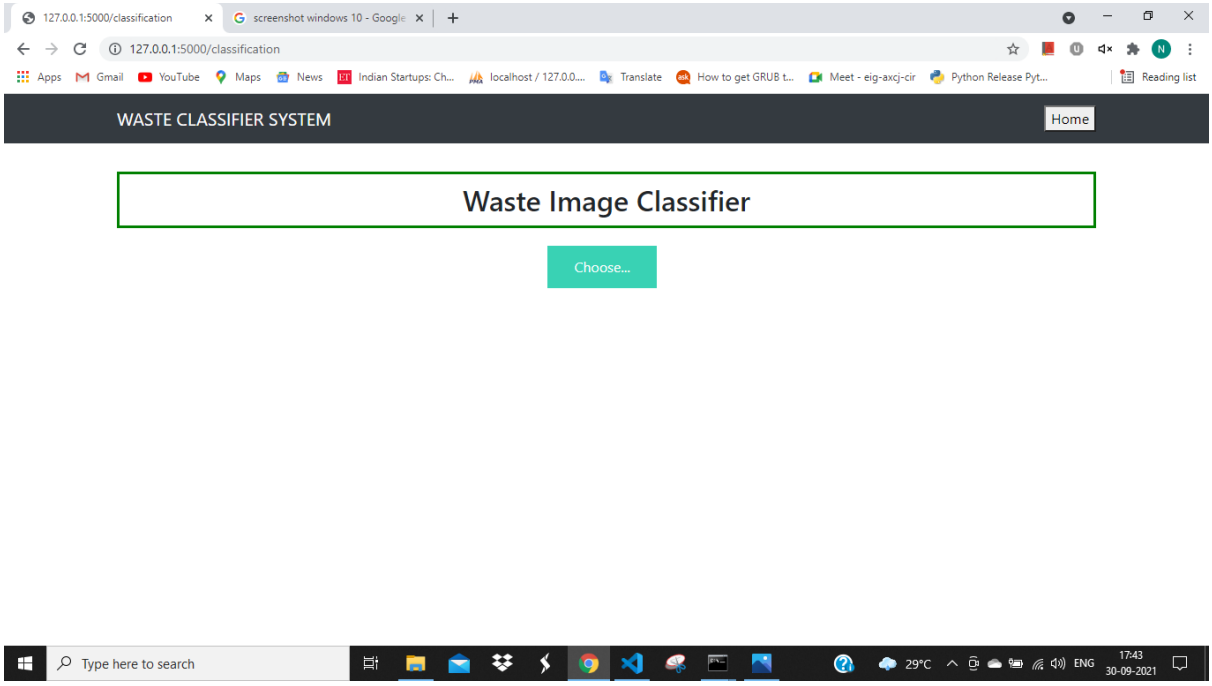
Login Page

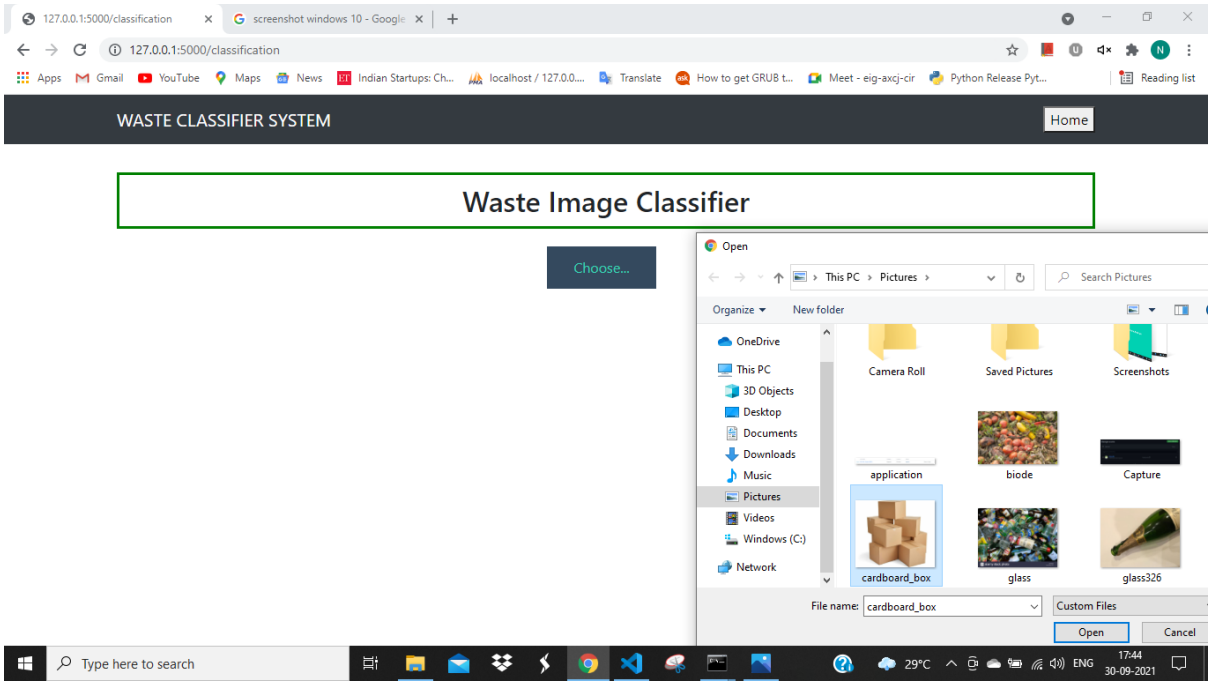


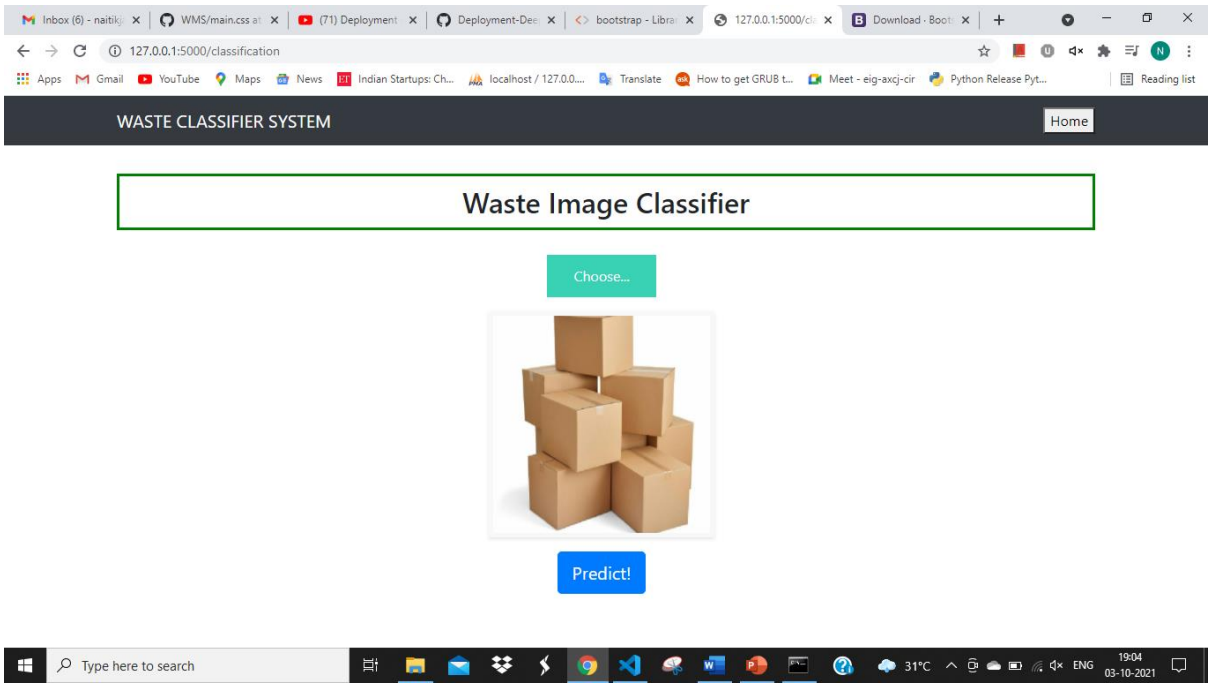
Invalid credentials

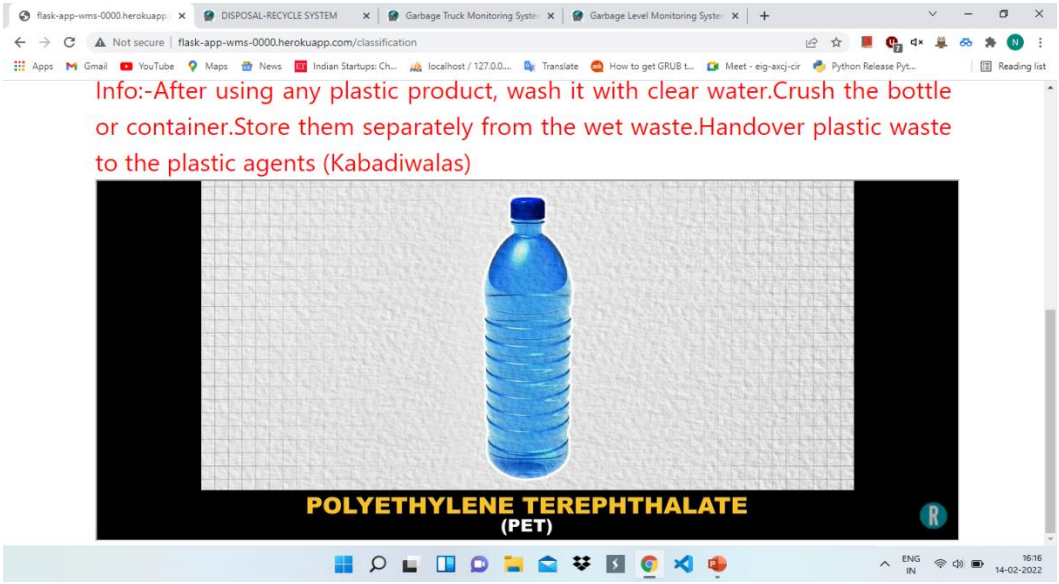



WMS
screenshot windows 10 - Google
127.0.0.1:5000/profile
Home
Contact Us
About
Services
Classify
Profile
Logout
Welcome! Naitik Jain
Welcome, Naitik Jain!
Type here to search


127.0.0.1:5000/classification
screenshot windows 10 - Google
127.0.0.1:5000/classification
WASTE CLASSIFIER SYSTEM
Home
Waste Image Classifier
Choose...
Type here to search


127.0.0.1:5000/classification
screenshot windows 10 - Google
127.0.0.1:5000/classification
WASTE CLASSIFIER SYSTEM
Home
Waste Image Classifier
Choose...
Open
This PC › Pictures ›
Search Pictures
Organize
New folder
OneDrive
This PC
3D Objects
Desktop
Documents
Downloads
Music
Pictures
Videos
Windows (C:)
Network
Camera Roll
Saved Pictures
Screenshots
application
biode
Capture
cardboard_box
glass
glass326
File name: cardboard_box
Custom Files
Open
Cancel
Type here to search
29°C
ENG
17:44
30-09-2021

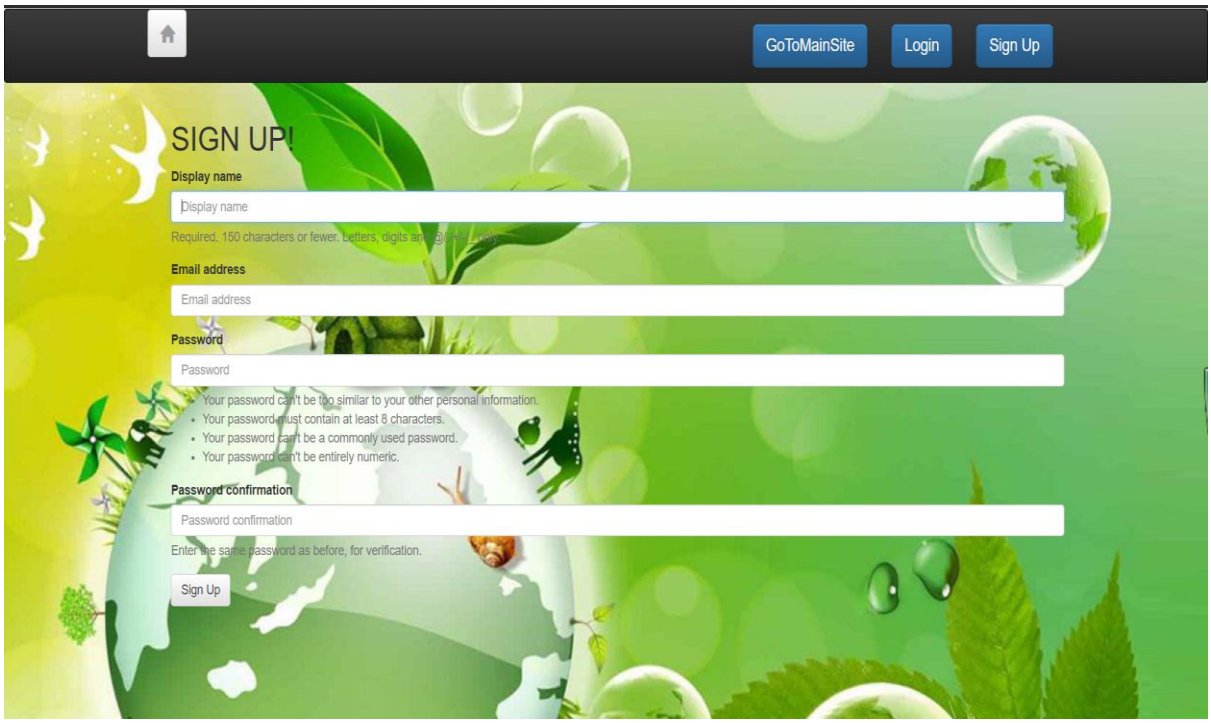

127.0.0.1:5000/classification
WASTE CLASSIFIER SYSTEM
Home
Waste Image Classifier
Choose...
Predict!
Type here to search
31°C
ENG
19:04
03-10-2021



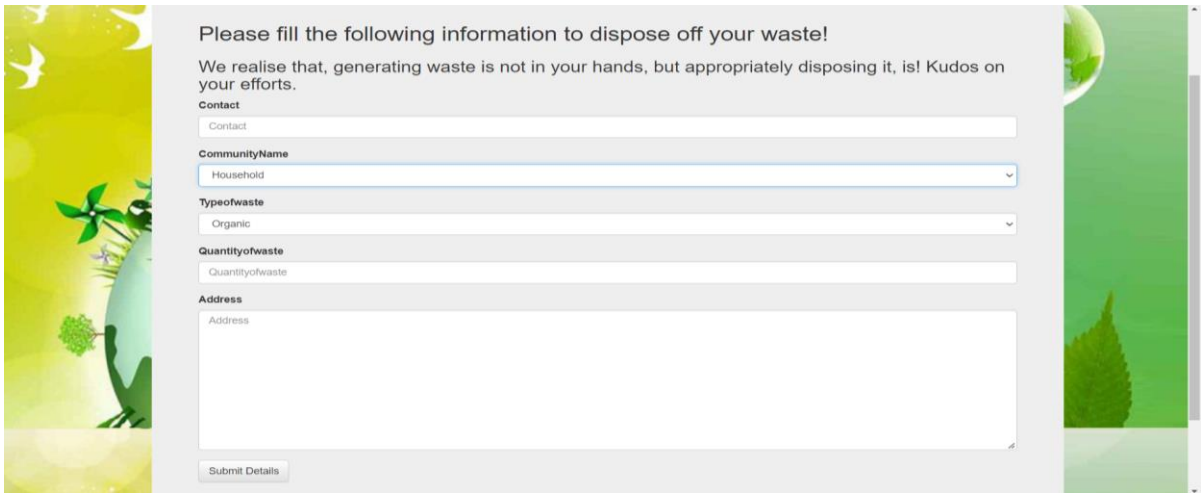
2) DISPOSAL-RECYCLE SYSTEM

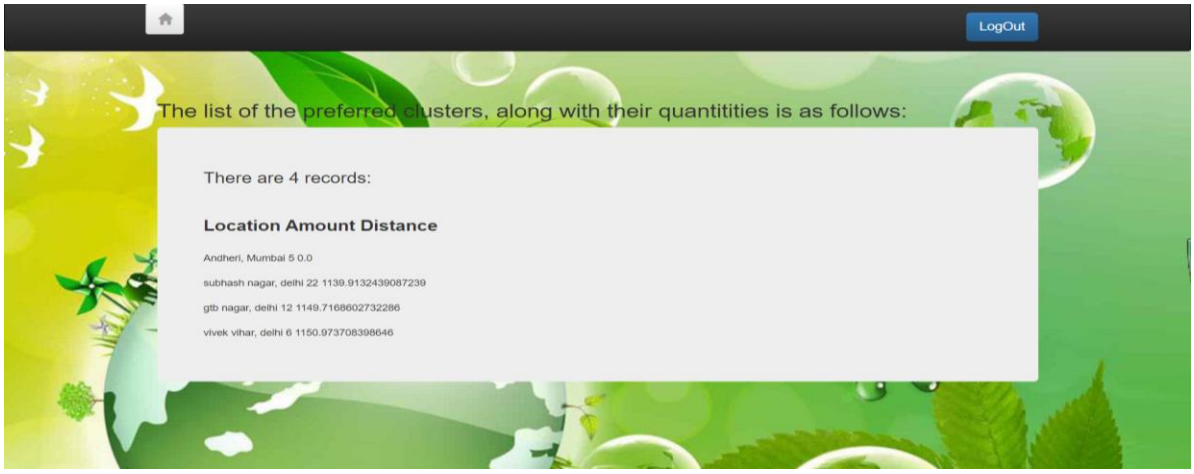
- The purpose of the system is to collection of waste from the user. The waste collected is divided in 5 Categories: Paper, Plastic, Organic, Glass, Metal. The users can submit the information regarding their waste so that it can be located by the recycler so as for collection.
- Utilization of Waste: The company now, uses the waste by amicably collecting it, profusely processing it and efficiently recycling it.

- Here our home page consists of Dispose and Recycle options, where the user can dispose or request waste.
- Along with this, we have also integrated a Chatbot which can help the user with basic queries.
- Here the user can fill out the information regarding the waste they have present to dispose off.
- This data is then stored in the database, where the collector can fetch it from.
- The collectors of waste can use this feature to know about the waste which they can procure.
- They can fill in the information, and then they will get results about the type of waste, the amount of waste and the distance.




LogOut
DISPOSAL-RECYCLE SYSTEM
Dispose Waste
Recycle Waste
Samarth_Assistant
An agent to help you solve all your doubts regarding Waste Management. Ask away!
POWERED BY Dialogflow
why recycle
Reduces the amount of waste sent to landfills and incinerators. Conserves natural resources such as timber, water and minerals. Increases economic security by tapping a domestic source of materials. Prevents pollution by reducing the need to collect new raw materials. Saves energy.
Ask something...


Please fill the following information to dispose off your waste!
We realise that, generating waste is not in your hands, but appropriately disposing it, is! Kudos on your efforts.
Contact
Contact
CommunityName
Household
Typeofwaste
Organic
Quantityofwaste
Quantityofwaste
Address
Address
Submit Details


LogOut
The list of the preferred clusters, along with their quantitities is as follows:
There are 4 records:
Location Amount Distance
Andheri, Mumbai 5 0.0
subhash nagar, delhi 22 1139.9132439087239
gtb nagar, delhi 12 1149.7168602732286
vivek vihar, delhi 6 1150.973708398646

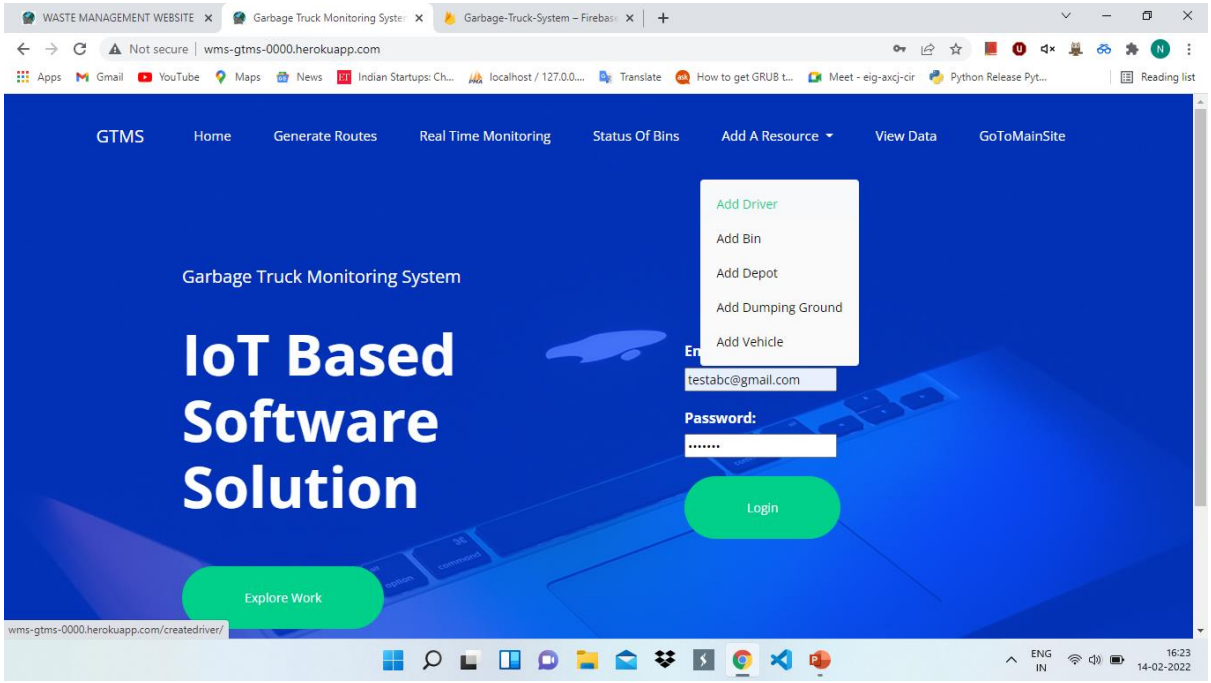
3) GARBAGE TRUCK MONITORING SYSTEM

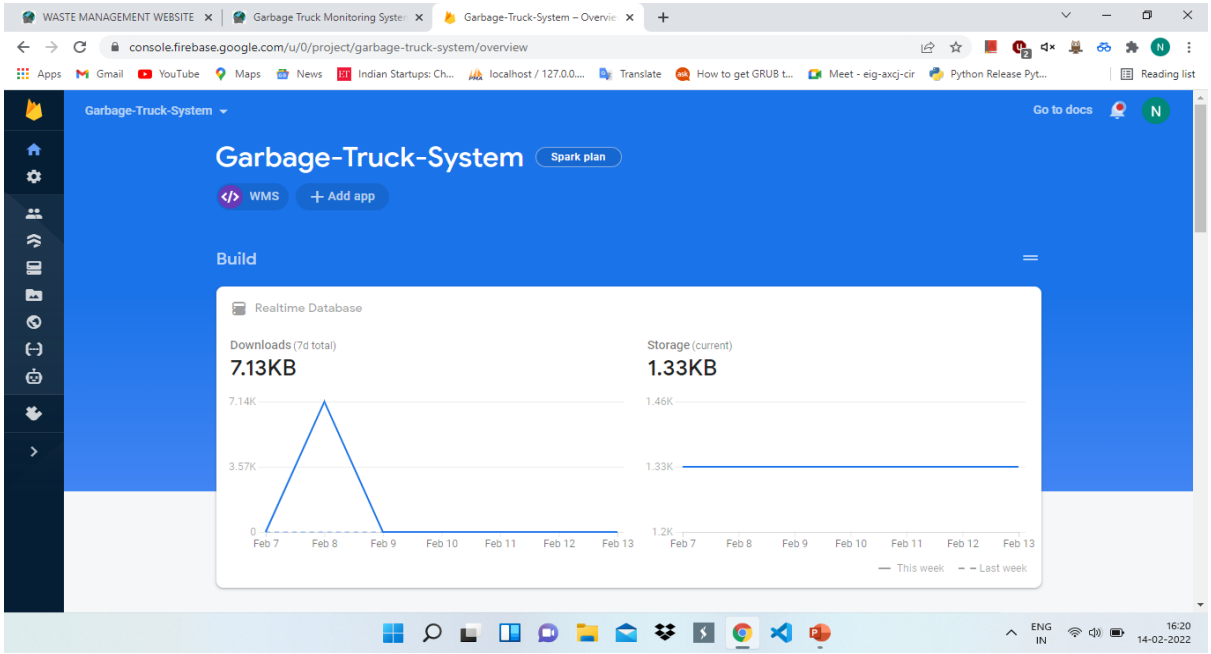
- Garbage Truck Monitoring System is a web-based application service which is used for automatic smart route generation for day-to-day garbage collection which minimizes the fuel consumption of garbage trucks by providing systematic routes on the basis of real time percentage level of garbage in the bins, capacity of trucks, road feasibility.
- Garbage Truck Monitoring System is a role-based system having three roles admin, driver and a citizen. Admin has a dashboard from which admin can add resources such as drivers, bins, depot, dumping ground and vehicles. Admin will have facility of viewing the current data in the system and monitor the drivers in real time.

❖ FEATURES

- 1) Add resources
- 2) Add Driver
- 3) Add Bin
- 4) Add Depot
- 5) Add Dumping Ground
- 6)Add Vehicle
- 7)Generate Routes

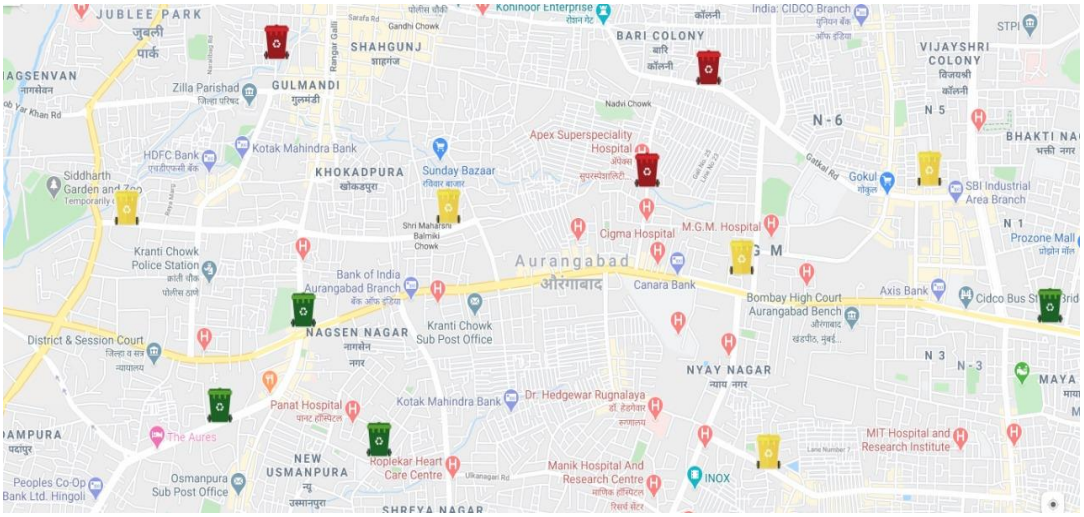
- ❑ 8)Real Time Monitoring
- ❑ 9)Status of Bins
- ❑ 10) View Data





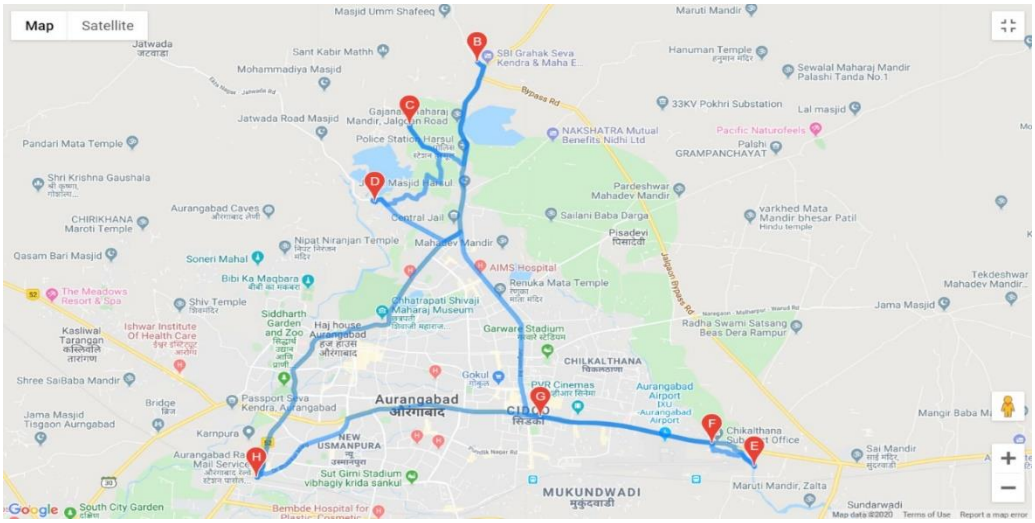
STATUS OF BINS

- The bin status will be shown to admin wherein bins are classified into three categories based on the level of garbage. Red, yellow and green bins represent overfilled bin, normally filled bin and underfilled bin respectively.

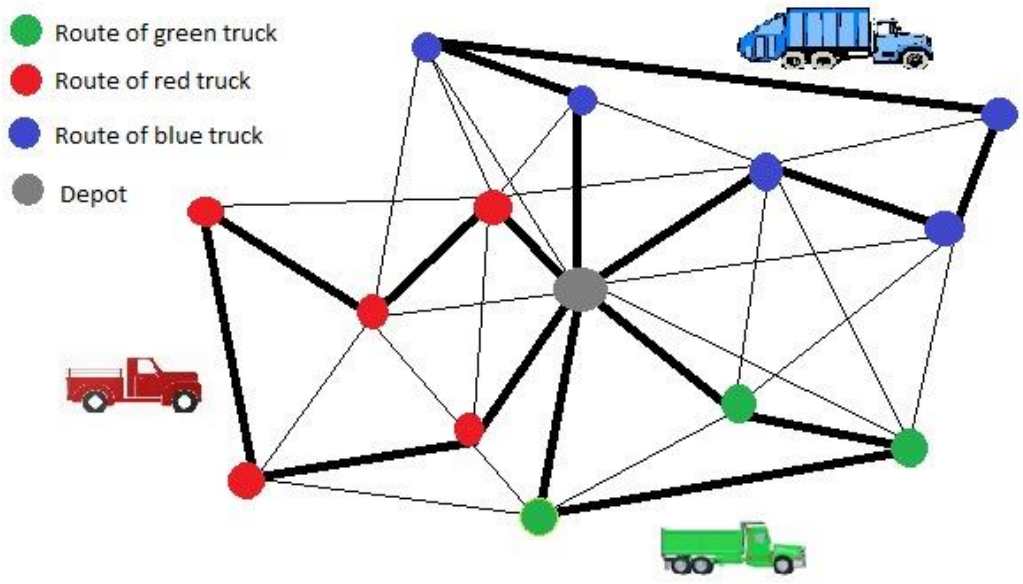


GENERATE ROUTES

- The routes will be generated using our algorithm which follows the approach followed by CVRP algorithm. Daily, routes will be generated taking into account the real time garbage level, capacity of vehicles, the distance between bins, etc. G Maps API provides an efficient way and real time distances according to the traffic parameter for the inputs.

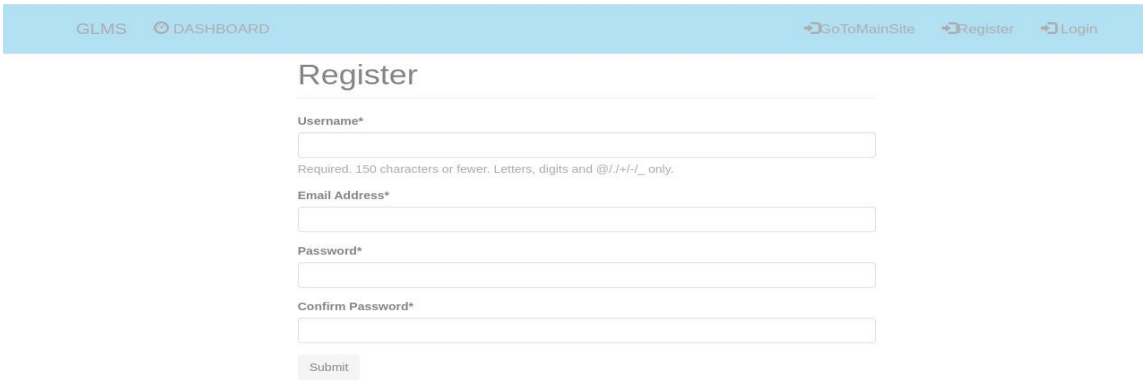


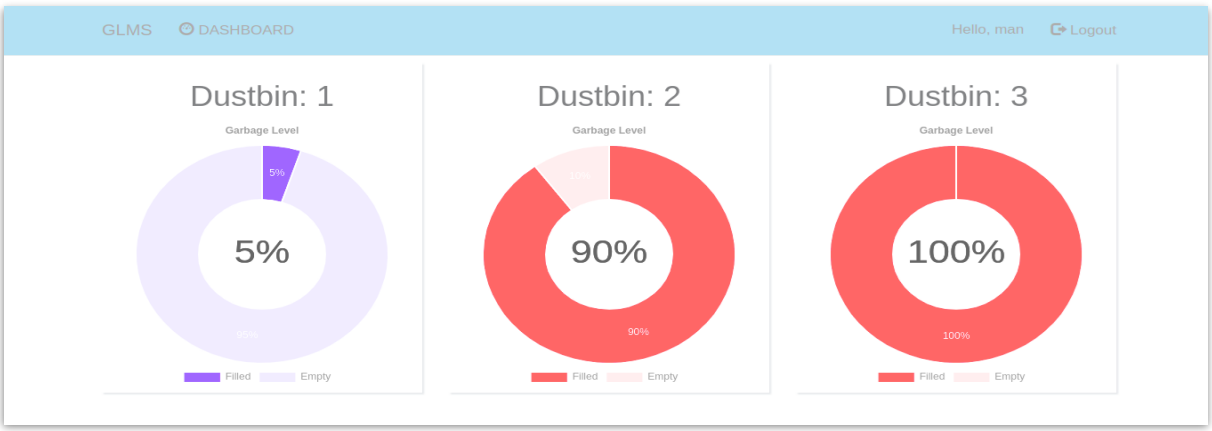
The visualization of CVRP is given as follows.



4) GARBAGE LEVEL MONITORING SYSTEM

- It is the application which will help municipalities to track the garbage level in particular Dustbin.
- It will show how much percent dustbin is filled in circular progress bar.
- The page will refresh every 10 sec, that mean we are getting live tracking of Dustbin.
- We can even find location of each dustbin by clicking on it.





Garbage level of different dustbin

Status of specific Dustbin

CHAPTER 5

CONCLUSION AND FUTURE WORK

- This kind of system is a step forward to make the existing system of waste management system easier by using technology. It is an efficient system which saves time, and due to it being automated, it provides a quick and easy solution.
- The classification of trash into various recycling categories is possible through machine learning and computer vision algorithms.
- Other services such as disposal-recycle system, garbage truck monitoring system, garbage level monitoring system when used as a combination of hardware such as IoT (Internet of Things) and software can help in improving the waste management techniques efficient and better in future.
- Thus, this kind of system can bring a revolutionary change in improving waste management across the globe and thus making our lives better for future generations.

- Thus, we are trying to implement a Model with Machine Learning to Classify Waste. Also, we have learned about convolutional neural network in machine learning and we have also learned about how training a machine learning algorithm takes place. We have also learned about the requirements needed for training a deep learning algorithm along with languages like python and its libraries. We have also learned about multiple frameworks which are used or may be used in training and implementation of algorithms.

- We are planning to deploy our classification model on a web-based application using python framework such as flask or similar technologies.

- We are also planning to provide an authentication system such as register/login/logout in our application so that user can login any-time and use our model conveniently.

- We also plan to create a contact us web page where user can mail his query or questions regarding the disposal of waste so that we can solve it as soon as possible.

- We aim to create a disposal system via waste generator and waste collector option so that it would be easy to collect the waste for disposal.

- We aim to provide a user-friendly/interactive system for our users.

- This kind of system is a step forward to make the existing system of classification easier by using technology. It is an efficient system which saves time, and due to it being automated, it provides a quick and easy solution.

- The classification of trash into various recycling categories is possible through machine learning and computer vision algorithms.

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Note: References should be written in IEEE format

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