# COAL CLASSIFICATION USING IBM WATSON

## 1. INTRODUCTION

### 1.1. Overview

In this project, we will be building a deep learning model that can classify four types of Coal. The most common classification is based on rank, referring to the degree of coalification that has occurred. The rank of a coal is determined primarily by the depth of burial and temperature to which the coal was subjected over time. A web application is integrated with the model, from where the user can upload a coal image like Anthracites, Bituminous, Lignite and Peat, and see the analyzed results on User Inter face.

### 1.2. Purpose

The purpose of coal classification is to identify various types of coal as accurately as possible.

## 2. LITERATURE SURVEY

### 2.1. Existing problem

In the process of using coal, if the type of coal cannot be accurately determined, it will have a significant impact on production efficiency, environmental pollution, and economic loss. At present, the traditional classification method of coal mainly relies on technician's experience. This requires a lot of manpower and time, and it is difficult to automate.

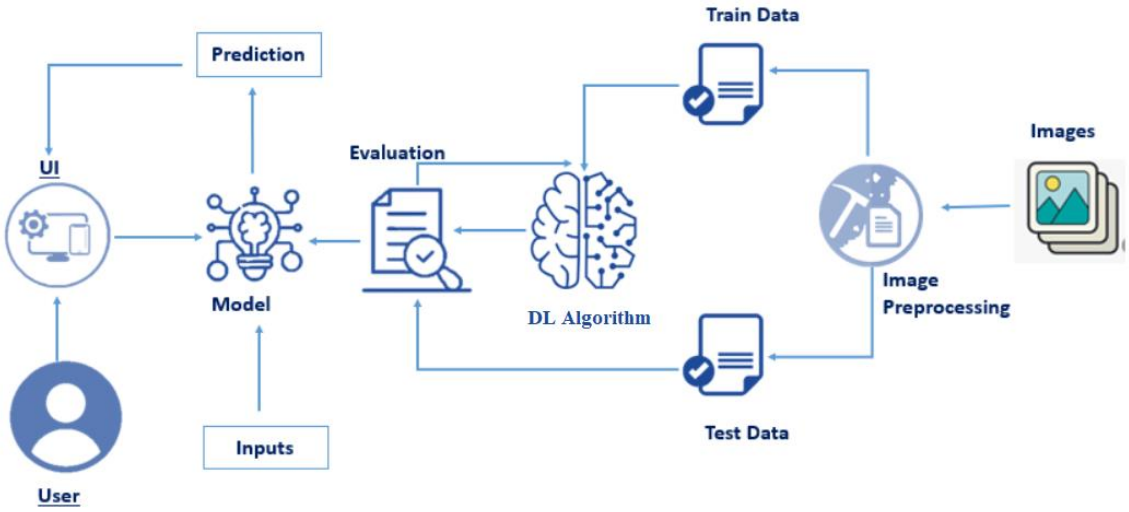
### 2.2. Proposed solution

In order to solve the problems for the accuracy of the classification system, we proposed a new classification model. First, based on the pretrained models, the models w ere fine-tuned with the public dataset

we used. Based on their performance, the best model was selected in order to further adjust the performance for high accuracy in classifying coals. After selecting the best model, the model was adjusted, and classification was conducted based on the modification of the network.

# 3. THEORITICAL ANALYSIS

## 3.1. Block diagram




## 3.2. Hardware/software design

**Software**

**Python packages:**

- Anaconda Navigator is a free and open-source distribution of the Python and R programming languages for data science and machine learning related applications. It can be installed on Windows, Linux, and macOS.Conda is an open-source, cross-platform, package management system. Anaconda comes with so very nice tools like JupyterLab, Jupyter Notebook,

  QtConsole, Spyder, Glueviz, Orange, Rstudio, Visual Studio Code. For this project, we will be using Jupyter notebook and Spyder

- NumPy : NumPy is a Python package that stands for 'Numerical Python. It is the core library for scientific computing, which contains a powerful n-dimensional array of objects.

- Pandas : pandas is a fast, powerful, flexible, and easy-to-use open-source data analysis and manipulation tool, built on top of the Python programming language.

- Keras: Keras is an open-source library that provides a Python interface for artificial neural networks. Keras acts as an interface for the TensorFlow library. Up until version 2.3, Keras supported multiple backends, including TensorFlow, Microsoft Cognitive Toolkit, R, Theano, and PlaidML. Designed to enable fast experimentation with deep neural networks, it focuses on being user-friendly, modular, and extensible.

- Scikit-learn is an open source data analysis library, and the gold standard for Machine Learning (ML) in the Python ecosystem. Key concepts and features include: Algorithmic decision-making methods, including: Classification: identifying and categorizing data based on patterns.

- TensorFlow: TensorFlow is just one part of a much bigger, and growing ecosystem of libraries and extensions that help you accomplish your machine learning goals. It is a free and open-source software library for data flow and differentiable programming across a range of tasks. It is a symbolic math library and is also used for machine learning applications such as neural networks.

- Flask: Web framework used for building Web applications

**Hardware**

**Device name :** DESKTOP-IQ3GDDO

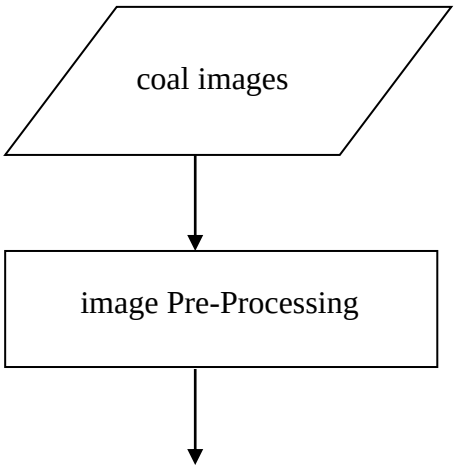
**Processor :** Intel(R) Pentium(R) CPU @ 2.30GHz  2.30 GHz

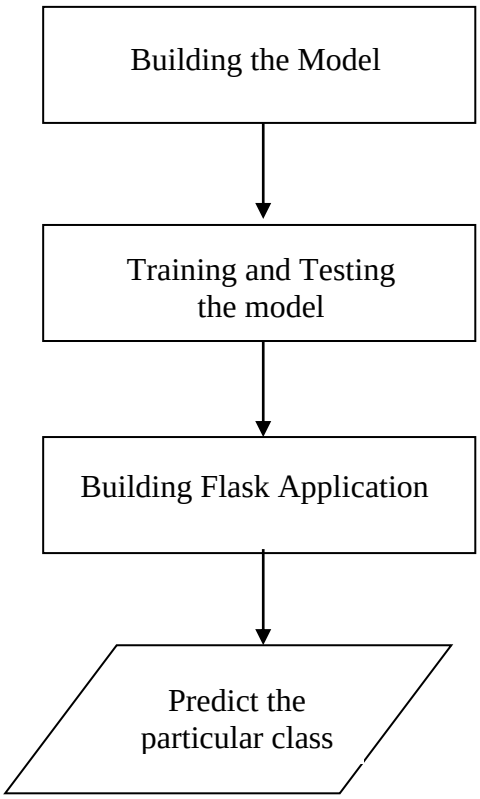
**System type** : 64-bit operating system, x64-based processor

## 4. EXPERIMENTAL INVESTIGATIONS

The images need to be organized before proceeding with the project. The original dataset has a single folder known as images. We will be using the train.csv file to fetch the image ID's of training images. Then we are creating subdirectories with in train folder and move images to them. The dataset images are to be pre-processed before giving to the model. We will create a function that uses the pre-trained VGG16 model for predicting custom classes. Then we have to test and train the model. After the model is build, we will be integrating it to a web application.

## 5. FLOWCHART






## 6. RESULT

The output of this project is if we are giving an image of coal then it will predict which category it belongs to.

## 7. CONCLUSION

This project was about classifying the coal. This project improved the performance of the classification model for classifying coals. The new proposed method achieved high accuracy compared with the other existing algorithms. It was compared with other existing algorithms in classifying different classes of coals and our proposed method achieved better results compared with the others.

## 8. FUTURE SCOPE

In future works, the proposed method will be improved in order to classify the coals.

## 9. BIBILOGRAPHY


- https://www.mdpi.com/2078-2489/12/8/302/htm
- http://cs229.stanford.edu/proj2017/final-reports/5244159.pdf


## 10. APPENDIX

```
import re
import numpy as np
import os
from flask import Flask, app,request,render_template
from tensorflow.keras import models
from tensorflow.keras.models import load_model
from tensorflow.keras.preprocessing import image
from tensorflow.python.ops.gen_array_ops import concat
#Loading the model
model=load_model(r"coall.h5")

app=Flask(__name__)



#default home page or route
@app.route('/')
def index():
    return render_template('index.html')

@app.route('/prediction.html')
def prediction():
    return render_template('prediction.html')

@app.route('/index.html')
def home():
    return render_template("index.html")

@app.route('/result',methods=["GET","POST"])
```

```
def res():
    if request.method=="POST":
        f=request.files['image']
        basepath=os.path.dirname(__file__) #getting the current path i.e where app.py is present
        #print("current path",basepath)
        filepath=os.path.join(basepath,'uploads',f.filename) #from anywhere in the system we can give image but we want that image later  to process so we are saving it to uploads folder for reusing
        #print("upload folder is",filepath)
        f.save(filepath)

        img=image.load_img(filepath,target_size=(128,128))
        x=image.img_to_array(img)#img to array
        x=np.expand_dims(x,axis=0)#used for adding one more dimension
        #print(x)
        prediction=model.predict(x)#instead of predict_classes(x) we can use predict(X) ---->predict_classes(x) gave error
        #print("prediction is ",prediction)
        index=["Anthracite","Bituminous","Lignite","Peat"]
        result=str(index[ prediction[0].tolist().index(1)])
        return render_template('prediction.html',prediction=result)



""" Running our application """
if __name__ == "__main__":
    app.run()
```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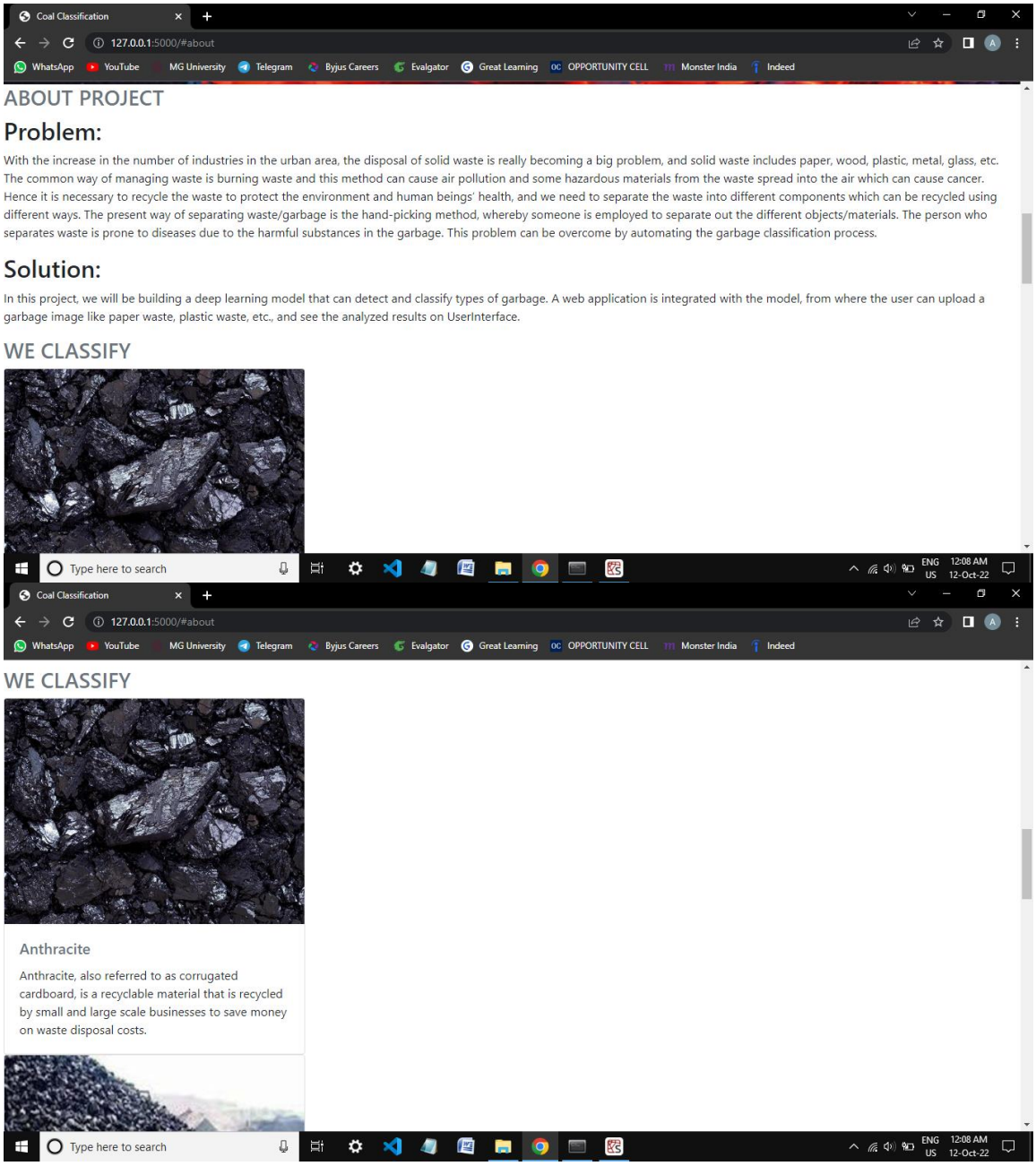
We Help You To Classify Coal
Stick with coal rather than getting nuked.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ABOUT PROJECT
Problem:
With the increase in the number of industries in the urban area, the disposal of solid waste is really becoming a big problem, and solid waste includes paper, wood, plastic, metal, glass, etc. The common way of managing waste is burning waste and this method can cause air pollution and some hazardous materials from the waste spread into the air which can cause cancer. Hence it is necessary to recycle the waste to protect the environment and human beings' health, and we need to separate the waste into different components which can be recycled using different ways. The present way of separating waste/garbage is the hand-picking method, whereby someone is employed to separate out the different objects/materials. The person who separates waste is prone to diseases due to the harmful substances in the garbage. This problem can be overcome by automating the garbage classification process.
Solution:
In this project, we will be building a deep learning model that can detect and classify types of garbage. A web application is integrated with the model, from where the user can upload a garbage image like paper waste, plastic waste, etc., and see the analyzed results on UserInterface.
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WE CLASSIFY
Anthracite
Anthracite, also referred to as corrugated cardboard, is a recyclable material that is recycled by small and large scale businesses to save money on waste disposal costs.
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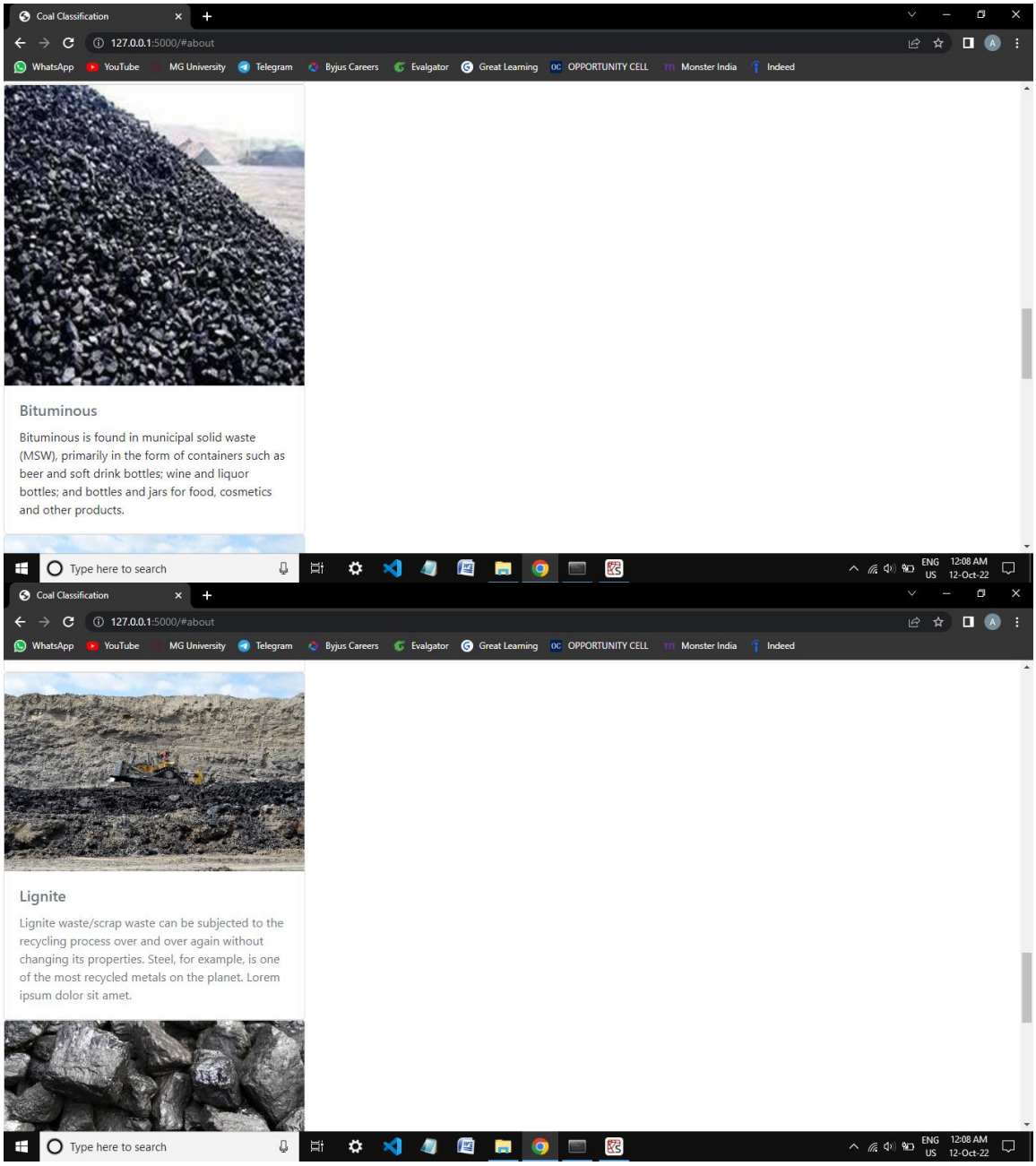
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Bituminous
Bituminous is found in municipal solid waste (MSW), primarily in the form of containers such as beer and soft drink bottles; wine and liquor bottles; and bottles and jars for food, cosmetics and other products.
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Lignite
Lignite waste/scrap waste can be subjected to the recycling process over and over again without changing its properties. Steel, for example, is one of the most recycled metals on the planet. Lorem ipsum dolor sit amet.
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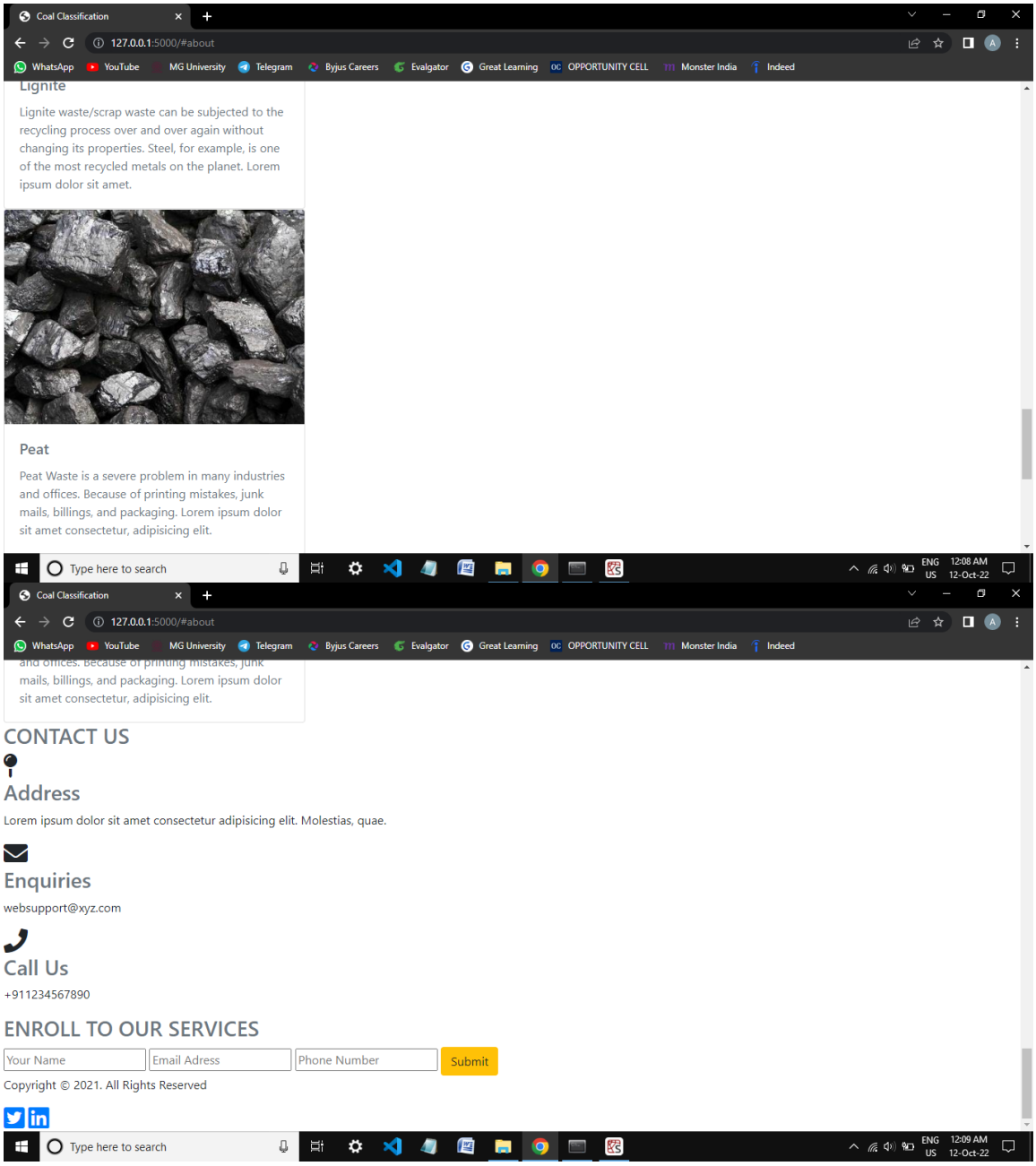
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Lignite
Lignite waste/scrap waste can be subjected to the recycling process over and over again without changing its properties. Steel, for example, is one of the most recycled metals on the planet. Lorem ipsum dolor sit amet.
Peat
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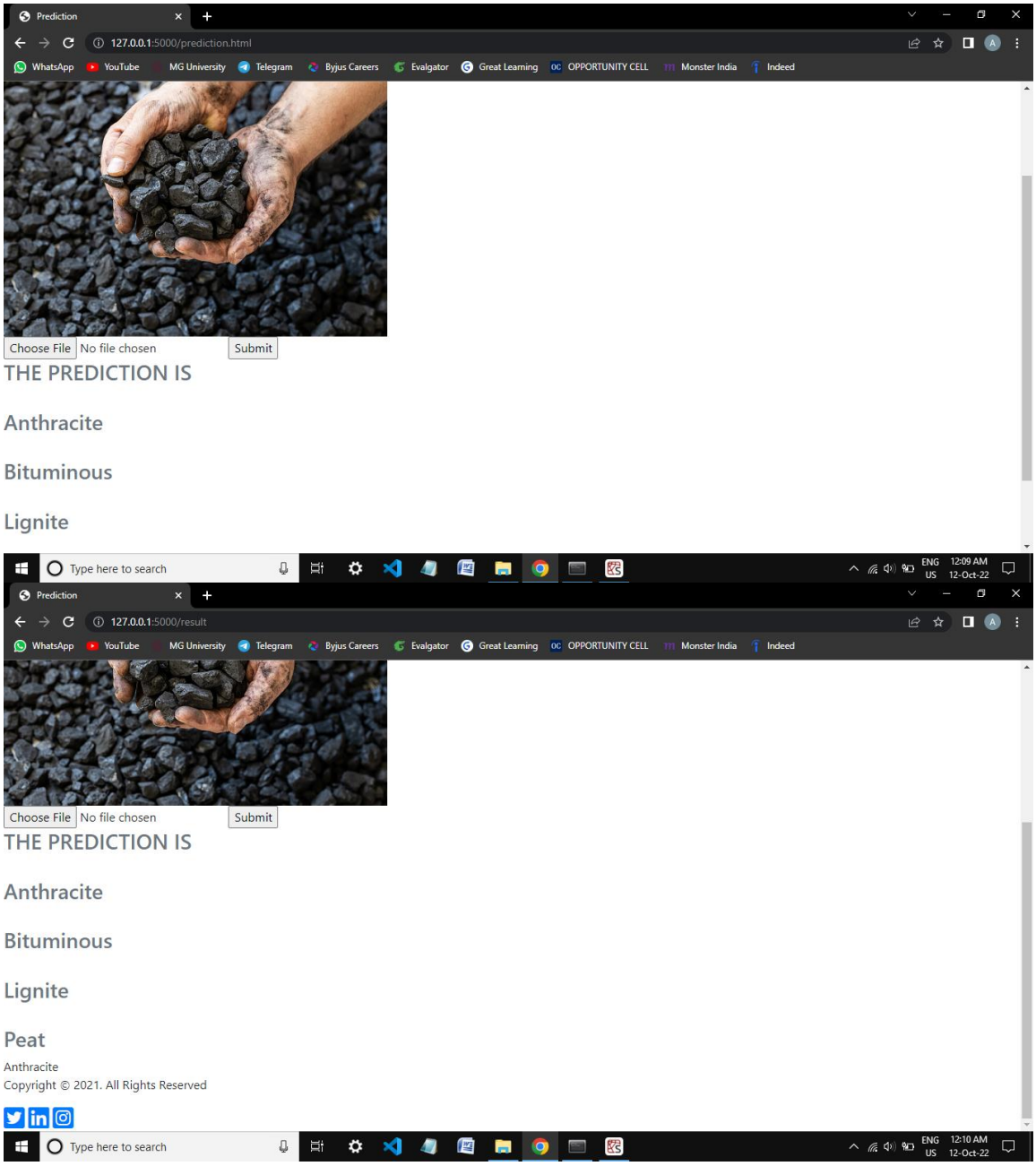
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