PROJECT REPORT

A GESTURE-BASED TOOL FOR STERILE BROWSING OF RADIOLOGY IMAGES

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1.INTRODUCTION :

1.1 Project Overview

- Interactive presentation systems use advanced Human Computer Interaction (HCI) techniques to provide a more convenient and user-friendly interface for controlling presentation displays, such as page up/down controls of x-rays and relayed images in the medical field .
- Compared with traditional mouse and the interface for human-machine keyboard control, new experience is significantly improved with these techniques.
- Hand gesture has wide- ranging applications. In this study, we apply it to an interactive presentation system to create an easy-to-understand interaction interface.
- The use of doctor-computer interaction devices in the operation room (OR) requires new modalities that support medical imaging manipulation while allowing doctors' hands to remain sterile. We are presenting "Gestix," a visionbased hand gesture capture and recognition system that interprets in real time the user's gestures for navigation and manipulation of images in an electronic medical record (EMR) database.
- "Gestix" was tested during a brain biopsy procedure. In the in vivo experiment, this interface prevented the surgeon's focus shift and change of location while achieving a rapid intuitive reaction and easy interaction.

2.LITERATURE SURVEY :

2.1 Existing Problem

- A major challenge involved is to provide Doctors with efficient, intuitive, accurate and safe means of interaction without affecting the quality of their work.
- However the use of computer keyboards and mouse by doctors in intensive care unit(ICU) is a common mean for spreading infections.
- We suggest the use of hand gestures in medical field as an alternative to the existing interface techniques by offering maximum level of sterility.

2.2 References

- Robust Part-Based Hand Gesture Recognition Using Kinect SensorZhou Ren, Junsong Yuan, Member, IEEE, Jingjing Meng, Member, IEEE, and Zhengyou Zhang, Fellow, IEEE, 15, AUGUST 2013.

- A Fast Gesture Recognition Scheme for Real-Time HumanMachine Interaction Systems . Ching-Hao Lai* Smart Network System Institute for Information Industry Taipei City, Taiwan , 2010.

- Intension, Context and Gesture Recognition for Sterile MRI Navigation in the Operating Room by Agency for Healthcare Research and Quality (AHRQ)

- Hand Gestures Recognition Using Radar Sensors for Human-ComputerInteraction Supported by the Bio ad Medical Technology Development Program of the National Research Foundation(NRF)

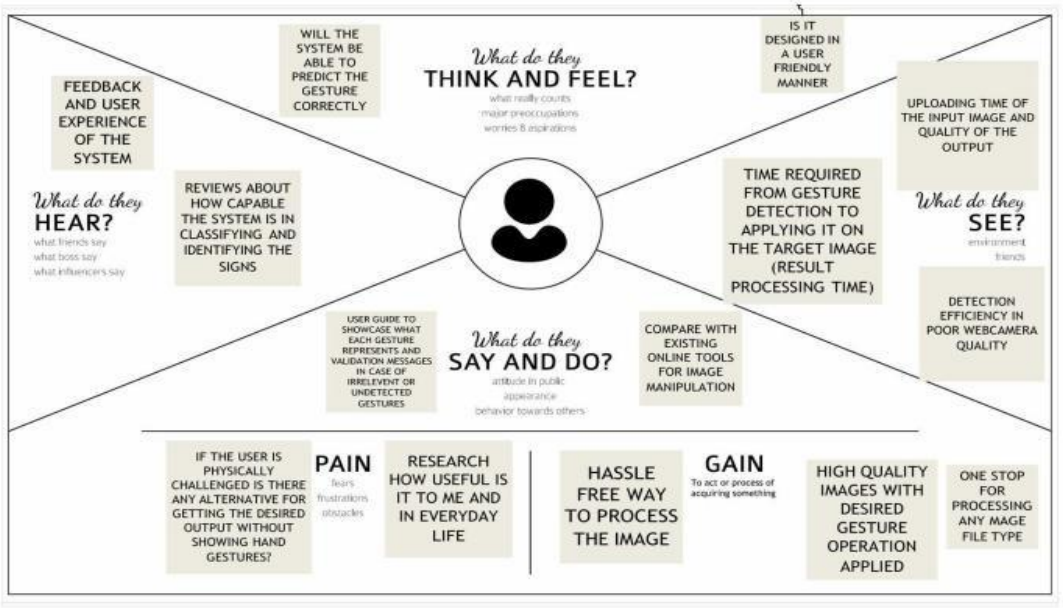
- A Preliminary Study of Kinect-Based Real-Time Hand Gesture Interaction Systems for Touchless Visualizations of Hepatic Structures in Surgery by Medical Imaging and Information Sciences, Jiaqing LIU, Tomoko Tateyama.
- Vision Based Hand Gesture Recognition by World Academy of Science, Engineering and Technology, Pragati Garg, Naveen Aggarwal, Sanjeev Sofat

2.3 Problem Statement Definition

- A major challenge involved is to provide Doctors with efficient, intuitive, accurate and safe means of interaction without affecting the quality of their work. However the use of computer keyboards and mouse by doctors in intensive care unit(ICU) is a common mean for spreading infections.We suggest the use of hand gestures in medical field as an alternative to the existing interface techniques by offering maximum level of sterility.

3.IDEATION & PROPOSED SOLUTION :

3.1 Empathy Map Canvas



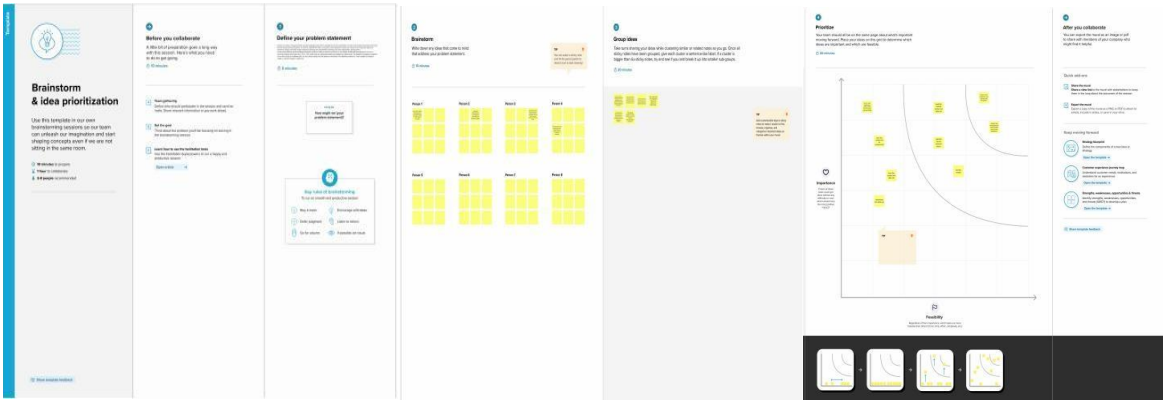
3.2 Ideation & Brainstorming

Brainstorming provides a free and open environment that encourages everyone within a team to participate in the creative thinking process that leads to problem solving. Prioritizing volume over value, out-of-the-box ideas are welcome and built upon, and all participants are encouraged to collaborate, helping each other develop a rich amount of creative solutions.

Step-1: Team Gathering, Collaboration and Select the Problem Statement.

Step-2: Brainstorm, Idea Listing and Grouping.

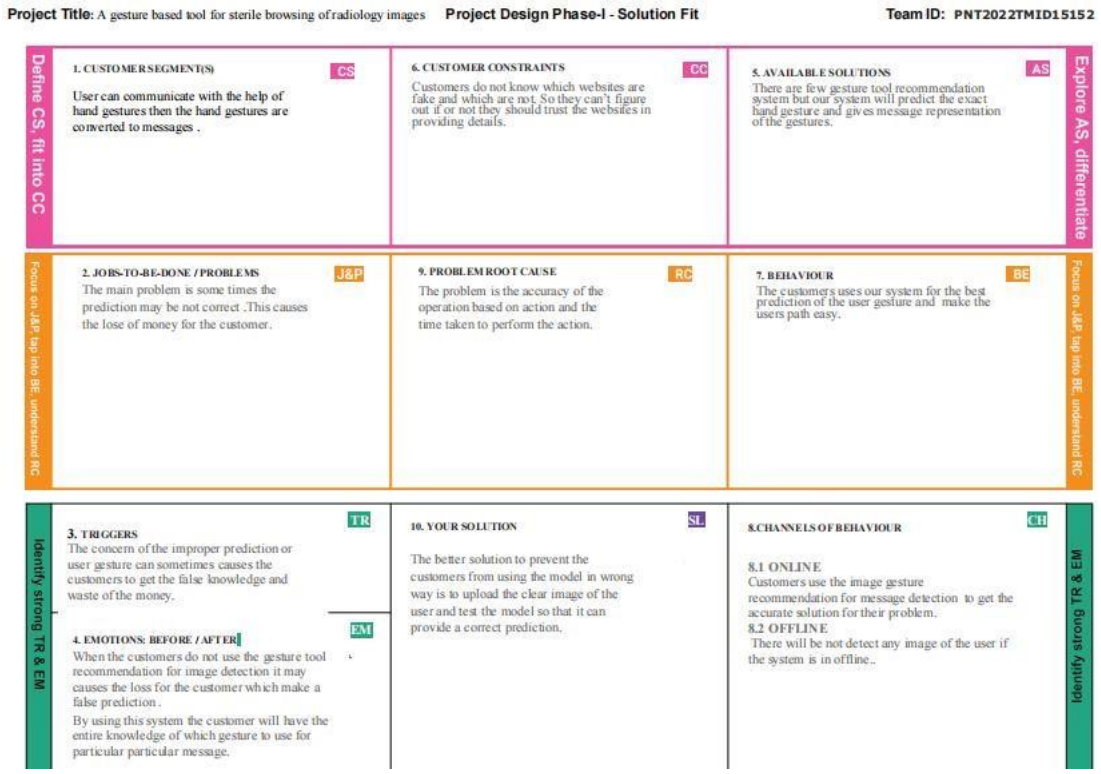
Step-3: Idea Prioritization.



3.3 Proposed Solution

- The interaction with interventional imaging systems within a sterile environment is a challenging task for physicians. Direct physician–machine interaction during an intervention is rather limited because of sterility and workspace restrictions.
- We propose a method of gesture-controlled projection display that enables a direct and natural physician–machine interaction during computed tomography (CT)-based interventions.
- Therefore, a graphical user interface is projected on a radiation shield located in front of the physician. Hand gestures in front of this display are captured and classified using a leap motion controller.
- We propose a gesture set to control basic functions of intervention software such as gestures for 2D image exploration, 3D object manipulation and selection. Our methods were evaluated in a clinically oriented user study with 12 participants.
- The results of the performed user study confirm that the display and the underlying interaction concept are accepted by clinical users. The recognition of the gestures is robust, although there is potential for improvements.
- The gesture training times are less than 10 min, but vary heavily between the participants of the study. The developed gestures are connected logically to the intervention software and intuitive to use.
- The proposed gesture-controlled projection display counters current thinking, namely it gives the radiologist complete control of the intervention software. It opens new possibilities for direct physician–machine interaction interventions most importantly during surgeries.

3.4 Problem Solution Fit



4.REQUIREMENT ANALYSIS :

4.1 Functional Requirements

Functional Requirements:

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	Launching the model	Launch the trained CNN model from the cloud
FR-2	Capturing the images	After capturing the images in camera we have to upload the images in the system
FR-3	Performing gestures	After classifying, identify the correct image by the gesture and it should perform the operation
FR-4	Model rendering	After capturing the image the algorithm will start its processing task
FR-5	Sterile browsing	The sterile browsing can be performed after identifying the gestures
FR-6	Visibility of images	After completing all the processes,a user can be able to see the images

4.2 Non - Functional Requirements

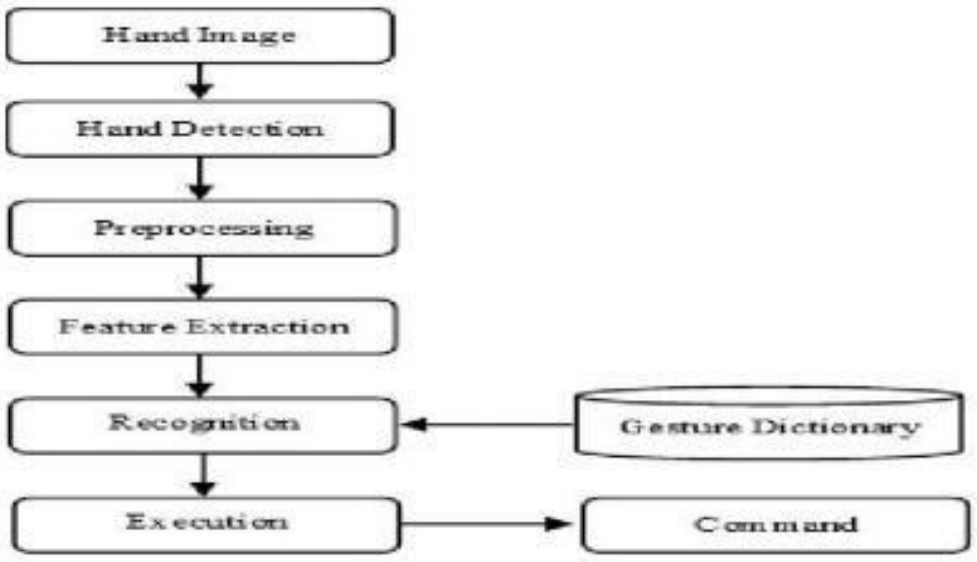
Non-functional Requirements:

Following are the non-functional requirements of the proposed solution.

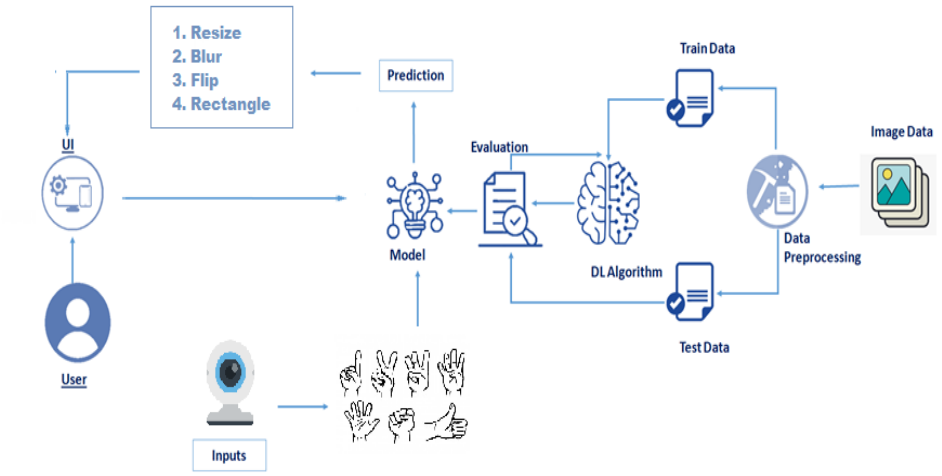
FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	This system helps to have the control over images without having direct contact with system which avoids the harmful rays and is ease of use
NFR-2	**Security**	This system is protected and only authorized users can access it
NFR-3	**Reliability**	After installing the application,the system will predict the gesture and performs sterile browsing
NFR-4	**Performance**	The system responds to a user in seconds and the hardware and software works well
NFR-5	**Availability**	It is accessible by authorised user from anywhere at any time whenever there is an emergency
NFR-6	**Scalability**	This system allows more number of users at a time and there is no loss can be identified

5.PROJECT DESIGN :

5.1 Data Flow Diagrams



5.2 Solution & Technical Architecture



5.3 User Stories

Use the below template to list all the user stories for the product.

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority
Customer (Mobile user)	Download the database	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	I can access my account / dashboard	High
	Register	USN-2	As a user, I can register for the application by entering my email, password, and confirming my password.	I can receive confirmation email & click confirm	High
	Login	USN-3	As a user, I will receive confirmation email once I have registered for the application	I can register & access the dashboard with Facebook Login	Low
	Upload the image	USN-4	As a user, I must upload the image to execute the command		High
Customer (Web user)	The functional requirements are same as mobile user	Same as mobile user	Same as mobile user	Same as mobile user	High when compared to mobile users

6. PROJECT PLANNING & SCHEDULING

6.1 Sprint Planning & Estimation

To accomplish the above task, you must complete the below activities and tasks:

1 .Collect the Image Data.

2 .Preprocess the collected images.

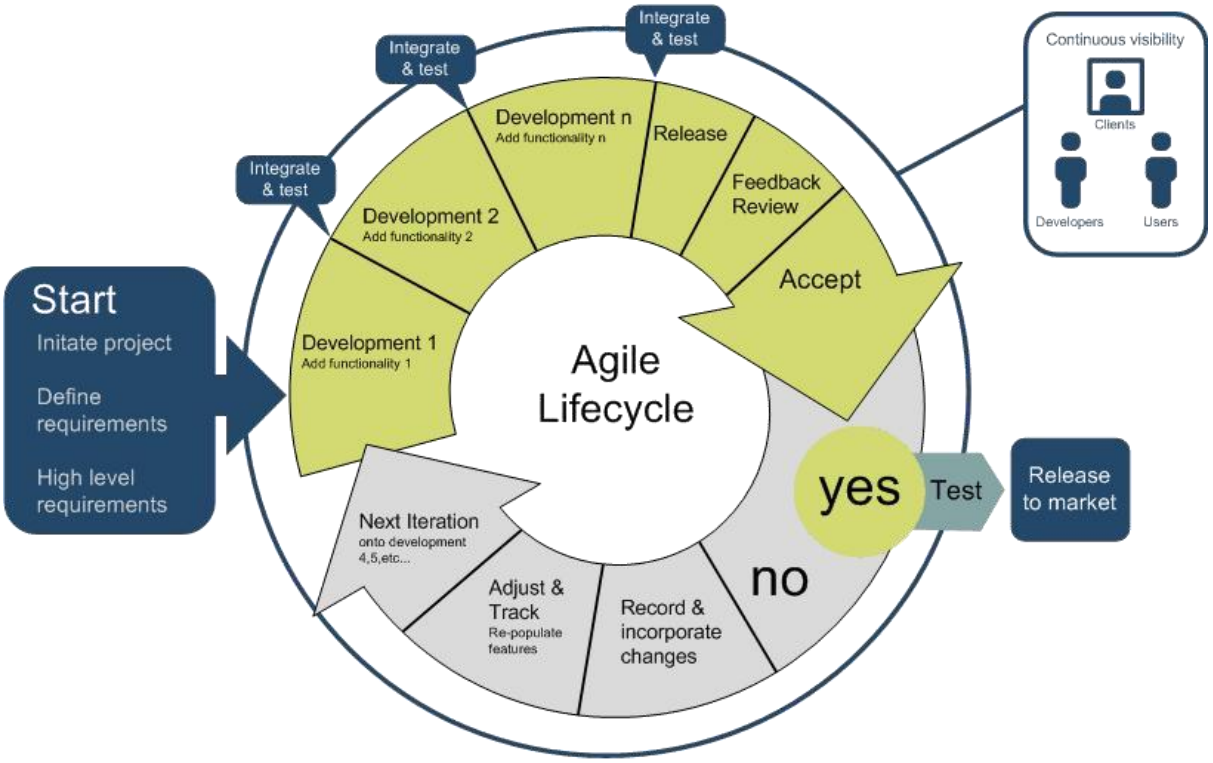
3.Train the model.
4.Test the model.

5 .Model is generated (gesture.h 5).

6.Apllication building using HTML & CSS.

7 .Form for uploading the image for prediction.

8 .Python flask for connecting Model and webpages.



6.2 Sprint Delivery Schedule Product Backlog, Sprint Schedule, and Estimation

Product Backlog, Sprint Schedule, and Estimation (4 Marks)

Use the below template to create product backlog and sprint schedule

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Model Building	USN-5	As a user, I need an AI model which could classify or recognize the hand gestures	10	Medium	AJITHA K M HARITHA S DHARSHINI V AARTHI V
Sprint-2	User Interface Building	USN-6	As a user, I need a web app for human computer interaction	10	Medium	AJITHA K M HARITHA S DHARSHINI V AARTHI V
Sprint-3	Deployment of webapp in the cloud	USN-3	As a user, I need the webapp to be accessible all over the world	10	Medium	AJITHA K M HARITHA S DHARSHINI V AARTHI V
Sprint-3	Deployment of AI model in the cloud	USN-4	As a user, I need the AI model to be accessible all over the world	10	Medium	AJITHA K M HARITHA S DHARSHINI V AARTHI V
Sprint-4	Launch Web App deployed in cloud	USN-1	As a user, I can launch the webapp where I can upload the images for recognition	20	High	AJITHA K M HARITHA S DHARSHINI V AARTHI V

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-4	Prediction	USN-2	As a user, I can get the predicted results from the model deployed in the cloud	20	High	AJITHA K M HARITHA S DHARSHINI V AARTHI V

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	10	6 Days	24 Oct 2022	29 Oct 2022	20	29 oct 2022
Sprint-2	10	6 Days	31 Oct 2022	05 Nov 2022	20	05 nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	12 nov 2022
Sprint-4	40	6 Days	14 Nov 2022	19 Nov 2022	20	19 nov 2022

7.CODING & SOLUTIONING :

7.1 Feature 1

1:IMAGE PREPROCESSING:

Import the ImagesDataGenerator Library:

```
from keras.preprocessing.image import ImageDataGenerator
```

Configure ImageDataGenerator Functionality To Trainset And Testset:

Image Data Agumentation

```
#setting parameter for Image Data agumentation to the traing data
train_datagen = ImageDataGenerator(rescale=1./255,shear_range=0.2,zoom_range=0.2,horizontal_flip=True)
#Image Data agumentation to the testing data
test_datagen=ImageDataGenerator(rescale=1./255)
```

Apply ImageDataGenerator Functionality To Trainset And Testset

```
x_train = traindatagen.flow_from_directory('Dataset/train',target_size=(64,64),batch_size=5,color_mode='grayscale',class_mode='ca
```

```
Found 594 images belonging to 6 classes.
```

```
x_test = testdatagen.flow_from_directory('Dataset/test',target_size=(64,64),batch_size=5,color_mode='grayscale',class_mode='categ
```

```
Found 30 images belonging to 6 classes.
```

2:MODEL BULIDING:

Importing The Model Building Libraries

```
from tensorflow.keras.preprocessing.image import ImageDataGenerator
from keras.models import Sequential
from keras.layers import Dense
from keras.layers import Conv2D
from keras.layers import MaxPooling2D
from keras.layers import Flatten
from tensorflow.keras.models import load_model
from tensorflow.keras.preprocessing import image
import numpy as np
```

Initializing The Model

```
In [31]: model = Sequential()
```

Adding CNN Layers

```
model.add(Conv2D(32, (3, 3), input_shape=(64, 64, 1), activation='relu'))
model.add(MaxPooling2D(pool_size=(2, 2)))
model.add(Conv2D(32, (3, 3), activation='relu'))
model.add(MaxPooling2D(pool_size=(2, 2)))
model.add(Flatten())
```

Adding Dense Layers

```
model.add(Dense(units=128,activation='relu'))
model.add(Dense(units=6,activation='softmax'))
```

```
model.summary()
```

```
Model: "sequential_1"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
conv2d_2 (Conv2D)            (None, 62, 62, 32)        320

max_pooling2d_2 (MaxPooling  (None, 31, 31, 32)        0
2D)

conv2d_3 (Conv2D)            (None, 29, 29, 32)        9248

max_pooling2d_3 (MaxPooling  (None, 14, 14, 32)        0
2D)

flatten_1 (Flatten)          (None, 6272)              0

dense_2 (Dense)              (None, 128)               802944

dense_3 (Dense)              (None, 6)                 774

=================================================================
Total params: 813,286
Trainable params: 813,286
Non-trainable params: 0
```

Configure The Learning Process

```
model.compile(optimizer='adam',loss='categorical_crossentropy',metrics=['accuracy'])
```

```
import tensorflow as tf
tf . print(tf. _version_)
```

Training Model

```
: model.fit_generator(generator=x_train,steps_per_epoch=len(x_train),epochs=20,
  validation_data=x_test,validation_steps=len(x_test))
```

```
Epoch 1/20
/tmp/ipykernel_70901/1633189495.py:1: UserWarning: `Model.fit_generator` is deprecated and will be removed in a fut
ure version. Please use `Model.fit`, which supports generators.
  model.fit_generator(generator=x_train,steps_per_epoch=len(x_train),epochs=20,
119/119 [==============================] - 1s 7ms/step - loss: 1.3736 - accuracy: 0.4259 - val_loss: 0.7573 - val_a
ccuracy: 0.6667
Epoch 2/20
119/119 [==============================] - 1s 7ms/step - loss: 0.6477 - accuracy: 0.7525 - val_loss: 0.7432 - val_a
ccuracy: 0.7667
Epoch 3/20
119/119 [==============================] - 1s 7ms/step - loss: 0.4472 - accuracy: 0.8131 - val_loss: 0.5949 - val_a
ccuracy: 0.8000
Epoch 4/20
119/119 [==============================] - 1s 7ms/step - loss: 0.4017 - accuracy: 0.8519 - val_loss: 0.5183 - val_a
ccuracy: 0.8667
Epoch 5/20
119/119 [==============================] - 1s 6ms/step - loss: 0.2610 - accuracy: 0.8990 - val_loss: 0.4658 - val_a
ccuracy: 0.9000
Epoch 6/20
119/119 [==============================] - 1s 7ms/step - loss: 0.2626 - accuracy: 0.9108 - val_loss: 0.2314 - val_a
ccuracy: 0.9000
Epoch 7/20
119/119 [==============================] - 1s 7ms/step - loss: 0.2177 - accuracy: 0.9226 - val_loss: 0.4094 - val_a
ccuracy: 0.9000
Epoch 8/20
119/119 [==============================] - 1s 7ms/step - loss: 0.1487 - accuracy: 0.9512 - val_loss: 0.4178 - val_a
ccuracy: 0.9333
Epoch 9/20
119/119 [==============================] - 1s 7ms/step - loss: 0.1261 - accuracy: 0.9529 - val_loss: 0.3710 - val_a
ccuracy: 0.9333
Epoch 9/20
119/119 [==============================] - 1s 7ms/step - loss: 0.1261 - accuracy: 0.9529 - val_loss: 0.3710 - val_a
ccuracy: 0.9333
Epoch 10/20
119/119 [==============================] - 1s 7ms/step - loss: 0.1235 - accuracy: 0.9529 - val_loss: 0.2879 - val_a
ccuracy: 0.9000
Epoch 11/20
119/119 [==============================] - 1s 7ms/step - loss: 0.0820 - accuracy: 0.9731 - val_loss: 1.2046 - val_a
ccuracy: 0.7000
Epoch 12/20
119/119 [==============================] - 1s 6ms/step - loss: 0.0780 - accuracy: 0.9731 - val_loss: 0.2134 - val_a
ccuracy: 0.9667
Epoch 13/20
119/119 [==============================] - 1s 7ms/step - loss: 0.1159 - accuracy: 0.9596 - val_loss: 0.3745 - val_a
ccuracy: 0.9000
Epoch 14/20
119/119 [==============================] - 1s 7ms/step - loss: 0.0644 - accuracy: 0.9731 - val_loss: 0.1958 - val_a
ccuracy: 0.9333
Epoch 15/20
119/119 [==============================] - 1s 7ms/step - loss: 0.0581 - accuracy: 0.9781 - val_loss: 0.4044 - val_a
ccuracy: 0.9000
Epoch 16/20
119/119 [==============================] - 1s 7ms/step - loss: 0.0992 - accuracy: 0.9697 - val_loss: 0.2571 - val_a
ccuracy: 0.9333
Epoch 17/20
119/119 [==============================] - 1s 7ms/step - loss: 0.0534 - accuracy: 0.9832 - val_loss: 0.3824 - val_a
ccuracy: 0.9667
Epoch 18/20
119/119 [==============================] - 1s 7ms/step - loss: 0.0410 - accuracy: 0.9815 - val_loss: 0.3097 - val_a
ccuracy: 0.9667
Epoch 19/20
119/119 [==============================] - 1s 7ms/step - loss: 0.0402 - accuracy: 0.9815 - val_loss: 0.3617 - val_a
ccuracy: 0.9667
Epoch 20/20
119/119 [==============================] - 1s 6ms/step - loss: 0.0281 - accuracy: 0.9933 - val_loss: 0.4102 - val_a
ccuracy: 0.9000
```

Save the Model

```
model.save('gesture.h5')
```

Test the Model

```
model_json = model.to_json()
```

```
with open('model-bw.json',"w") as json_file:
    json_file.write(model_json)
```

```
model = load_model('gesture.h5')
```

```
img = image.load_img('Dataset/test/2/3.jpg',grayscale=True,target_size=(64,64))
img
```

```
x = image.img_to_array(img)
x = np.expand_dims(x,axis=0)
pred = np.argmax(model.predict(x),axis=1)
pred
```

```
1/1 [==============================] - 0s 46ms/step
```

```
array([2])
```

```
index = ['0','1','2','3','4','5']
res = str(index[pred[0]])
res
```

```
'2'
```

7.2 Feature 2

- Let us build flask file ‘app.py’ which is a web framework written in python for server-side scripting. Let’s see step by step procedure for building the backend application.
- App starts running when “__name__” constructor is called in main.
- render_template is used to return html file.
- “GET” method is used to take input from the user.
- “POST” method is used to display the output to the user.

1:Importing Libraries

```
from tensorflow.keras.preprocessing.image import ImageDataGenerator
from keras.models import Sequential
from keras.layers import Dense
from keras.layers import Conv2D
from keras.layers import MaxPooling2D
from keras.layers import Flatten
from tensorflow.keras.models import load_model
from tensorflow.keras.preprocessing import image
import numpy as np
```

2:Creating our flask application and loading our model

```
app = Flask(__name__,template_folder="templates") # initializing a flask app
# Loading the model
model=load_model('gesture.h5')
print("Loaded model from disk")
```

3:Routing to the html page

```
@app.route('/')# route to display the home page
def home():
    return render_template('home.html')#rendering the home page


@app.route('/intro') # routes to the intro page
def intro():
    return render_template('intro.html')#rendering the intro page

@app.route('/image1',methods=['GET','POST'])# routes to the index html
def image1():
    return render_template("index6.html")
```

```
@app.route('/predict',methods=['GET', 'POST'])# route to show the predictions in a web UI
def launch():
```

And the predict route is used for prediction and it contains all the codes which are used for predicting our results.

- Firstly, inside launch function we are having the following things:
    - Getting our input and storing it ○
      Grab the frames from the web cam.
    - Creating ROI
    - Predicting our results
    - Showcase the results with the help ofopencv
    - Finally run the application
- Getting our input and storing it
  Once the predict route is called, we will check whether the method is POST or not if is POST then we will request the image files and with the help of os function we will be storing the image in the uploads folder in our local system.

```
if request.method == 'POST':
    print("inside image")
    f = request.files['image']

    basepath = os.path.dirname(__file__)
    file_path = os.path.join(basepath, 'uploads', secure_filename(f.filename))
    f.save(file_path)
    print(file_path)
```

- Grab the frames from the web cam

  Now when we run the code a web cam will be opening to take the gesture input so we will be capturing the frames of the gesture for predicting our results.

```
cap = cv2.VideoCapture(0)
while True:
    _, frame = cap.read() #capturing the video frame values
    # Simulating mirror image
    frame = cv2.flip(frame, 1)
```

- Creating ROI

  Aregion of interest (ROI)is a portion of an image that you want to filter or operate on in some way. The toolbox supports a set of ROI objects that you can use to create ROIs of many shapes, such circles, ellipses, polygons, rectangles, and hand-drawn shapes. ... A common use of an ROI is to create a binary mask image.

  So, we will be creating a ROI to mask our gesture.

```
# Got this from collect-data.py
# Coordinates of the ROI
x1 = int(0.5*frame.shape[1])
y1 = 10
x2 = frame.shape[1]-10
y2 = int(0.5*frame.shape[1])
# Drawing the ROI
# The increment/decrement by 1 is to compensate for the bounding box
cv2.rectangle(frame, (x1-1, y1-1), (x2+1, y2+1), (255,0,0) ,1)
# Extracting the ROI
roi = frame[y1:y2, x1:x2]

# Resizing the ROI so it can be fed to the model for prediction
roi = cv2.resize(roi, (64, 64))
roi = cv2.cvtColor(roi, cv2.COLOR_BGR2GRAY)
_, test_image = cv2.threshold(roi, 120, 255, cv2.THRESH_BINARY)
cv2.imshow("test", test_image)
```

- Predicting our results

  After placing the ROI and getting the frames from the web cam now its time to predict the gesture result using the model which we trained and stored it into a variable for the further operations.

```
result = model.predict(test_image.reshape(1, 64, 64, 1))
prediction = {'ZERO': result[0][0],
              'ONE': result[0][1],
              'TWO': result[0][2],
              'THREE': result[0][3],
              'FOUR': result[0][4],
              'FIVE': result[0][5]}
# Sorting based on top prediction
prediction = sorted(prediction.items(), key=operator.itemgetter(1), reverse=True)

# Displaying the predictions
cv2.putText(frame, prediction[0][0], (10, 120), cv2.FONT_HERSHEY_PLAIN, 1, (0,255,255), 1)
```

- Showcase the results with the help of opencv

  Finally according to the result predicted with our model we will be performing certain operations like resize, blur , rotate etc.

```
#loading an image
image1=cv2.imread(file_path)
if prediction[0][0]=='ONE':

    resized = cv2.resize(image1, (200, 200))
    cv2.imshow("Fixed Resizing", resized)
    key=cv2.waitKey(3000)

    if (key & 0xFF) == ord("1"):
        cv2.destroyWindow("Fixed Resizing")

elif prediction[0][0]=='ZERO':

    cv2.rectangle(image1, (480, 170), (650, 420), (0, 0, 255), 2)
    cv2.imshow("Rectangle", image1)
    cv2.waitKey(0)
    key=cv2.waitKey(3000)
    if (key & 0xFF) == ord("0"):
        cv2.destroyWindow("Rectangle")

elif prediction[0][0]=='TWO':
    (h, w, d) = image1.shape
    center = (w // 2, h // 2)
    M = cv2.getRotationMatrix2D(center, -45, 1.0)
    rotated = cv2.warpAffine(image1, M, (w, h))
    cv2.imshow("OpenCV Rotation", rotated)
    key=cv2.waitKey(3000)
    if (key & 0xFF) == ord("2"):
        cv2.destroyWindow("OpenCV Rotation")

elif prediction[0][0]=='THREE':
    blurred = cv2.GaussianBlur(image1, (11, 11), 0)
    cv2.imshow("Blurred", blurred)
    key=cv2.waitKey(3000)
    if (key & 0xFF) == ord("3"):
        cv2.destroyWindow("Blurred")
else:
    continue
```

```
        interrupt = cv2.waitKey(10)
        if interrupt & 0xFF == 27: # esc key
            break


    cap.release()
    cv2.destroyAllWindows()
return render_template("home.html")
```

RUN THE APPLICATION:

At last, we will run our flask application

```
if __name__ == "__main__":
   # running the app
    app.run(debug=False)
```

Run The app in local browser

- Open anaconda prompt from the start menu ● Navigate to the folder where your python script is.
- Now type “python app.py” command
- Navigate to the localhost where you can view your web page

```
(base) E:\>cd E:\PROJECTS\number-sign-recognition\Flask

(base) E:\PROJECTS\number-sign-recognition\Flask>python app.py
```

Then it will run on localhost:5000

```
* Serving Flask app "app" (lazy loading)
* Environment: production
  WARNING: This is a development server. Do not use it in a production deployment.
  Use a production WSGI server instead.
* Debug mode: off
* Running on http://127.0.0.1:5000/ (Press CTRL+C to quit)
```

Navigate to the localhost (http://127.0.0.1:5000/)where you can view your web page.

8.TESTING :

8.1 Test Cases

Security	1	0	0	1
Outsource Shipping	0	0	0	0
Exception Reporting	1	0	0	1
Final Report Output	1	0	0	1
Version Control	1	0	0	1

8.2 User Acceptance Testing

1. Purpose of Document

The purpose of this document is to briefly explain the test coverage and open issues of the AI-based A Gesture-based Tool for Sterile Browsing of Radiology Image project at the time of the release to User Acceptance Testing (UAT).

2. Defect Analysis

they were resolved

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	1	0	0	0	1
Duplicate	4	1	3	0	8
External	1	3	0	0	4
Fixed	2	4	4	2	12
Not Reproduced	0	0	0	1	1
Skipped	0	0	0	0	0
Won't Fix	0	0	0	0	0
Totals	8	8	4	2	22

This report shows the number of resolved or closed bugs at each severity level, and how

9.RESULTS :

9.1 Performance Matrics

Locust Test Report

During: 11/17/2022, 4:18:19 PM - 11/17/2022, 4:21:00 PM

Target Host: http://127.0.0.1:5000/

Script: locustfile.py

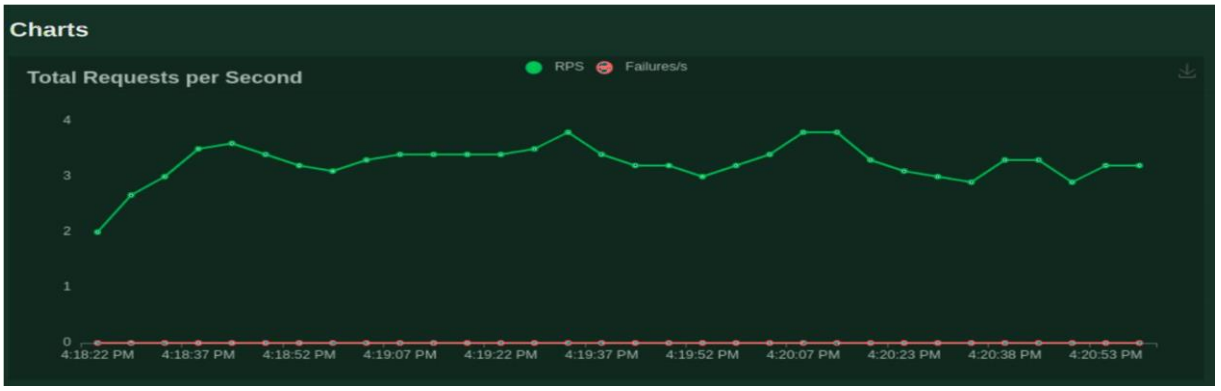
Request Statistics

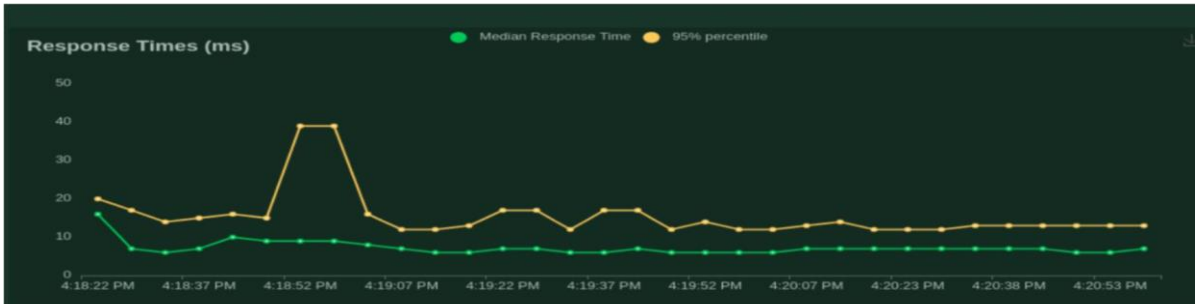
Method	Name	# Requests	# Fails	Average (ms)	Min (ms)	Max (ms)	Average size (bytes)	RPS	Failures/s
GET	//	126	0	13	9	59	6900	0.8	0.0
GET	/image1	129	0	6	5	27	7394	0.8	0.0
GET	/intro	139	0	7	4	38	8349	0.9	0.0
GET	/predict	136	0	6	5	12	6900	0.8	0.0
	Aggregated	**530**	**0**	**8**	**4**	**59**	**7400**	**3.3**	**0.0**

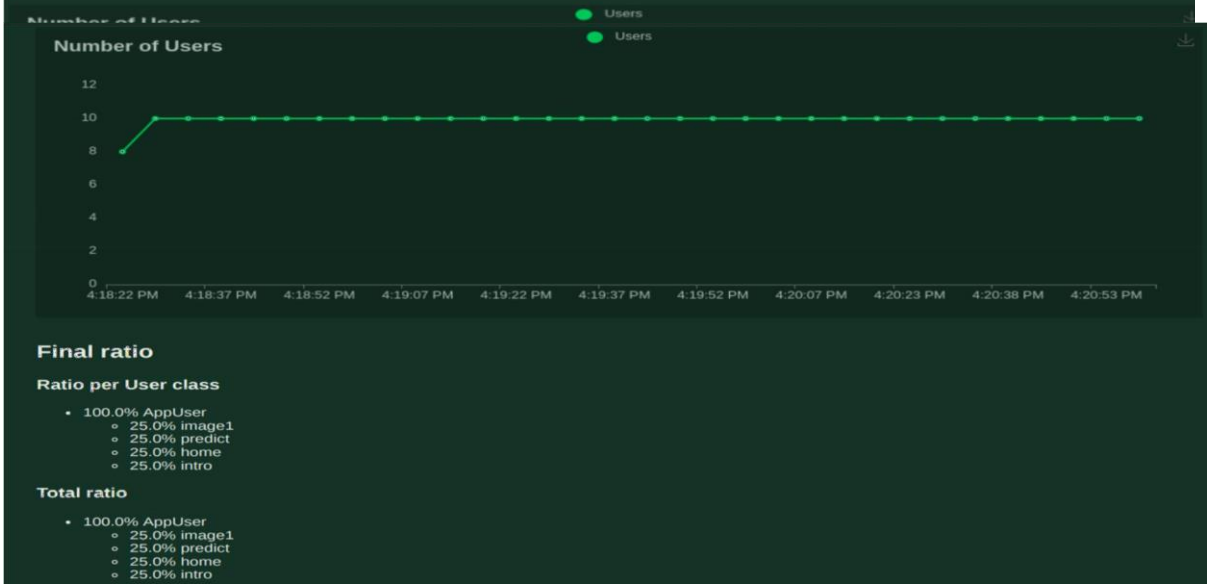
Response Time Statistics

Method	Name	50%ile (ms)	60%ile (ms)	70%ile (ms)	80%ile (ms)	90%ile (ms)	95%ile (ms)	99%ile (ms)	100%ile (ms)
GET	//	12	12	13	14	16	17	40	60
GET	/image1	6	6	7	7	8	9	11	27
GET	/intro	6	6	7	7	9	13	22	39
GET	/predict	6	7	7	8	9	10	11	13
	Aggregated	**7**	**7**	**9**	**11**	**12**	**15**	**22**	**60**

Charts







Final ratio

Ratio per User class

- 100.0% AppUser
  - 25.0% image1
  - 25.0% predict
  - 25.0% home
  - 25.0% intro

Total ratio

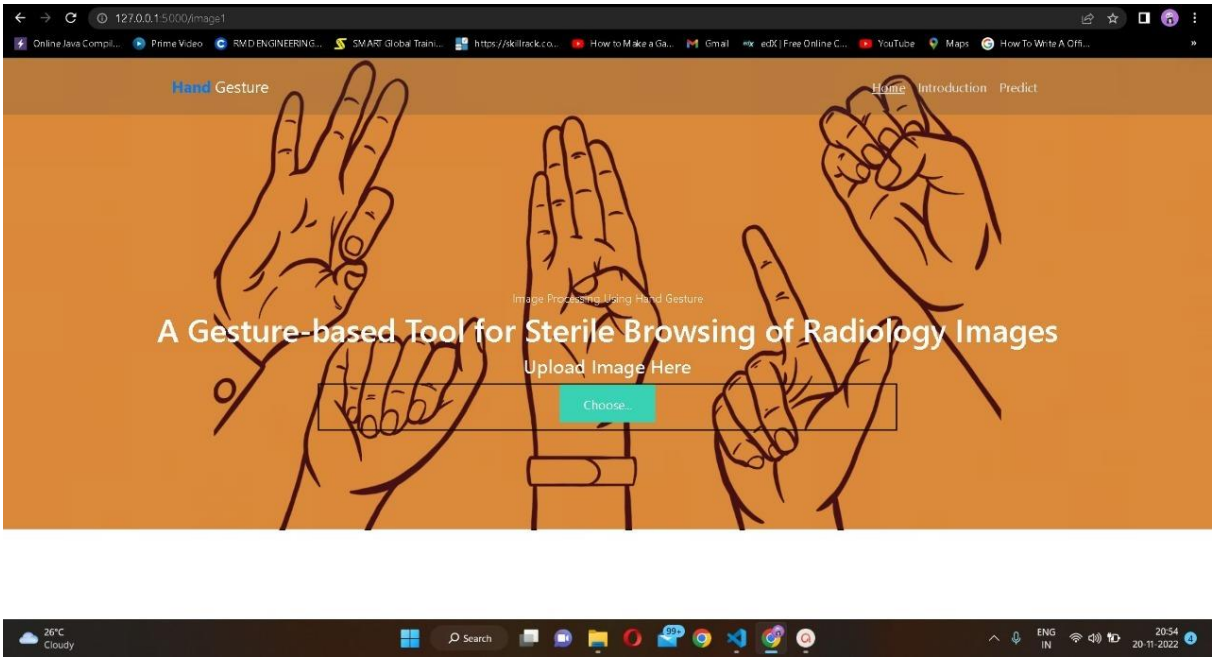
- 100.0% AppUser
  - 25.0% image1
  - 25.0% predict
  - 25.0% home
  - 25.0% intro

9.2 Output

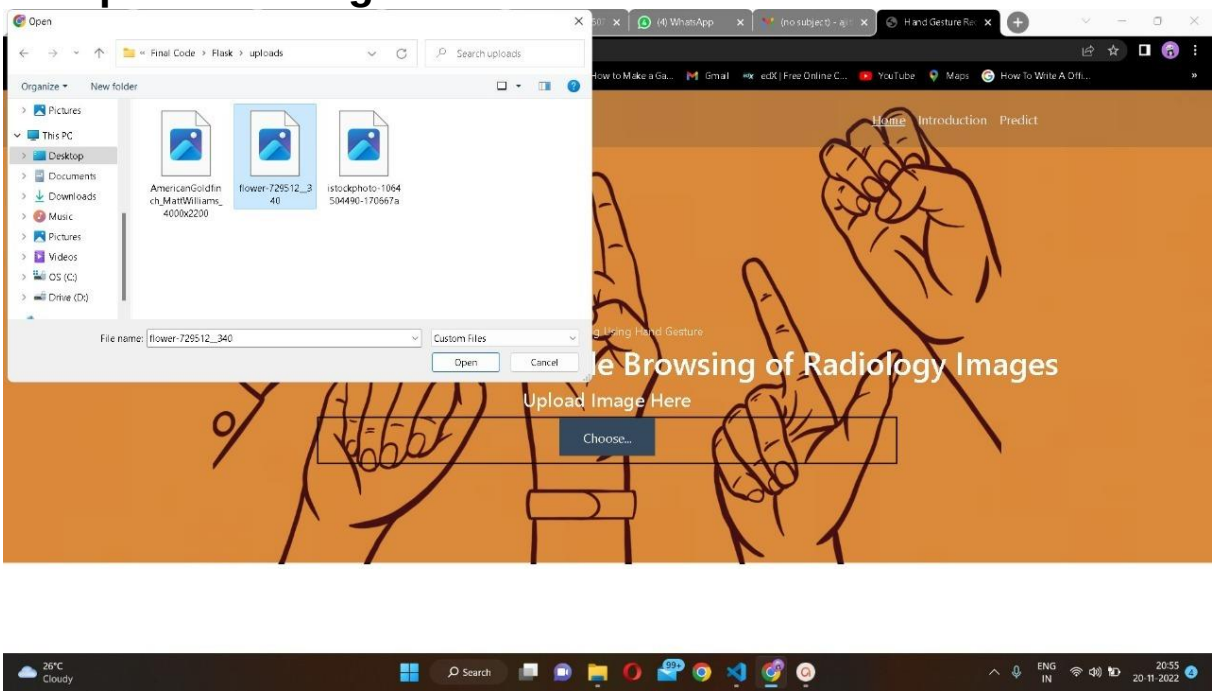
1:Home Page:

2:Introduction Page:

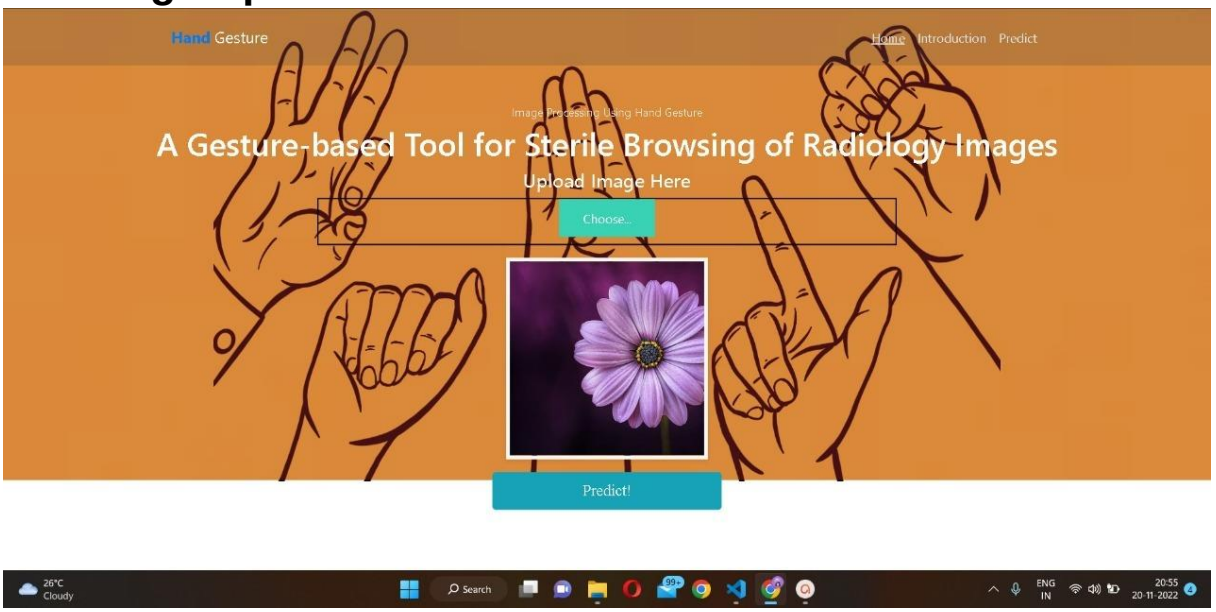
3:Prediction Page:

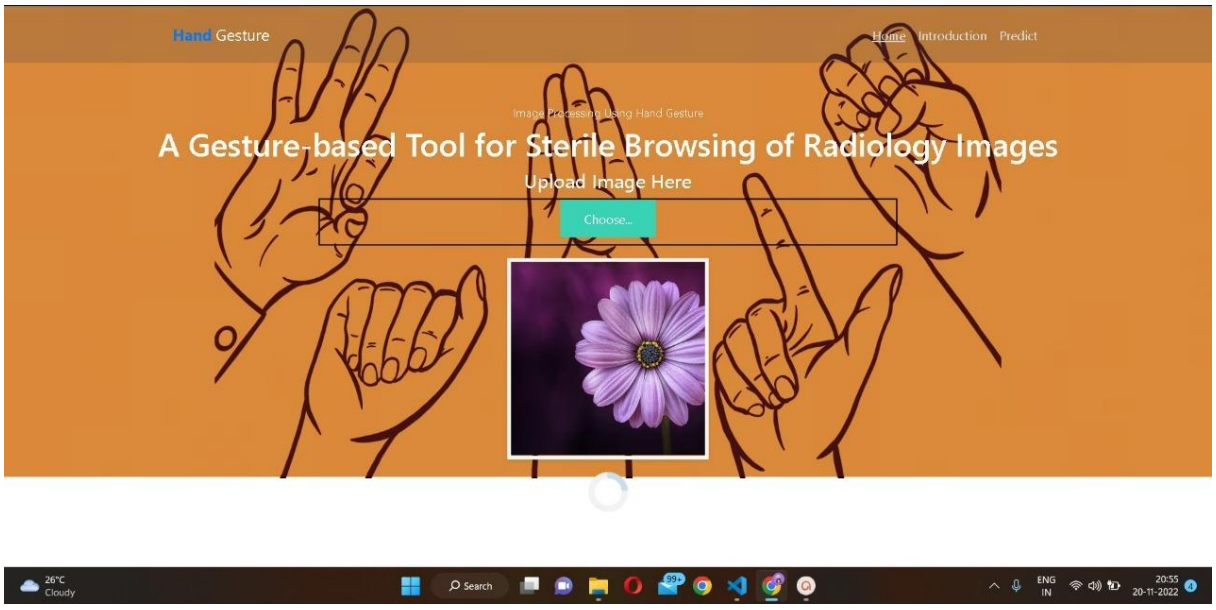


3.1 Uploaded Image:

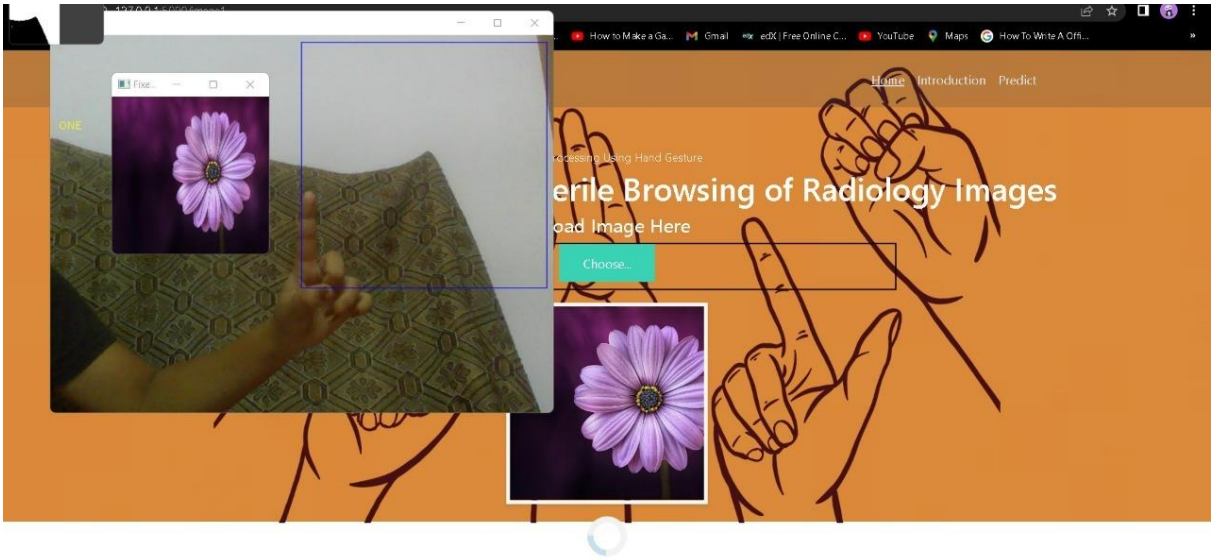


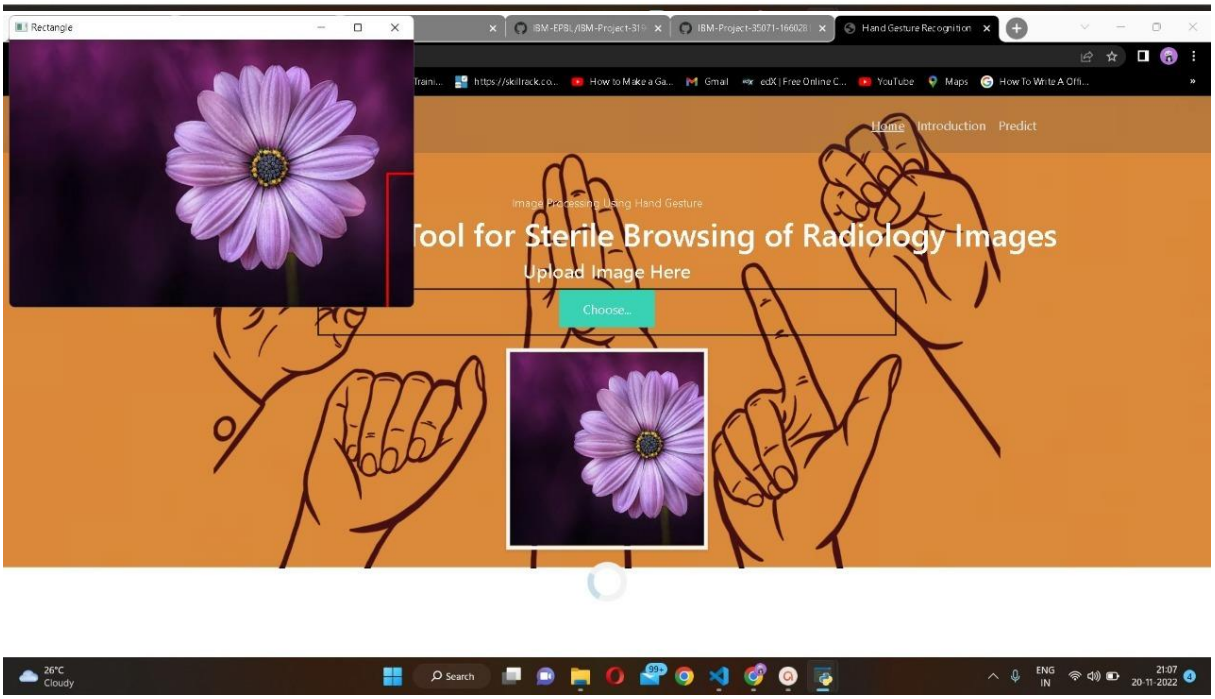
3.2:Image Uploaded:





3.3 Prediction :





4.Actions:

- ➤ 0- Rectangle
- ➤ 1- Fixed Resizing (200,200)
- ➤ 2- OpenCV Rotation
- ➤ 3- Blurred
- ➤ 4- Fixed Resizing (400,400)
- ➤ 5- OpenCV Grey Scale

10.ADVANTAGES & DISADVANTAGES:

10.1 Advantages:

- **Ease of use**—the system allows the surgeon to use his/her hands, their natural work tool
- **Rapid reaction**—nonverbal instructions by hand gesture commands are intuitive and fast (In practice, the “Gestix” system can process images and track hands at a frame-rate of 150 Hz, thus, responding to the surgeon's gesture commands in real-time)
- **An unencumbered interface**—the proposed system does not require the surgeon to attach a microphone, use head-mounted (body-contact) sensing devices or to use foot pedals
- **Distance control**—the hand gestures can be performed up to 5 meters from the camera and still be recognized accurately.
- Accuracy is high.
- Memory Saving. [due to cloud] ● An Unecumbered Interface. ● Distance Control.

  Translation independent.

10.2 Disadvantages:

- This kind of input also raises issues that are not relevant with traditional input. On the user's side, these problems are to learn, to remember and to accurately execute gestures.
- The developer has to provide a system that correctly recognizes these gestures. Freeman et al. remarked that the observation of gestures does not suffice in order to learn them, as the observer is unable to differentiate relevant and irrelevant movements.
- The teaching of multi-touch and mid-air gestures is more difficult than that of single-touch gestures. In the case of the latter, the hand posture is irrelevant users only need to follow a path correctly to perform a command.
- Image Framing is not accurate.
- Small number of dataset.
- Wrong prediction in low light.
- Accuracy is less.
- Dataset is not suitable for real time.

11.CONCLUSION :

- In this project , we proposed an idea for feasible communication between hearing impaired and normasl person with the help of deep learning and machine learning approach. This is ever the surrounding challenge to develop a sign language system in data the collection remains invariant of the unconstraint environment. This project can be ectended to the real time data. Our method shows to have potential in tackling this problem employing a straight forward camera as a premade dataset has been used.as been used, in case sufficient substantial training information is given, which can be continuously done and included through the previously mentioned process.

12.FUTURE SCOPE :

- The use of doctor-computer interaction devices in the operation room (OR) requires new

modalities that support medical imaging manipulation while allowing doctors' hands to remain sterile, supporting their focus of attention, and providing fast response times.In future everything become automated **.**

13.APPENDIX :

13.1 Source Code

1:home.html

```
<! DOCTYPE html >
< html lang="en" > <
head >
        < meta charset="utf-8" >
    < meta name="viewport" content="width=device-width, initial-scale=1, shrink-
tofit=no">
    < meta name="description" content="Start your development with Creative Design
landing page.">
    < meta name="author" content="Devcrud" >
    < title>Hand Gesture Recognition</title >
  < link rel="stylesheet" href="../static/vendors/themify-icons/css/themify-icons.css" >
        < link rel="stylesheet" href="../static/css/creative-design.css" >
< style >
```

```
.header { background: #efefef
  url(../static/imgs/3.jpg); background-size:
  cover; background-position: center center;
  background-repeat: no-repeat; text-align:
  center; color: white; position: relative;
  height: 598px; position: relative;
}
< /style >
< /head >
<body data-spy="scroll" data-target=".navbar" data-offset="40" id="home">
    <!-- Page Navbar -->
    < nav id="scrollspy" class="navbar page-navbar navbar-light navbar-expand-md
fixed-top" data-spy="affix" data-offset-top="20">
        < div class="container" >
            < a class="navbar-brand" href="#"><strong
class="textprimary">Hand</strong> <span class="text-dark">Gesture</span></a>
            < button class="navbar-toggler" type="button" data-toggle="collapse"
datatarget="#navbarSupportedContent" aria-controls="navbarSupportedContent"
ariaexpanded="false" aria-label="Toggle navigation">
                < span class="navbar-toggler-icon"></span >
            < /button >

            < div class="collapse navbar-collapse" id="navbarSupportedContent" >
                < ul class="navbar-nav ml-auto" >
                    < li class="nav-item" >
                        < a class="nav-link" href="{{ url_for('home')}}"><u>Home</u></a >
                    < /li >
                    < li class="nav-item" >
                        < a class="nav-link" href="{{ url_for('intro')}}">Introduction</a >
                    < /li >
                    < li class="nav-item" >
                        < a class="nav-link" href="{{ url_for('index6')}}">Predict</a > <
                    /li >
                < /ul >
            < /div >
        < /div >
    < /nav><!-- End of Page Navbar -->

    <!-- Page Header -->
```

```
   < header id="home" class="header" >
<img src="../static/imgs/11 .png" style="width:1000px;height:600px;" >


      < div class="overlay"></div >
      < div class="header-content" >
         < p>Image Processing Using Hand Gesture</p >
         <h1>A Gesture-based Tool for Sterile Browsing of Radiology Images</h1> <
      /div >
   < /header><!-- End of Page Header -->
```

2:intro.html

```
<!DOCTYPE html>
<html lang="en">
<head>
        <meta charset="utf-8">
   <meta name="viewport" content="width=device-width, initial-scale=1,
shrink-to-fit=no">
   <meta name="description" content="Start your development with
Creative Design landing page.">
   <meta name="author" content="Devcrud">
   <title>Hand Gesture Recognition</title>
   <link rel="stylesheet" href="../static/vendors/themify-
icons/css/themifyicons.css">
        <link rel="stylesheet" href="../static/css/creative-design.css">
<style>
.header { background: #efefef
  url(../static/imgs/1.jpg); background-size:
  cover; background-position: center center;
  background-repeat: no-repeat; text-align:
  center; color: white; position: relative;
  height: 598px; position: relative;
}
</style>
</head>
```

```
<body data-spy="scroll" data-target=".navbar" data-offset="40"
id="home">
   <!-- Page Navbar -->
   <nav id="scrollspy" class="navbar page-navbar navbar-light
navbarexpand-md fixed-top" data-spy="affix" data-offset-top="20">
      <div class="container">
                  <a class="navbar-brand" href="#"><strong
            class="textprimary">Hand</strong> <span class="text-
                        dark">Gesture</span></a>

         <div class="collapse navbar-collapse"
id="navbarSupportedContent">
            <ul class="navbar-nav ml-auto">
               <li class="nav-item">
                  <a class="nav-link" href="{{
url_for('home')}}"><u>Home</u></a>
               </li>
               <li class="nav-item">
                  <a class="nav-link" href="{{
url_for('intro')}}">Introduction</a>
               </li>
               <li class="nav-item"> <a class="nav-
                  link" href="{{
url_for('index6')}}">Predict</a>
               </li>
            </ul>
         </div>
      </div>
   </nav><!-- End of Page Navbar -->

   <!-- Page Header -->
   <header id="home" class="header">

      <div class="overlay"></div>
```

Image Processing Using Hand Gesture

<h3 style="color:yellow;">A Gesture-based Tool for Sterile Browsing of Radiology Images</h3>

<h4> Hand Gesture recognition system provides us with an innovative, natural, user-friendly way of interacting with the computer which is more familiar to human beings. In our project, the hand region is extracted from the background by using the Region of interest. Then, we will be predicted the labels based on the CNN-trained model weights of hand gestures using that predicted labels we apply if conditions to control some of the actions like reshaping, blurring, and flip of the given image. <h4>

</header><!-- End of Page Header -->

3:index6.html

```
<html lang="en">
  <head>
    <meta charset="utf-8">
    <meta http-equiv="X-UA-Compatible" content="IE=edge">
   <meta name="viewport" content="width=device-width, initial-scale=1, shrink-to-fit=no">
   <meta name="description" content="Start your development with Creative Design landing page.">
   <meta name="author" content="Devcrud">
   <title>Hand Gesture Recognition</title>
   <link rel="stylesheet" href="../static/vendors/themify-icons/css/themifyicons.css">
       <link rel="stylesheet" href="../static/css/creative-design.css">
   <link href="../static/css/creative-design.css/main.css" rel="stylesheet">
   <link href="{{ url_for('static', filename='css/main.css') }}" rel="stylesheet">
    <meta name="viewport" content="width=device-width, initialscale=0.6">
```

```
    <script
src="https://ajax.googleapis.com/ajax/libs/jquery/3.3.1/jquery.min.js"></s
cript>
    <link
href="https://cdn.bootcss.com/bootstrap/4.0.0/css/bootstrap.min.css"
rel="stylesheet">


    <script
src="https://cdn.bootcss.com/popper.js/1.12.9/umd/popper.min.js"></scr
i pt>
    <script
src="https://cdn.bootcss.com/jquery/3.3.1/jquery.min.js"></script>
    <script
src="https://cdn.bootcss.com/bootstrap/4.0.0/js/bootstrap.min.js"></scrip
t>
    <link href="{{ url_for('static', filename='css/main.css')
}}" rel="stylesheet"> <style>
.header { background: #efefef
  url(../static/imgs/3.jpg); background-size:
  cover; background-position: center center;
  background-repeat: no-repeat; text-align:
  center; color: white; position: relative;
  height: 598px; position: relative;
}
.btncls{ position: relative; top: 133px;
  left: 33px; border-radius: 20px;
  height:30px; font-size: 12px;
  border: none; background-color:
  rgb(45, 45, 43); color:rgb(252,
  248, 248); font-weight: 600;
}
#display-image{ width: 400px;
  height: 225px; border: 3px solid
  rgb(45, 45, 43);
  borderradius:25px;
  backgroundposition: center;
  backgroundsize: cover; position:
  relative; top: -143px; left: 33px;
}
```

```
#image-input{ position: relative; top:
  -153px; left: 33px; border-radius:
  20px; background-color: rgb(45,
  45, 43);
}
.topnav { overflow: hidden; background-
    color: #056959;
  }

  .topnav-right a { float:
    left; color: black;
    textalign: center;
    padding: 14px 16px;
    textdecoration: none;
    font-size: 18px;
  }

  .topnav-right a.active {
    background-color: #07201e;
    color: rgb(238, 226, 234);
  }

  .topnav-right a:hover { background-color:
    rgb(181, 228, 236); color: rgb(6, 27,
    36);
  }



  .topnav-right { float:
    right;
    padding-right:100px;
  }
  .button { background-color:
  #091425; border: none;
  color: black; padding: 15px
  32px; text-align: center; text-
  decoration: none; display:
```

```
  inline-block; fontsize: 12px;
  border-radius:
  16px;
  }
  .button:hover { box-shadow: 0 12px 16px 0 rgba(0,0,0,0.24),
    0 17px 50px 0
rgba(0,0,0,0.19);
  }
  form {border: 2px solid black; margin-left:400px;margin-right:400px;}

  input[type=text], input[type=password]
    { width: 100%; padding: 12px 20px;
    display: inline-block;
    marginbottom:18px; border: 1px solid
    #ccc; boxsizing: border-box;
  }

  button {
    background-color:  #091425;
    color:  black;  padding:  14px
    20px;    margin-bottom:10px;
    border: none; cursor:
    pointer; width: 19%;
    borderradius:4px;
    fontfamily:Montserrat;
  }

  button:hover {
    opacity: 0.8;
  }

  .cancelbtn { width: auto;
    padding: 10px 18px;
    background-color: #f44336;
  }
  .imgcontainer { text-align:
    center; margin: 24px 0
```

```
  12px 0;
}

img.avatar { width:
  30%; borderradius:
  50%;
}

.container { padding:
  16px;
}

span.psw {
  float: right; padding-
  top: 16px;
}

/* Change styles for span and cancel button on extra small screens */
@media screen and (max-width: 300px)
  { span.psw { display: block; float: none;
  }
  .cancelbtn
    { width: 100%;
  }
}

.home{ margin:80px;

  width: 84%; height:
  500px;
  paddingtop:10px;
  padding-left: 30px;

}
```

```
.login{ margin:80px; box-sizing: content-
  box; width: 84%; height: 420px;
  padding: 30px; border:
  10px solid rgb(12, 91, 94);
}
.left,.right{
 box-sizing: content-box; height:
 400px; margin:20px; border: 10px
 solid rgb(12, 91, 94);
}

.mySlides {display: none;}
img {vertical-align: middle;}

/* Slideshow container */
.slideshow-container {
  maxwidth: 1000px; position:
  relative; margin: auto;
}

/* Caption text */
.text { color: #f2f2f2; font-
  size: 15px; padding:
  8px 12px; position:
  absolute; bottom: 8px;
  width:
  100%; text-align:
  center;
}
/* The dots/bullets/indicators */
.dot { height: 15px; width: 15px; margin:
  0 2px; background-color: #bbb;
  border-radius: 50%; display:
  inlineblock; transition: background-
  color 0.6s ease;
}
.active { background-color:
```

```
  #267481;
 }

 /* Fading animation */
 .fade {
   -webkit-animation-name: fade; -
   webkitanimation-duration: 1.5s; animation-
   name: fade; animation-duration: 1.5s;
 }
 @-webkit-keyframes fade {
   from {opacity: .4} to
   {opacity: 1}
 }
 @keyframes fade {
   from {opacity: .4}
   to {opacity: 1}
 }

 /* On smaller screens, decrease text size */
 @media only screen and (max-width: 300px) {
   .text {font-size: 11px}
 }


</style>
</head>
<body data-spy="scroll" data-target=".navbar" data-offset="40"
id="home">
   <!-- Page Navbar -->
   <nav id="scrollspy" class="navbar page-navbar navbar-light
navbarexpand-md fixed-top" data-spy="affix" data-offset-top="20">
      <div class="container">
            <a class="navbar-brand" href="#"><strong
         class="textprimary">Hand</strong> <span class="text-
dark">Gesture</span></a> <button class="navbar-toggler" type="button"
      datatoggle="collapse" data-target="#navbarSupportedContent"
```

```
        ariacontrols="navbarSupportedContent" aria-expanded="false"
                                arialabel="Toggle navigation">
                    <span class="navbar-toggler-icon"></span>
                </button>

                <div class="collapse navbar-collapse"
id="navbarSupportedContent">
                    <ul class="navbar-nav ml-auto">
                        <li class="nav-item">
                            <a class="nav-link" href="{{
url_for('home')}}"><u>Home</u></a>
                        </li>
                        <li class="nav-item">
                            <a class="nav-link" href="{{
url_for('intro')}}">Introduction</a>
                        </li>
                        <li class="nav-item"> <a class="nav-
                            link" href="{{
url_for('index6')}}">Predict</a>
                        </li>
                    </ul>
                </div>
            </div>
        </nav><!-- End of Page Navbar -->

        <!-- Page Header -->
        <header id="home" class="header">
<img src="../static/imgs/11.png" style="width:1000px;height:600px;">

            <div class="overlay"></div>
             <div class="header-content"><br><br><br><br><br><br><br>
                <p>Image Processing Using Hand Gesture</p>
                <h1>A Gesture-based Tool for Sterile Browsing of Radiology
Images</h1>
```

```
        <div>
          <h4>Upload Image Here</h4>
       <form action = "http://localhost:5000/" id="upload-file"
method="post" enctype="multipart/form-data">
        <label for="imageUpload" class="upload-label">
          Choose...
        </label>
        <input type="file" name="image"
id="imageUpload" accept=".png, .jpg, .jpeg,.pdf">
</form>
            <center>
       <div class="image-section" style="display:none;">
        <div class="img-preview">
          <div id="imagePreview">
          </div>
        </div>
        <div>
            <button type="button" color="#f35ac5" class="btn btn-info btn-lg
" id="btn-predict">Predict!</button>
        </div>
       </div>
       <div class="loader" style="display:none;"></div>
            </center>
     </div>
     </div1>

        <footer>
     <script src="{{ url_for('static', filename='js/main.js') }}"
type="text/javascript"></script>
  </footer>
  </html>
```

13.2 GitHub Link

PROJECT GITHUB LINK: https://github.com/IBM-EPBL/IBM-Project31942-1660206772