PROJECT REPORT

A GESTURE - BASED TOOL FOR STERILE BROWSING OF RADIOLOGY IMAGES

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Team Member - **Saravanakumaran E**
Team Member - **Sakthivel S**
Team Member - **Naveen P**

CONTENT

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 vision-based 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 Human Machine 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-Computer Interaction 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.

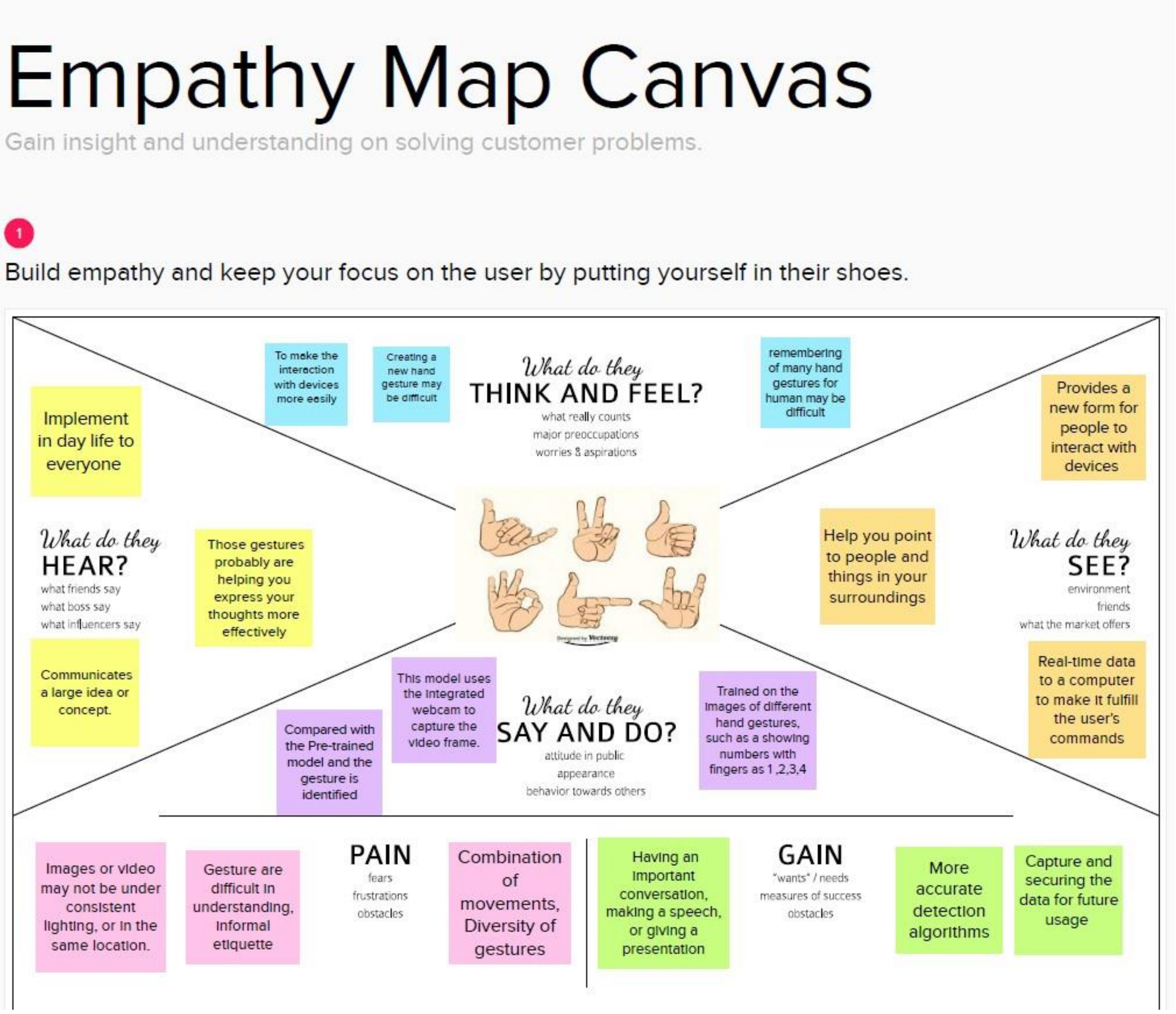
- Vision Based Hand Gesture Recognition by World Academy of Science, Engineering and Technology, Pragati Garg, Naveen Aggarwal, Sanjeev Sofat

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



Empathy Map Canvas

Gain insight and understanding on solving customer problems.

1

Build empathy and keep your focus on the user by putting yourself in their shoes.

What do they THINK AND FEEL?

what really counts

major preoccupations

worries & aspirations

To make the interaction with devices more easily

Creating a new hand gesture may be difficult

remembering of many hand gestures for human may be difficult

What do they HEAR?

what friends say

what boss say

what influencers say

Implement in day life to everyone

Those gestures probably are helping you express your thoughts more effectively

Communicates a large idea or concept.

What do they SEE?

environment

friends

what the market offers

Provides a new form for people to interact with devices

Help you point to people and things in your surroundings

Real-time data to a computer to make it fulfill the user's commands

What do they SAY AND DO?

attitude in public

appearance

behavior towards others

Compared with the Pre-trained model and the gesture is identified

This model uses the integrated webcam to capture the video frame.

Trained on the images of different hand gestures, such as a showing numbers with fingers as 1 ,2,3,4

PAIN

fears

frustrations

obstacles

Images or video may not be under consistent lighting, or in the same location.

Gesture are difficult in understanding, informal etiquette

Combination of movements, Diversity of gestures

GAIN

"wants" / needs

measures of success

obstacles

Having an important conversation, making a speech, or giving a presentation

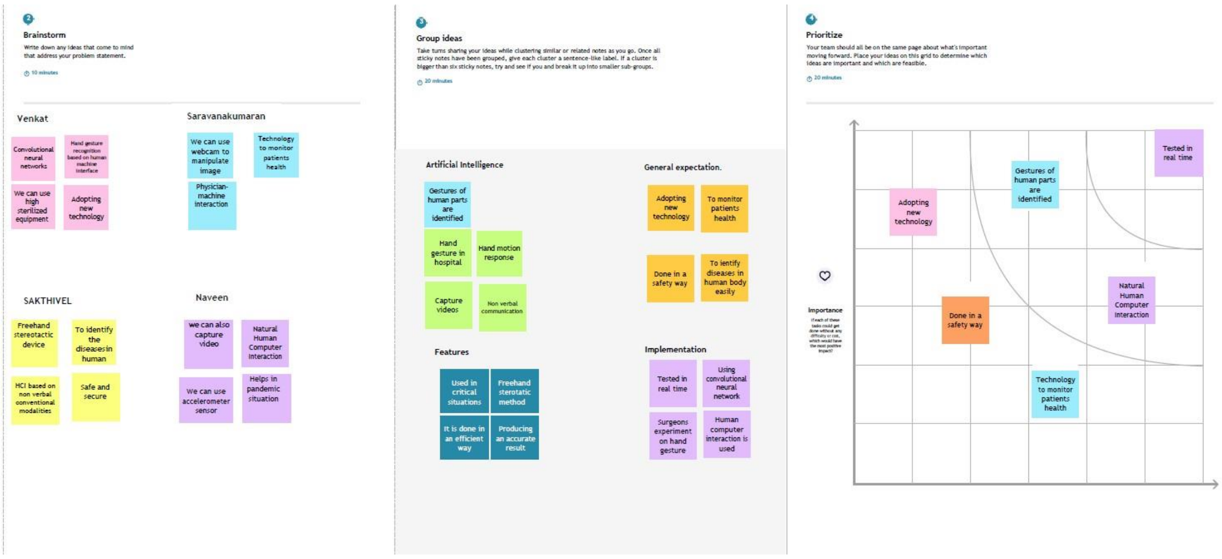
More accurate detection algorithms

Capture and securing the data for future usage

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.



Brainstorm

Write down any ideas that come to mind that address your problem statement.

10 minutes

Group ideas

Take turns sharing your ideas while clustering similar or related notes as you go. Once all sticky notes have been grouped, give each cluster a sentence-like label. If a cluster is bigger than six sticky notes, try and see if you and break it up into smaller sub-groups.

20 minutes

Prioritize

Your team should all be on the same page about what's important moving forward. Place your ideas on this grid to determine which ideas are important and which are feasible.

20 minutes

Importance

If each of these tasks could get done without any difficulty or cost, which would have the most positive impact?

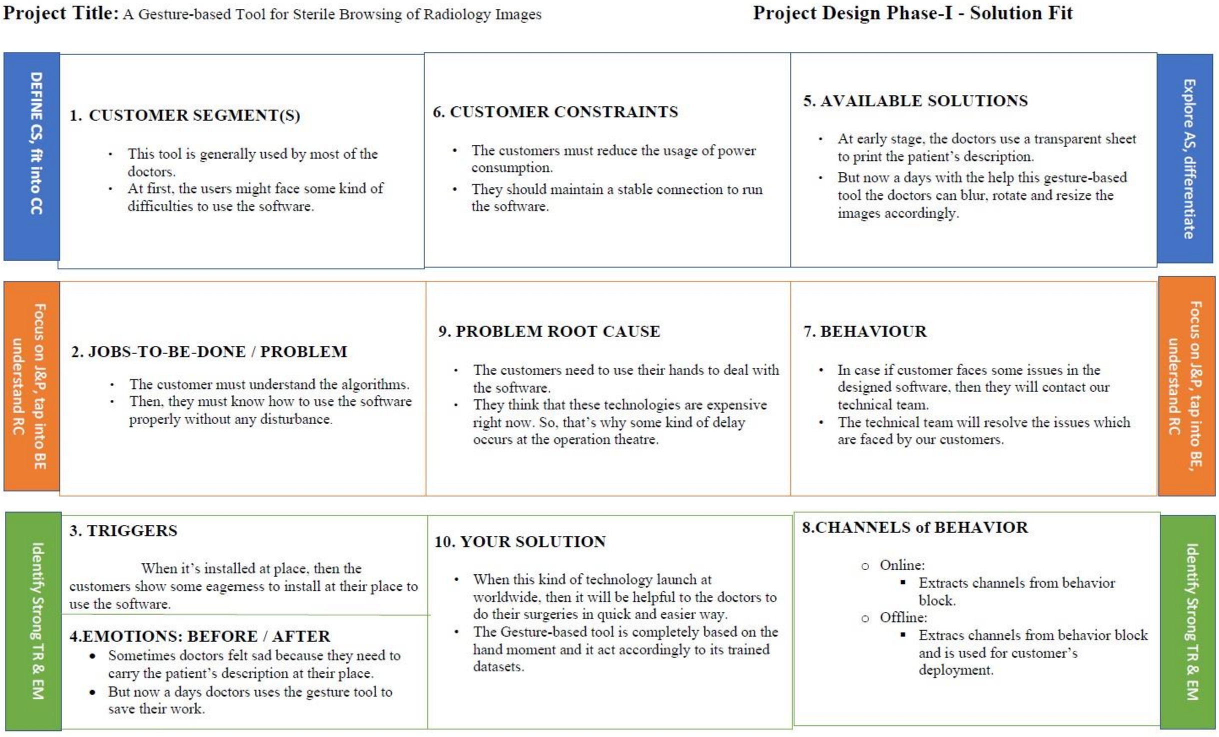
2
3
4
Venkat
Convolutional neural networks
Hand gesture recognition based on human machine interface
We can use high sterilized equipment
Adopting new technology
Saravanakumaran
We can use webcam to manipulate image
Technology to monitor patients health
Physician-machine interaction
SAKTHIVEL
Freehand stereotactic device
To identify the diseasesin human
HCI based on non verbal conventional modalities
Safe and secure
Naveen
we can also capture video
Natural Human Computer Interaction
We can use accelerometer sensor
Helps in pandemic situation
Artificial Intelligence
Gestures of human parts are identified
Hand gesture in hospital
Hand motion response
Capture videos
Non verbal communication
General expectation.
Adopting new technology
To monitor patients health
Done in a safety way
To ientify diseases in human body easily
Features
Used in critical situations
Freehand sterotatic method
It is done in an efficient way
Producing an accurate result
Implementation
Tested in real time
Using convolutional neural network
Surgeons experiment on hand gesture
Human computer interaction is used
Tested in real time
Gestures of human parts are identified
Adopting new technology
Natural Human Computer Interaction
Done in a safety way
Technology to monitor patients health

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



Project Title: A Gesture-based Tool for Sterile Browsing of Radiology Images

Project Design Phase-I - Solution Fit

DEFINE CS, fit into CC

1. CUSTOMER SEGMENT(S)

- This tool is generally used by most of the doctors.
- At first, the users might face some kind of difficulties to use the software.

6. CUSTOMER CONSTRAINTS

- The customers must reduce the usage of power consumption.
- They should maintain a stable connection to run the software.

5. AVAILABLE SOLUTIONS

- At early stage, the doctors use a transparent sheet to print the patient's description.
- But now a days with the help this gesture-based tool the doctors can blur, rotate and resize the images accordingly.

Explore AS, differentiate

Focus on J&P, tap into BE understand RC

2. JOBS-TO-BE-DONE / PROBLEM

- The customer must understand the algorithms.
- Then, they must know how to use the software properly without any disturbance.

9. PROBLEM ROOT CAUSE

- The customers need to use their hands to deal with the software.
- They think that these technologies are expensive right now. So, that's why some kind of delay occurs at the operation theatre.

7. BEHAVIOUR

- In case if customer faces some issues in the designed software, then they will contact our technical team.
- The technical team will resolve the issues which are faced by our customers.

Focus on J&P, tap into BE, understand RC

Identify Strong TR & EM

3. TRIGGERS

When it's installed at place, then the customers show some eagerness to install at their place to use the software.

4.EMOTIONS: BEFORE / AFTER

- Sometimes doctors felt sad because they need to carry the patient's description at their place.
- But now a days doctors uses the gesture tool to save their work.

10. YOUR SOLUTION

- When this kind of technology launch at worldwide, then it will be helpful to the doctors to do their surgeries in quick and easier way.
- The Gesture-based tool is completely based on the hand moment and it act accordingly to its trained datasets.

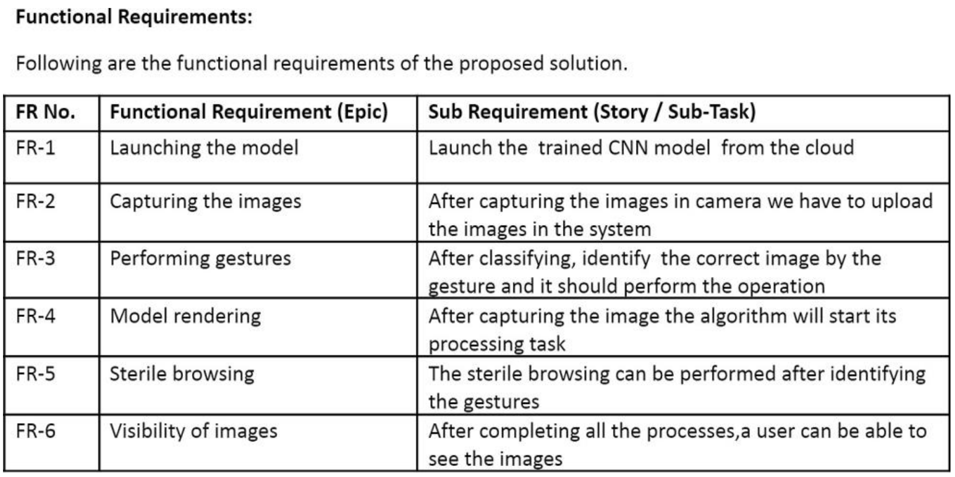
8.CHANNELS of BEHAVIOR

- Online:
  - Extracts channels from behavior block.
- Offline:
  - Extracs channels from behavior block and is used for customer's deployment.

Identify Strong TR & EM

4. REQUIREMENT ANALYSIS :

4.1 Functional Requirements

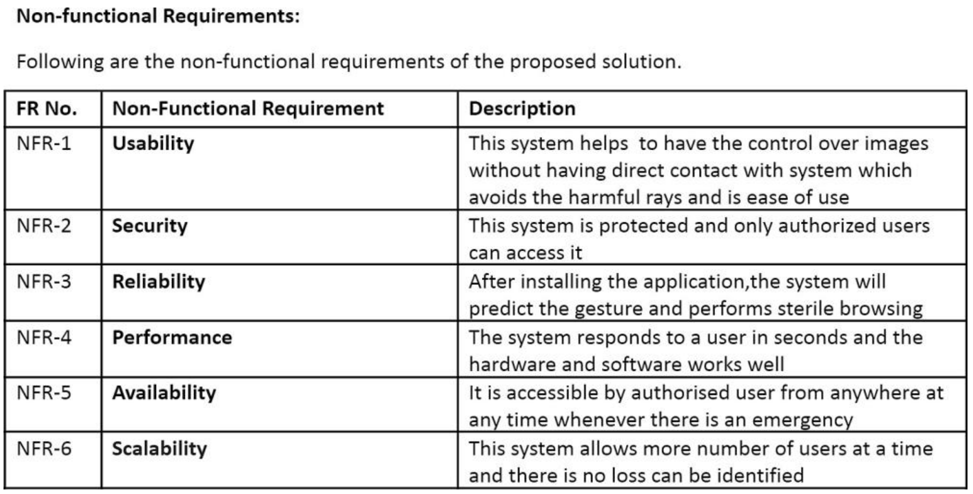


Functional Requirements:

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



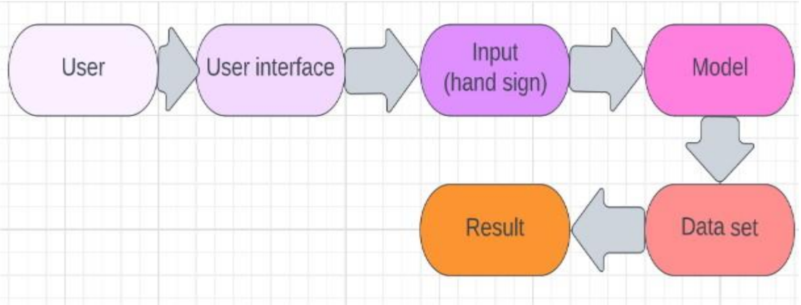
Non-functional Requirements:

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

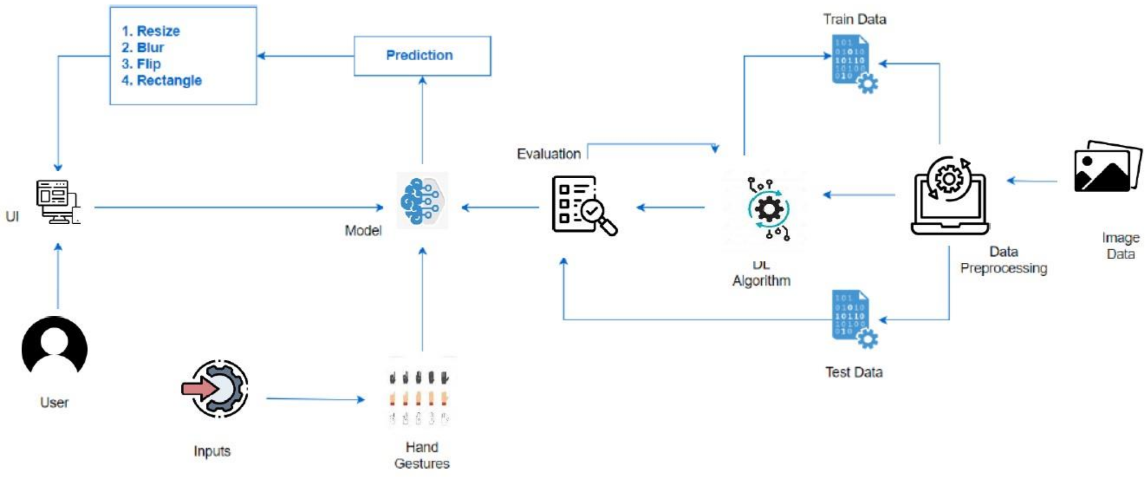
5.PROJECT DESIGN :

5.1 Data Flow Diagrams

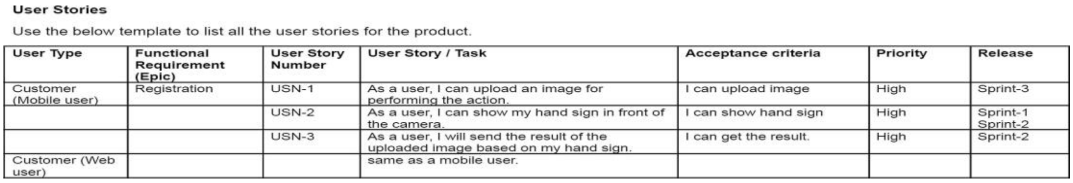


5.2 Solution & Technical Architecture

Project - A Gesture-based Tool for Sterile Browsing of Radiology



5.3User Stories



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	Release
Customer (Mobile user)	Registration	USN-1	As a user, I can upload an image for performing the action.	I can upload image	High	Sprint-3
		USN-2	As a user, I can show my hand sign in front of the camera.	I can show hand sign	High	Sprint-1 Sprint-2
		USN-3	As a user, I will send the result of the uploaded image based on my hand sign.	I can get the result.	High	Sprint-2
Customer (Web user)			same as a mobile user.			

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.

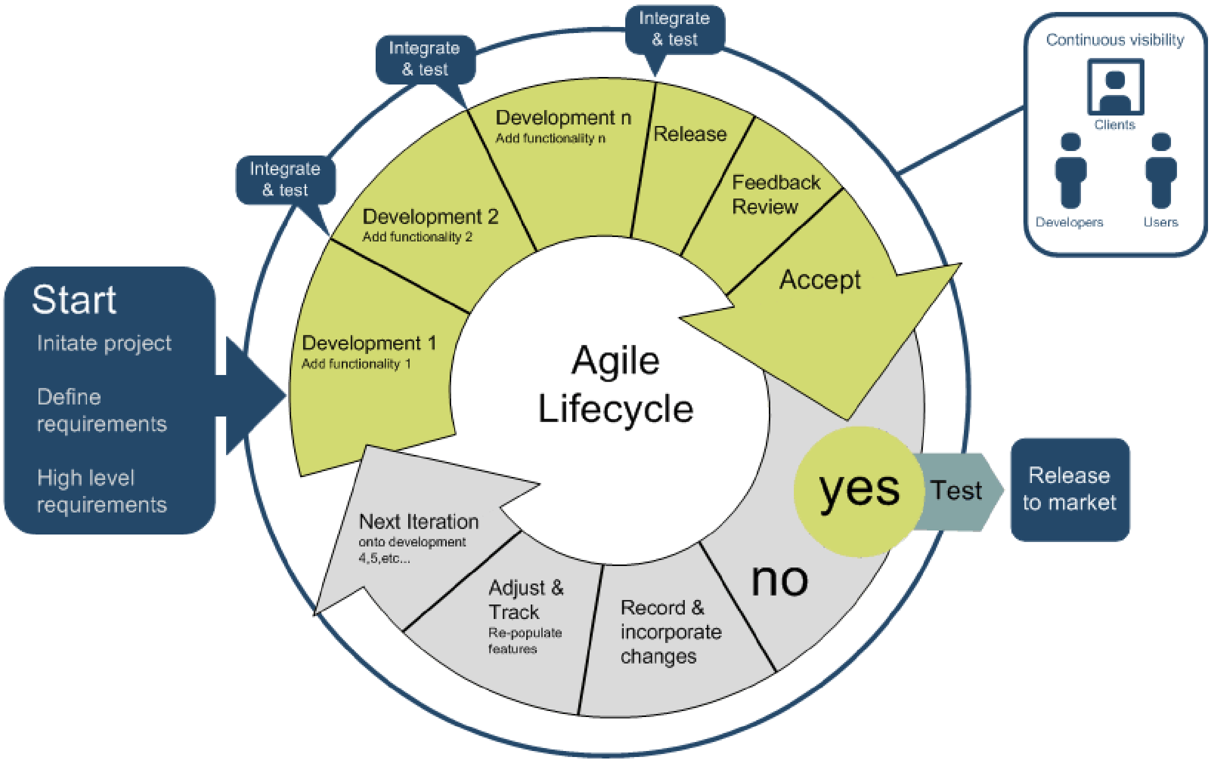
4.Test the model.

5.Model is generated (gesture.h5).

6.Apllication building using HTML & CSS.

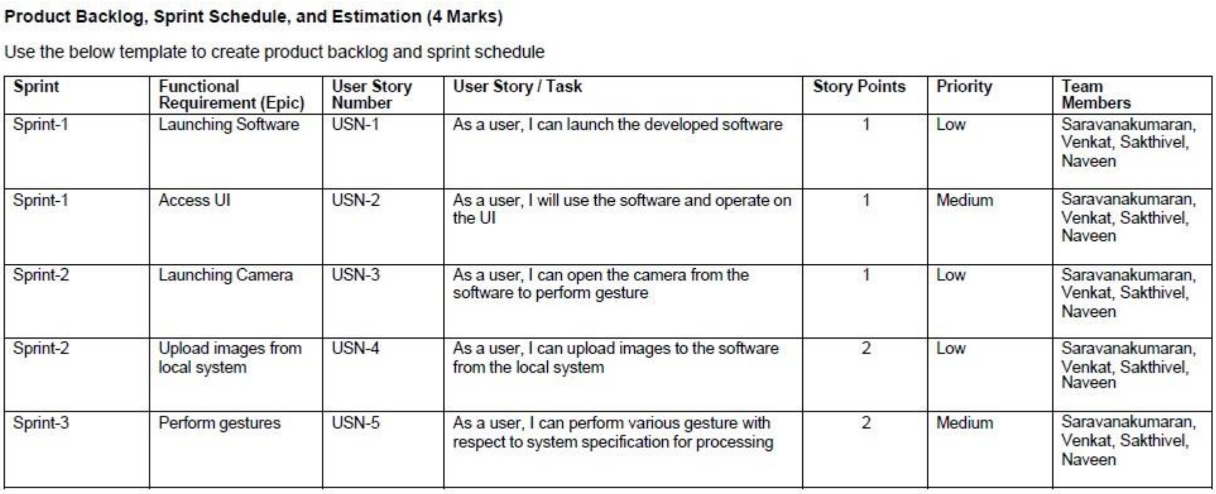
7.Form for uploading the image for prediction.

8.Python flask for connecting Model and webpages.



6.2 Sprint Delivery Schedule

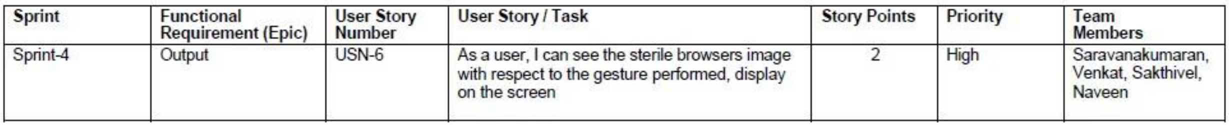
Product Backlog, Sprint Schedule, and Estimation



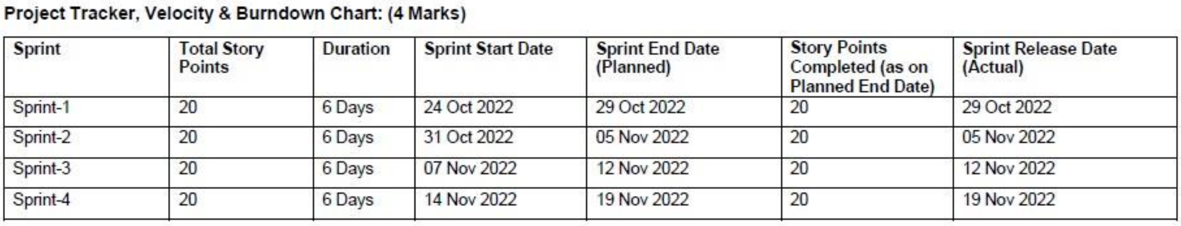
Product Backlog, Sprint Schedule, and Estimation (4 Marks)

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	Launching Software	USN-1	As a user, I can launch the developed software	1	Low	Saravanakumaran, Venkat, Sakthivel, Naveen
Sprint-1	Access UI	USN-2	As a user, I will use the software and operate on the UI	1	Medium	Saravanakumaran, Venkat, Sakthivel, Naveen
Sprint-2	Launching Camera	USN-3	As a user, I can open the camera from the software to perform gesture	1	Low	Saravanakumaran, Venkat, Sakthivel, Naveen
Sprint-2	Upload images from local system	USN-4	As a user, I can upload images to the software from the local system	2	Low	Saravanakumaran, Venkat, Sakthivel, Naveen
Sprint-3	Perform gestures	USN-5	As a user, I can perform various gesture with respect to system specification for processing	2	Medium	Saravanakumaran, Venkat, Sakthivel, Naveen



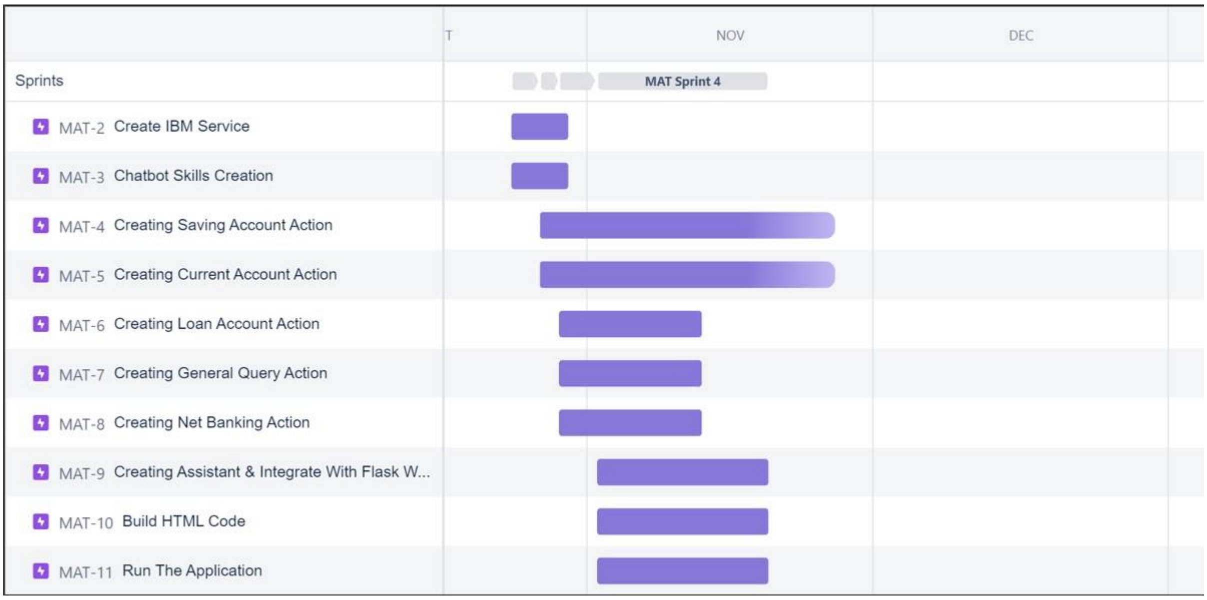
Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-4	Output	USN-6	As a user, I can see the sterile browsers image with respect to the gesture performed, display on the screen	2	High	Saravanakumaran, Venkat, Sakthivel, Naveen



Project Tracker, Velocity & Burndown Chart: (4 Marks)

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	20	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	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	20	6 Days	14 Nov 2022	19 Nov 2022	20	19 Nov 2022

6.3 Reports from JIRA



Sprints

MAT-2 Create IBM Service

MAT-3 Chatbot Skills Creation

MAT-4 Creating Saving Account Action

MAT-5 Creating Current Account Action

MAT-6 Creating Loan Account Action

MAT-7 Creating General Query Action

MAT-8 Creating Net Banking Action

MAT-9 Creating Assistant & Integrate With Flask W...

MAT-10 Build HTML Code

MAT-11 Run The Application

7 CODING & SOLUTIONING :

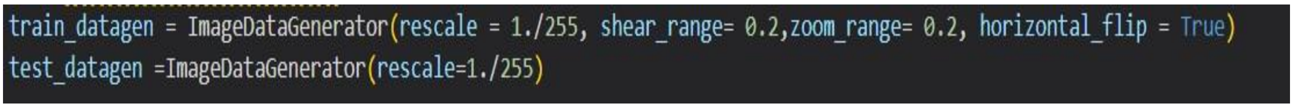
7.1 Feature 1

1:IMAGE PREPROCESSING:

Import the ImagesDataGenerator Library:

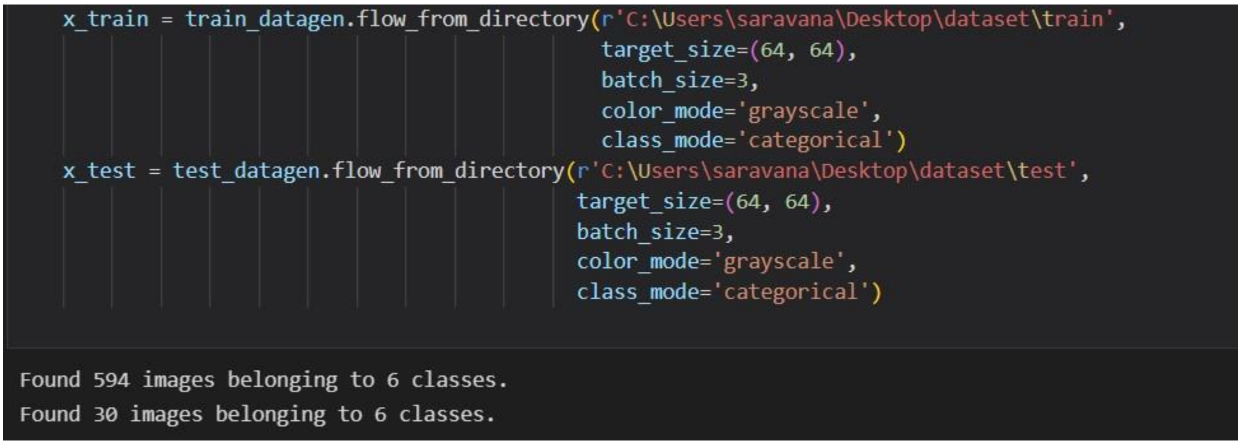
```
from keras.preprocessing.image import ImageDataGenerator
```

Configure ImageDataGenerator Functionality To Trainset And Test set:



```
train_datagen = ImageDataGenerator(rescale = 1./255, shear_range= 0.2,zoom_range= 0.2, horizontal_flip = True)
test_datagen =ImageDataGenerator(rescale=1./255)
```

Apply ImageDataGenerator Functionality To Trainset And Test set

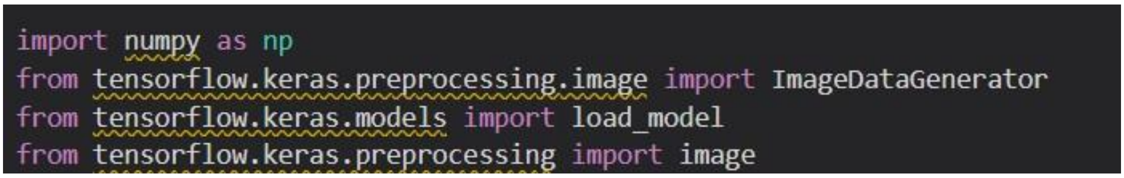


```
    x_train = train_datagen.flow_from_directory(r'C:\Users\saravana\Desktop\dataset\train',
                                                target_size=(64, 64),
                                                batch_size=3,
                                                color_mode='grayscale',
                                                class_mode='categorical')
    x_test = test_datagen.flow_from_directory(r'C:\Users\saravana\Desktop\dataset\test',
                                              target_size=(64, 64),
                                              batch_size=3,
                                              color_mode='grayscale',
                                              class_mode='categorical')
```

```
Found 594 images belonging to 6 classes.
Found 30 images belonging to 6 classes.
```

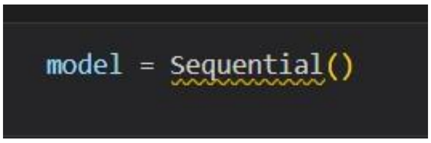
2:MODEL BULIDING:

Importing The Model Building Libraries



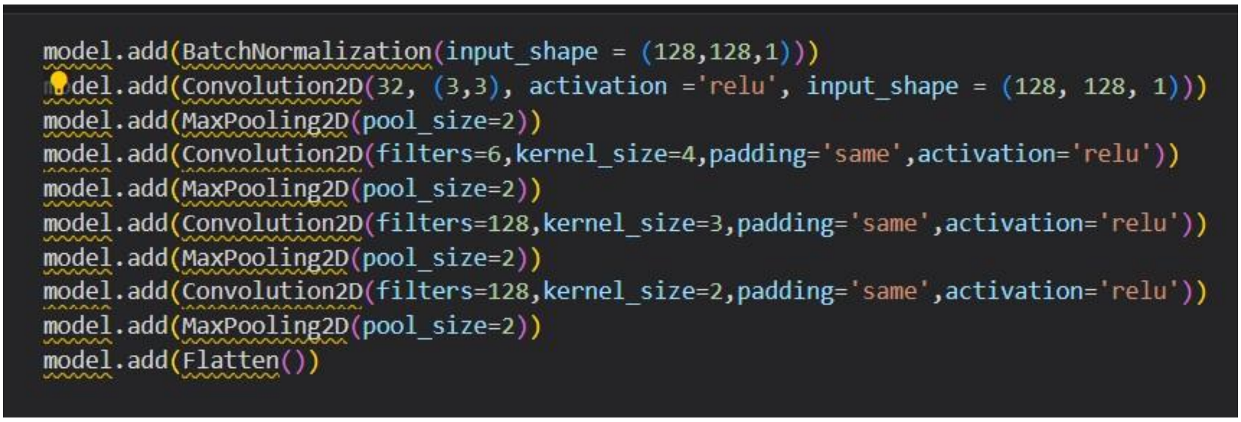
```
import numpy as np
from tensorflow.keras.preprocessing.image import ImageDataGenerator
from tensorflow.keras.models import load_model
from tensorflow.keras.preprocessing import image
```

Initializing The Model



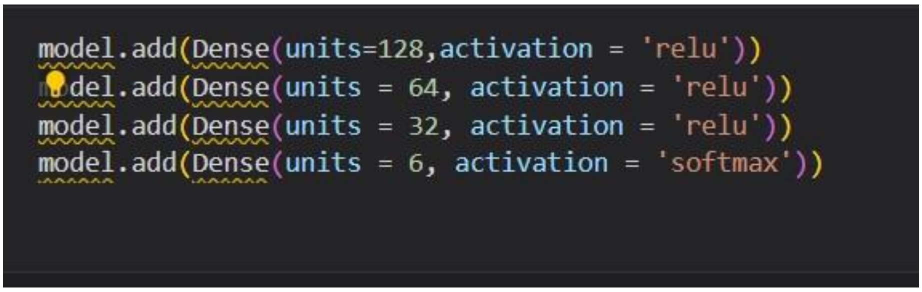
```
model = Sequential()
```

Adding CNN Layers

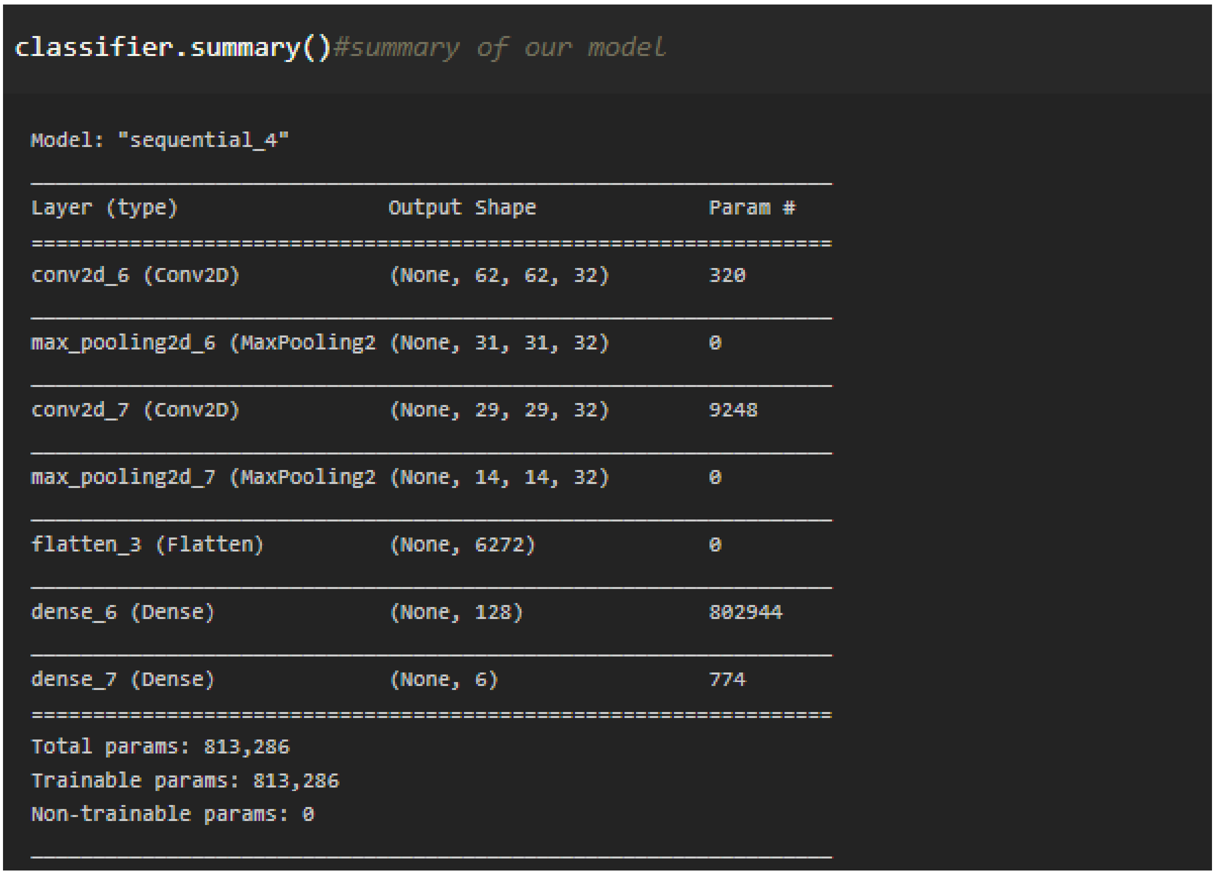


```
model.add(BatchNormalization(input_shape = (128,128,1)))
model.add(Convolution2D(32, (3,3), activation ='relu', input_shape = (128, 128, 1)))
model.add(MaxPooling2D(pool_size=2))
model.add(Convolution2D(filters=6,kernel_size=4,padding='same',activation='relu'))
model.add(MaxPooling2D(pool_size=2))
model.add(Convolution2D(filters=128,kernel_size=3,padding='same',activation='relu'))
model.add(MaxPooling2D(pool_size=2))
model.add(Convolution2D(filters=128,kernel_size=2,padding='same',activation='relu'))
model.add(MaxPooling2D(pool_size=2))
model.add(Flatten())
```

Adding Dense Layers



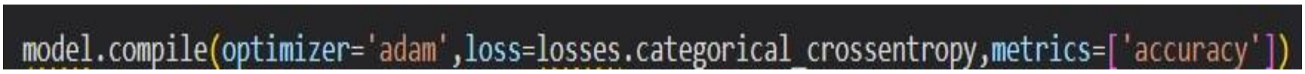
```
model.add(Dense(units=128,activation = 'relu'))
model.add(Dense(units = 64, activation = 'relu'))
model.add(Dense(units = 32, activation = 'relu'))
model.add(Dense(units = 6, activation = 'softmax'))
```



```
classifier.summary()#summary of our model
```

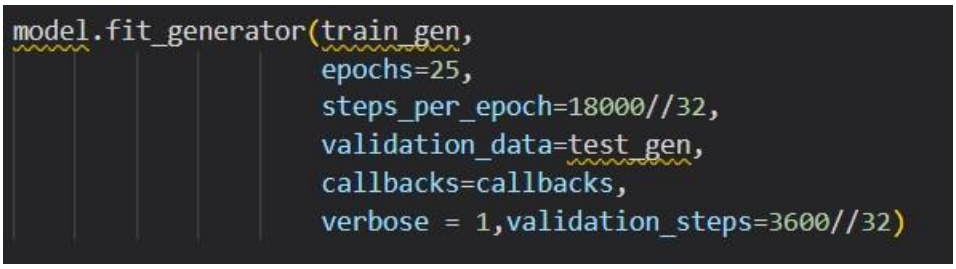
```
Model: "sequential_4"
_________________________________________________________________
Layer (type)                 Output Shape              Param #   
=================================================================
conv2d_6 (Conv2D)            (None, 62, 62, 32)        320       
_________________________________________________________________
max_pooling2d_6 (MaxPooling2 (None, 31, 31, 32)        0         
_________________________________________________________________
conv2d_7 (Conv2D)            (None, 29, 29, 32)        9248      
_________________________________________________________________
max_pooling2d_7 (MaxPooling2 (None, 14, 14, 32)        0         
_________________________________________________________________
flatten_3 (Flatten)          (None, 6272)              0         
_________________________________________________________________
dense_6 (Dense)              (None, 128)               802944    
_________________________________________________________________
dense_7 (Dense)              (None, 6)                 774       
=================================================================
Total params: 813,286
Trainable params: 813,286
Non-trainable params: 0
_________________________________________________________________
```

Configure The Learning Process



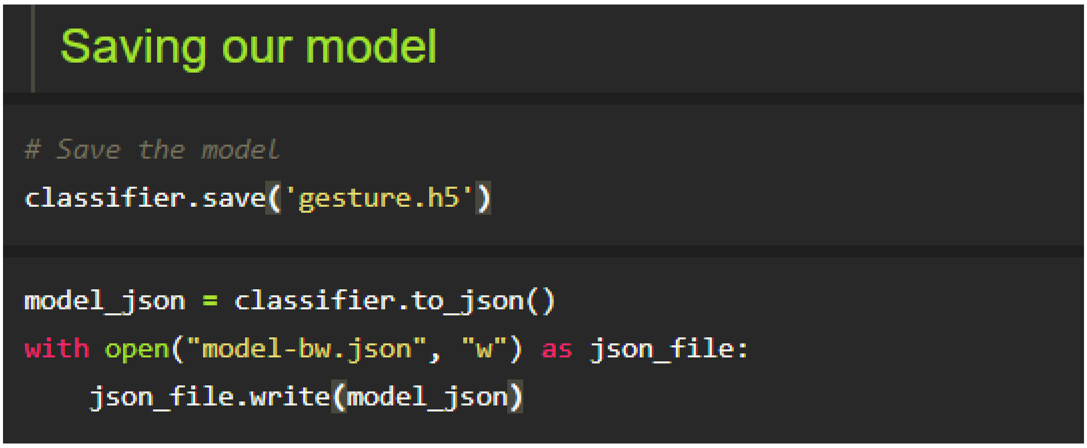
```
model.compile(optimizer='adam',loss=losses.categorical_crossentropy,metrics=['accuracy'])
```

Training Model



```
model.fit_generator(train_gen,
                    epochs=25,
                    steps_per_epoch=18000//32,
                    validation_data=test_gen,
                    callbacks=callbacks,
                    verbose = 1,validation_steps=3600//32)
```

Save the Model

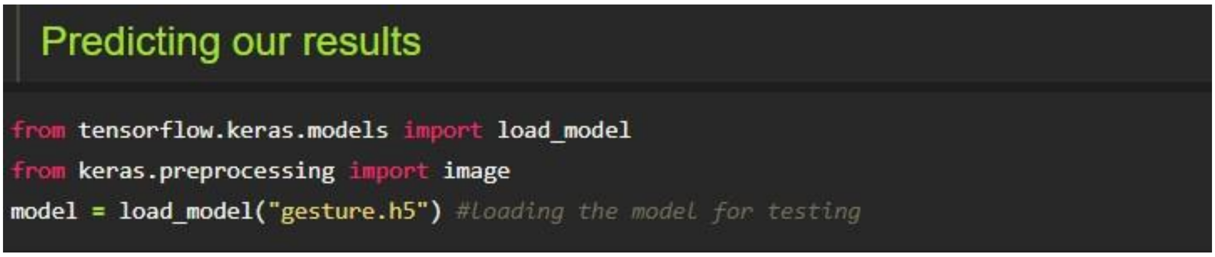


Saving our model

```
# Save the model
classifier.save('gesture.h5')
```

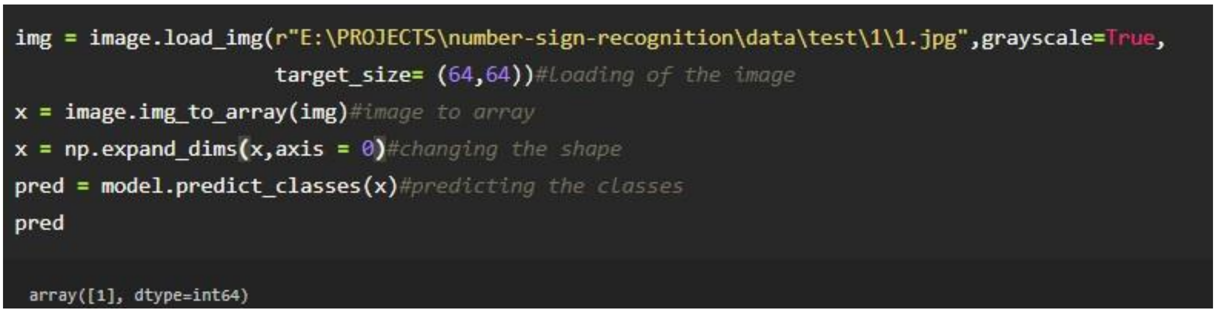
```
model_json = classifier.to_json()
with open("model-bw.json", "w") as json_file:
    json_file.write(model_json)
```

Test the Model



Predicting our results

```
from tensorflow.keras.models import load_model
from keras.preprocessing import image
model = load_model("gesture.h5") #loading the model for testing
```



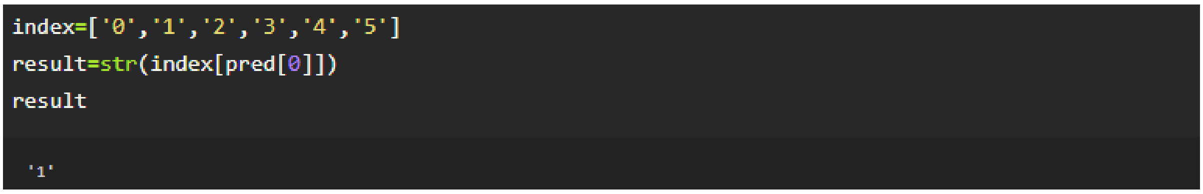
```
img = image.load_img(r"E:\PROJECTS\number-sign-recognition\data\test\1\1.jpg",grayscale=True,
                     target_size= (64,64))#loading of the image
x = image.img_to_array(img)#image to array
x = np.expand_dims(x,axis = 0)#changing the shape
pred = model.predict_classes(x)#predicting the classes
pred
```

```
array([1], dtype=int64)
```

7.2 Feature 2

7.2.1 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.

7.2.2 App starts running when “ name ” constructor is called in main.



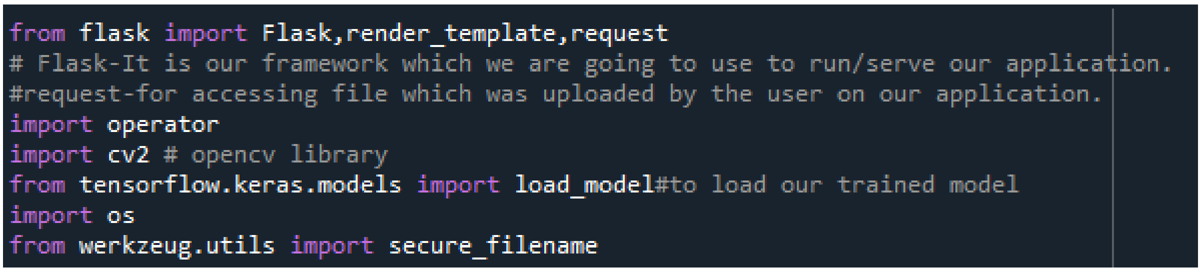
```
index=['0','1','2','3','4','5']
result=str(index[pred[0]])
result

 '1'
```

7.2.3 Render _template is used to return html file.

7.2.4 “GET” method is used to take input from the user.

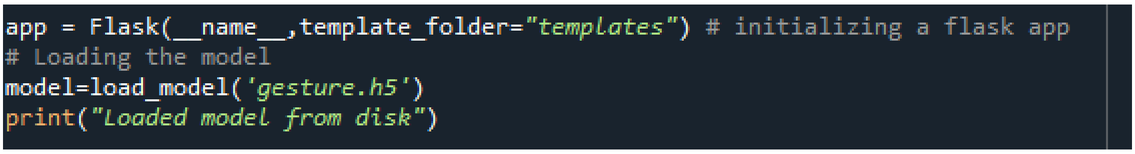
7.2.5 “POST” method is used to display the output to the user.

1:Importing Libraries



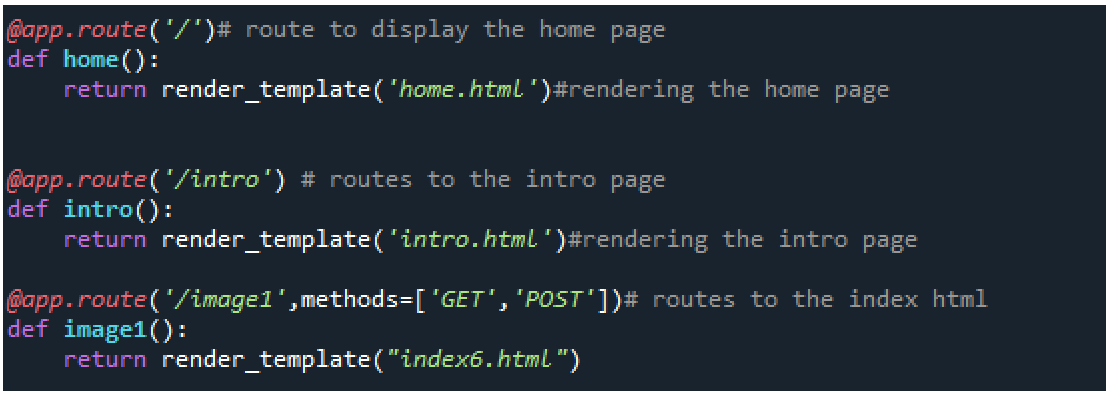
```
from flask import Flask,render_template,request
# Flask-It is our framework which we are going to use to run/serve our application.
#request-for accessing file which was uploaded by the user on our application.
import operator
import cv2 # opencv library
from tensorflow.keras.models import load_model#to load our trained model
import os
from werkzeug.utils import secure_filename
```

2:Creating our flask application and loading our model

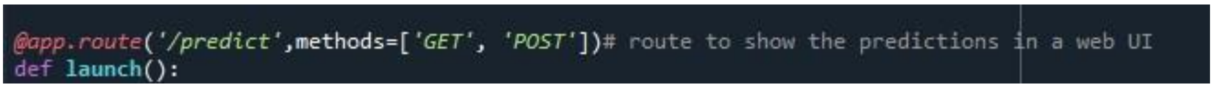


```
app = Flask(__name__,template_folder="templates") # initializing a flask app
# Loading the model
model=load_model('gesture.h5')
print("Loaded model from disk")
```

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.

7.2.6 Firstly, inside launch function we are having the following things:

7.2.6.1 Getting our input and storing it

7.2.6.2 Grab the frames from the web cam.

7.2.6.3 Creating ROI

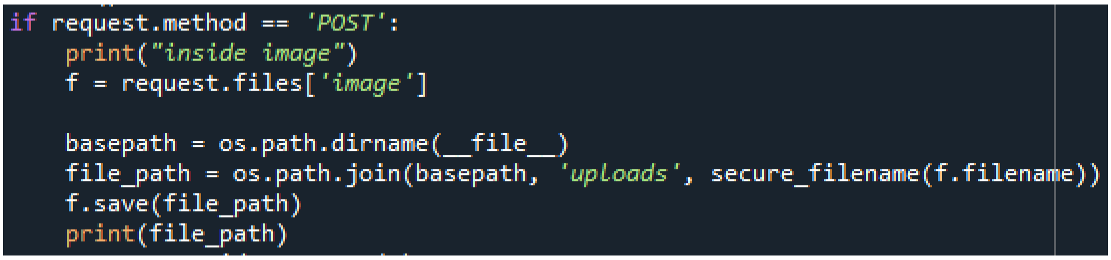
7.2.6.4 Predicting our results

7.2.6.5 Showcase the results with the help of opencv

7.2.6.6 Finally run the application

7.2.7 Getting our input and storing it

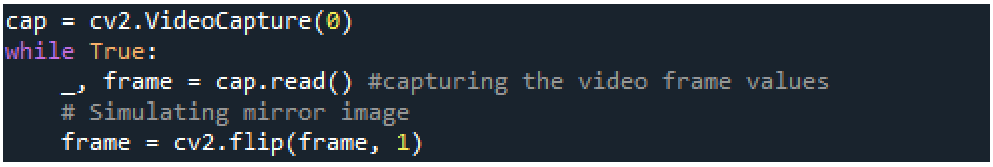
Once the predict route is called, we will check whether the method is POST or not if is POST then we will request the image files and with the help of os function we will be storing the image in the uploads folder in our local system.



```
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)
```

7.2.8 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.

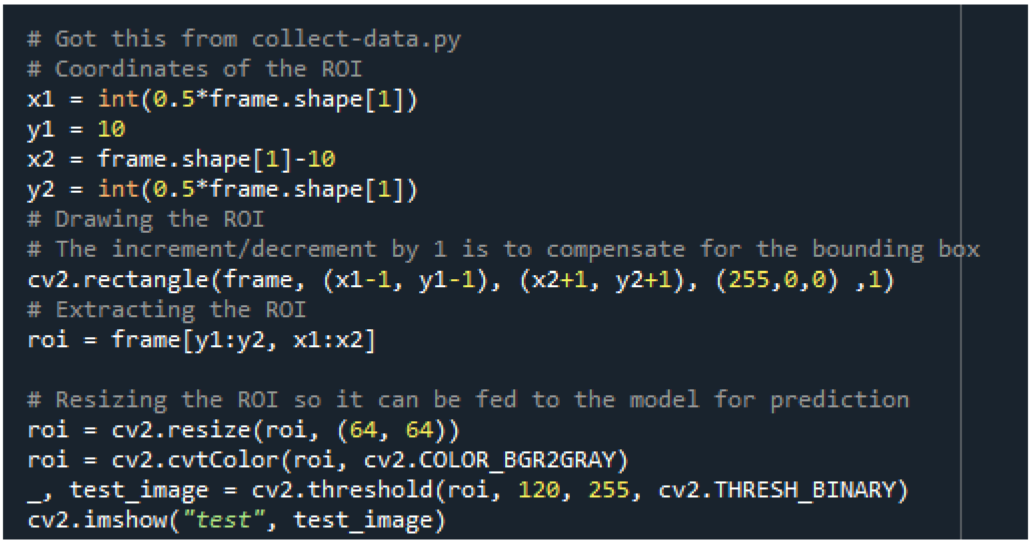


```
cap = cv2.VideoCapture(0)
while True:
    _, frame = cap.read() #capturing the video frame values
    # Simulating mirror image
    frame = cv2.flip(frame, 1)
```

7.2.9 Creating ROI

Are going 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.

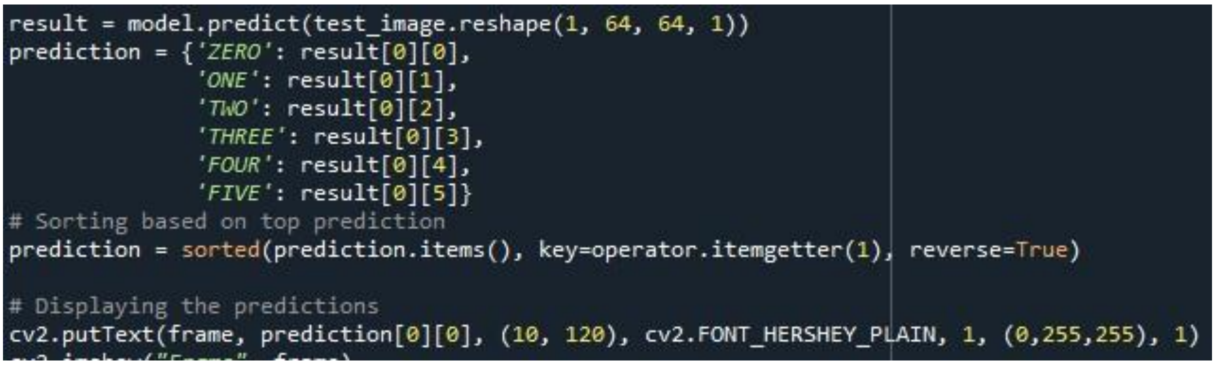
So, we will be creating a ROI to mask our gesture.



```
# 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)
```

7.2.10 Predicting our results

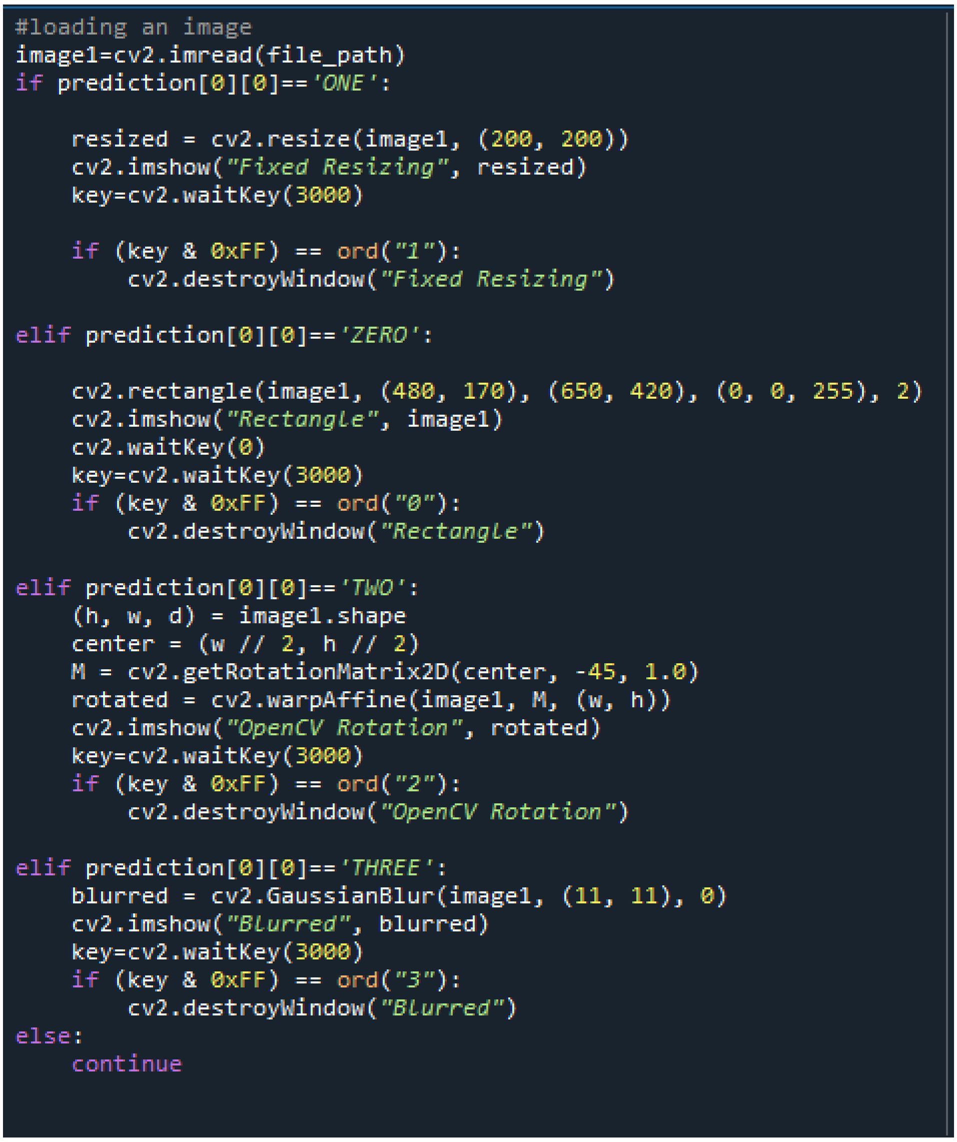
After placing the ROI and getting the frames from the web cam now its time to predict the gesture result using the model which we trained and stored it into a variable for the further operations.



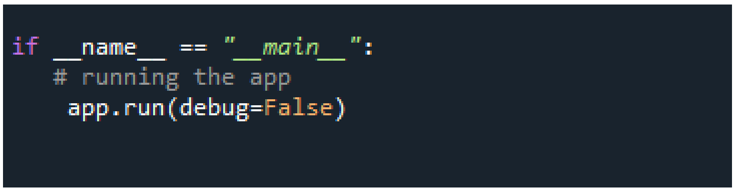
```
result = model.predict(test_image.reshape(1, 64, 64, 1))
prediction = {'ZERO': result[0][0],
              'ONE': result[0][1],
              'TWO': result[0][2],
              'THREE': result[0][3],
              'FOUR': result[0][4],
              'FIVE': result[0][5]}
# Sorting based on top prediction
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)
cv2.imshow("Frame", frame)
```

7.2.11 Showcase the results with the help of opencv

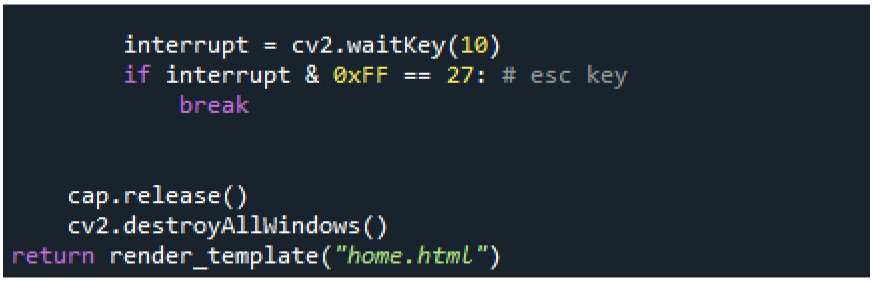
Finally according to the result predicted with our model we will be performing certain operations like resize, blur , rotate etc.



```
#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
```



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



```
        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

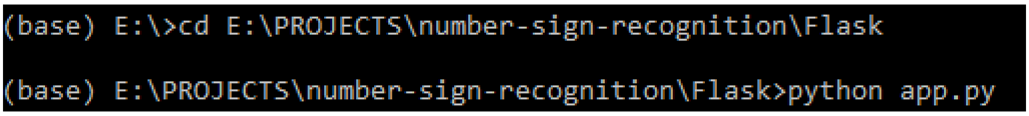
Run The app in local browser

7.2.12 Open anaconda prompt from the start menu

7.2.13 Navigate to the folder where your python script is.

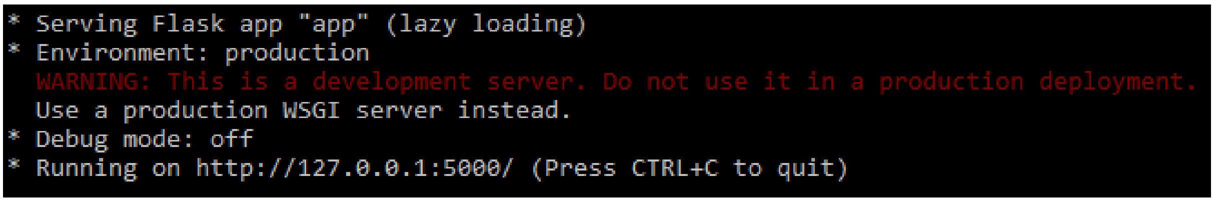
7.2.14 Now type “python app.py” command

7.2.15 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

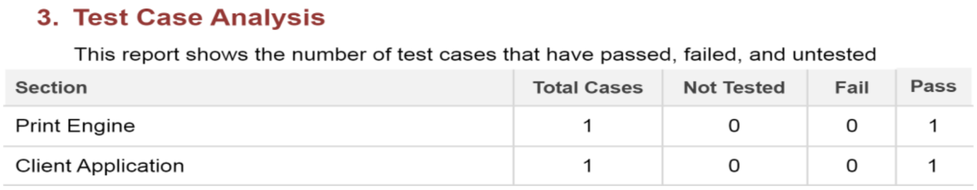


```
* Serving Flask app "app" (lazy loading)
* Environment: production
  WARNING: This is a development server. Do not use it in a production deployment.
  Use a production WSGI server instead.
* Debug mode: off
* Running on http://127.0.0.1:5000/ (Press CTRL+C to quit)
```

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

8 TESTING :

8.1 Test Cases

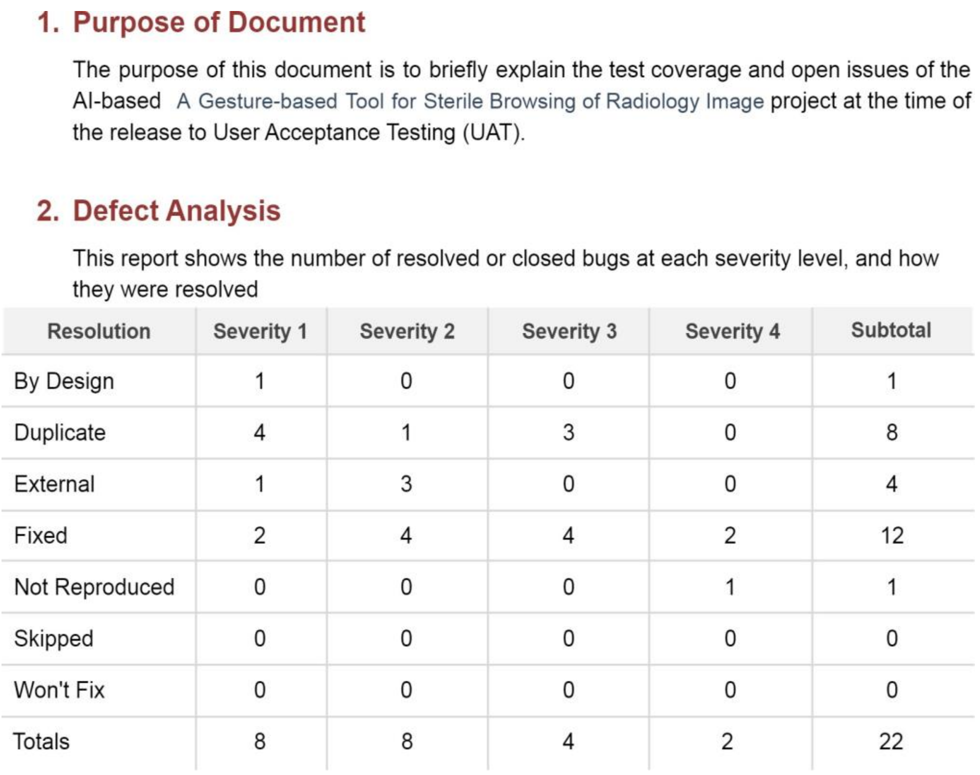


3. Test Case Analysis

This report shows the number of test cases that have passed, failed, and untested

Section	Total Cases	Not Tested	Fail	Pass
Print Engine	1	0	0	1
Client Application	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).

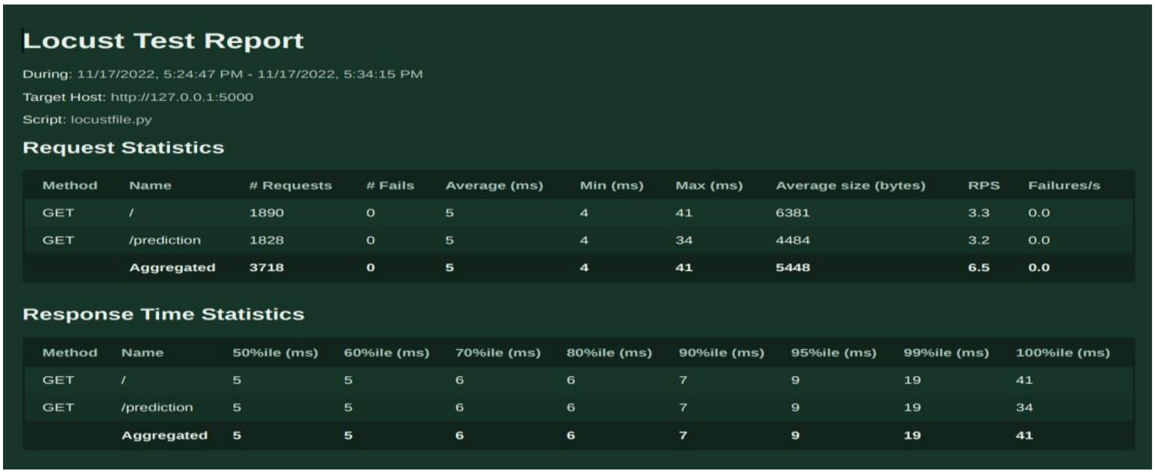
2. Defect Analysis

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

9 RESULTS :

9.1 Performance Matrices



Locust Test Report

During: 11/17/2022, 5:24:47 PM - 11/17/2022, 5:34:15 PM

Target Host: http://127.0.0.1:5000

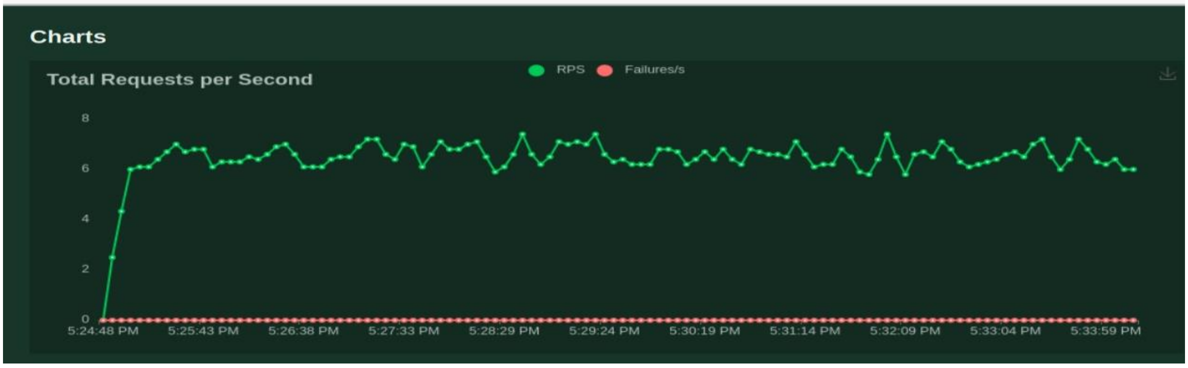
Script: locustfile.py

Request Statistics

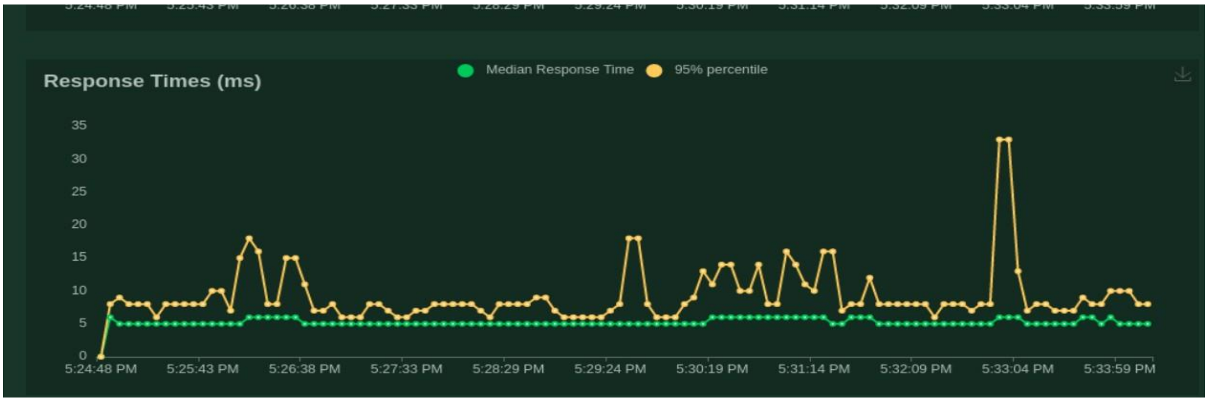
Method	Name	# Requests	# Fails	Average (ms)	Min (ms)	Max (ms)	Average size (bytes)	RPS	Failures/s
GET	/	1890	0	5	4	41	6381	3.3	0.0
GET	/prediction	1828	0	5	4	34	4484	3.2	0.0
	Aggregated	**3718**	**0**	**5**	**4**	**41**	**5448**	**6.5**	**0.0**

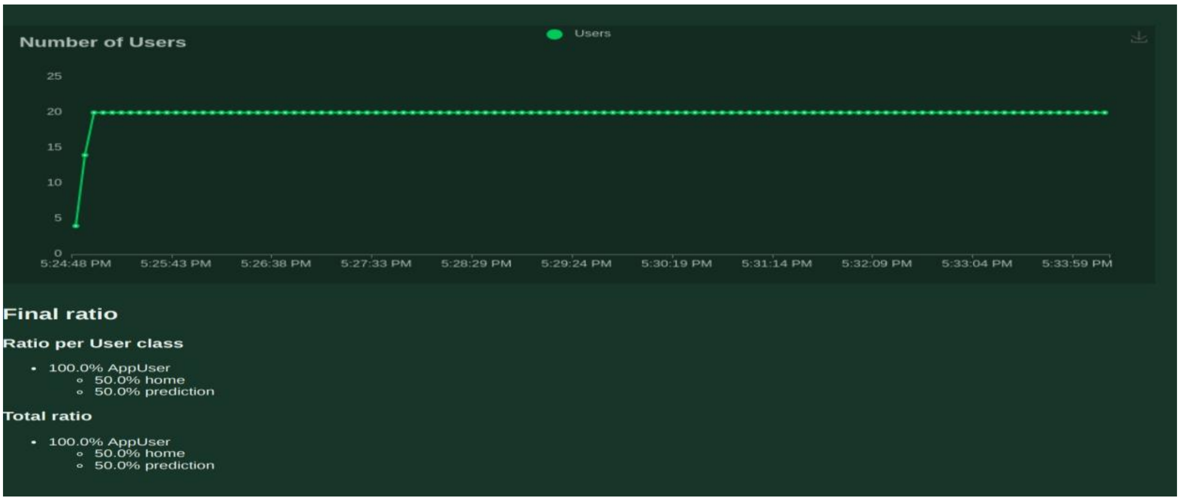
Response Time Statistics

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	/	5	5	6	6	7	9	19	41
GET	/prediction	5	5	6	6	7	9	19	34
	Aggregated	**5**	**5**	**6**	**6**	**7**	**9**	**19**	**41**



Charts





Final ratio

Ratio per User class

- 100.0% AppUser
  - 50.0% home
  - 50.0% prediction

Total ratio

- 100.0% AppUser
  - 50.0% home
  - 50.0% prediction

9.2 Output

1:Home Page:

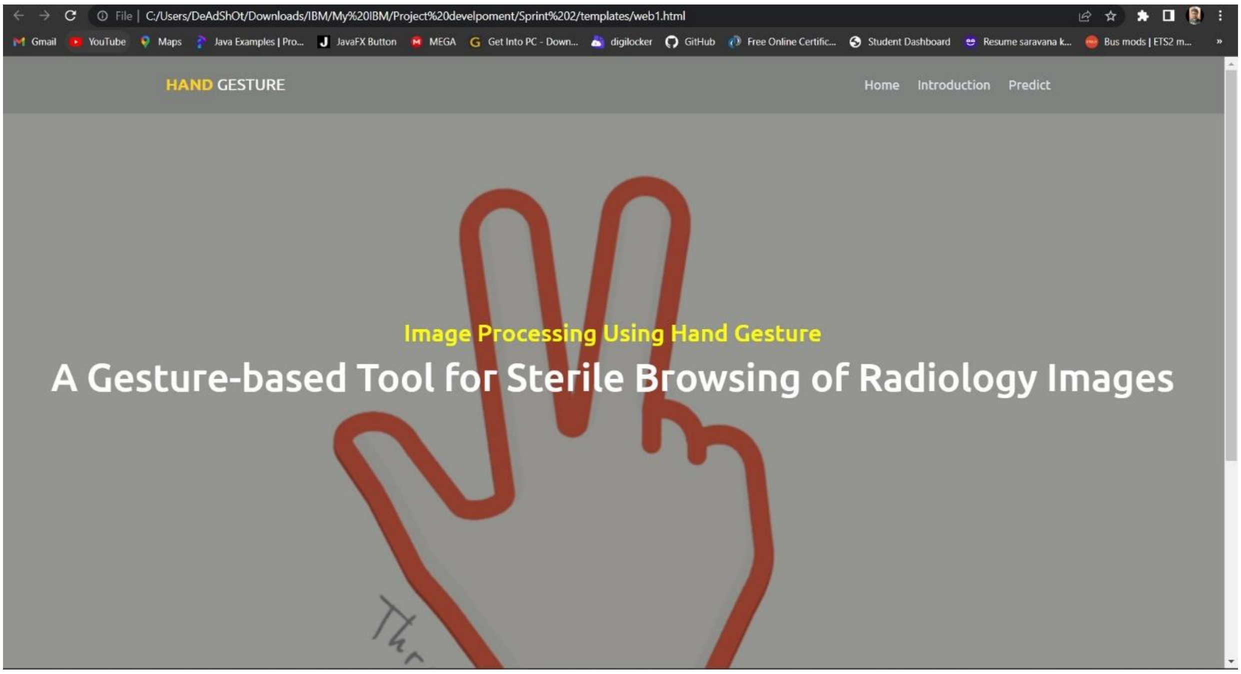


Image Processing Using Hand Gesture

A Gesture-based Tool for Sterile Browsing of Radiology Images

2:Introduction Page:

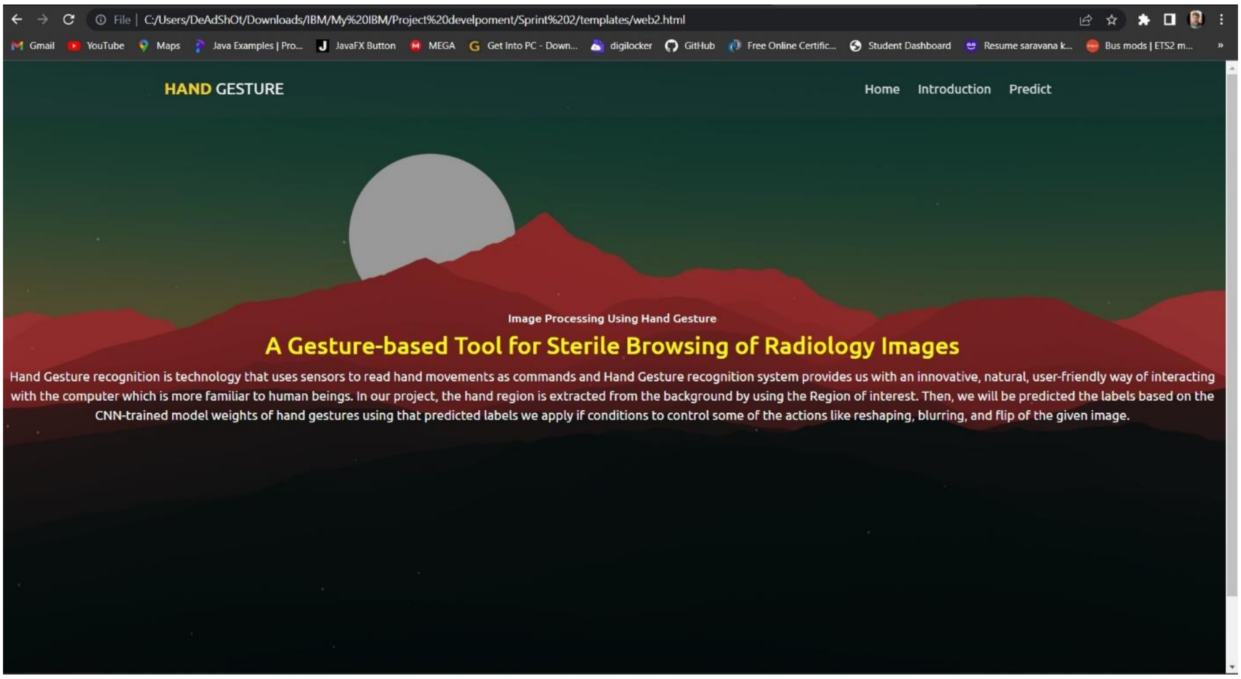


Image Processing Using Hand Gesture

A Gesture-based Tool for Sterile Browsing of Radiology Images

Hand Gesture recognition is technology that uses sensors to read hand movements as commands and 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.

3:Predict Page:

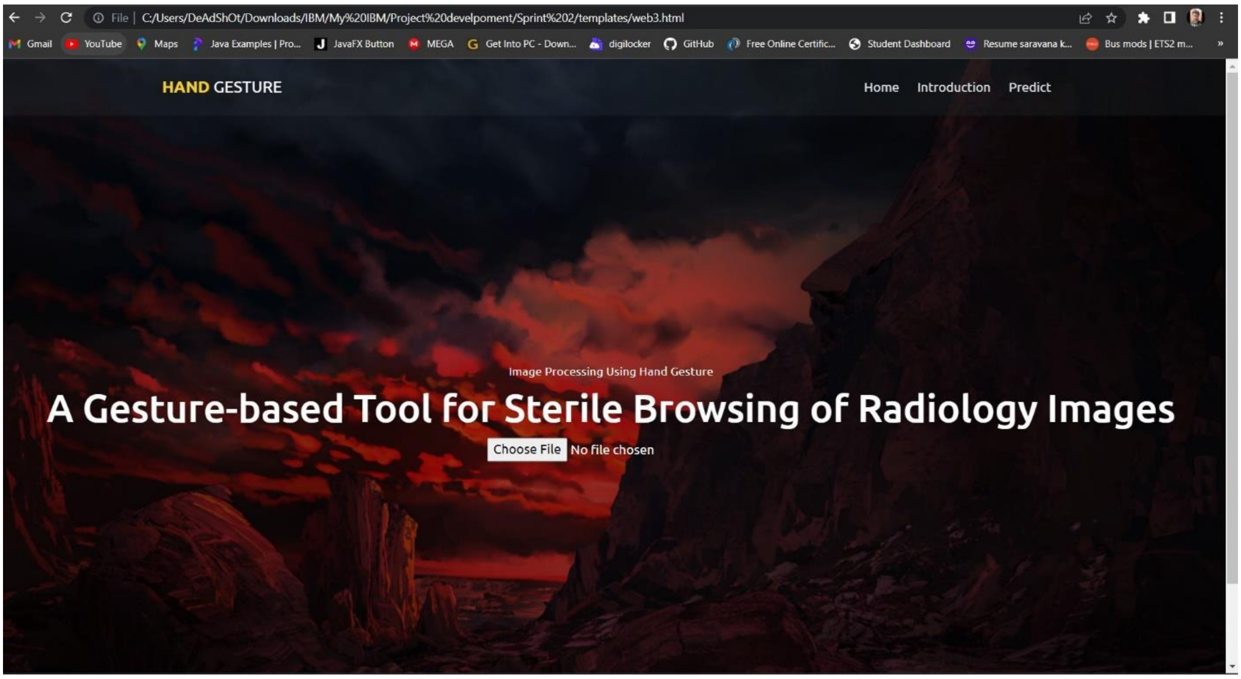
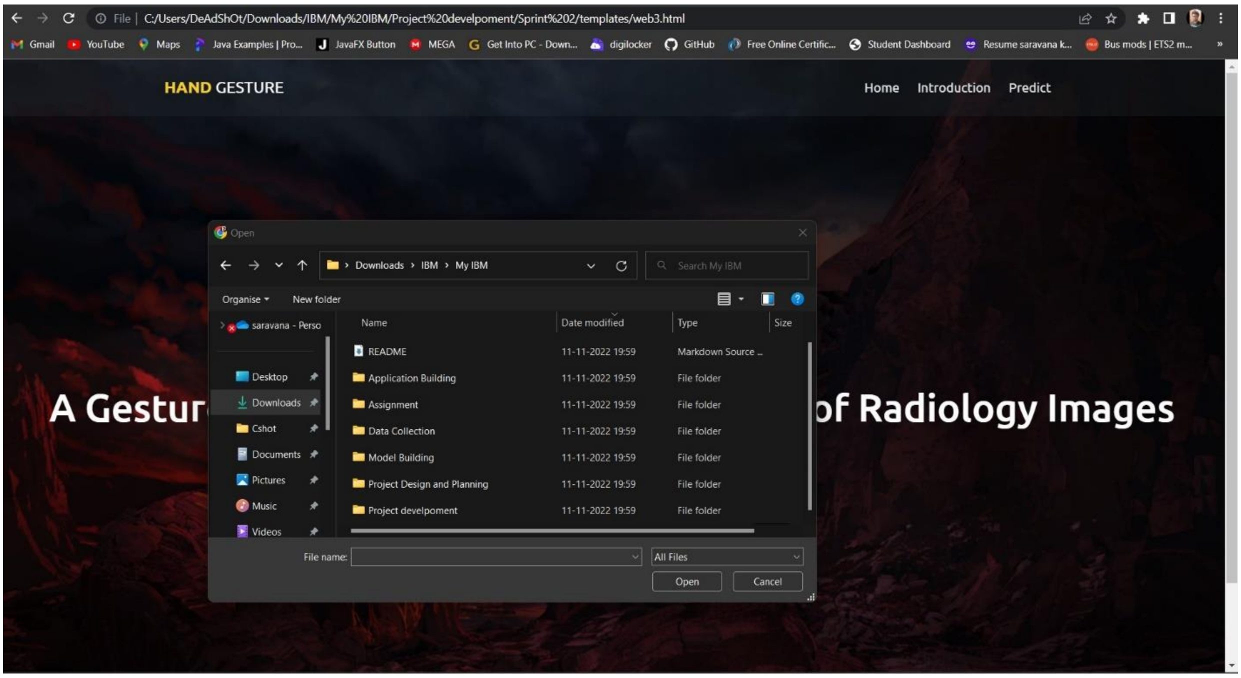


Image Processing Using Hand Gesture

A Gesture-based Tool for Sterile Browsing of Radiology Images

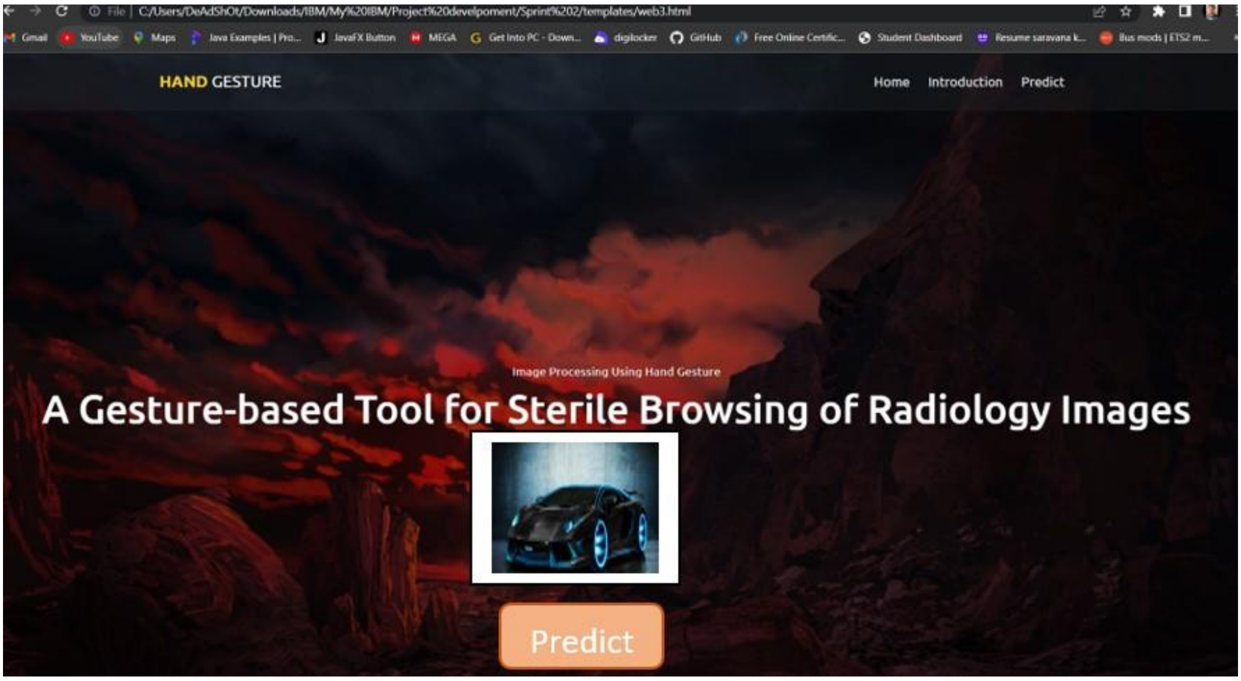
3.1 :Upload Image:



C:/Users/DeAdShOt/Downloads/IBM/My%20IBM/Project%20develpoment/Sprint%202/templates/web3.html

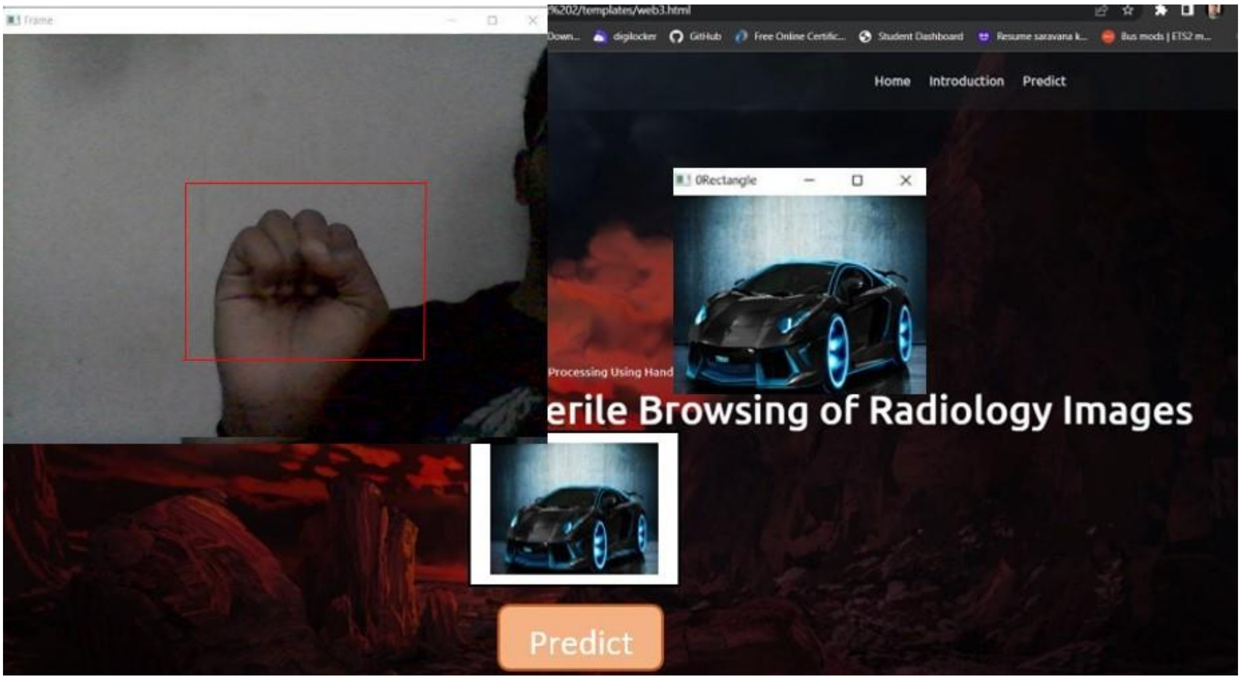
Name	Date modified	Type	Size
README	11-11-2022 19:59	Markdown Source ...	
Application Building	11-11-2022 19:59	File folder	
Assignment	11-11-2022 19:59	File folder	
Data Collection	11-11-2022 19:59	File folder	
Model Building	11-11-2022 19:59	File folder	
Project Design and Planning	11-11-2022 19:59	File folder	
Project develpoment	11-11-2022 19:59	File folder	

3.2 :Image Uploaded:



C:/Users/DeAdShOt/Downloads/IBM/My%20IBM/Project%20develpoment/Sprint%202/templates/web3.html

3.3 :Predict:


Frame
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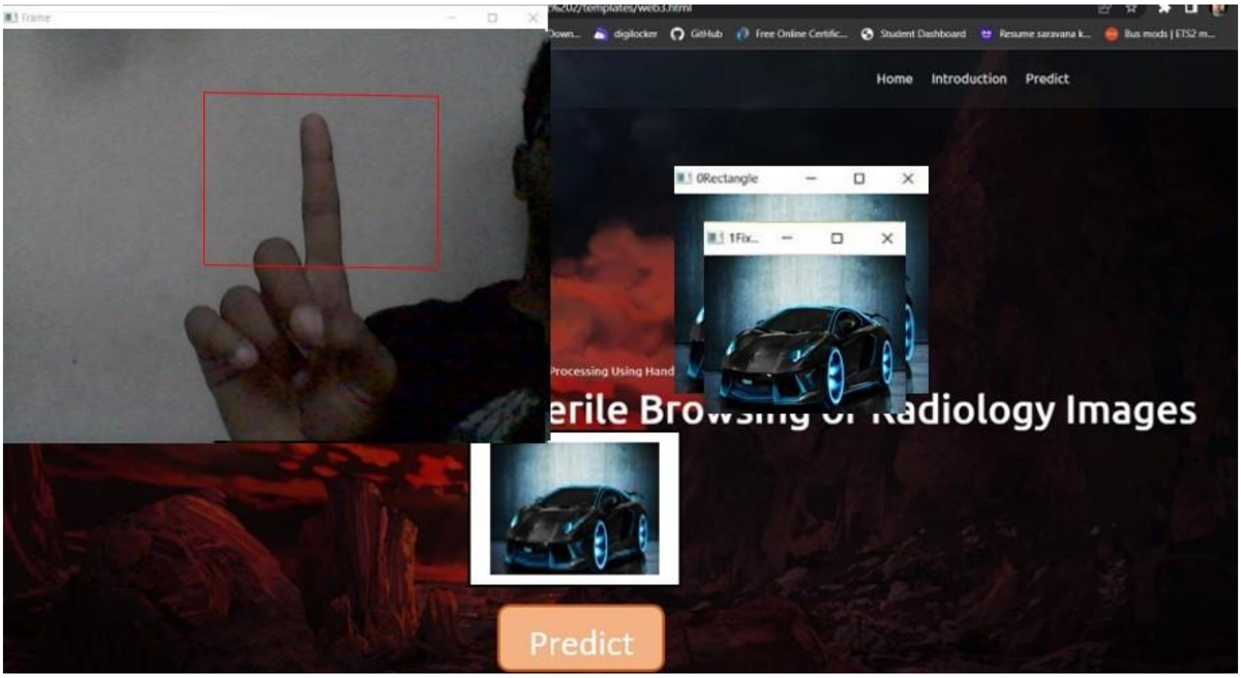
Down... digilocker GitHub Free Online Certific... Student Dashboard Resume saravana k... Bus mods | ETS2 m...
Home Introduction Predict
0Rectangle
Processing Using Hand
erile Browsing of Radiology Images
Predict


Frame
%202/templates/web3.html
Down... digilocker GitHub Free Online Certific... Student Dashboard Resume saravana k... Bus mods | ETS2 m...
Home Introduction Predict
0Rectangle
1Fix...
Processing Using Hand
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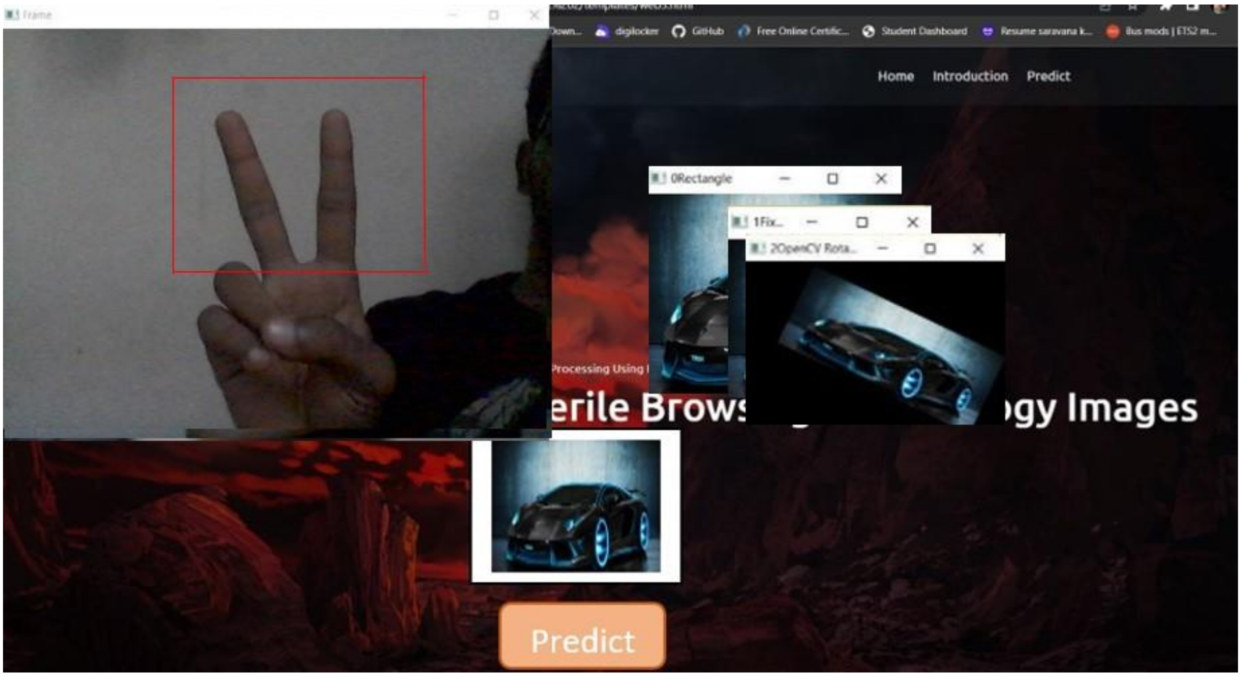
Predict


Frame
Down... digilocker GitHub Free Online Certific... Student Dashboard Resume saravana k... Bus mods | ETS2 m...
Home Introduction Predict
0Rectangle
1Fix...
2OpenCV Rota...
Processing Using I
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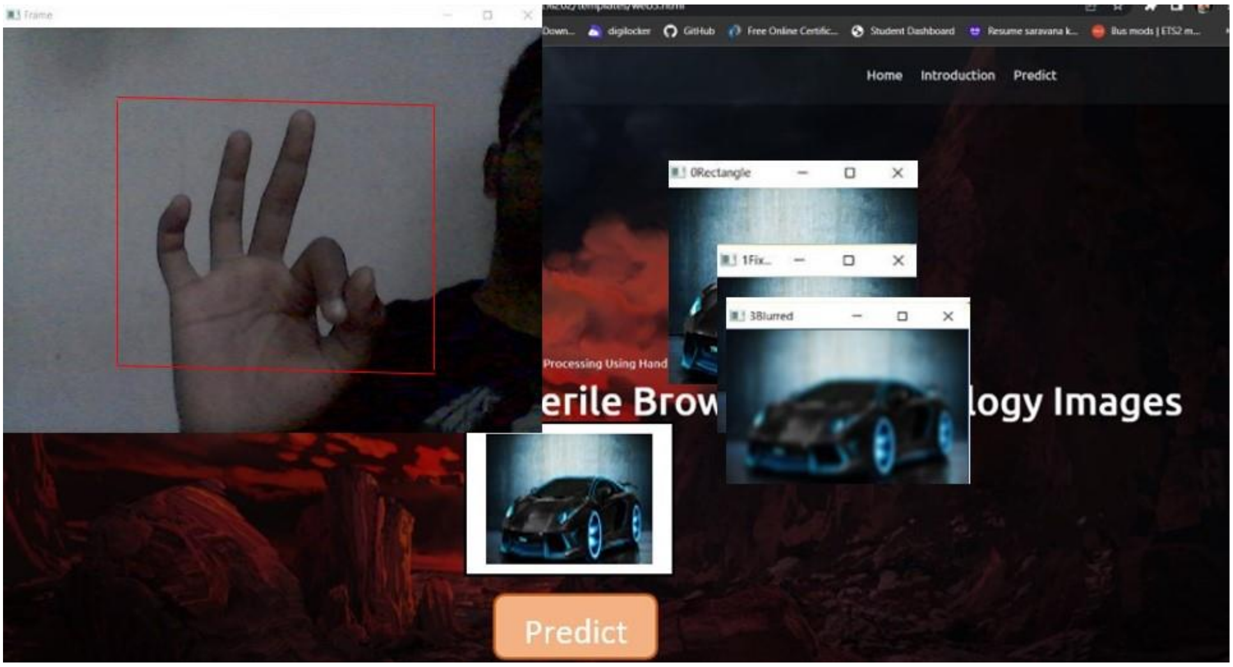
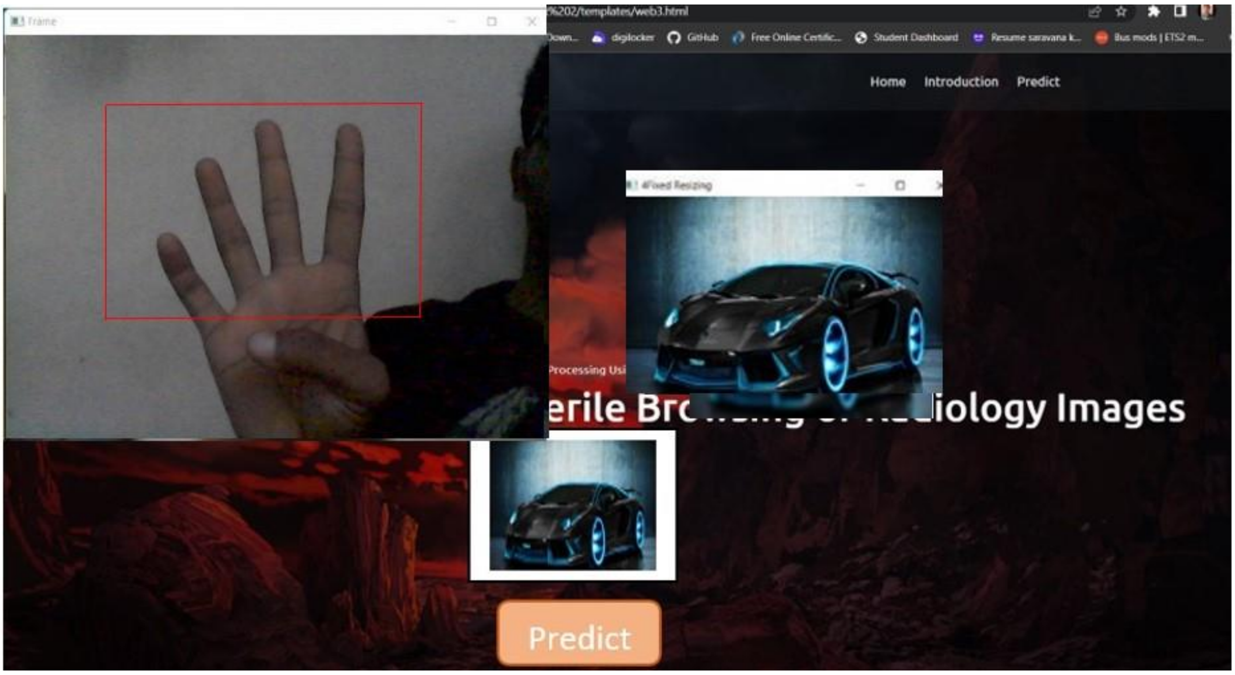
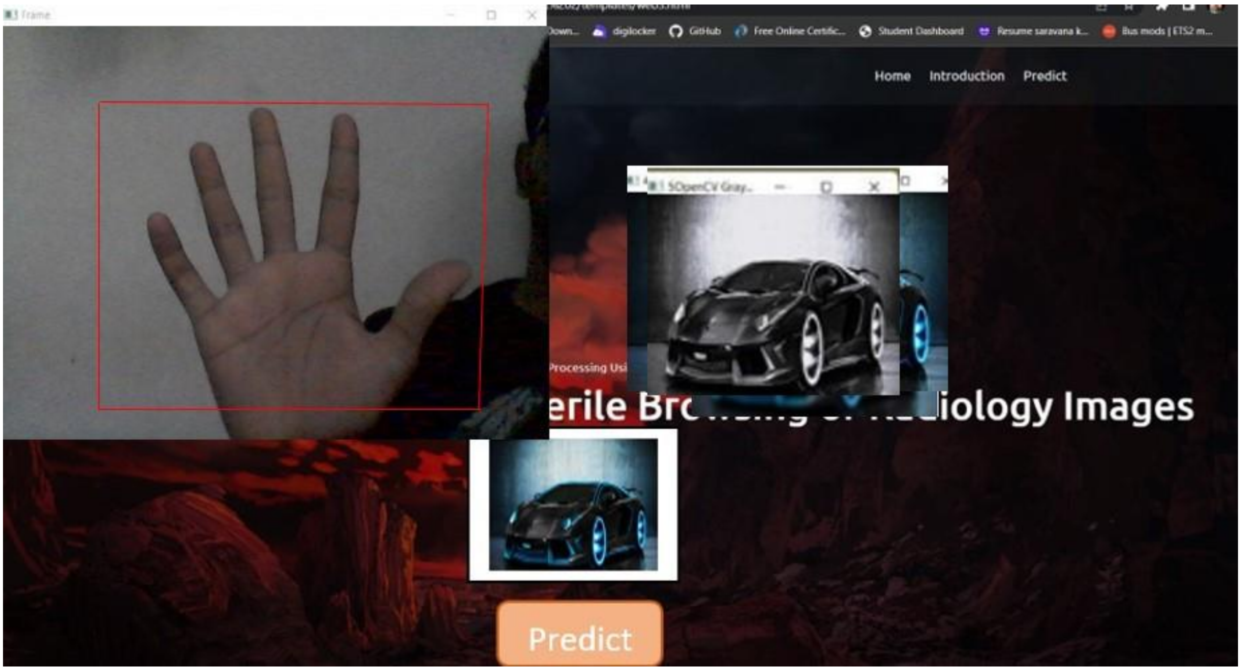
Predict


Frame
Down... digilocker GitHub Free Online Certific... Student Dashboard Resume saravana k... Bus mods | ETS2 m...
Home Introduction Predict
0Rectangle
1Fix...
3Blurred
Processing Using Hand
erile Brow
logy Images
Predict

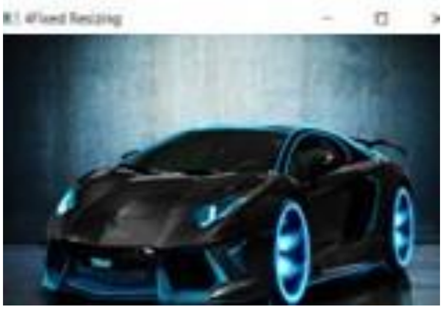

Frame
%202/templates/web3.html
Down... digilocker GitHub Free Online Certific... Student Dashboard Resume saravana k... Bus mods | ETS2 m...
Home Introduction Predict
4Fixed Resizing
Processing Usi
erile Br iology Images
Predict


Frame
Down... digilocker GitHub Free Online Certific... Student Dashboard Resume saravana k... Bus mods | ETS2 m...
Home Introduction Predict
5OpenCV Gray...
Processing Usi
erile Br iology Images
Predict

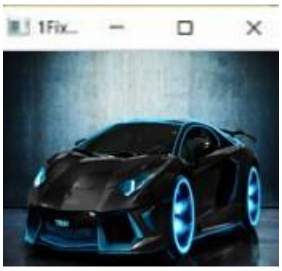
4.Actions:

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

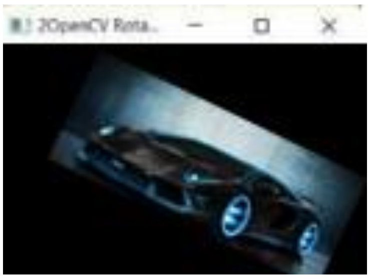
0-Rectangle



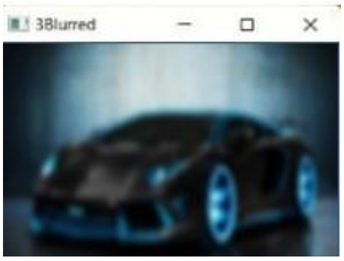
1-Fixed Resizing(200,200)



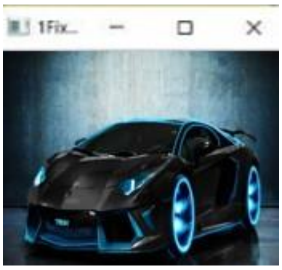
2-OpenCV Rotation



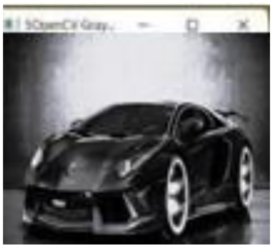
3-Blurred



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 Unnumbered 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 normal 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 extended 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.Web1.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/themify-icons.css">
        <link rel="stylesheet" href="../static/css/creative-design.css">
<style>
.header {
  background: url(../static/imgs/3.png);
height: 100%;
  background-size: cover;
  background-position:center;
  background-repeat: no-repeat;
  text-align: center;
  color: white;


}
</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="text-
    primary">HAND</strong> <span class="text-dark">GESTURE</span></a>
            <button class="navbar-toggler" type="button" data-toggle="collapse" data-
    target="#navbarSupportedContent" aria-controls="navbarSupportedContent" aria-
    expanded="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="web1.html">Home</a>
                    </li>
                    <li class="nav-item">
                        <a class="nav-link" href="web2.html">Introduction</a>
                    </li>
                    <li class="nav-item">
                        <a class="nav-link" href="web3.html">Predict</a>
                    </li>
                </ul>
            </div>
        </div>
    </nav><!-- End of Page Navbar -->

    <!-- Page Header -->
    <header id="home" class="header">
<img src="../static/imgs/3.gif" style="width:100%;height:100%;">

        <div class="overlay"></div>
        <div class="header-content">
            <h3 style="color:yellow;">Image Processing Using Hand Gesture</p>
            <h1 style="color:white;">A Gesture-based Tool for Sterile Browsing of
    Radiology Images</h1>
        </div>
    </header><!-- End of Page Header -->
```

2.Web.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/themify-icons.css">
      <link rel="stylesheet" href="../static/css/creative-design.css">
<style>
.header {
  background: #efefef url(../static/imgs/3.png);
  background-size: cover;
  background-position: center center;
  background-repeat: no-repeat;
  text-align: center;
  color: white;

  height: 100%;

}
</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="text-primary">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="web1.html">Home</a>
                   </li>
                   <li class="nav-item">
                       <a class="nav-link" href="web2.html">Introduction</a>
                   </li>
```

```
                    <li class="nav-item">
                        <a class="nav-link" href="web3.html">Predict</a>
                    </li>
                </ul>
            </div>
        </div>
    </nav><!-- End of Page Navbar -->


    <!-- Page Header -->
    <header id="home" class="header">
<img src="../static/imgs/3.png" style="width:100%;height:100%;">
        <div class="overlay"></div>
        <div class="header-content">
            <h5><p>Image Processing Using Hand Gesture</p></h5>
            <h3 style="color:yellow;">A Gesture-based Tool for Sterile Browsing of Radiology Images</h3>
                                                Hand Gesture recognition is technology that uses sensors to read hand movements as commands and 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.
        </div>
    </header><!-- End of Page Header -->
```

3.Web3.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/themify-icons.css">
       <link rel="stylesheet" href="../static/css/creative-design.css">
<style>
.header {
  background: #efefef url(../static/imgs/3.png);
  background-size: cover;
  background-position: center center;
  background-repeat: no-repeat;
  text-align: center;
  color: white;
  position: relative;
  height: 100%;
  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="text-primary">HAND</strong> <span class="text-dark">GESTURE</span></a>
            <button class="navbar-toggler" type="button" data-toggle="collapse" data-target="#navbarSupportedContent" aria-controls="navbarSupportedContent" aria-expanded="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="web1.html">Home</a>
                    </li>
                    <li class="nav-item">
                        <a class="nav-link" href="web2.html">Introduction</a>
                    </li>
                    <li class="nav-item">
                        <a class="nav-link" href="web3.html">Predict</a>
                    </li>
                </ul>
            </div>
        </div>
    </nav><!-- End of Page Navbar -->

    <!-- Page Header -->
    <header id="home" class="header">
<img src="../static/imgs/11.jpg" style="width:100%;height:100%;">

        <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>
 <input type="file" id="myFile" name="filename">

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

13.2 GitHub & Project Demo Link

PROJECT GITHUB:

https://github.com/IBM-EPBL/IBM-Project-4166-1658722646

PROJECT DEMO LINK:

https://drive.google.com/drive/folders/1GmlDg-9LOWYNltTrcRKHtWHvqlhv-XQJ?usp=sharing