ARTIFICIAL INTELLEGENCE

A GESTURE BASED TOOL FOR STERILE BROWSING OF RADIOLOGY IMAGES

IBM Project-Team ID: PNT2022TMID39568

Team Lead Gowtham R-510619104024

TEAM MEMBERS

GOWTHAM R	**510619104024**
ADHITHYA U	**510619104005**
GANESH C	**510619104017**
GOPI M	**510619104022**

Of

BACHELOR OF ENGINEERINGIN

COMPUTER SCIENCE AND ENGINEERING

C.ABDUL HAKEEM COLLEGE OF ENGINEERING AND TECHNOLOGY

ANNA UNIVERSITY CHENNAI 600 025

CONTENTS

7. CODING & SOLUTIONING (Explain the features added in the project along with code)

7.1. Feature 1

7.2. Feature 2

8. TESTING

8.1. Test Cases

8.2. User Acceptance Testing

9. RESULTS

9.1. Performance Metrics

10. ADVANTAGES & DISADVANTAGES

11. CONCLUSION

12. FUTURE SCOPE

13. APPENDIX

- Source Code
- Output Screenshots
- GitHub & Project Demo Link

1. INTRODUCTION

Humans are able to recognize body and sign language easily. This is possible due to the combination of vision and synaptic interactions that were formed along brain development. In order to replicate this skill in computers, some problems need to be solved: how to separate objects of interest in images and which image capture technology and classification technique are more appropriate, among others.

1.1. PROJECT OVERVIEW

In this project Gesture based Desktop automation, First the model is trained pre trained on the images of different hand gestures, such as a showing number with fingers as 1 ,2,3,4.

- This model uses the integrated webcam to capture the video frame.
- The image of the gesture captured in the video frame is compared with the pre-trained model and the gesture is identified.
- If the gesture predicts is 1 then images is blurred;2, image is resized; 3, image is rotated etc.

1.2. PURPOSE

The Main purpose of this “Web Application” is to make the life to even a better place to life by developing the technology through improving the “Human and Computer” communication.

To Make the

2. LITERATURE SURVEY

2.1. EXISTING PROBLEM

Humans are able to recognize body and sign language easily. This is possible due to the combination of vision and synaptic interactions that were formed along brain development. In order to replicate this skill in computers, some problems need to be solved: how to separate objects of interest in images and which image capture technology and classification technique are more appropriate, among others.

2.2. REFERENCES

01: A gesture-based tool for sterile browsing of radiology images.

02: Hand-gesture-based sterile interface for the operating room using contextual cues for the navigation of radiological images.

03: A gesture-controlled projection display for CT-guided interventions.

04: Touchless gesture recognition system for imaging controls in sterile environment.

05: Gesture-controlled image system positioning for minimally invasive interventions.

06: Intention, Context and Gesture Recognition for Sterile MRI Navigation in the Operating Room.

07: Simulation Interface for Gesture-Based Remote Control of a Surgical Lighting Arm.

08: Gesture-Controlled Image Management for Operating Room: A Randomized Crossover Study to Compare Interaction Using Gestures, Mouse, and Third Person Relaying.

09: Touchless interaction with software in interventional radiology and surgery: a systematic literature review.

10: Real-Time Hand Gesture Interface for Browsing Medical Images.

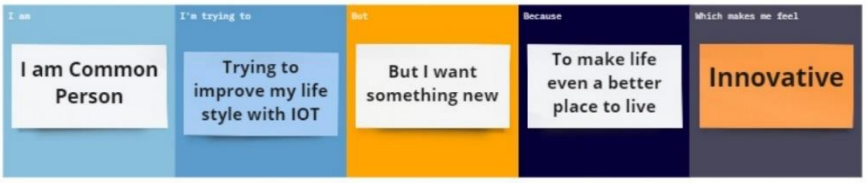
2.3. PROBLEM STATEMENT DEFINITION

IDEATION PHASE

The Problem Statement

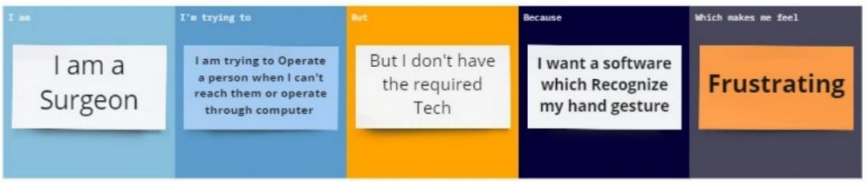
DATE	21 October 2022
TEAM ID	PNT2022TMID39568
PROJECT NAME	A Gesture - Based Tool for Sterile Browsing of Radiology Ideations Images
MAXIMUM MARKS	2 Marks

Problem Statement 1

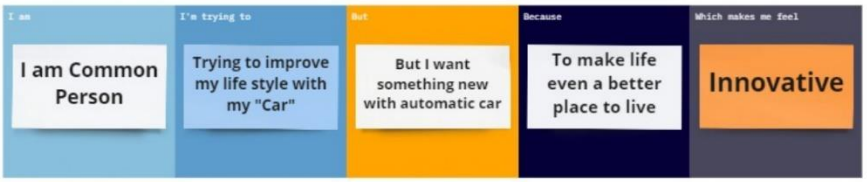


Problem Statement 2

Problem Statement 3

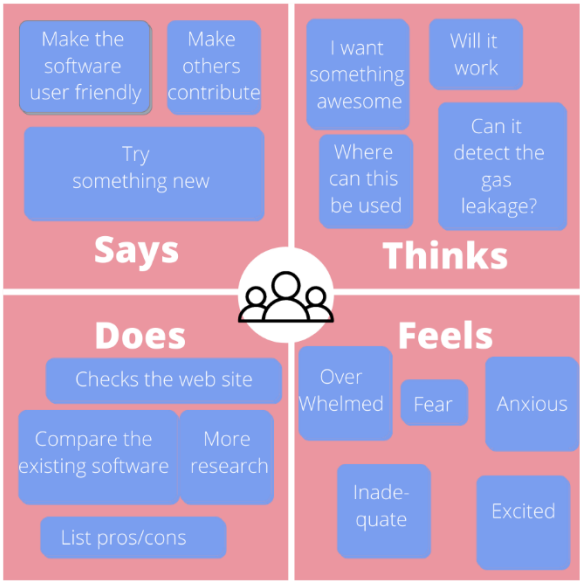


Problem Statement 4

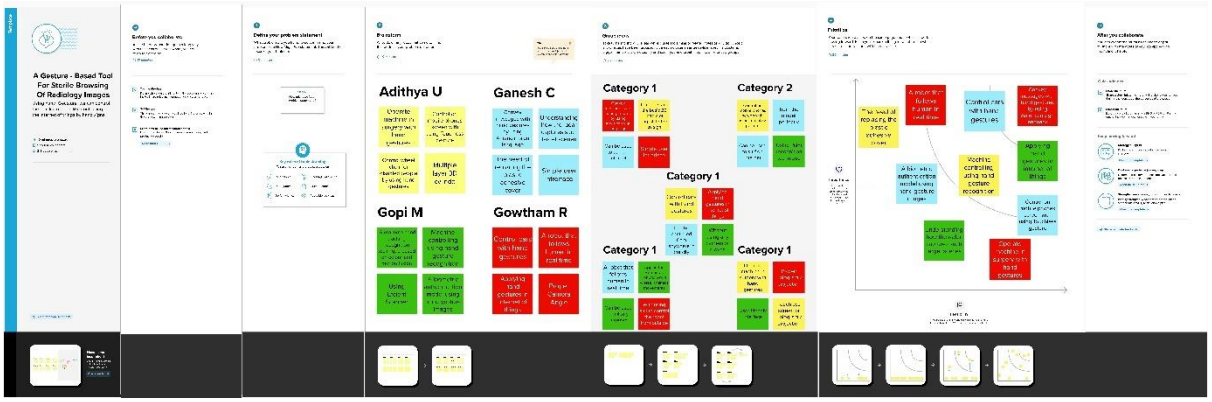


3. IDEATION & PROPOSED SOLUTION

3.1. EMPATHY MAP CANVAS



3.2. IDEATION & BRAINSTORMING



3.3. PROPOSED SOLUTION

PROJECT DESIGN PHASE – I

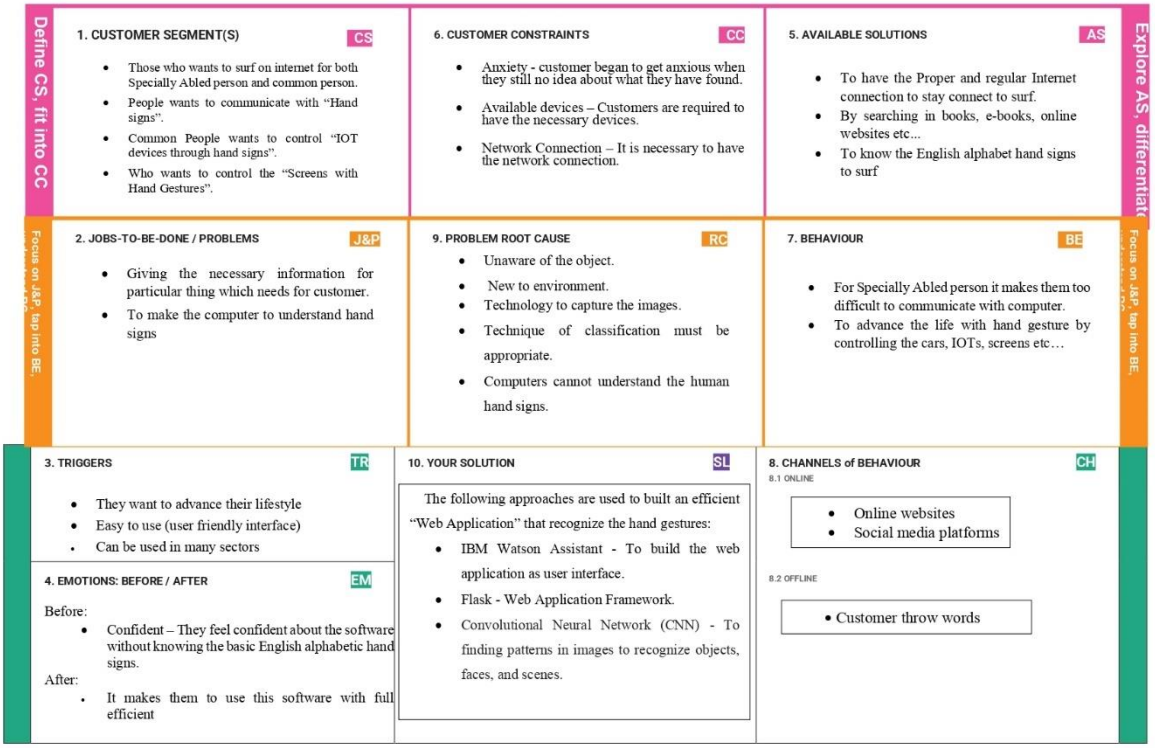
DATE	29 – 09 – 2022
TEAM ID	PNT2022TMID39568
PROJECT NAME	A Gesture - Based Tool for Sterile Browsing of Radiology Ideations Images
MAXIMUM MARKS	2 Marks

PROPOSED SOLUTION:

SI.NO:	PARAMETER	DESCRIPTION
01.	Problem statement (Problem to be solved)	Humans are able to recognize body and sign language easily. This is possible due to the combination of vision and synaptic interactions that were formed along brain development. In order to replicate this skill in computers, some problems need to be solved: • To separate objects of interest in images. • Technology to capture the images. • Technique of classification must be appropriate.
02.	Idea / Solution description	The following approaches are used to built an efficient "Web Application" that recognize the hand gestures: • IBM Watson Assistant - To build the web application as user interface. • Flask - Web Application Framework. • Convolutional Neural Network (CNN) - To finding patterns in images to recognize objects, faces, and scenes.
03.	Novelty / Uniqueness	This Web Application is used to understand the hand signs of human. With the hand signs we can "Convey messages to anyone, We can surf on internet, Specially with this we can control the cars".

3.4. PROBLEM SOLUTION FIT

Project Title: A Gesture-based Tool for Sterile Browsing of Radiology Image
Project Design Phase-I - Solution Fit Template
Team ID: PNT2022TMID39568



4. REQUIREMENT ANALYSIS

4.1. FUNCTIONAL REQUIREMENT

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	**User Registration**	Registration is done at the Registration and login page at Web application
FR-2	**User Confirmation**	Confirmation via Email Confirmation via OTP
FR-3	**Authentication**	Through Password authentication protocol
FR-4	**External Interfaces**	Microphone, Camera Ethernet, Wi-Fi and USB dongle to provide internet facilities
FR-5	**Reporting**	If any issues are faced by the customer or user, it will be directly notified to the developer.
FR-6	**Compliance to Rules or Laws**	Privacy policy, Terms and Conditions, End user agreement.

4.2. NON-FUNCTIONAL REQUIREMENTS

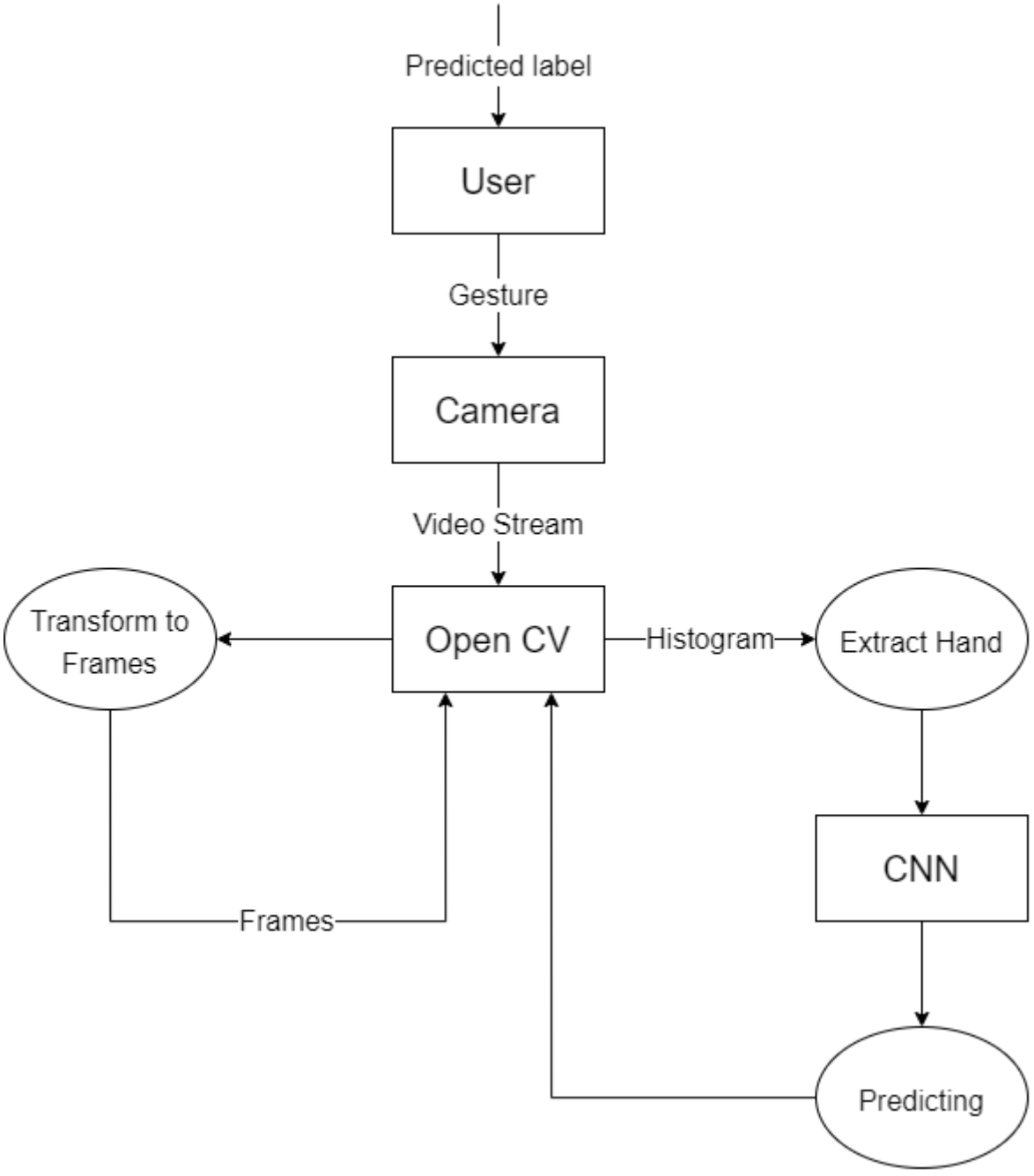
Following are the non-functional requirements of the proposed solution.

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	Can be used for many purposes some of them important are: ● Communicate with Computer via Hand Sign ● Able to control IOT via Hand Sign
NFR-2	**Security**	It is a Web Application platform which is secured by "Encrypting the user data"
NFR-3	**Reliability**	With this software the users can do many things example: ● Surf on the internet ● Communicate with Computer ● Controlling IOTs
NFR-4	**Performance**	The Performance of the software is high because ● The speed and accuracy are high ● It Upgrades the lifestyle of human beings by controlling things via hand signs.
NFR-5	**Availability**	The Demand for this technology is high cause with this: ● We can control over object ● Able to use wave screen technology ● Able to control the cars etc..
NFR-6	**Scalability**	In future we can develop the cars that would being controlled by hand gestures

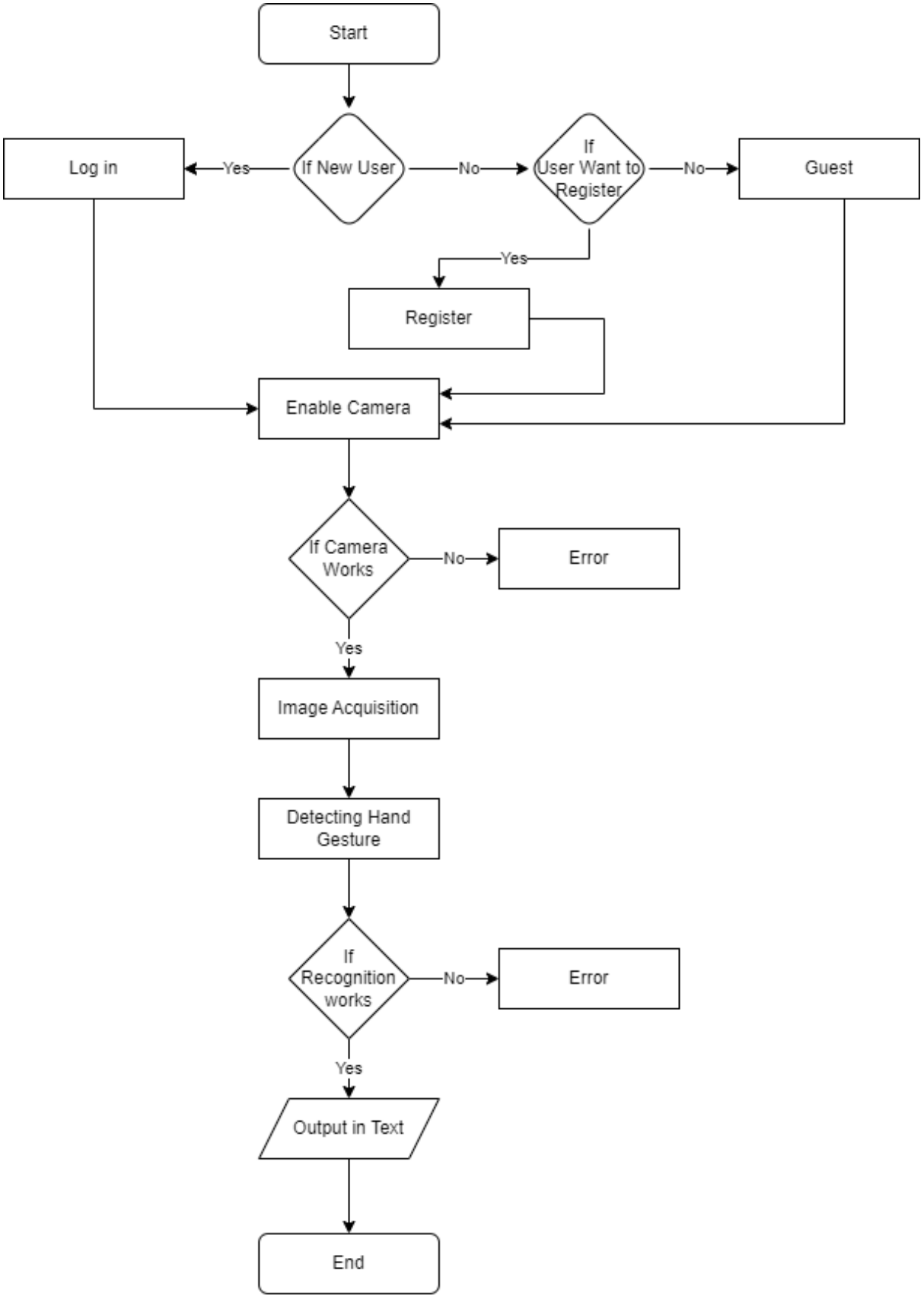
5. PROJECT DESIGN

5.1. DATA FLOW DIAGRAMS

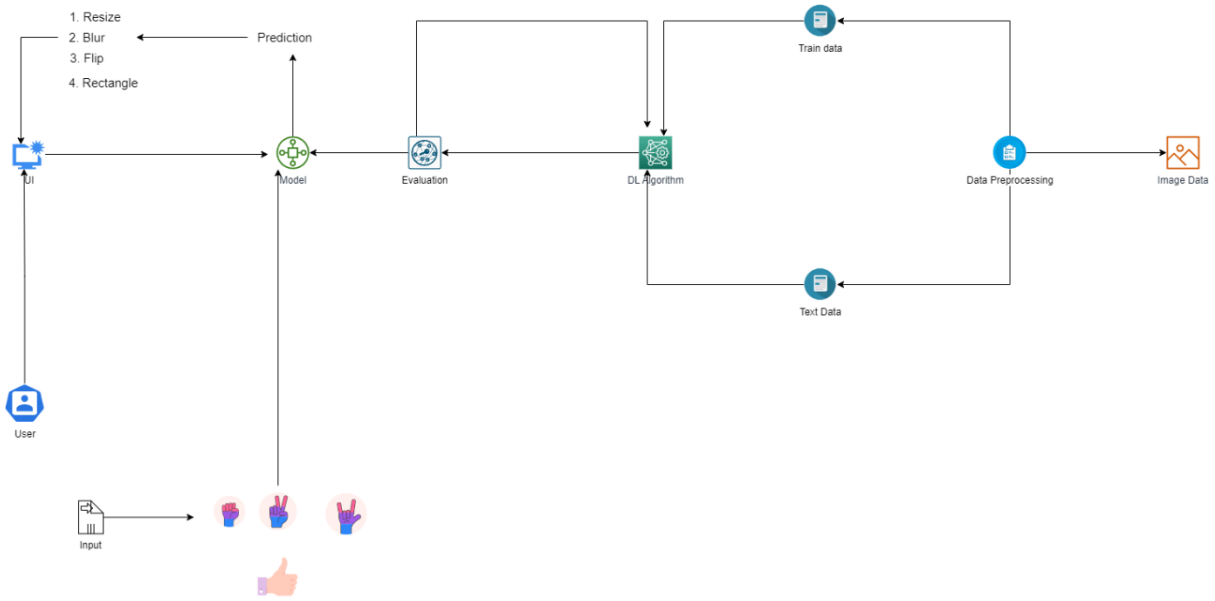
5.1.1. Simplified DFD:



5.1.2. Insdustry Standard DFD:



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	Release
Customer (Mobile user)	Registration	USN-1	As a user, I can register for The Web Application by entering my email, password, and confirming my password.	I can access my account / dashboard	High	Sprint-1
		USN-2	As a user, I will receive confirmation email once I have registered for The Web Application	I can receive confirmation email & click confirm	High	Sprint-1
Common People and Specially Abled People	Login	USN-3	As a user, I can log into The Web Application by entering email & password	If the registered information matches the given information accept login.	High	Sprint-1
	Dashboard		• The Dash board is simple, User-Friendly Interface and Common to Every User • After the amazing landing page, the user can log in with email and password or the user can use the access the feature as a guest	I can access my account / dashboard I can access the features as a guest	High	Sprint 2
Customer (Web user)			Give access to camera to recognize the Hand Gestures to communicate with the computer	I can access the camera and use it to communicate message	High	Sprint 2
Common People	Feedback		Give access to comment about the software and share this Web	I can give suggestion and recommend the site to my	High	Sprint 3

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
			application site to friends or end the session and restart over	friends Or I can end the current session and go out or restart the process		

6. PROJECT PLANNING & SCHEDULING

6.1. SPRINT PLANNING & ESTIMATION

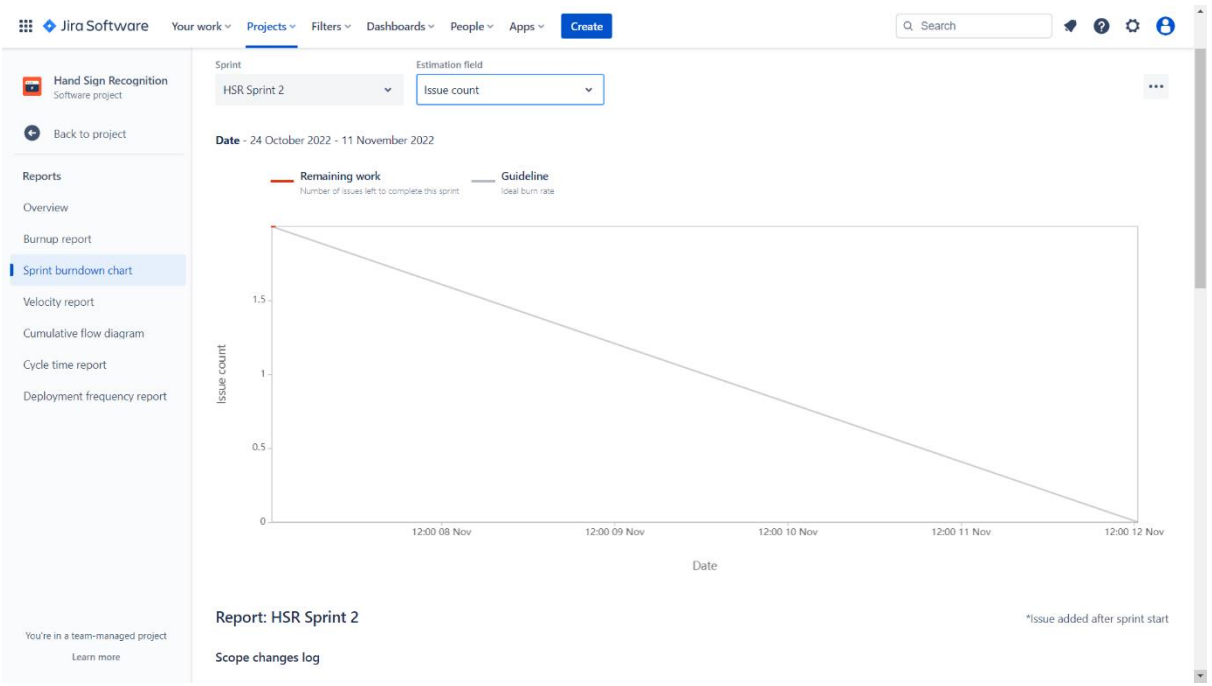
Use the below template to create product backlog and sprint schedule

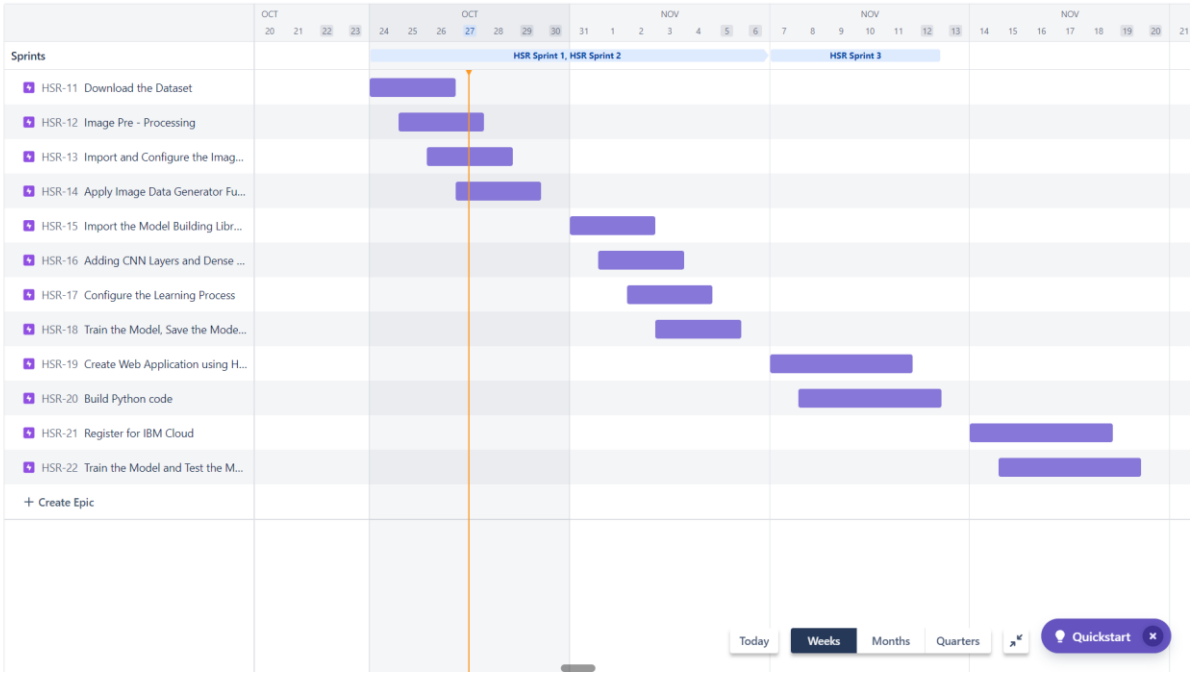
Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	**Data Collection**	USN-1	Download the Dataset	10	High	U. Adhithya C. Ganesh
Sprint-1		USN-2	Image Pre-processing	10	High	M. Gopi R. Gowtham
Sprint-1		USN-3	Import and Configure the Image Data Generator Library and Class	10	High	C. Ganesh M. Gopi
Sprint-1		USN-4	Apply Image Data Generator Functionality to Train-Set and Test-Set	10	High	U. Adhithya R. Gowtham
Sprint-2	**Model Building**	USN-5	Import the Model Building Libraries and Initializing the Model	10	High	U. Adhithya C. Ganesh M. Gopi R. Gowtham
Sprint-2		USN-6	Adding CNN Layers and Dense Layers	10	High	U. Adhithya C. Ganesh M. Gopi R. Gowtham
Sprint-2		USN-7	Configure the Learning Process	10	High	U. Adhithya C. Ganesh M. Gopi R. Gowtham
Sprint-2		USN-8	Train the Model, Save the Model and Test the Model	10	High	U. Adhithya C. Ganesh M. Gopi R. Gowtham
Sprint-3	**Application Building**	USN-9	Create Web Application using HTML, CSS, JavaScript	10	High	U. Adhithya C. Ganesh M. Gopi R. Gowtham
Sprint-3		USN-10	Build Python code	10	High	U. Adhithya C. Ganesh M. Gopi R. Gowtham
Sprint-4	**Train The Model on IBM**	USN-11	Register for IBM Cloud	10	High	U. Adhithya C. Ganesh M. Gopi R. Gowtham
Sprint-4		USN-12	Train the Model and Test the Model and its Overall Performance	10	High	U. Adhithya C. Ganesh M. Gopi R. Gowtham

6.2. SPRINT DELIVERY SCHEDULE

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	10	29 Oct 2022
Sprint-2	10	6 Days	31 Oct 2022	05 Nov 2022	10	05 Nov 2022
Sprint-3	10	6 Days	07 Nov 2022	12 Nov 2022	10	12 Nov 2022
Sprint-4	10	6 Days	14 Nov 2022	19 Nov 2022	10	19 Nov 2022

6.3. REPORTS FROM JIRA





7. CODING & SOLUTIONING (EXPLAIN THE FEATURES ADDED IN THE PROJECT ALONG WITH CODE)

7.1. FEATURE 1

Build Python Code

- 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.

- 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
```

- 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")
```

- Routing to the html Page

```python
@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")
```

The above three route are used to render the home, introduction and the index html pages.

```python
@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 of opencv
    - 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.

```python
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.

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

- Creating ROI

A region 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")
```

7.2. FEATURE 2

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)
```

8. TESTING

8.1. TEST CASES

Reference	Problem Identified	Method Used	Inference
Zhang et al., 2008	Complex background	Based on differencing background image between consecutive image frames using 3σ principle of normal distribution	Effective to eliminate noise due to illumination and shadow changes.
Lee et al., 2004	Complex background	(1) Frame differencing followed by entropy measurement to get color information in order to separate out the hand region (2) Chain code of the detected hand contour is taken as feature for recognition	(1) Invariant to change in lighting condition and is user-independent (2) System is able to recognize 6 types of hand postures with around 95% recognition rate
Saavedra et al., 2013	Variation in lighting condition	(1) Hand location is obtained by using STELA, which is then used to extract a training region for the hand (2) The color of the training region is used as a tool for segmenting the hand region from the background	Handles a variety of skin colors and illumination conditions
Chen et al., 2003	Real time hand tracking	(1) Hand region is extracted by combining motion, skin color and edge information (2) Fourier descriptor as spatial feature and motion analysis as temporal feature comprises of the feature vector which is fed to a HMM for recognition	(1) Robust and reliable in complex background (2) The system is tested for 20 different types of gestures and provides a recognition rate of around 90%
Binh et al., 2005	Real time hand tracking	(1) Hand location estimated by using a Kalman filter, serves as a starting point for searching a skin colored region (2) The skin color region which gives the best match to the estimated hand location is the segmented hand region.	(1) The system is fast and fairly robust to background clutter. (2) Recognition accuracy up to 98% has been achieved on a single handed database comprising of 36 American Sign Language (ASL) alphabets and digits
Agrawal et al., 2012	Feature selection	Shape descriptors, HOG and SIFT are combined to form a feature vector for recognizing two-handed signs of ISL using a multiclass Support Vector Machine (SVM)	(1) Provides a recognition rate of around 95% while testing 36 different signs performed by 4 users (2) Incorporating multiple features provides better results than considering the features individually
Zaki et al., 2011	Feature selection	(1) Feature vector comprises of three appearance based features: PCA, Kurtosis position and MCC to represent four important components of sign language viz. hand shape, place of articulation, orientation and movement (2) A three-layer HMM network is used for recognition	(1) Recognizes manual gestures of ASL. Different combinations of features were tested for recognition purpose. Amongst them, fusing all the three proposed features provided the least error rate. (2)Limitation is that the system fails to detect the hand in case of hand over face occlusion
Yang et al., 2009	Coarticulation	(1) A CRF based threshold model is built for separating out signs in vocabulary and non-sign patterns (2) Two motion based features viz. MCC for left and right hand and four location based features viz. position of left hand and right hand, vertical symmetry of the two hands and occlusion of two hands are used for recognition (3) A short sign detector, hand appearance based sign verification system and a sub-sign detector are also included to enhance the sign spotting accuracy	(1) The proposed system does not require non-sign patterns for training the CRF model (2) Provides a recognition rate of 87% for spotting signs from continuous data and 93.5% for spotting signs from isolated data

8.2. USER ACCEPTANCE TESTING

Purpose of Document

The purpose of this document is to briefly explain the test coverage and open issues of the [ProductName] project at the time of the release to User Acceptance Testing (UAT).

Defect Analysis

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

Resolution	Low	Medium	High	Subtotal
By Design	8	0	0	8
Duplicate	0	6	0	6
External	2	3	0	5
Fixed	0	7	2	9
Not Reproduced	0	0	1	1
Skipped	1	0	1	2
Won't Fix	0	1	7	8
Totals	11	17	11	39

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
Security	2	0	0	2
Outsource Shipping	6	0	0	6
Exception Reporting	2	0	0	2
Final Report Output	1	0	0	1
Version Control	1	0	0	1

9. RESULTS

9.1. PERFORMANCE METRICS

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

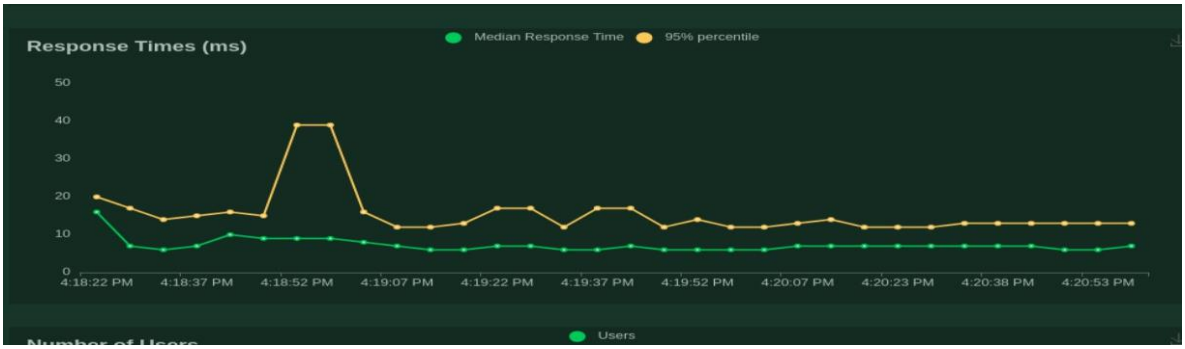
Request Statistics

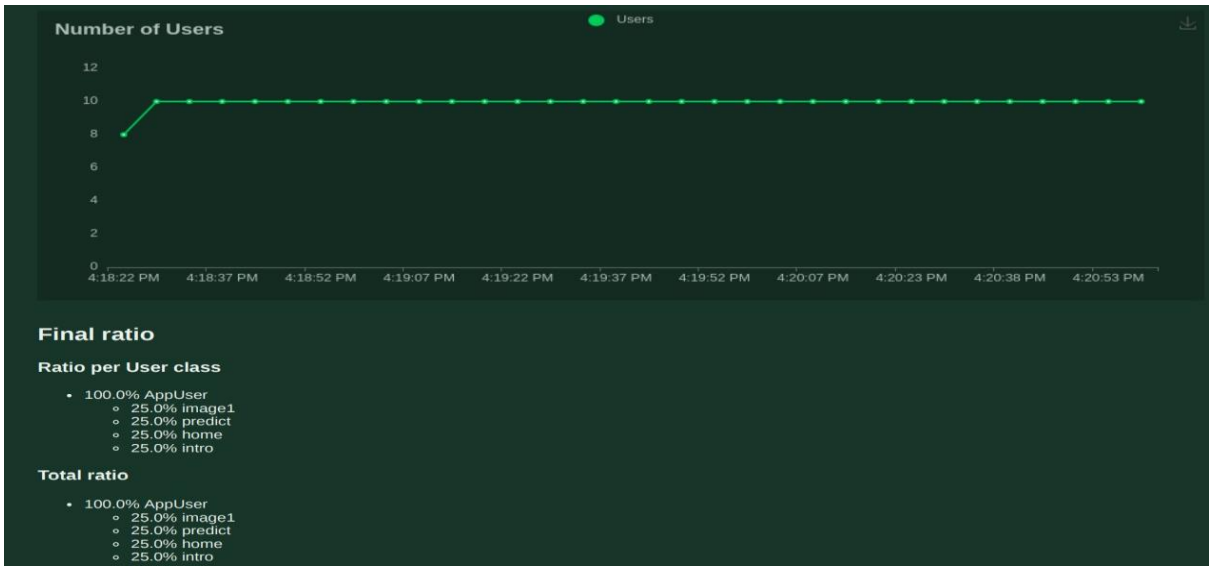
Method	Name	# Requests	# Fails	Average (ms)	Min (ms)	Max (ms)	Average size (bytes)	RPS	Failures/s
GET	//	126	0	13	9	59	6900	0.8	0.0
GET	/image1	129	0	6	5	27	7394	0.8	0.0
GET	/intro	139	0	7	4	38	8349	0.9	0.0
GET	/predict	136	0	6	5	12	6900	0.8	0.0
	Aggregated	**530**	**0**	**8**	**4**	**59**	**7400**	**3.3**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





10. ADVANTAGES & DISADVANTAGES

10.1 Advantages:

- **Ease of use**—the system allows the surgeon to use his/her hands, theirnatural work tool
- **Rapid reaction**—nonverbal instructions by hand gesture commands are intuitive and fast (In practice, the "Gestix" system can process images andtrack 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) sensingdevices or to use foot pedals
- **Distance control**—the hand gestures can be performed up to 5 meters fromthe 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 notsuffice 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 developa 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, incase 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' handsto 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-to-fit=no">
    <meta name="description" content="Start your development with Creative Designlanding
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-mdfixed-
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="{{ 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 withCreative 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/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 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="{{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>
        <div class="header-content">
            <p>Image Processing Using Hand Gesture</p>
            <h3 style="color:yellow;">A Gesture-based Tool for SterileBrowsing of
Radiology Images</h3>
                                <h4>      Hand Gesture recognition system provides us with
an innovative, natural, user-friendly way of interactingwith the computer which
is more familiar to human beings. In our project, the hand region isextracted
from the background by using the Region of interest. Then, we will bepredicted
the labels based on the CNN-trained model weights of hand gestures using that predicted
labels we apply if conditions to control some of theactions like reshaping, blurring, and flip
of the given image. <h4>
        </div>
    </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 withCreative 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">

    <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,initial-
scale=0.6">

      <script src="https://ajax.googleapis.com/ajax/libs/jquery/3.3.1/jquery.min.js"></script>

      <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"></script>

      <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"></script>

      <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);border-
   radius:25px;
   background-position: center;
   background-size: 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;
      text-align: center; padding:
      14px 16px; text-decoration:
      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; font-
size: 12px; border-radius:
16px;
}
.button:hover {
  box-shadow: 0 12px 16px 0 rgba(0,0,0,0.24), 0 17px 50px 0rgba(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; margin-
  bottom:18px; border: 1px
  solid #ccc;box-sizing:
  border-box;
}

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

```
  font-family: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%;
  border-radius: 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; padding-
  top: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 {max-
  width: 1000px; position:
  relative;
```

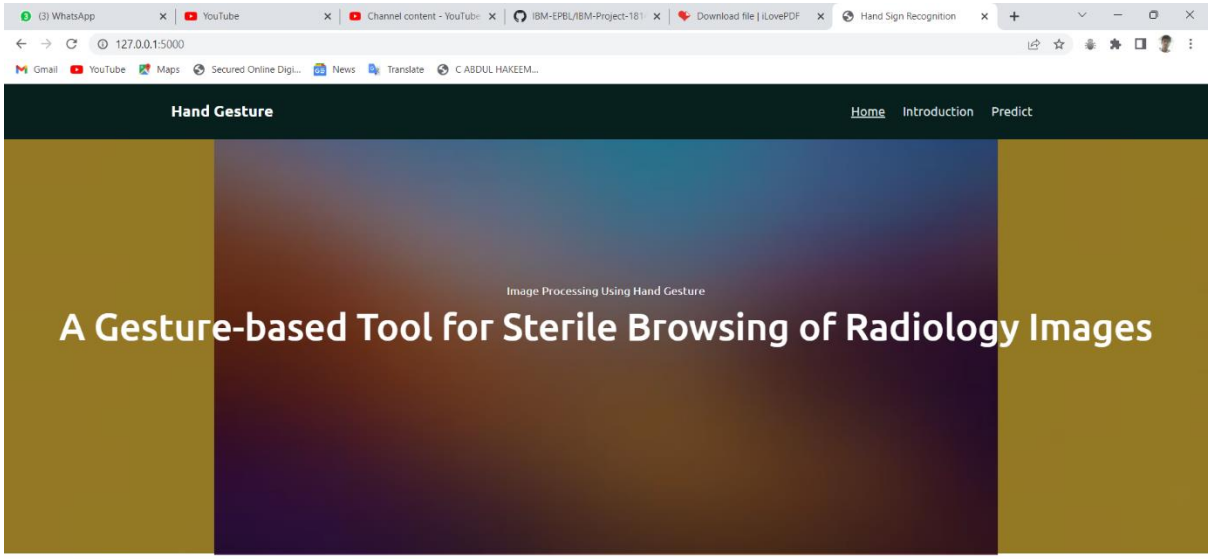
```
  margin: auto;
}

/* 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:
  inline-block;
  transition: background-color 0.6s ease;
}

.active {
  background-color: #267481;
}

/* Fading animation */
.fade {
  -webkit-animation-name: fade;
  -webkit-animation-duration: 1.5s;
  animation-name: fade; animation-
  duration: 1.5s;
}
@-webkit-keyframes fade {
```

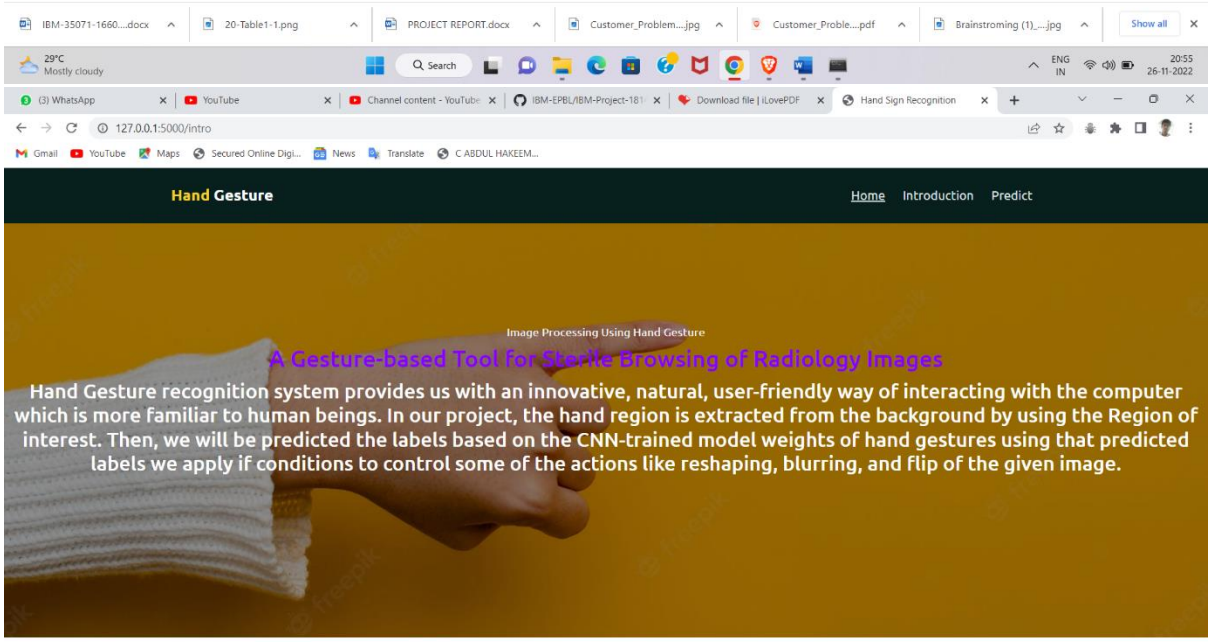
```
    from {opacity: .4}
    to {opacity: 1}
  }
  @keyframes fade {from
    {opacity: .4}
    to {opacity: 1}
  }

  /* 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 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">
```

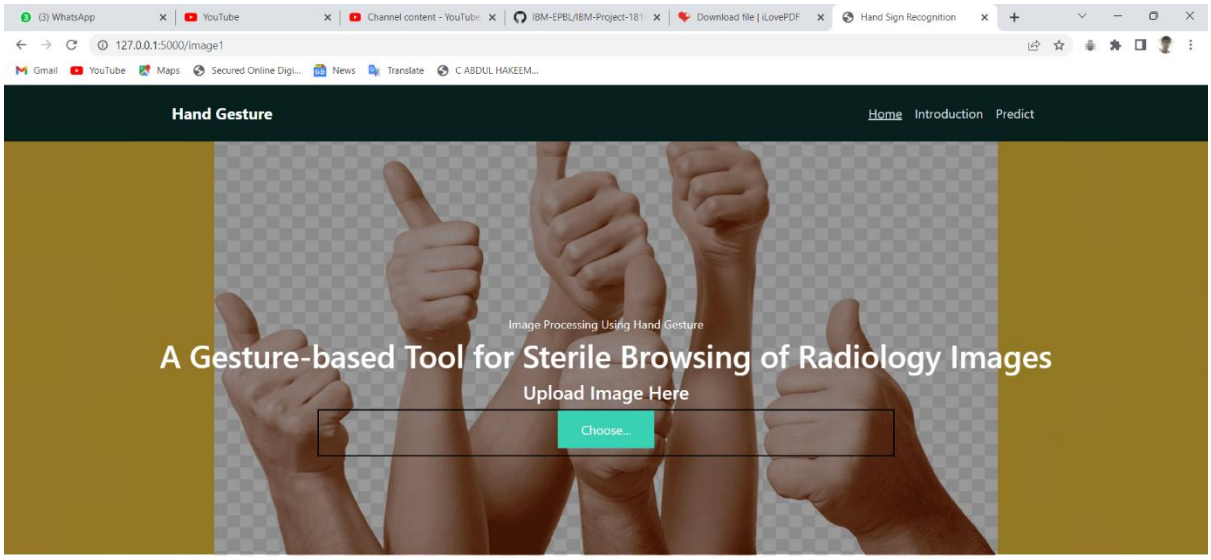
```
                    <a class="nav-link" href="{{url_for('home')}}"><u>Home</u></a>
                </li>
                <li class="nav-item">
                    <a class="nav-link" href="{{url_for('intro')}}">Introduction</a>
                </li>
                <li class="nav-item">
                    <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 RadiologyImages</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>
```

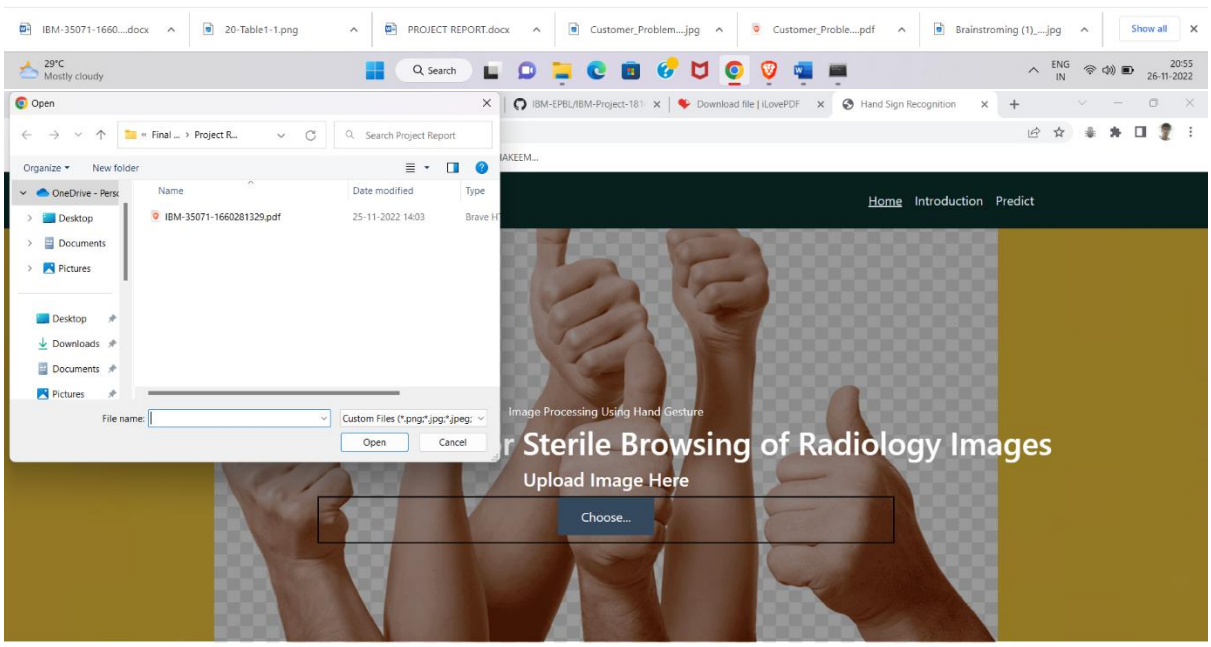
```
        <div class="image-section" style="display:none;">
          <div class="img-preview">
            <div id="imagePreview">
            </div>
          </div>
          <div>
            <button type="button"  color="#f35ac5" class="btn btn-info btn-lg" id="btn-predict">Predict!</button>
          </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>
```

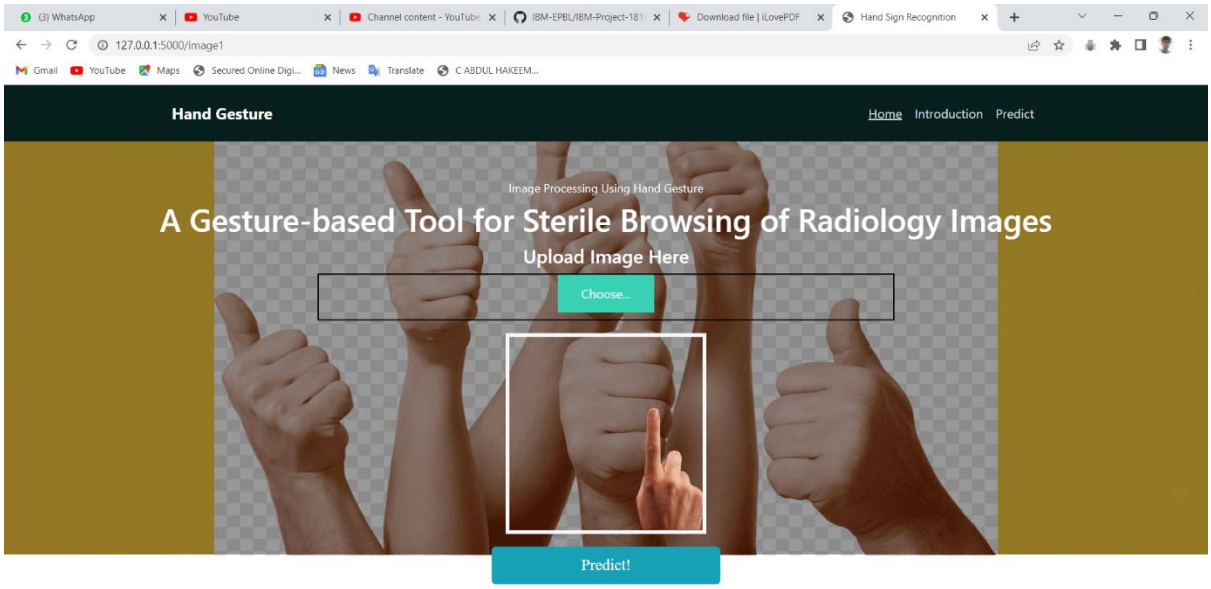
13.2. Output:

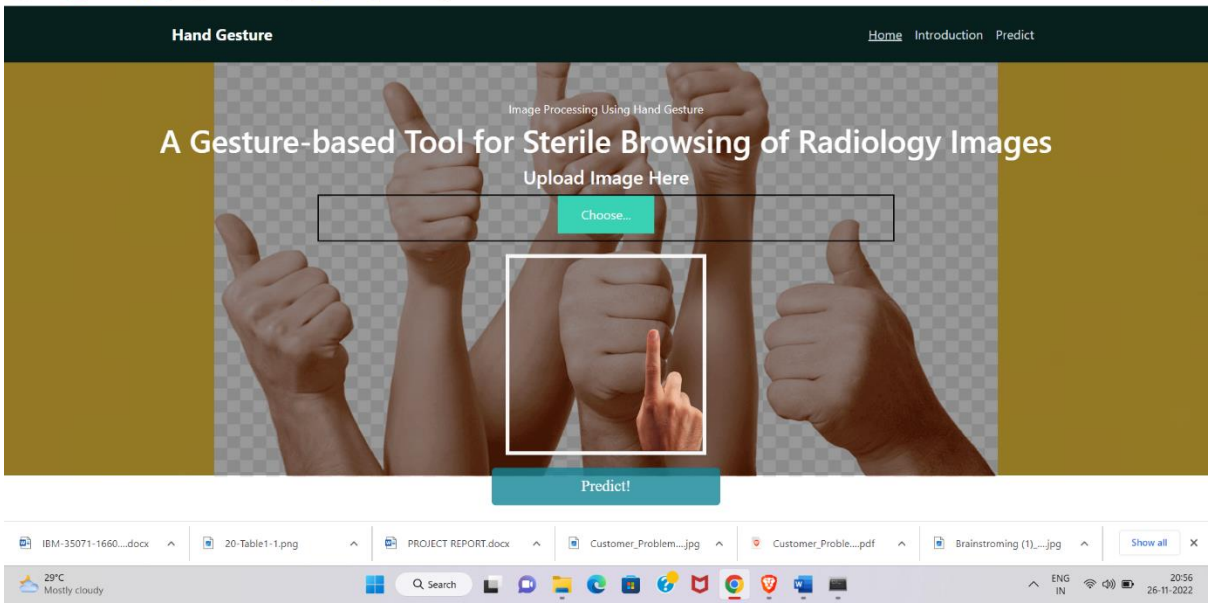

Hand Gesture
Home
Introduction
Predict
Image Processing Using Hand Gesture
A Gesture-based Tool for Sterile Browsing of Radiology Images

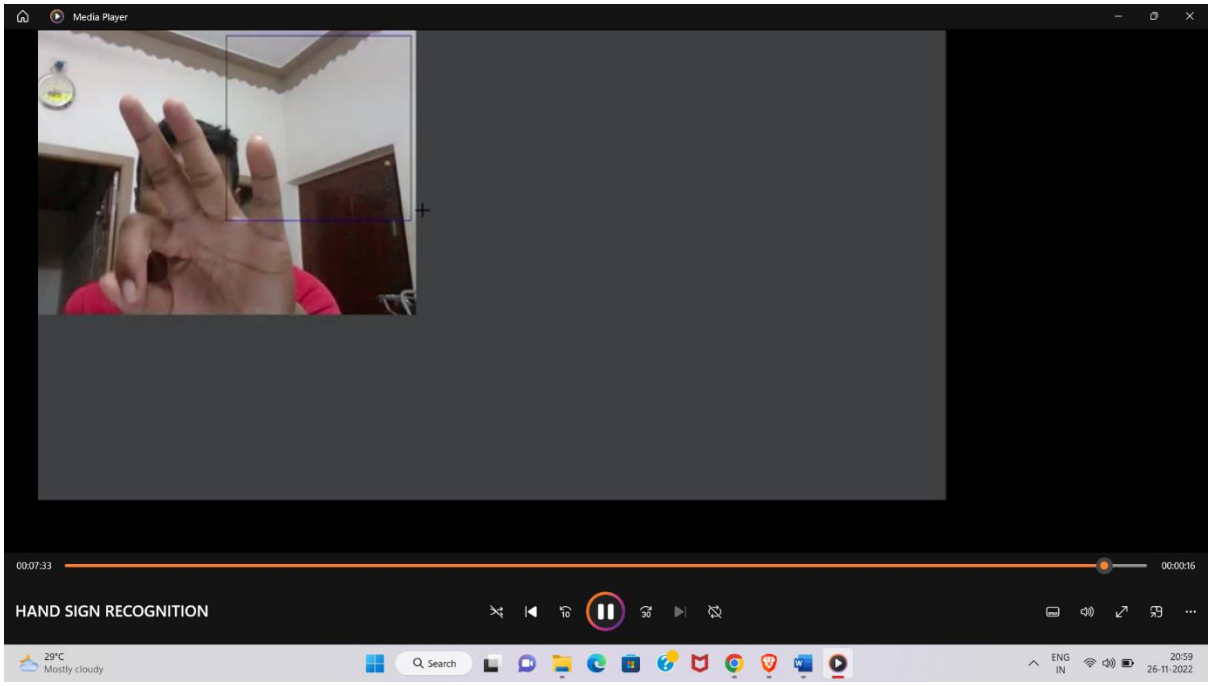

Hand Gesture
Home
Introduction
Predict
Image Processing Using Hand Gesture
A Gesture-based Tool for Sterile Browsing of Radiology Images
Hand Gesture recognition system provides us with an innovative, natural, user-friendly way of interacting with the computer which is more familiar to human beings. 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.


Hand Gesture
Home
Introduction
Predict
Image Processing Using Hand Gesture
A Gesture-based Tool for Sterile Browsing of Radiology Images
Upload Image Here
Choose...


Open
Organize
New folder
Search Project Report
Name
Date modified
Type
IBM-35071-1660281329.pdf
25-11-2022 14:03
Desktop
Documents
Pictures
Downloads
File name:
Custom Files (*.png;*.jpg;*.jpeg;
Open
Cancel
Home
Introduction
Predict
Image Processing Using Hand Gesture
Upload Image Here
Choose...


Hand Gesture
Home
Introduction
Predict
Image Processing Using Hand Gesture
A Gesture-based Tool for Sterile Browsing of Radiology Images
Upload Image Here
Choose...
Predict!


Hand Gesture
Home
Introduction
Predict
Image Processing Using Hand Gesture
A Gesture-based Tool for Sterile Browsing of Radiology Images
Upload Image Here
Choose...
Predict!



13.3.GitHub & Project Demo Link

GITHUB LINK: https://github.com/IBM-EPBL/IBM-Project-18140-1659679841

PROJECT DEMO LINK: https://youtu.be/Z9LZz2c1Vic