A GESTURE- BASED TOOL FOR STERILE BROWSING OF RADIOLOGY IMAGES

(TEAM ID : PNT2022TMID52914)

PROJECT REPORT

Submitted by

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CHAPTER 1

INTRODUCTION

Computer information technology is increasingly penetrating into the hospital domain. A major challenge involved in this process is to provide doctors with efficient, intuitive, accurate and safe means of interaction without affecting the quality of their work. Keyboards and pointing devices, such as a mouse, are today's principal method of human—computer interaction. However, the use of computer keyboards and mice by doctors and nurses in intensive care units (ICUs) is a common method for spreading infections. In this project, we suggest the use of hand gestures as an alternative to existing interface techniques, offering the major advantage of sterility. Even though voice control also provides sterility, the noise level in the operating room (OR) deems it problematic.

In this project, we refer to gestures as a basic form of non-verbal communication made with the hands. Psychological studies showed that young children use gestures to communicate before they learn to talk. Manipulation, as a form of gesticulation, is often used when people speak to each other about some object. Naturalness of expression, non-encumbered interaction, intuitiveness and high sterility are all good reasons to replace the current interface technology (e.g., keyboard, mouse, and joystick) with more natural interfaces.

1.1 Project Overview

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.

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 numbers 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

Purpose of the project is used to browse the radiology images using hand gestures rather than using mouse, keyboard etc, to maintaining sterility inside the operation room.

CHAPTER 2

LITERATURE SURVEY

1. Systematic analysis on 55 scientific papers and 33 journal publications that focus on touchless human–computer interaction in operating rooms and interventional radiology suites was performed.Most of the identified literature (62 %) deals with the control of medical image viewers.The others present interaction techniques for laparoscopic assistance, telerobotic assistance and operating room control as well as for robotic operating room assistance and intraoperative registration.

2. This paper proposes a new medical image control concept based on a Brain Computer Interface (BCI) that allows for hands-free and direct image manipulation without relying on gesture recognition methods or voice commands.This yielded promising results, and showed its potential for future intraoperative applications.

3. In this work, three different interaction modes for image manipulation that are usable in a surgery setting:

. 1. gesture-controlled approach using Kinect ;
2. oral instructions to a third part dedicated to manipulate the images; and
3. direct manipulation using a mouse.

The study shows with formal evaluation that the use of gestures is advantageous over instructions to a third person.The given gestures could be learned easily and reliability of the tested gesture-control system is good.

2.1 Existing problem

When the doctors inside the operation room use keyboard and mouse, there is a possibility of spreading infection. So, in this project we used hand gesture methodology to keep the doctor sterile.

2.2 References

1. *Mewes, A., Hensen, B., Wacker, F., & Hansen, C. (2016). Touchless interaction with software in interventional radiology and surgery: a systematic literature review.*
International Journal of Computer Assisted Radiology and Surgery, 12(2), 291–305.

2. Introducing a brain-computer interface to facilitate intraoperative medical imaging control – a feasibility studyHooman Esfandiari, Pascal Troxler , Sandro Hodel , Daniel Suter , Mazda Farshad , Collaboration Group and Philipp Fürnstahl BMC Musculoskeletal Disorders, Volume 23, Article Number:701(2022)

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

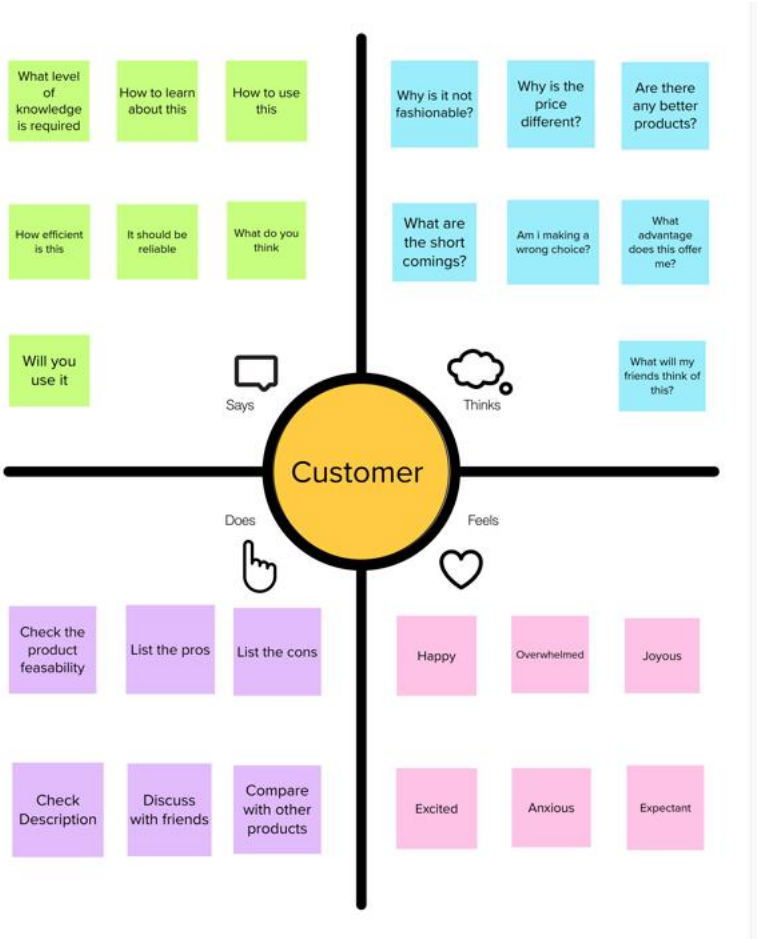
2.3 Problem Statement Definition

Problem Statement (PS)	**I am (Customer)**	**I'm trying to**	**But**	**Because**	**Which makes me feel**
PS-1	A doctor	Browse the radiology images inside the operation room	It's the highest chance to spread infection	Using the same hand for operation as well as to touch the keyboard, mouse, screen etc	Not sterile
PS-2	A doctor	Browse the radiology images inside the operation room	It affects the patient	Of the noice produced during the voice recognition	Annoying

CHAPTER 3

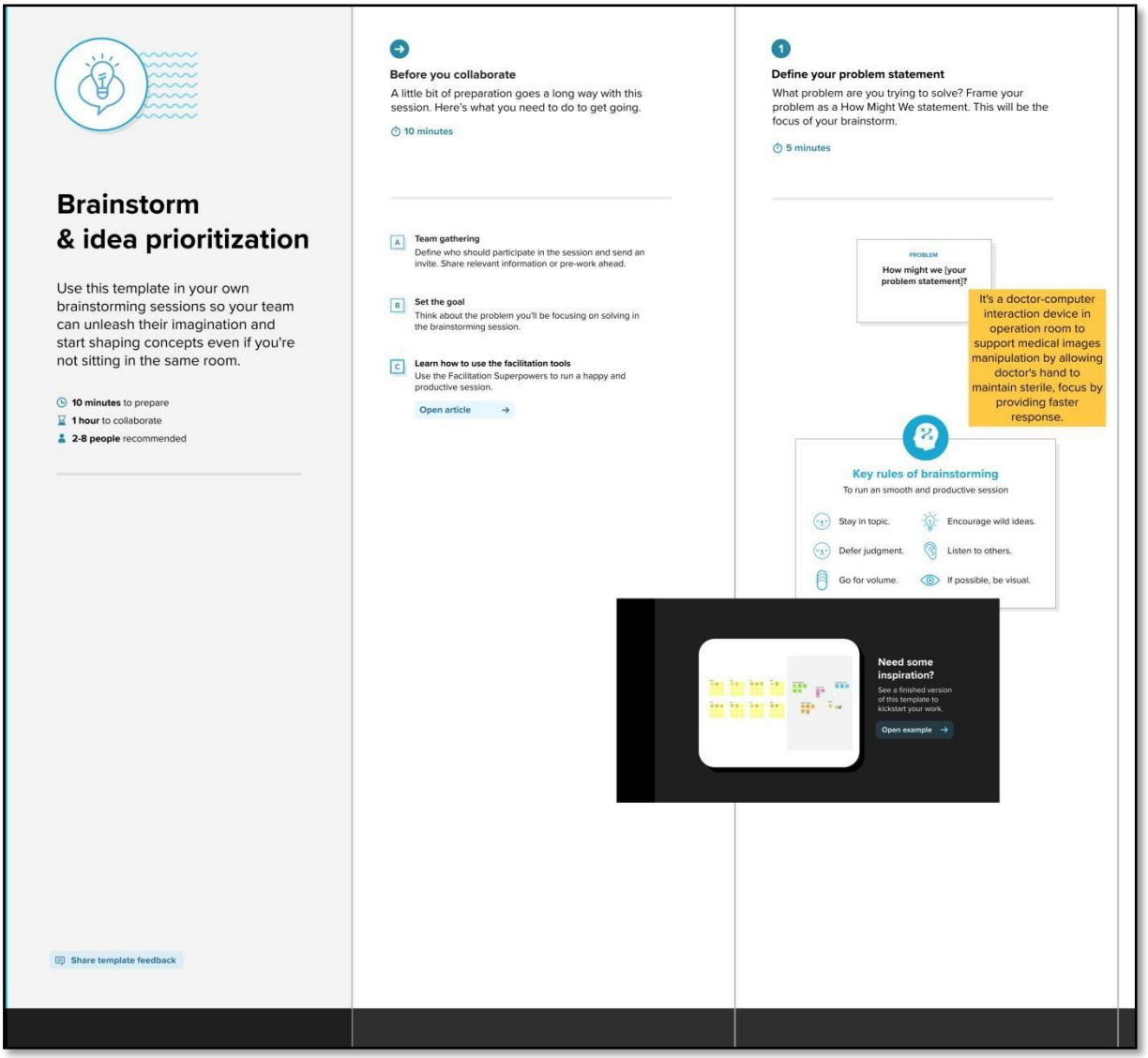
IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas



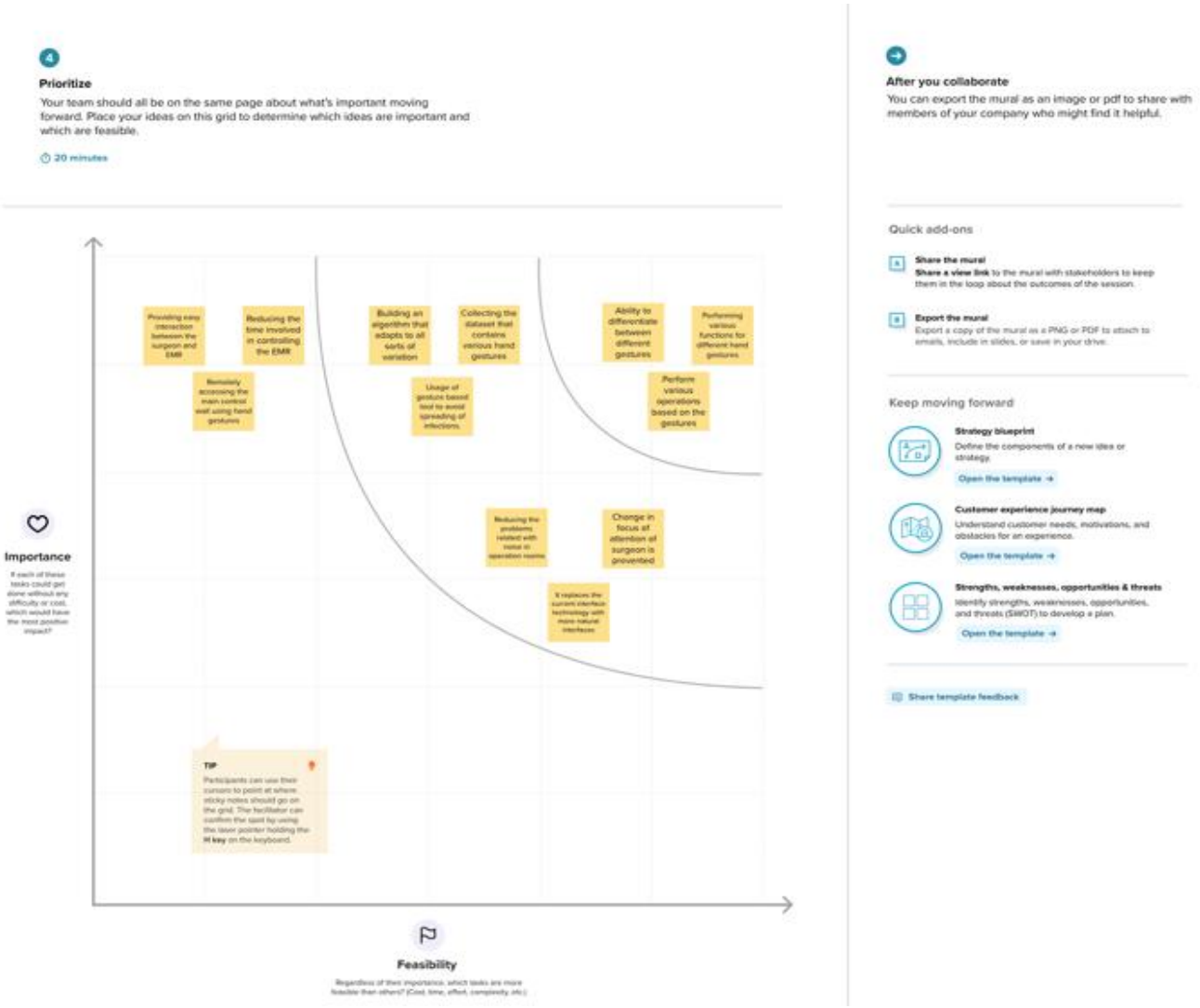
3.2 Ideation & Brainstorming

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



Step-2: Brainstorm, Idea Listing and Grouping

Step-3: Idea Prioritization

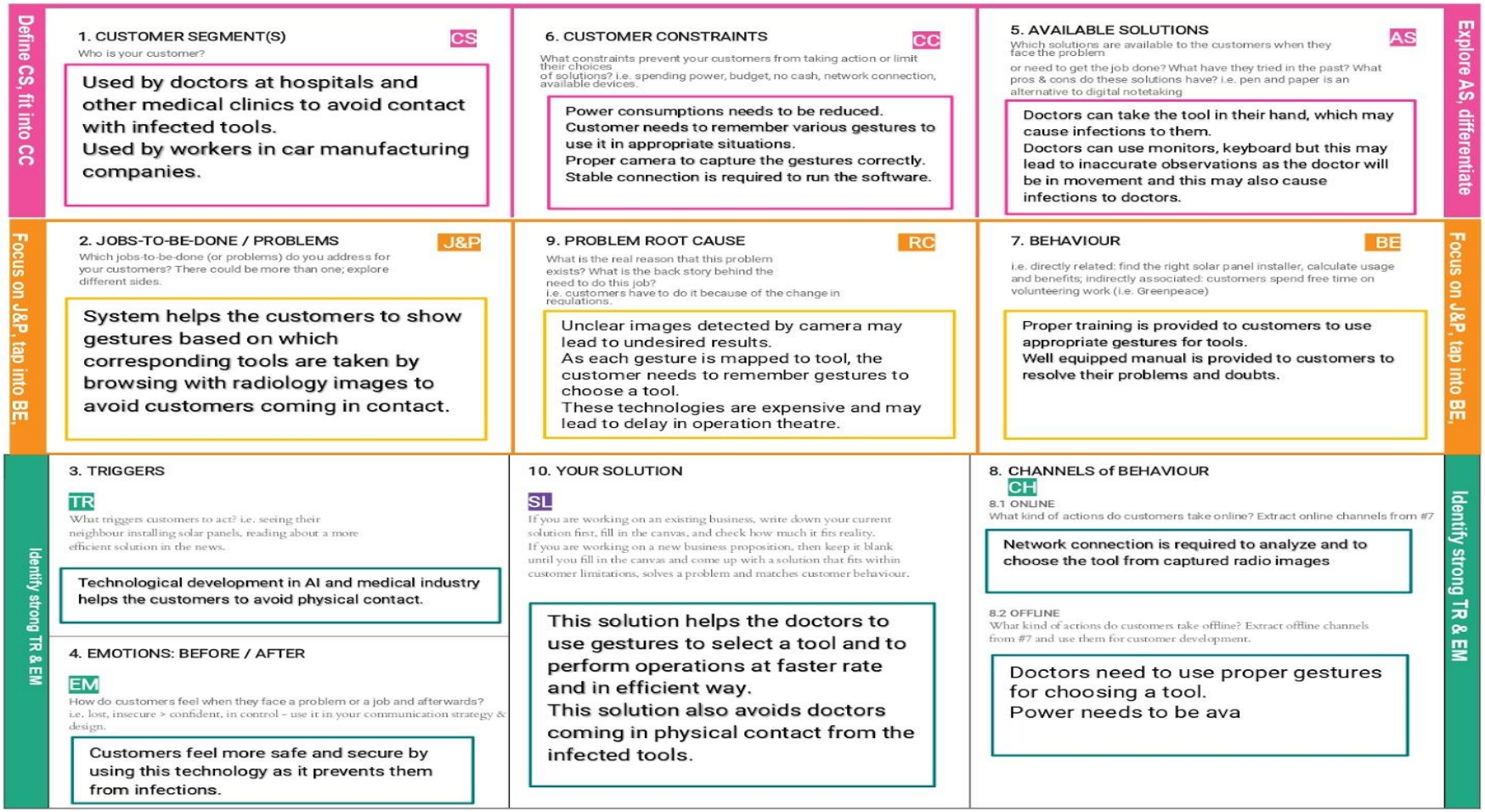


3.3 Proposed Solution

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	A Gesture-Based Tool For Sterile Browsing Of Radiology Images.
2.	Idea / Solution description	The image of the gesture captured in the video frame is compared with the Pre-trained model and the gesture is identified. If the model predicts the gestures, then image is blurred , resized & rotated based on the gestures.
3.	Novelty / Uniqueness	Sterile detection method for Radiology Method browsing.
4.	Social Impact / Customer Satisfaction	Formulates more hygiene practices and makes it more easy to browse and upload radiology images. Simplifies
5.	Business Model (Revenue Model)	This comes under the medical field , thus Government allowance and concessions can be expected and the main target user are doctors specialising in radiology related work and multispecialty hospitals
6.	Scalability of the Solution	The structure used for this solution can also be applied to other devices and applications to make them contactless and more smart.

3.4 Problem Solution fit

Project Title: A Gesture-based Tool for Sterile Browsing of Radiology Images **Project Design Phase-I** - Solution Fit Template



CHAPTER 4

REQUIREMENT ANALYSIS

4.1 Functional Requirements

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	Identifying User Gestures	Camera captures the gestures of the user Identification of gestures using the images
FR-2	Deployment in Cloud	Deep Learning model is trained The model is deployed in cloud
FR-3	User Interface	The user interface, which helps in the Human Computer Interaction is designed
FR-4	Gestures related to the Application Domain	The model should be trained with the gestures related to the application domain

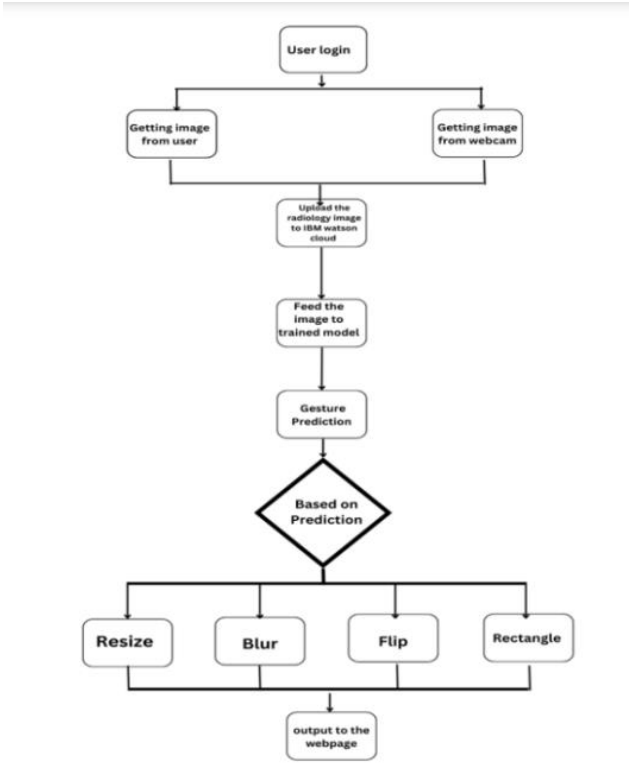
4.2 Non-functional Requirements

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	The user interface which acts as an intermediate between the user and the DL Model which is deployed in the cloud
NFR-2	**Security**	The model deployed in the cloud should be accessible only by the approved users and it should be inaccessible by the attackers or the terrorists
NFR-3	**Reliability**	The tool or the systemis 95% reliability for a year
NFR-4	**Performance**	The tool or the system should respond with the accurate response within 4-5 seconds
NFR-5	**Availability**	The model deployed in the cloud must be available to 99.8% of the people over a month during working hours
NFR-6	**Scalability**	The model deployed in the cloud must be accessible by over 10,00,000 people trying to access it using the user interface

CHAPTER 5

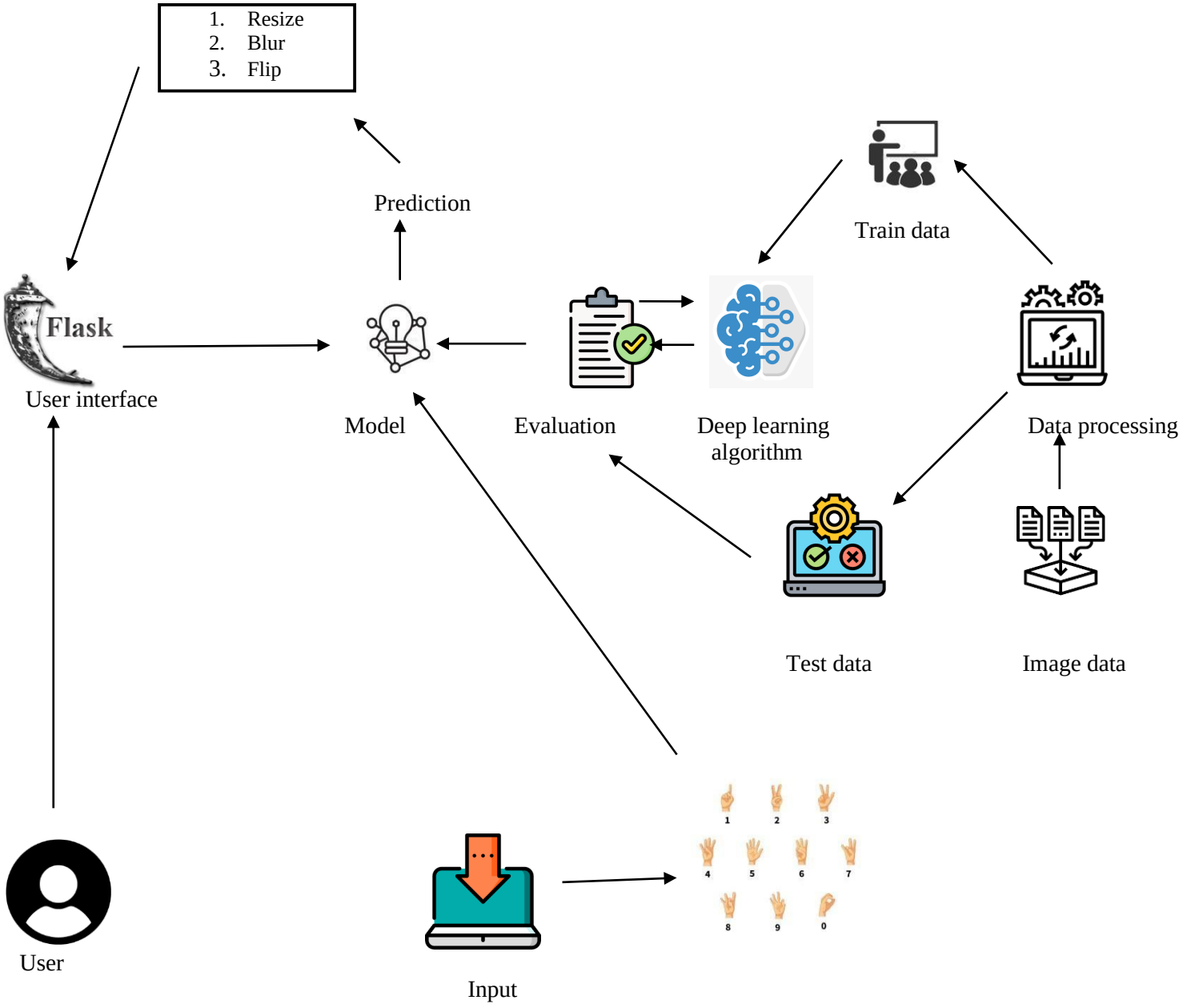
PROJECT DESIGN

5.1 Data flow diagams



Data Flow Diagram

5.2 Solution Architecture



Technical Architecture

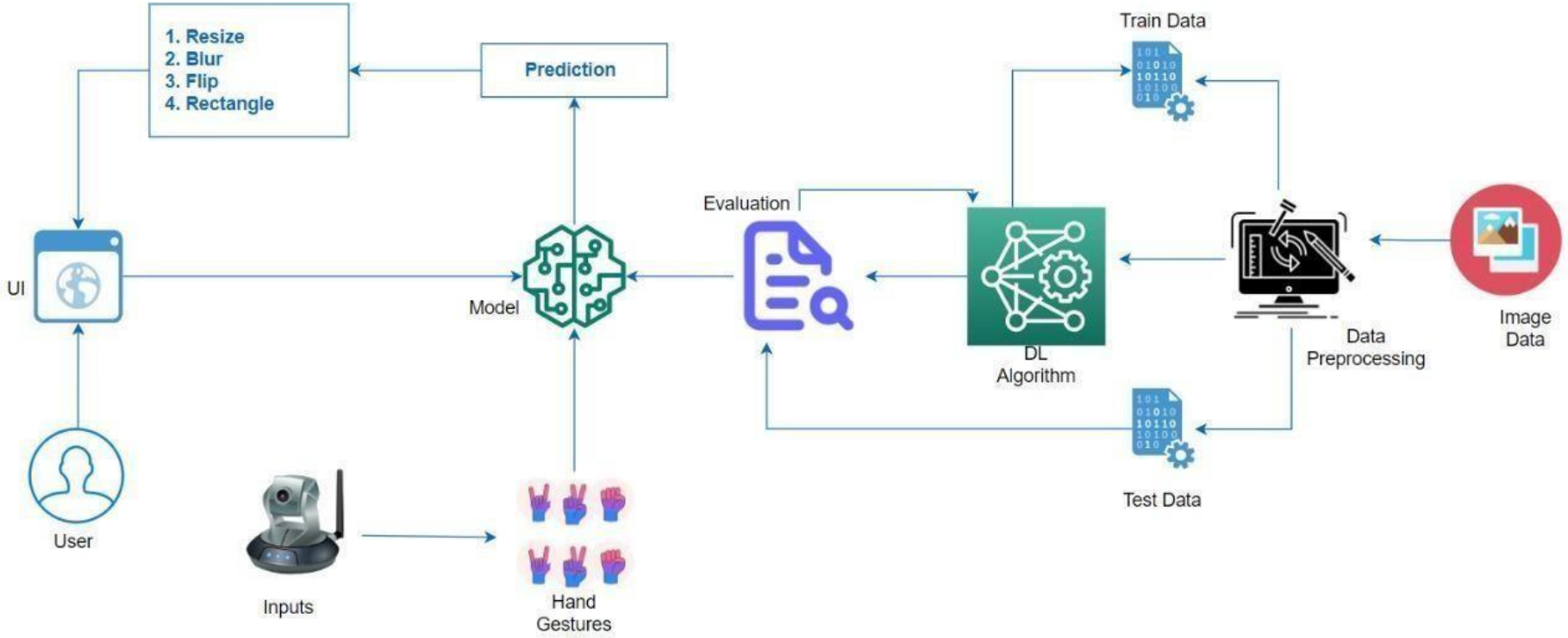


Table-1 : Components & Technologies:

S.No	Component	Description	Technology
1.	User Interface	UI (Web)	HTML, CSS, JavaScript.
2.	Application Logic-1 Image Pre-processing	Input image is pre-processed with the help of library files.	Python, TensorFlow
3.	Application Logic-2Building Model	Building CNN model to recognize the gesture.	Python, Keras
4.	Application Logic-3Creation of app	App is built to obtain gesture as input and to provide as output.	HTML, CSS, JavaScript
5.	Dataset	Hand gesture data set.	From IBM
6.	Cloud Database	User input image is stored in cloud.	IBM Cloud
7.	File Storage	File storage contains dataset and source code.	Device or Drive
8.	Machine Learning Model	CNN Model was used to recognize the pre-processed image by image capturing or by video segmenting.	CNN Model by Python, Keras

Table-2: Application Characteristics:

S.No	Characteristics	Description	Technology
1.	Open-Source Frameworks	Application development, data pre-processing.	Visual studio code, Anaconda navigator, TensorFlow
2.	Security Implementations	It identifies the gesture only when the hand is in front of the camera.	OpenCV
3.	Scalable Architecture	It can be used in any environment and is able to identify the gesture	OpenCV
4.	Availability	It is used to reduce the possibility of spreading infections	AI
5.	Performance	Rapid response to the gesture.	CNN

5.3 User Stories

User Type	Functional Requirement(Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer	Login	USN-1	Entering Webpage	Enter the application	High	Sprint 1
	Homepage	USN-2	Entering to the "Homepage" of theUI(Webpage)	Enter the homepage	High	Sprint 1
	About	USN-3	I can click on the "About" to details about theApplication	Get the details about theapplication	Low	Sprint 2
	Begin	USN-4	As a user I can upload my radiology imagefrom the computer.	Choose any imagefrom my device	High	Sprint 2
	Predict	USN-5	As a user I can turn on the camera usingpredictbutton	Turn on the camera forprediction	High	Sprint 3
		USN-6	Predicting the images using Hand Gesture	Can resize, blur, and flip my image using my handgesture	High	Sprint 3
		USN-7	I can give a gesture of raised fist and itrecognizes	Can get my fixed resizedimage	High	Sprint 4
		USN-8	I can show my index finger	Can get a rectangularimage	High	Sprint 4
		USN-9	I can show my index finger, middle finger andringfinger at once	Can get my image blurred	High	Sprint 4

CHAPTER 6

PROJECT PLANNING & SCHEDULING

6.1 Sprint Planning & Estimation

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirmingmy password.	5	High	TM – 1 TM – 4
Sprint-1	Login	USN-2	As a user, I will receive confirmation email onceI have registered for the application	5	High	TM – 2 TM – 3
Sprint-2	Dashboard	USN-3	As a user, I can register for the application through Facebook	10	Low	TM – 1 TM – 2
Sprint-1	Details about	USN-4	As a user, I can register for the application through Gmail	5	Medium	TM – 3 TM – 1
Sprint-1	Login and repeated usage	USN-5	As a user, I can log into the application by entering email & password	5	High	TM – 2 TM – 4
Sprint - 2	web page details	USN-6	As a user I must capture images of hand and upload it into the web portal.	10	High	TM – 1 TM – 3
Sprint - 3	Upload the image in the web application	USN-7	As a user I must receive a correct hand gesture as output	20	High	TM – 1 TM – 2
Sprint - 4	Provide efficient customer support	USN-8	As a user, I need to get support from developers in case of queries and failure of service provided	10	Medium	TM – 3 TM –4
Sprint - 4	Overview the entire process. Take all the responsibility and act bridge between users and developers	USN-9	We need to satisfy the customer needs in an efficient way and make sure any sort of errors are fixed	10	High	TM – 2 TM – 1

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	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

Velocity:

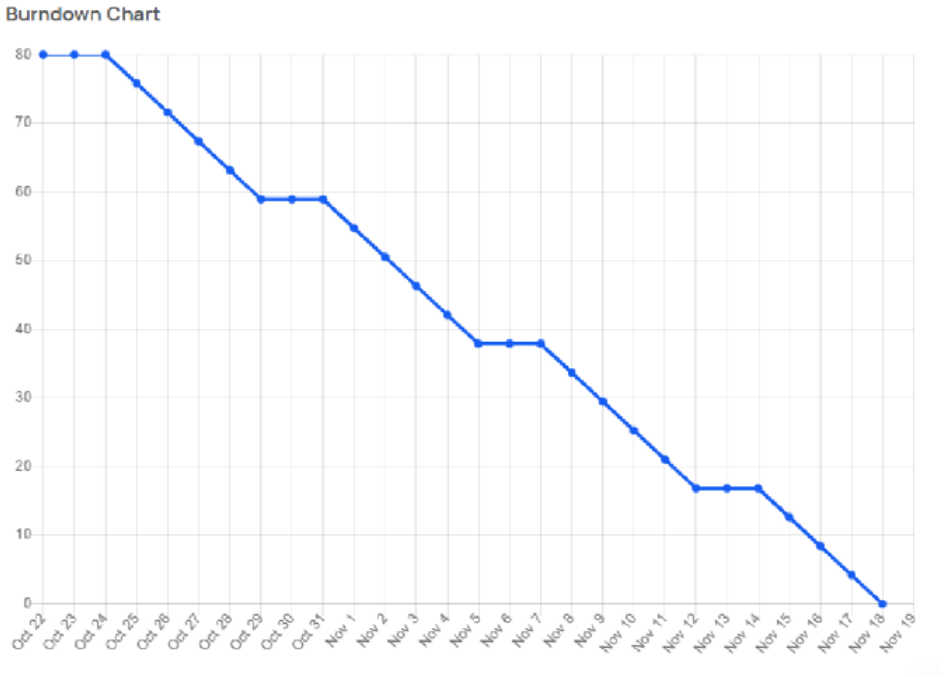
Imagine we have a 10-day sprint duration, and the velocity of the team is 20 (points per sprint). Let's calculate the team's average velocity (AV) per iteration unit (story points per day)

$$AV = \frac{sprint\ duration}{velocity} = \frac{20}{10} = 2$$

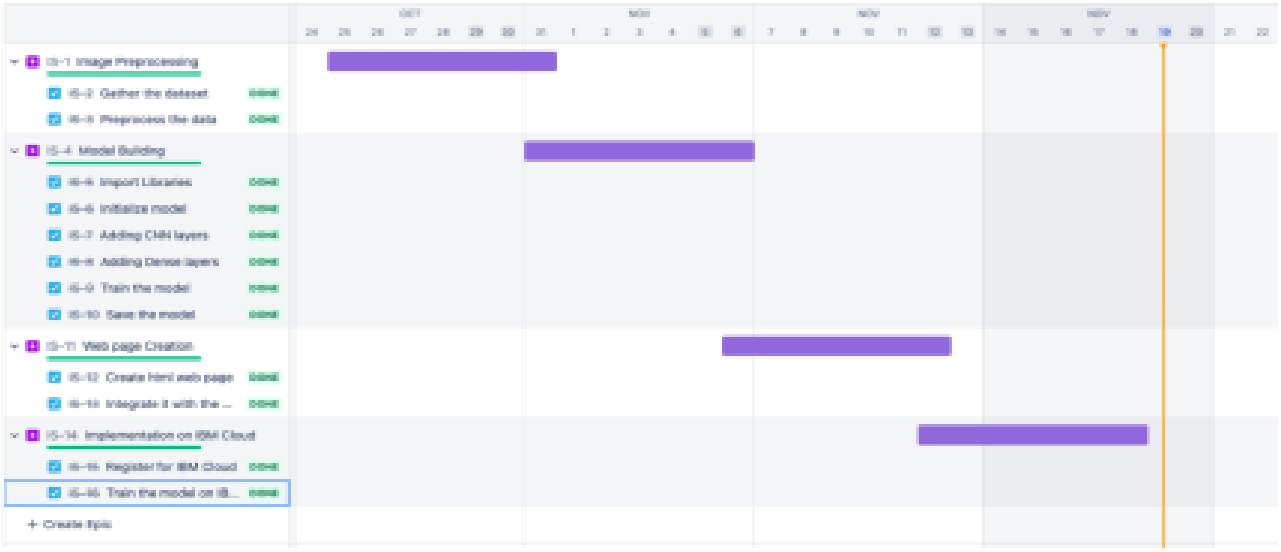
AV = sprint duration / velocity = 20/6 = 3.33

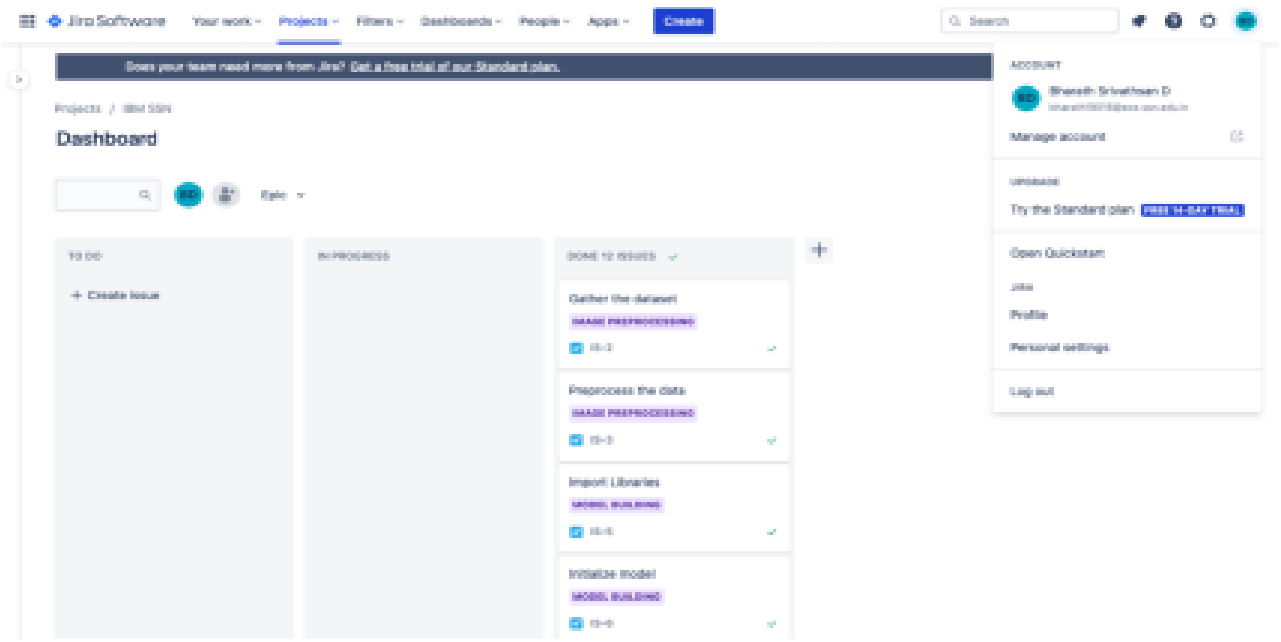
Burn down Chart:

A burn down chart is a graphical representation of work left to do versus time. It is often used in agile software development methodologies suchas Scrum. However, burn down charts can be applied to any project containing measurable progress over time.



6.3 Reports from JIRA





CHAPTER 7
CODING AND SOLUTIONING

```
from flask import *

from datetime import date

import ibm_db

from flask import Flask, render_template, request

import numpy as np

import operator

import cv2 # opencv library

import os

from tensorflow.keras.models import load_model

from tensorflow.keras.utils import load_img, img_to_array

from werkzeug.utils import secure_filename


app = Flask(_name_,template_folder="templates")

model=load_model('gesture.h5')

print("Loaded model from disk")

conn = ibm_db.connect("DATABASE=bludb;HOSTNAME=54a2f15b-5c0f-46df-8954-
7e38e612c2bd.c1ogj3sd0tgtu0lqde00.databases.appdomain.cloud;PORT=32733;SECURITY=SSL;PR
OTOCOL=TCPIP;UID=mml48790;PWD=dMMqquglkWltg4Jo", "", "")

print(conn)

print("Connecting Successful.....")

user_id=0


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

def login():

    if request.method=='GET':
```

```
        return render_template("index.html",status="",colour="red")
    elif request.method=='POST':
        global retailer_id
        email=request.form["email"]
        password=request.form["password"]
        query = '"select * from user where email = \'{}\'"'.format(email)
        exec_query = ibm_db.exec_immediate(conn, query)
        row = ibm_db.fetch_both(exec_query)
        if(row is not False):
            if(row['PASSWORD'] != password):
                return render_template("index.html",status="Invalid Password",colour="red")
            else:
                temp='"select id from user where email = \'{}\'"'.format(email)
                exec_query = ibm_db.exec_immediate(conn, temp)
                dict= ibm_db.fetch_both(exec_query)
                user_id=dict["ID"]
                return render_template("home.html")

        return render_template("index.html",status="Invalid Email",colour="red")

@app.route("/signup", methods=['GET','POST'])
def signup():

    if request.method=='GET':
        return render_template("register.html",status="",colour="red")
    elif request.method=='POST':
        email=request.form["email"]
```

```
        password=request.form["password"]
        username=request.form["username"]
        query = '"select * from user where email = \'{}\'"'.format(email)
        exec_query = ibm_db.exec_immediate(conn, query)
        row = ibm_db.fetch_both(exec_query)
        if(row is False):
            query = '"insert into user(email, password, username) values('{}', '{}', '{}')"'.format(email,
password, username)
            exec_query = ibm_db.exec_immediate(conn, query)
            return render_template("index.html",status="Signup Success",colour="green")
        else:
            return render_template("register.html",status="User Already Exists",colour="red")


@app.route('/home') # routes to the intro page
def home():
    return render_template('home.html') #rendering the intro 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 index6():
    return render_template("index6.html")
```

```
@app.route('/predict', methods=['GET', 'POST'])  # route to show the predictions in a web UI
def launch():
    #Getting input and storing it
    if request.method == 'POST':
        print('inside launch function')
        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('img saved successfully')
        print(file_path)
        # test_image=cv2.imread(file_path,cv2.IMREAD_COLOR)
        # test_image=cv2.resize(test_image,(64,64))
        # result= model.predict(test_image.reshape(1,64,64,1))

        # img = load_img(file_path, grayscale=True, target_size=(64, 64))
        # x = img_to_array(img)
        # x = np.expand_dims(x, axis = 0)

    cap=cv2.VideoCapture(0)
    image1=cv2.imread(file_path)
    cv2.imshow("Output",image1)
    prev='NULL'
    while True:
        _, frame=cap.read()
        frame=cv2.flip(frame,1)
```

```
x1=int(0.5*frame.shape[1])
y1=10
x2=frame.shape[1]-10
y2=int(0.5*frame.shape[1])

cv2.rectangle(frame,(x1-1,y1-1),(x2+1,y2+1),(255,0,0)),1
roi = frame[y1:y2,x1:x2]

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)

result = model.predict(test_image.reshape(1,64,64,1))
print(result)
prediction =
{'ZERO':result[0][0],'ONE':result[0][1],'TWO':result[0][2],'THREE':result[0][3],'FOUR':result[0][4],'FI
VE':result[0][5]}
prediction=sorted(prediction.items(),key=operator.itemgetter(1),reverse=True)

cv2.putText(frame,prediction[0][0],(10,120), cv2.FONT_HERSHEY_PLAIN,1,(0,255,255),1)
cv2.imshow("frame",frame)



interrupt=cv2.waitKey(10)
if interrupt & 0xFF == 27: #Esc key to break from the while loop
   break
```

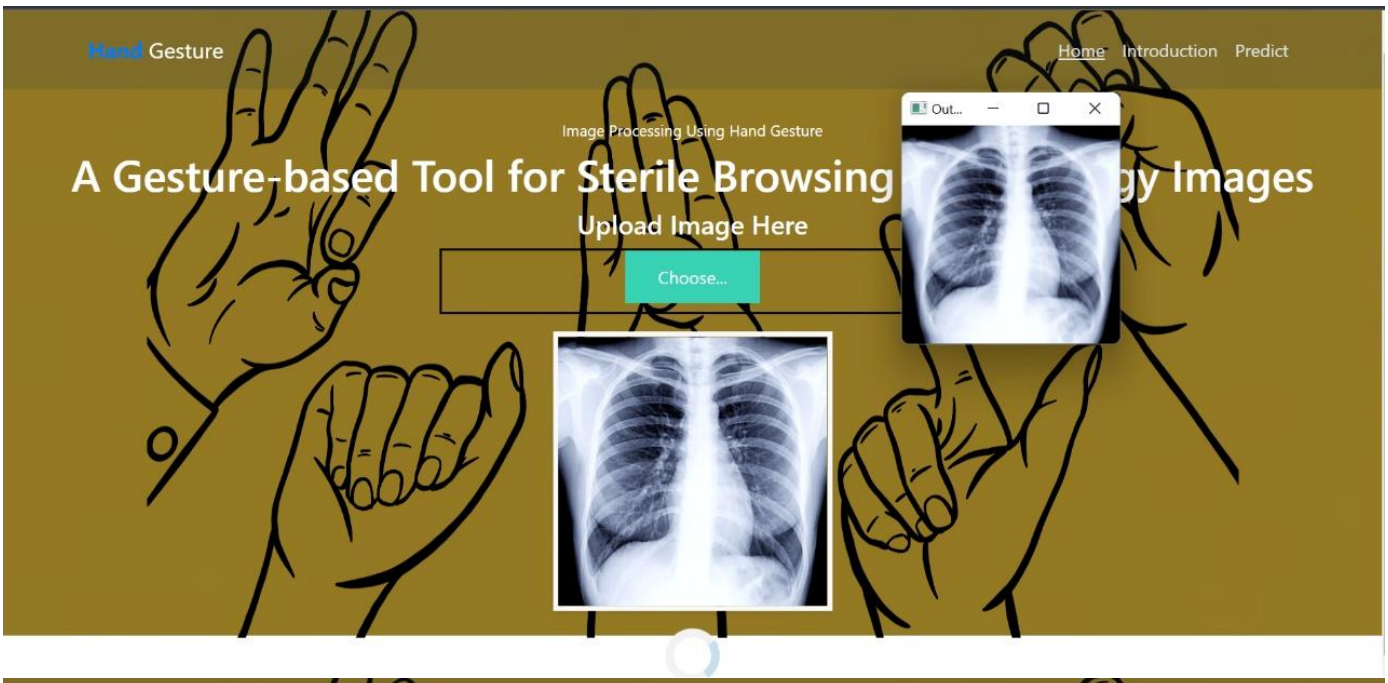
```
        if prev == prediction:
            continue

        prev = prediction


        image1=cv2.imread(file_path)
        image1=cv2.resize(image1,(255,255))
        if prediction[0][0]=='ONE':
           resized=cv2.resize(image1,(200,200))
           cv2.destroyWindow("Output")
           cv2.imshow("Output",resized)
##           key=cv2.waitKey(3000)
##
##           if(key & 0xFF) == ord("1"):
##              cv2.destroyWindow("Fixed Resizing - One")

        elif prediction[0][0]=='ZERO':
           cv2.rectangle(image1,(480,170),(650,420),(0,0,255),2)
           cv2.destroyWindow("Output")
           cv2.imshow("Output",image1)
           #cv2.imshow("Rectangle - Zero",image1)
           #cv2.waitKey(0)
##           key=cv2.waitKey(3000)
##
##           if(key & 0xFF)==ord("0"):
```

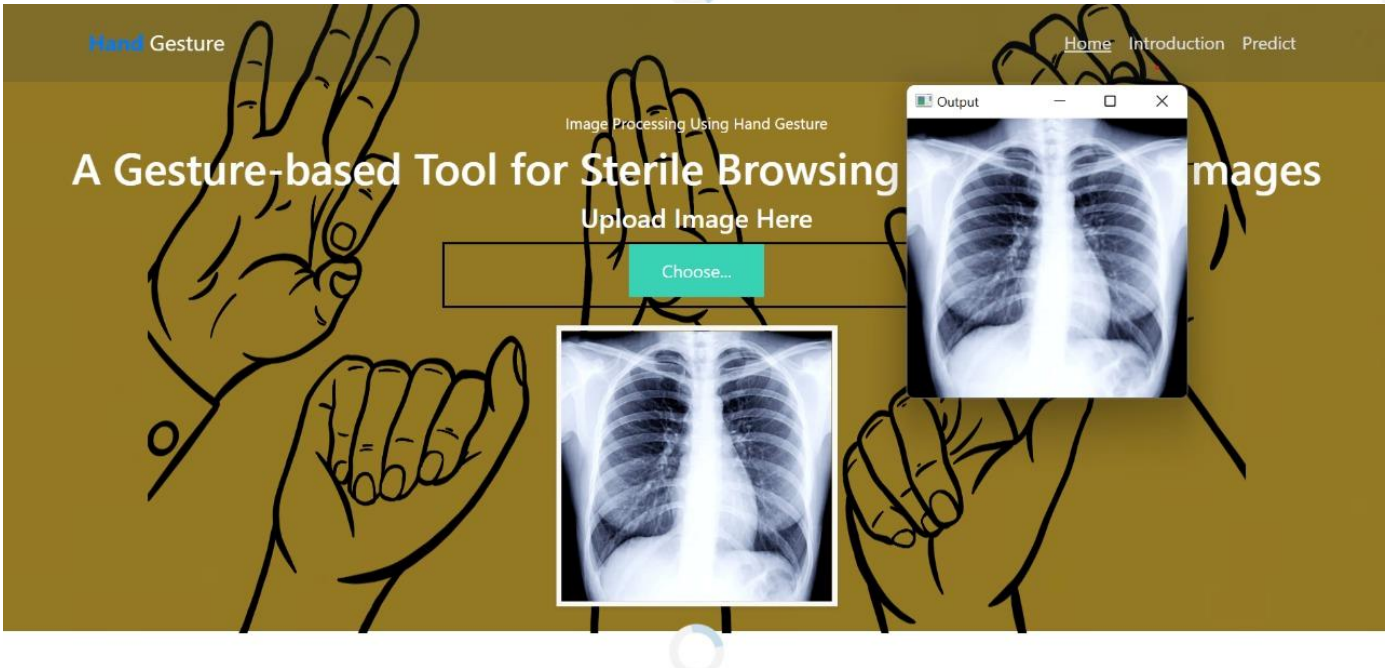
```
##          cv2.destroyWindow("Rectangle - Zero")

    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.destroyWindow("Output")
        cv2.imshow("Output",rotated)
##          cv2.imshow("OpenCV Rotation - Two",rotated)
##          key=cv2.waitKey(3000)
##          if(key & 0xFF)==ord("2"):
##              cv2.destroyWindow("OpenCV Rotation - Two")

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

    elif prediction[0][0]=='FOUR':
        zoomed=cv2.resize(image1,(400,400))
        cv2.destroyWindow("Output")
        cv2.imshow("Output",zoomed)
```

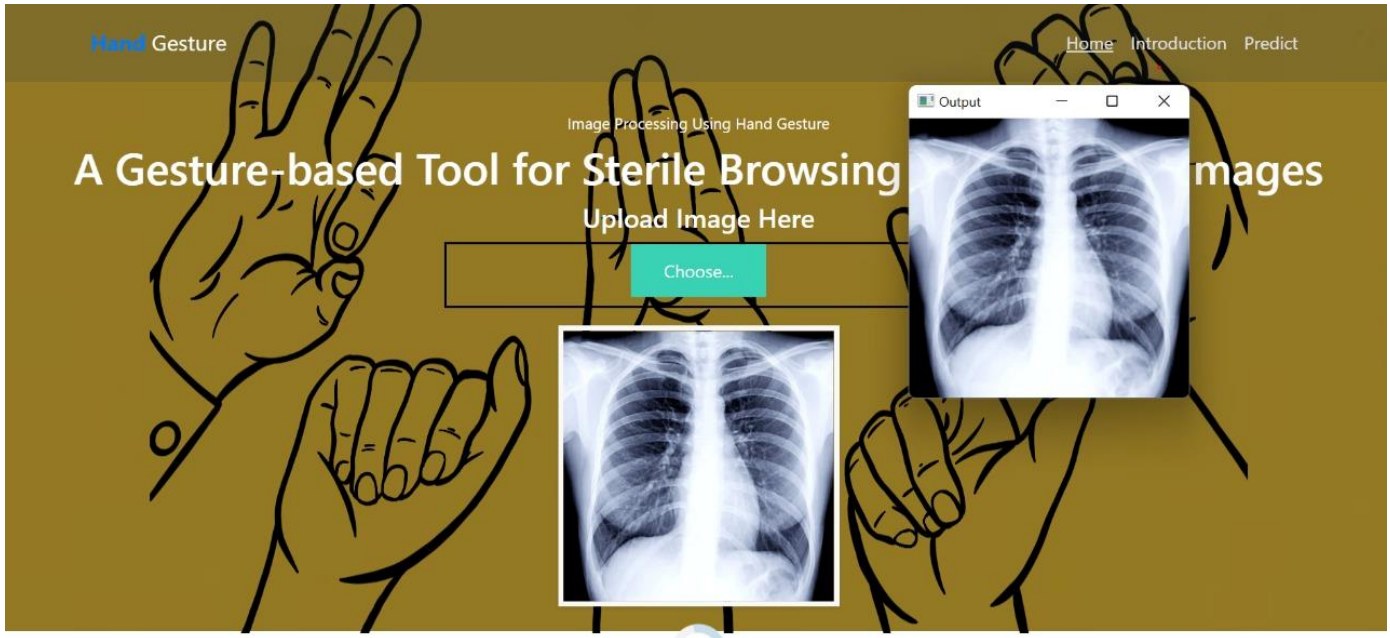
```
##            cv2.imshow("Zoomed - Four",zoomed)
##            key=cv2.waitKey(3000)
##            if(key & 0xFF)==ord("4"):
##                cv2.destroyWindow("Zoomed - Four")

        elif prediction[0][0]=='FIVE':
            neg=255-image1
            cv2.destroyWindow("Output")
            cv2.imshow("Output",neg)
##            cv2.imshow("Negative - Five",neg)
##            key=cv2.waitKey(3000)
##            if(key & 0xFF)==ord("5"):
##                cv2.destroyWindow("Negative - Five")

        else:
            continue



    cap.release()
    cv2.destroyAllWindows()

    return render_template("home.html")

if _name=="main_":
    app.run(host='0.0.0.0',debug=True)
```

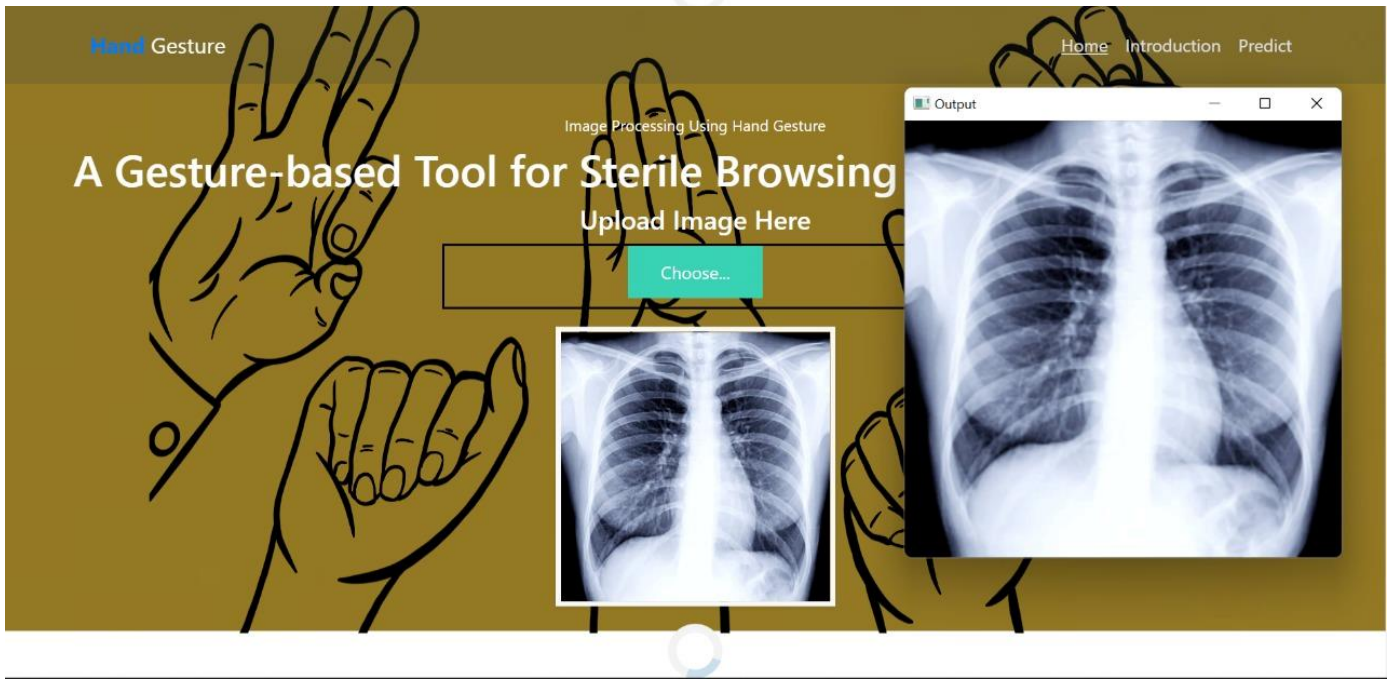
CHAPTER 8

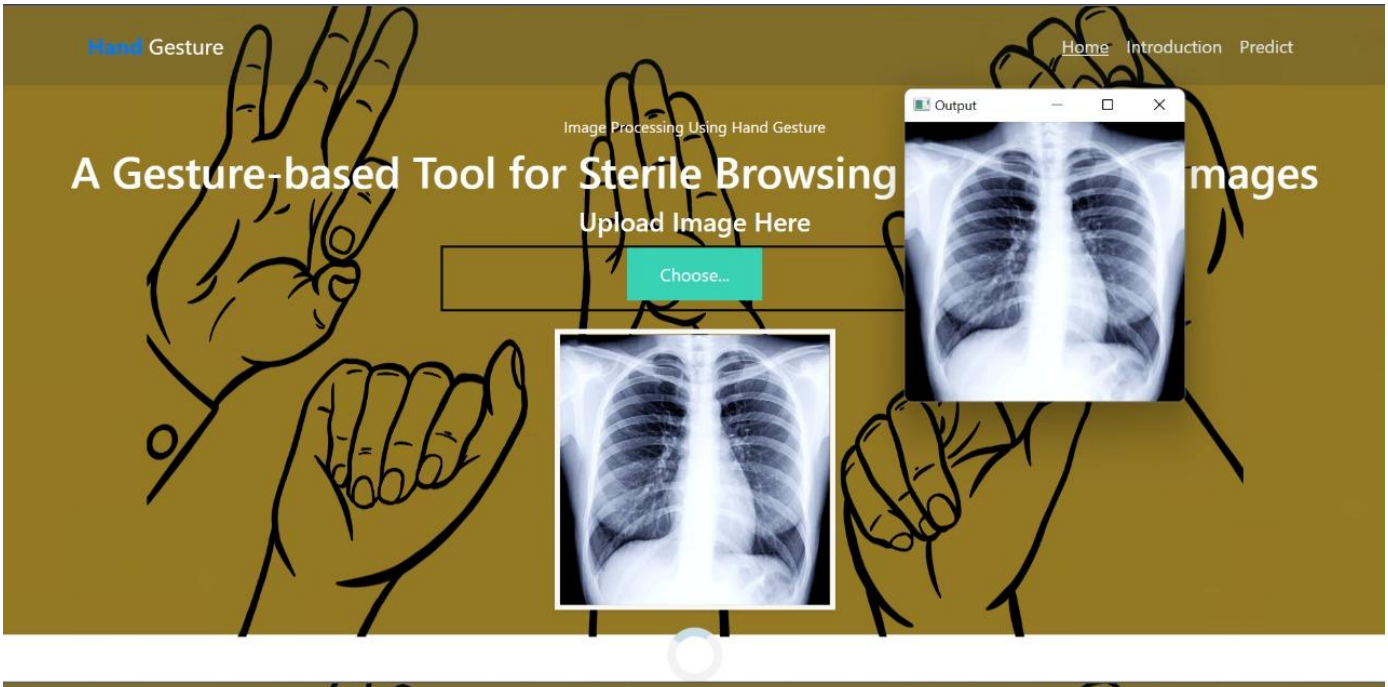
TESTING

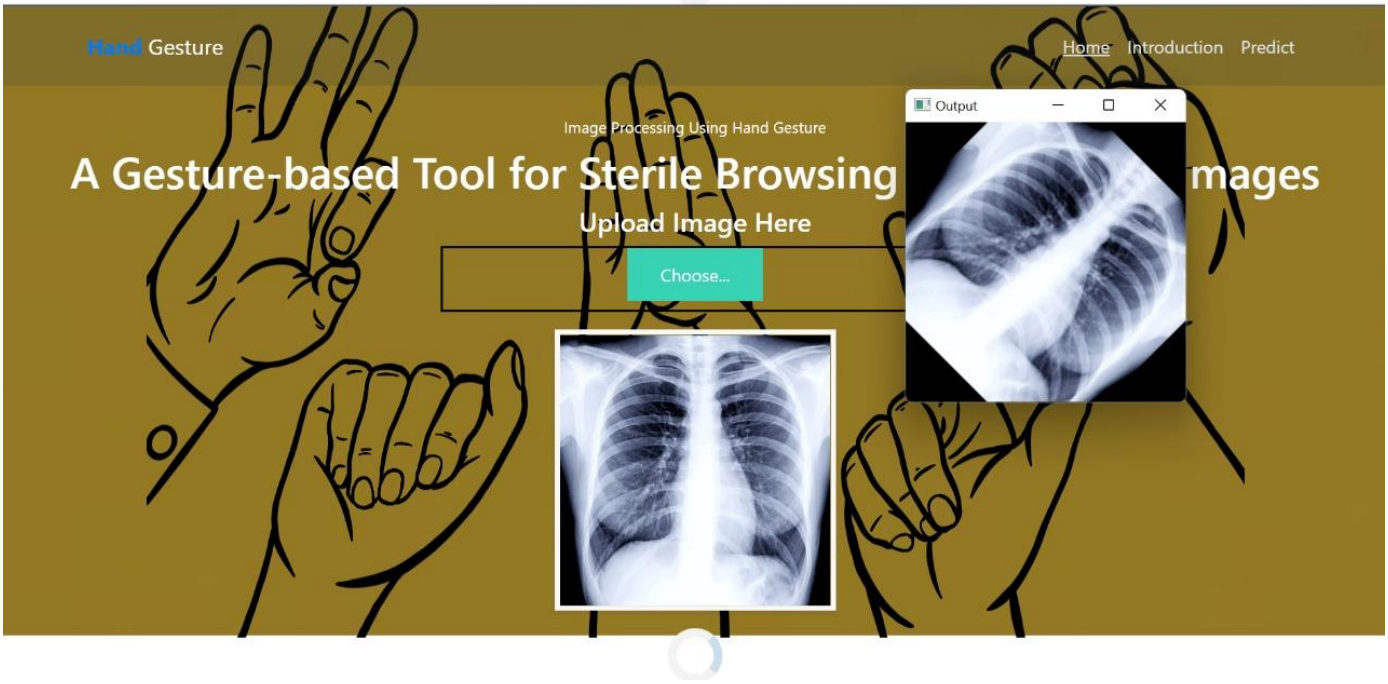





Hand Gesture
Home Introduction Predict
Image Processing Using Hand Gesture
A Gesture-based Tool for Sterile Browsing
mages
Upload Image Here
Choose...
Output


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


Hand Gesture
Home Introduction Predict
Image Processing Using Hand Gesture
A Gesture-based Tool for Sterile Browsing mages
Upload Image Here
Choose...
Output

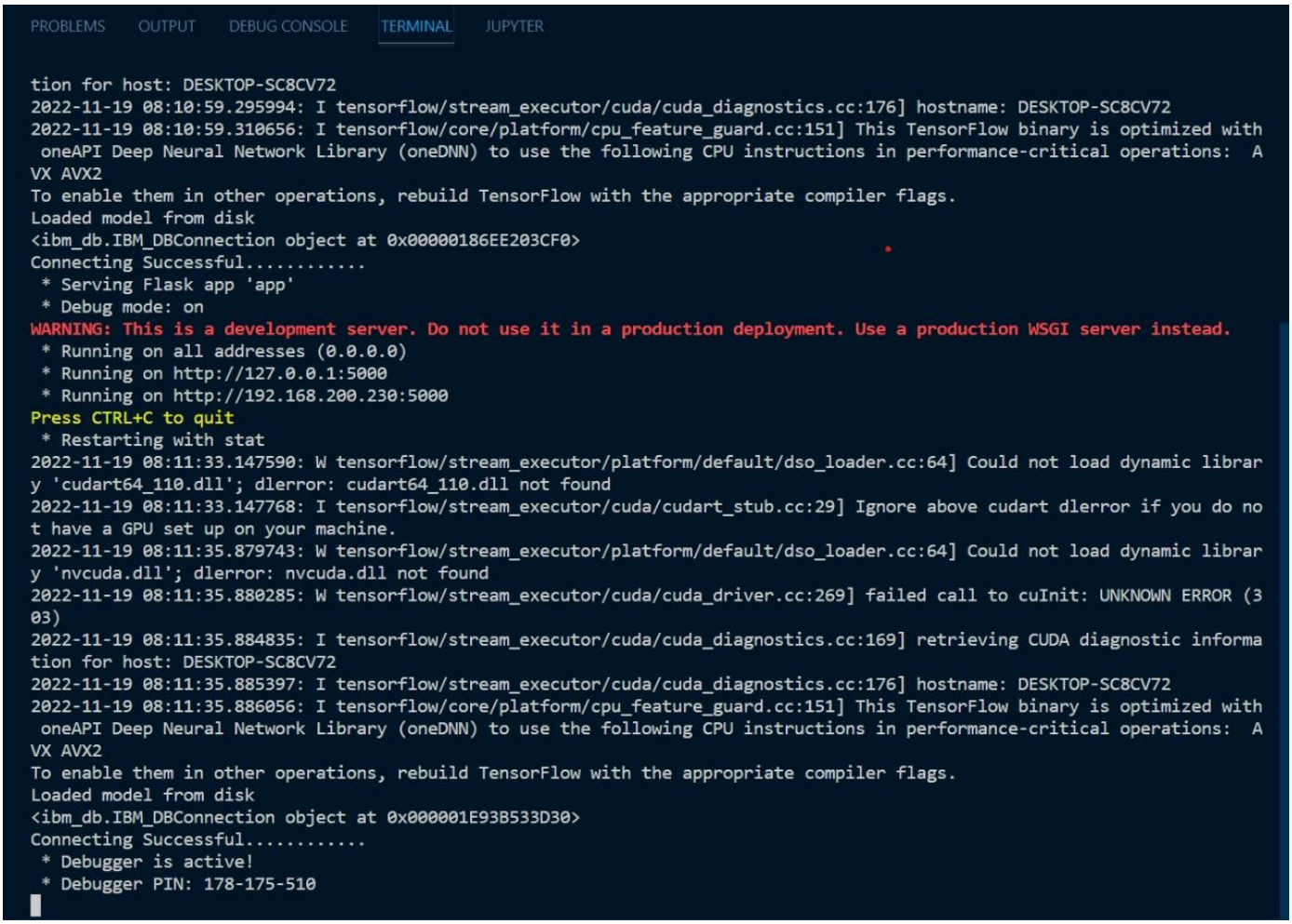

Hand Gesture
Home Introduction Predict
Image Processing Using Hand Gesture
A Gesture-based Tool for Sterile Browsing mages
Upload Image Here
Choose...
Output

CHAPTER 9

RESULTS

In this project, we found that we can maintain the sterility of an operation theater, etc by using hand based gesture tools to browse the images obtained.

Final findings (Output) of the project along with screenshots as follows.



CHAPTER 10

ADVANTAGES & DISADVANTAGES

Advantages:

- Major advantage of this tool is that it helps to maintain the sterility of the environment.
- It is also easy to use and is quicker than the existing methods to browse images.
- It can also be performed even if the surgeon is a bit far away from the system, this helps t o save time.
- The tool does not need the person using it to have an apparatus or any devices on them to use it.
- They can simply move their hands to browse through the images.

Disadvantages:

- The tool can be quite expensive as it requires cameras and other expensive devices to cap ture images and process it.

CHAPTER 11

CONCLUSION

In this project we developed a tool which recognizes the hand gestures and enables doctors to browse through radiology images using these gestures. This enables doctors and surgeons to maintain the sterility as they would not have to touch any mouse or keyboard to go through the images. This tool is also easy to use and is quicker than the regular method of using mouse/keyboard. It can be used regardless of the users location since they don't have to be in contact with any device. It also does not require the user to have any device on them to use it. Further this technology can be extended to other industries like it can be used by presenters, by teachers for show images in the classroom, etc.

CHAPTER 12

FUTURE SCOPE

- The tool can be made quicker by increasing the recognition speed.
- More number of gestures can be added thereby increasing this tool's functionality and use ability for different purposes.
- Tracking of both hands can be added to increase the set of commands.
- Voice commands can also be added to further increase the functionality.

CHAPTER 13
APPENDIX

Source Code:

```
from
flas
k
impo
rt *
        from datetime import date
        import ibm_db
        from flask import Flask, render_template, request
        import numpy as np
        import operator
        import cv2 # opencv library
        import os
        from tensorflow.keras.models import load_model
        from tensorflow.keras.utils import load_img, img_to_array
        from werkzeug.utils import secure_filename

        app = Flask(__name__,template_folder="templates")
        model=load_model('gesture.h5')
        print("Loaded model from disk")
        conn = ibm_db.connect("DATABASE=bludb;HOSTNAME=54a2f15b-5c0f-46df-8954-
        7e38e612c2bd.c1ogj3sd0tgtu0lqde00.databases.appdomain.cloud;PORT=32733;SECURITY=SSL;PROTOCOL=T
        CPIP;UID=mml48790;PWD=dMMqquglkWltg4Jo", "", "")
        print(conn)
        print("Connecting Successful.............")
        user_id=0

        @app.route("/", methods=['GET','POST'])
        def login():
            if request.method=='GET':
                return render_template("index.html",status="",colour="red")
            elif request.method=='POST':
                global retailer_id
                email=request.form["email"]
                password=request.form["password"]
                query = '''select * from user where email = \'{}\''''.format(email)
                exec_query = ibm_db.exec_immediate(conn, query)
```

```
        row = ibm_db.fetch_both(exec_query)
        if(row is not False):
            if(row['PASSWORD'] != password):
                return render_template("index.html",status="Invalid Password",colour="red")
            else:
                temp='''select id from user where email = \'{}\''''.format(email)
                exec_query = ibm_db.exec_immediate(conn, temp)
                dict= ibm_db.fetch_both(exec_query)
                user_id=dict["ID"]
                return render_template("home.html")

        return render_template("index.html",status="Invalid Email",colour="red")

@app.route("/signup", methods=['GET','POST'])
def signup():

    if request.method=='GET':
        return render_template("register.html",status="",colour="red")
    elif request.method=='POST':
        email=request.form["email"]
        password=request.form["password"]
        username=request.form["username"]
        query = '''select * from user where email = \'{}\''''.format(email)
        exec_query = ibm_db.exec_immediate(conn, query)
        row = ibm_db.fetch_both(exec_query)
        if(row is False):
            query = '''insert into user(email, password, username) values('{}', '{}',
'{}')'''.format(email, password, username)
            exec_query = ibm_db.exec_immediate(conn, query)
            return render_template("index.html",status="Signup Success",colour="green")
        else:
            return render_template("register.html",status="User Already Exists",colour="red")

@app.route('/home') # routes to the intro page
def home():
    return render_template('home.html') #rendering the intro 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 index6():
    return render_template("index6.html")

@app.route('/predict', methods=['GET', 'POST'])  # route to show the predictions in a web UI
def launch():
    #Getting input and storing it
    if request.method == 'POST':
        print('inside launch function')
        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('img saved successfully')
        print(file_path)
        # test_image=cv2.imread(file_path,cv2.IMREAD_COLOR)
        # test_image=cv2.resize(test_image,(64,64))
        # result= model.predict(test_image.reshape(1,64,64,1))

        # img = load_img(file_path, grayscale=True, target_size=(64, 64))
        # x = img_to_array(img)
        # x = np.expand_dims(x, axis = 0)

    cap=cv2.VideoCapture(0)
    image1=cv2.imread(file_path)
    cv2.imshow("Output",image1)
    prev='NULL'
    while True:
        _, frame=cap.read()
        frame=cv2.flip(frame,1)

        x1=int(0.5*frame.shape[1])
        y1=10
        x2=frame.shape[1]-10
        y2=int(0.5*frame.shape[1])

        cv2.rectangle(frame,(x1-1,y1-1),(x2+1,y2+1),(255,0,0)),1
        roi = frame[y1:y2,x1:x2]

        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)

        result = model.predict(test_image.reshape(1,64,64,1))
        print(result)
        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]}
        prediction=sorted(prediction.items(),key=operator.itemgetter(1),reverse=True)

        cv2.putText(frame,prediction[0][0],(10,120), cv2.FONT_HERSHEY_PLAIN,1,(0,255,255),1)
        cv2.imshow("frame",frame)



        interrupt=cv2.waitKey(10)
        if interrupt & 0xFF == 27: #Esc key to break from the while loop
            break

        if prev == prediction:
                continue

        prev = prediction



        image1=cv2.imread(file_path)
        image1=cv2.resize(image1,(255,255))
        if prediction[0][0]=='ONE':
            resized=cv2.resize(image1,(200,200))
            cv2.destroyWindow("Output")
            cv2.imshow("Output",resized)
##            key=cv2.waitKey(3000)
##
##            if(key & 0xFF) == ord("1"):
##                cv2.destroyWindow("Fixed Resizing - One")

        elif prediction[0][0]=='ZERO':
            cv2.rectangle(image1,(480,170),(650,420),(0,0,255),2)
            cv2.destroyWindow("Output")
            cv2.imshow("Output",image1)
            #cv2.imshow("Rectangle - Zero",image1)
            #cv2.waitKey(0)
##            key=cv2.waitKey(3000)
##
##            if(key & 0xFF)==ord("0"):
```

```
##             cv2.destroyWindow("Rectangle - Zero")

        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.destroyWindow("Output")
            cv2.imshow("Output",rotated)
##            cv2.imshow("OpenCV Rotation - Two",rotated)
##            key=cv2.waitKey(3000)
##            if(key & 0xFF)==ord("2"):
##                cv2.destroyWindow("OpenCV Rotation - Two")

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

        elif prediction[0][0]=='FOUR':
            zoomed=cv2.resize(image1,(400,400))
            cv2.destroyWindow("Output")
            cv2.imshow("Output",zoomed)
##            cv2.imshow("Zoomed - Four",zoomed)
##            key=cv2.waitKey(3000)
##            if(key & 0xFF)==ord("4"):
##                cv2.destroyWindow("Zoomed - Four")

        elif prediction[0][0]=='FIVE':
            neg=255-image1
            cv2.destroyWindow("Output")
            cv2.imshow("Output",neg)
##            cv2.imshow("Negative - Five",neg)
##            key=cv2.waitKey(3000)
##            if(key & 0xFF)==ord("5"):
##                cv2.destroyWindow("Negative - Five")

        else:
            continue
```

```
        cap.release()
        cv2.destroyAllWindows()

        return render_template("home.html")

    if __name__=="__main__":
        app.run(host='0.0.0.0',debug=True)
```

Github Link:

https://github.com/IBM-EPBL/IBM-Project-19498-1659698742

Project Demo Link:

https://drive.google.com/file/d/1rwdC6QbhhNBRucegrVSkFI3El48Gbaly/view?usp=sharing