

A Gesture-based Tool for Sterile Browsing of Radiology Images

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ABSTRACT:

This paper presents “*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. Navigation and other gestures are translated to commands based on their temporal trajectories, through video capture. “*Gestix*” was tested during a brain biopsy procedure.

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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.¹ In this paper, 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.

This paper presents a video-based hand gesture capture and recognition system used to manipulate magnetic resonance images (MRI) within a graphical user interface. A hand gesture vocabulary of commands was selected as being natural in the sense that each gesture is cognitively associated with the notion or command that is meant to represent it. For example, moving the hand left represents a “turn left” command. The operation of the gesture interface was tested at the Washington Hospital Center in Washington, DC. Two operations were observed in the hospital's neurosurgery department and insights regarding the suitability of a hand gesture system was obtained. To our knowledge, this is the first time that a hand gesture recognition system was successfully implemented in an “in vivo” neurosurgical biopsy. A sterile human—machine interface is of supreme importance because it is the means by which the surgeon controls medical information avoiding contamination of the patient, the OR and the surgeon.

Fig1: Pediatric Chest-X-Ray



1.1 PROJECT OVERVIEW:

In two brain surgeries at the Neurosurgery OR at the Washington Hospital Center, procedures were observed by the authors to gain insights about the use of current technologies and how they affect the quality of the surgeon's performance. We found that: (a) surgeons kept their focus of attention between the patient and the surgical point of interest on the touch-screen navigation system; (b) a short distance between the surgeon and the patient was maintained during most of the surgery; (c) the surgeon had to move close to the main control wall to discuss and browse through the patient's MRI images.

The hand gesture control system “*Gestix*” developed by the authors helped the doctor to remain in place during the entire operation, without any need to move to the main control wall since all the commands were performed using hand gestures.

1.2 PURPOSE:

It is used to browse through the images obtained using radiology using hand gestures rather than using mouse, keyboard, etc thereby maintaining sterility.

2.LITERATION SURVEY

2.1 Existing Problem:

A Gesture-based Tool for Sterile Browsing of Radiology Images - research paper by national library of medicine.

The hand gesture control system “*Gestix*” developed by the authors helped the doctor to remain in place during the entire operation, without any need to move to the main control wall since all the commands were performed using hand gestures. The sterile gesture interface consists of a Canon VC-C4 camera, whose pan/tilt/zoom can be initially set using an infrared (IR) remote.

This camera is placed just over a large flat screen monitor . Additionally, an Intel Pentium IV, (600MHz, OS: Windows XP) with a Matrox Standard II video-capturing device is used.

2.2 REFERENCES:

H.AkaikeInstitute for Statistical Mathematics, Minato, Tokyo, Japan have proposed A new look at the statistical model identification.

Zhou Wang, Howard Hughes Medical Institute, Center for Neural Science and the Courant Institute for Mathematical Sciences, New York University, New York, NY, USA

Jia Deng,WeiDong,RichardSocher , Li-Jia Li , Kai Li , Li Fei-Fei have proposed A large-scale hierarchical image databasePublished in: **2009 IEEE Conference on Computer Vision and Pattern Recognition**

Shaoqing RenUniversity of Science and Technology of China, Hefei, Anhui, China,
Kaiming HeVisual Computing Group, Microsoft Research, Beijing, China ,

Ross Girshick Facebook AI Research, Seattle, WA 98109 , **Jian Sun**Visual Computing Group, Microsoft Research, Beijing, China have proposed Faster R-CNN: Towards Real-Time Object Detection with Region Proposal Networks published in **IEEE Transactions on Pattern Analysis and Machine Intelligence** (Volume: 39, **Issue: 6**, 01 June 2017)

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ESEN SistemEntegrasyon, ODTU Teknokent, Ankara, TÜRKİYE have proposedDirection Finding Using Convolutional Neural Networks and Convolutional Recurrent Neural Networks published in **2020 28th Signal Processing and Communications Applications Conference (SIU)**

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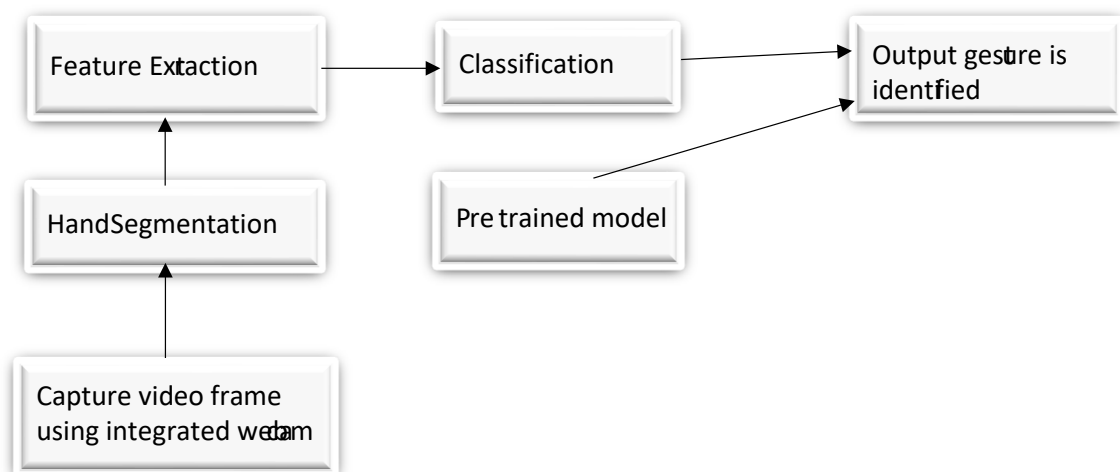
Have proposed Development of a Learning-aid tool using Hand Gesture Based Human Computer Interaction System. Published in: **2021 Advanced Communication Technologies and Signal Processing (ACTS)**

2.3 Problem Statement Definition:

Humans have the ability to recognize body and sign language but computers don't have this ability. Humans can recognize sign language because of the combination of **vision** and **synaptic interactions** with brain. To make computer recognize sign language we need to replicate this skill to computers.

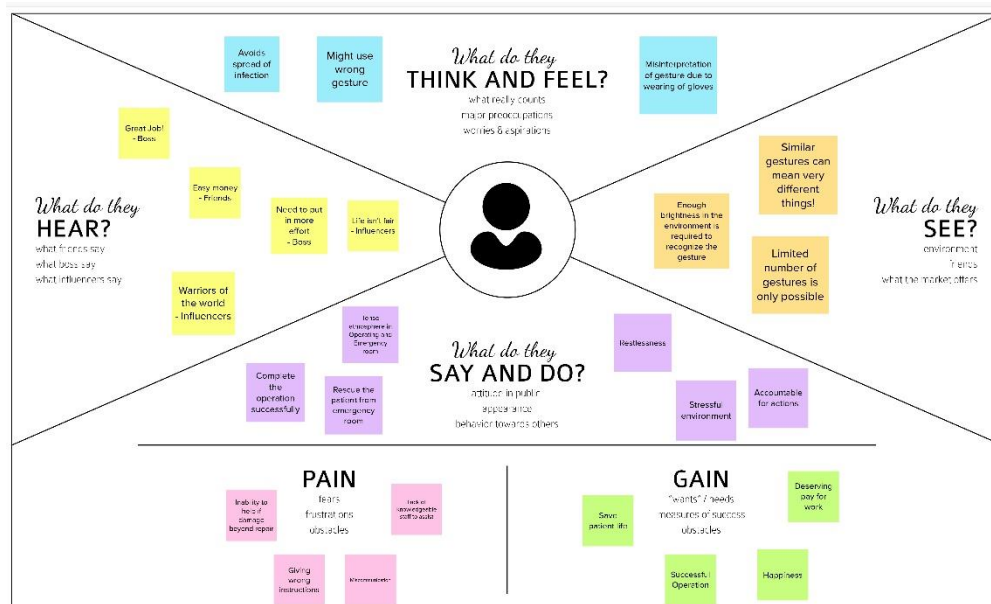
Through **position** and **shape** of the centre of the **palm** and the **fingers** we can obtain certain information. The gesture can be both static and dynamic. *Static hand gestures* are obtained by analysing shape of the hand. *Dynamic hand gestures* are obtained by analysing hand movements. The ability to spontaneously identify gestures without delay in hand motion is the problem. Through real-time hand gesture detection, we overcome these problems. Processing speed, image processing techniques and different recognition algorithms are used in this real-time hand gesture detection.

In this project, the model is first pre-trained on the images of different hand gestures, such as showing numbers with fingers as 1, 2, 3, 4. This model uses the integrated webcam to capture the video frame. The image captures in video frame is compared with the pretrained model and gesture is identified.

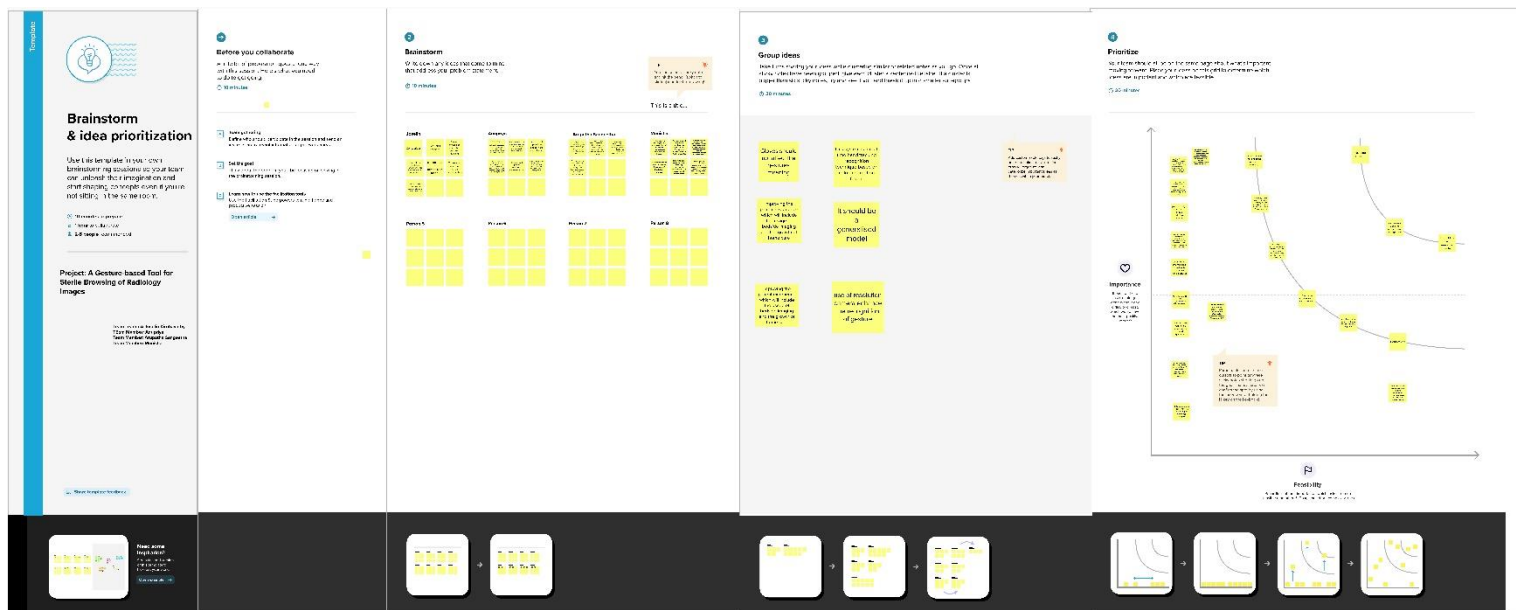


IDEATION&PROPOSED SOLUTION

3.1 Empathy Map Canvas:



3.2 Ideation & Brainstorming:



3.3 Proposed Solution:

s.no	Parameter	Description
1.	Problem statement	To design an ML model to identify and classify the hand gestures.
2.	Idea / Solution description	To develop a CNN based classifier model, which would be trained on our training data
3.	Novelty / Uniqueness	We train a CNN based model to recognize the hand gesture. The training data include images that captures the hand gestures of 1,2,3,4,5 and 0. The image is resized without much loss of information and used for training a CNN based model. We use Python Flask to provide an interactive platform for our model
4.	Social Impact / Customer Satisfaction	This project would help the doctors in operation theatres where physical contact between persons should be avoided in order to be sterilized and also prevent from any infections.
5.	Business Model (Revenue Model)	it can be sold as an open-source service to all the hospitals as a non-profitable work.
6.	Scalability of the Solution	The model could also be extended to other real world classifying problems like cancer detection from X-ray, COVID detection using X-ray images, mask detection, face detection etc.

3.4 Problem Solution Fit:

Project Title: A Gesture Based tool for sterile browsing of radiology images

Project Design Phase-I - Solution Fit Template

Team ID: PNT2022TMD49068

Define CS, fit into CC	1. CUSTOMER SEGMENT(S) CS Who is your customer? i.e. working parents of 0-5 y.o. kids • Doctors are our primary customers to solve their problem in browsing of radiology images • Our secondary customers are patients who wants to browse the radiology images using hand gestures	6. CUSTOMER CONSTRAINTS CC What constraints prevent your customers from taking action or limit their choices of solutions? i.e. spending power, budget, no cash, network connection, available devices. • This is basically a web application, which is supported in almost all devices. • The results for their problem will be one minute • Fast and efficient	5. AVAILABLE SOLUTIONS AS Which solutions are available to the customers when they face the problem or need to get the job done? What have they tried in the past? What pros & cons do these solutions have? i.e. pen and paper is an alternative to digital notetaking • By using AI will end up the existed problem, by provide results in low price. • Its affordable by all people and the results are provided instantly	Explore AS, differentiate
	2. JOBS-TO-BE-DONE / PROBLEMS J&P Which jobs-to-be-done (or problems) do you address for your customers? There could be more than one; explore different sides. • It moves radiology images with the help of hand gestures	9. PROBLEM ROOT CAUSE RC What is the real reason that this problem exists? What is the back story behind the need to do this job? i.e. customers have to do it because of the change in regulations. • There is less possibility for misunderstanding of hand gestures.	7. BEHAVIOUR BE What does your customer do to address the problem and get the job done? i.e. directly associated: customers spend free time on volunteering work (i.e. Greenpeace) • By using our product, they save a lot of time to spend for browsing images.	
Focus on J&P tap into BE, understand RC	3. TRIGGERS TR What triggers customers to act? i.e. seeing their neighbour installing solar panels, reading about a more efficient solution in the news. • People will feel that our product provides a bunch of valuable service affordable	10. YOUR SOLUTION SL If you are working on an existing business, write down your current solution first, fill in the canvas, and check how much it fits reality. If you are working on a new business proposition, then keep it blank until you fill in the canvas and come up with a solution that fits within customer limitations, solves a problem and matches customer behaviour. • By building a AI, MI based web application make their issues resolved in seconds. • Make their expensive process affordable. • Minimize the time for analyze their problem and provide results in seconds.	8. CHANNELS of BEHAVIOUR CH 8.1 ONLINE What kind of actions do customers take online? Extract online channels from #7 • Their data will be analyze early with the help of cloud rendering 8.2 OFFLINE What kind of actions do customers take offline? Extract offline channels from #7 and use them for customer development. • It browse the images with the help of hand gestures	Identify strong TR & EM
	4. EMOTIONS: BEFORE / AFTER EM How do customers feel when they face a problem or a job and afterwards? i.e. lost, insecure > confident, in control - use it in your communication strategy & design. • It reduces doctors unwanted work load, stress and time etc.,			

4. REQUIREMENT ANALYSIS:

4.1 Functional Requirements:

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
Fr.1	Identifying User Gestures	The user gestures are identified using the images of gestures captured by the camera.
Fr.2	Deployment in Cloud	The trained Deep Learning Model is deployed in cloud, which could be accessed anywhere around the world.
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.

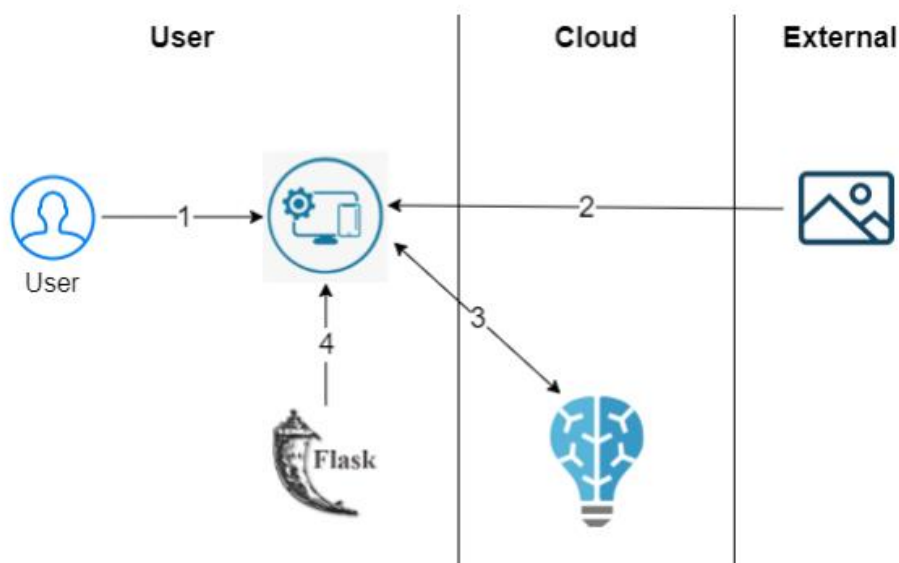
4.2 NON FUNCTIONAL REQUIREMENTS:

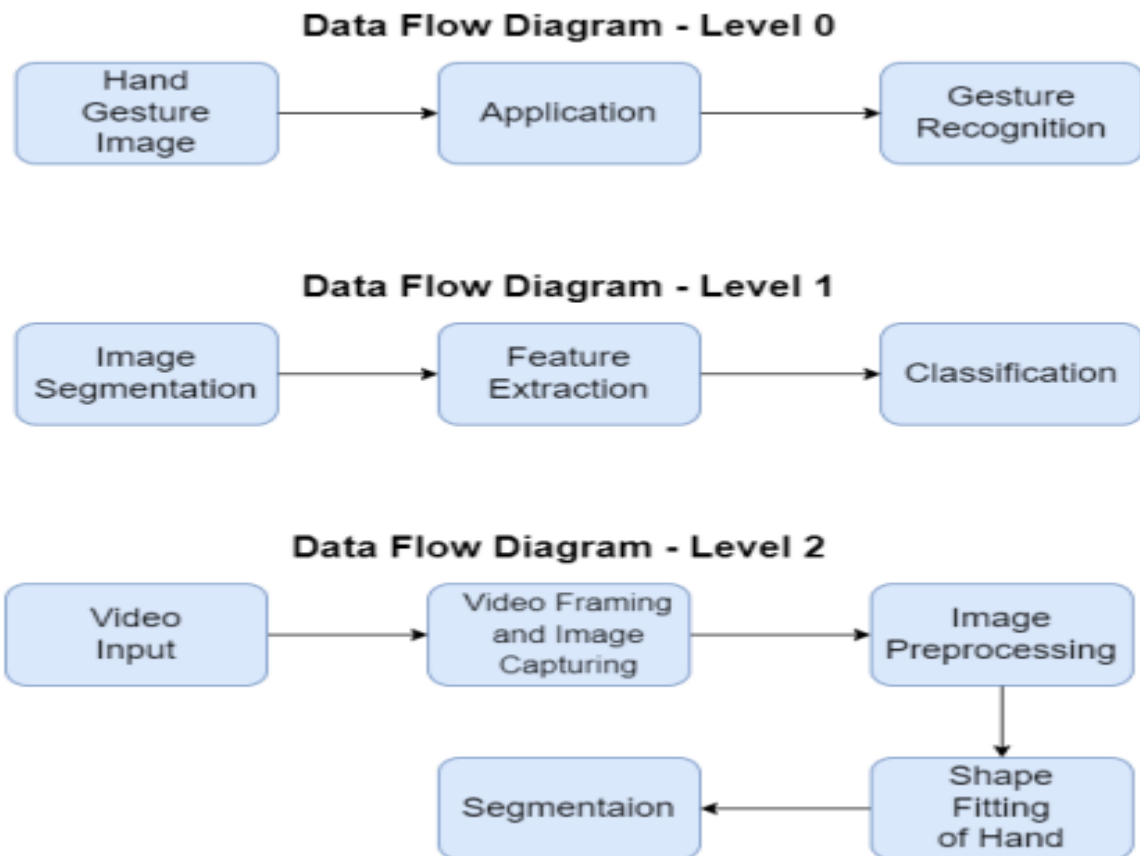
Following are the non-functional requirements of the proposed solution.

FR.NO	Non-Functional Requirement	Description
FR.1	Usability	The user interface which acts as an intermediate between the user and the DL Model which is deployed in the cloud.
FR.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.
FR.3	Reliability	The tool or the system is 95% reliability for a year.
FR.4	Performance	The tool or the system should respond with the accurate response within 4-5 seconds
FR.5	Availability	The model deployed in the cloud must be available to 99.8% of the people over a month during working hours
FR.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

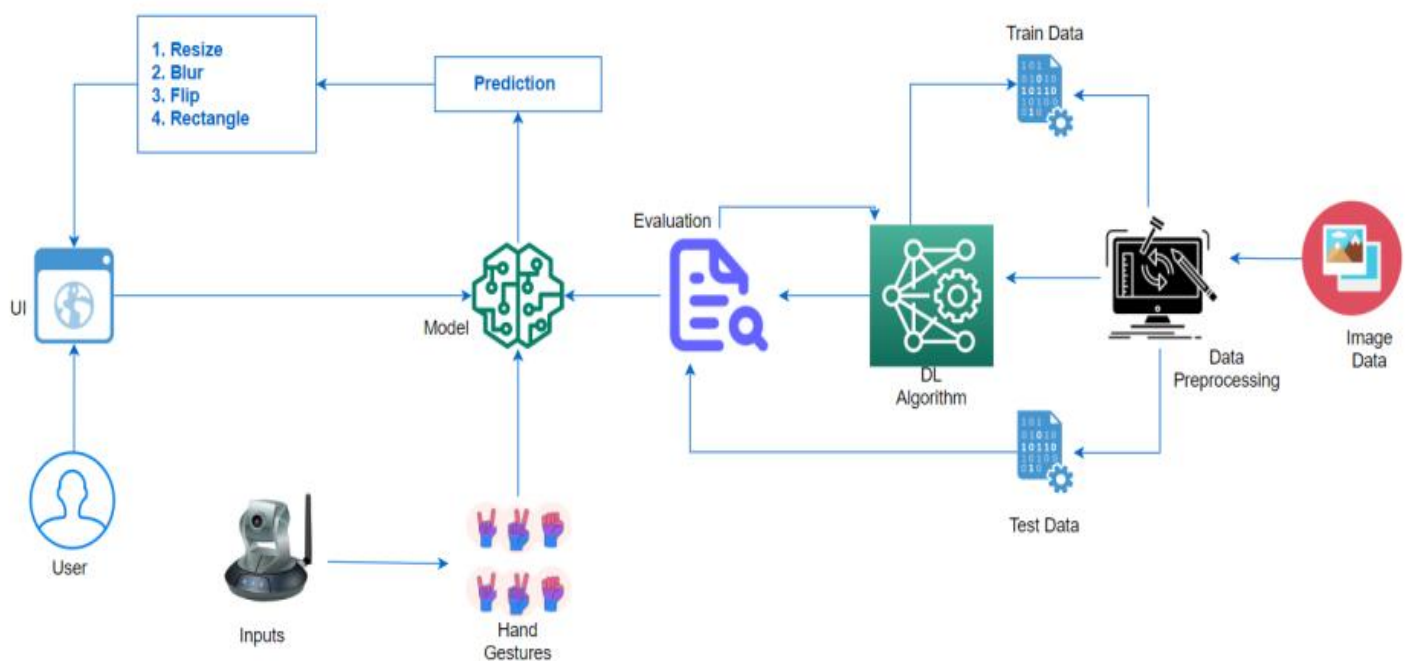
5.PROJECT DESIGN

5.1 Data Flow Daigrams:





5.2 Solution & Technical Architecture:



5.3 User Stories:

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Web user)	Launch Web App deployed in cloud	USN-1	As a user, I can launch the webapp where I can upload the images for recognition	I can upload the images for classification	High	Sprint-4
	Prediction	USN-2	As a user, I can get the predicted results from the model deployed in the cloud	I can resize the radiology image, blur the image, flip based on the hand gesture	High	Sprint-4
	Deployment of webapp in the cloud	USN-3	As a user, I need the webapp to be accessible all over the world	I can access the webapp deployed in the IBM cloud	Medium	Sprint-3
	Deployment of AI model in the cloud	USN-4	As a user, I need the AI model to be accessible all over the world	I can access the model deployed in the IBM cloud	Medium	Sprint-3
	Model Building	USN-5	As a user, I need an AI model which could classify or recognize the hand gestures	I can get the prediction from the AI model	Medium	Sprint-1
	User Interface Building	USN-6	As a user, I need a web app for human computer interaction	I get User Interface for interaction with the model	Medium	Sprint-2

6 PROJECT PLANNING & SCHEDULING:

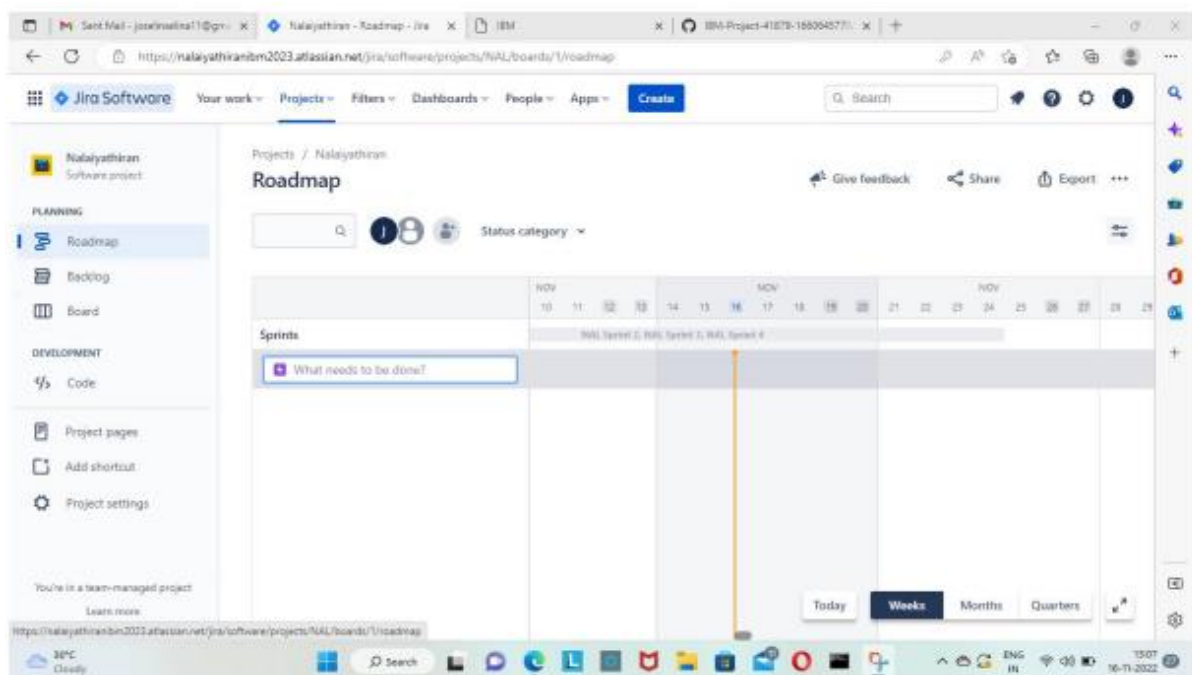
6.1,6.2 Sprint Planning & Estimation:

Product Bloging, Sprint Shedule and Estimation:

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Data collection (Dataset)	USN-1	As a user, I will download dataset of gestures for this project.	2	High	Joselin, Arputha Sangeetha, Monisha, Anupriya
Sprint-1	Image Preprocessing	USN-2	As a user, I will import necessary libraries for configuration of image datagenerator and applying them to test and train dataset.	1	High	Joselin, Arputha Sangeetha, Monisha, Anupriya
Sprint-2	Model Building	USN-3	As a user, I can import necessary libraries and models of CNN and adding Dense layers.	2	Low	Monisha, Anupriya
Sprint-2	Model Building	USN-4	As a user, I will train, save and test the model.	2	Medium	Monisha, Arputha Sangeetha
Sprint-3	Application Building	USN-5	As a user, I create html front page (CSS for styling webpage and JS to connect backend)	1	High	Arputha Sangeetha, Monisha
Sprint-3	Application Building	USN-6	As a user, I use python flask for building back end (for server side scripting.)	2	High	Joselin, Anupriya

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint - 3	Application Building	USN-7	As a user,going to run the application by combining both front end and back end	2	High	Joselin, Anupriya
Sprint-4	Train the model on IBM	USN-6	As a user, register for IBM cloud	1	Medium	Joselin, Monisha
Sprint-4	Train the model on IBM	USN-9	As a user, train the model on IBM and integrate it with the application	2	High	Joselin, Monisha, Arputha Sangeetha

6.3 Reports From JIRA:



[Jofinajoo - Profile - Jira \(atlassian.net\)](https://nalalyathiranibm2023.atlassian.net/jira/software/projects/NAL/boards/1/roadmap)

7 CODING & SOLUTIONING

7.1 Features 1:

About.html

```
<!DO
CTY
PE
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=1.0">
        <title>About Page</title>
        <style>
            /* ul {
                list-style-type: none;
                margin: 0;
                padding: 0px;
                overflow: hidden;
                position: fixed;
                background-color: aliceblue;

            }*/

            li {
                float: left;
            }

            li a {
                display: block;
                color:darkblue;
                font-size:20px;
                text-align: center;
                padding: 10px 20px;
                text-decoration: none;
            }
            .active{
                background-color: gray;
                color: white;
            }
        </style>
    </head>
    <body>
        <div>
            <ul>
                <li><a href="#">Home</a></li>
                <li><a href="#">About</a></li>
                <li><a href="#">Contact</a></li>
            </ul>
        </div>
    </body>
</html>
```



```

li a:hover {
    color: white;
}
#navbar{

    position: fixed;
    margin: 0;
    padding: 0px;
    top: 0;
    overflow: hidden;
    transition: top 0.3s;
    list-style-type: none;
}
.my-image {
    position: relative;
    left: 280px;
    top:-17px;
    border: 2px solid black;
    box-shadow: 10px 10px 10px #36454F;
}
.doclogo{
    position: relative;
    height:40px;
    width:45px;
    left:930px;
    top:-51px;
}
</style>
</head>
<body style= "margin:0;background-attachment:fixed;background:
linear-gradient(to bottom,#33ccff 0%,#ff99cc 100%);background-
repeat:no-repeat;background-size:cover;">
    <!--##### Nav bar #####-->
    <!--<div class="bg-image" style="background-image:
url('https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww
.rawpixel.com%2Fsearch%2Fmedicine&psig=AOvVaw0ZWZpbDi
xLLBHyPL95-
J9r&ust=1667986349057000&source=images&cd=vfe&ved=0CA0
QjRxqFwoTCMi9pMGjnvscFQAAAAAdAAAAABAJ');height:10
0vh;"></div>-->
    <div id = "navbar">
    <ul style = "list-style-type: none;">

```



```

<li><a href="{ { url_for('home') } }">Home</a></li>
<li><a href="{ { url_for('about') } }">About</a></li>
<li><a href="{ { url_for('login') } }">Login</a></li>
<li><a href="{ { url_for('register') } }">Signup</a></li>
</ul>
</div>

```

```

<h1 style = "z-index:-
1;top:60px;padding:50px;position:relative;color:darkblue;">A
Gesture-based Tool for Sterile Browsing of Radiology Images</h1>

```

```

<!---->

```

```



```

```

<div class="container">

```

```

<p style = "padding:50px;font-size:x-large;font-family:sans-
serif;text-align:justify;width:70%">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.<!--22-->

```

</p>

```

```

</div>

```

```

<!--<img class="my-image" src = "{ {url_for('static',
filename='img/docs.jpg') } }"/>-->

```

```

<img class="my-image" src = "About1.jpg"
style="width:40%;height:40%;"/>

```

```

<script>

```

```

var prevScrollpos = window.pageYOffset;
window.onscroll = function() {
var currentScrollPos = window.pageYOffset;
if (prevScrollpos > currentScrollPos) {

```

```

        document.getElementById("navbar").style.top = "0";
    } else {
        document.getElementById("navbar").style.top = "-70px";
    }
    prevScrollpos = currentScrollPos;
}

</script>
</body>
</html>

```

BASE.HTML:

```

<!DOCTYPE
TYPE
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=1.0">
        <title>{{ title }}</title>
        <link rel="icon" type="image/x-icon" href="{{ url_for('static',
filename='img/login.png') }}">

        <link
href="https://cdn.jsdelivr.net/npm/bootstrap@5.0.2/dist/css/boot
strap.min.css" rel="stylesheet" integrity="sha384-
EVSTQN3/azprG1Anm3QDgpJLIm9Nao0Yz1ztcQTwFspd3yD
65VohhpuuCOMLAsjC" crossorigin="anonymous">

    </head>
    <body>

```

7.2

Feature.

2

DASHBOARD.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=0.6">
  <script
src="https://ajax.googleapis.com/ajax/libs/jquery/3.3.1/jquery.mi
n.js"></script>

  <link
href="https://fonts.googleapis.com/icon?family=Material+Icons"
rel="stylesheet">
  <meta charset="UTF-8">
  <title>Predict</title>
  <link
href="https://cdn.bootcss.com/bootstrap/4.0.0/css/bootstrap.min.c
ss" 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">
  <link rel="stylesheet" href="main.css">
  <script src="main.js"></script>
<style>

*{
  position: relative;
}

/* .div1 {
```

```
width: 650spx;  
height: 800px;  
padding: 190px;  
margin: 10px;  
position: absolute;  
}*/
```

```
.header { position: relative;  
top:0;  
margin:0px;  
z-index: 1;  
left: 0px;  
right: 0px;  
position: fixed;  
background-color: rgb(10, 102, 109) ;  
color: black;  
box-shadow: 0px 8px 4px grey;  
overflow: hidden;  
padding-left:20px;  
font-family: 'Josefin Sans';  
font-size: 2vw;  
width: 100%;  
height:8%;  
text-align: center;  
}
```

```
.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 0
  rgba(0,0,0,0.19);
}
form { 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: 17%;
  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 style = "background-attachment:fixed;background:
linear-gradient(to bottom,#33ccff 0%,#ff99cc
100%);background-repeat:no-repeat;background-size:cover;">

  <div1 style = "text-align: center;" >
    <h1 style = "top:23px;"><font color="Black" size="6" font-
family="Roboto">Hand Gesture Recognition</h1><br>
    <p style = "padding-top:-50px"><i><font color="Black"
size="4" font-family="sans-serif"></i>Provide an image for
which you want to perform various operations</p>
    <br>
    <div>
      <h4 style="top:-14px;">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" 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>

```

HOME.HTML:

T

```

<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=1.0">
    <link rel="icon" type="image/x-icon" href="{ { url_for('static',
filename='img/home.png') } }">
    <title>Home</title>
    <link rel="stylesheet" href="main.css">
    <script src="main.js"></script>
<style>

```

```

a{
  background-color: #1271e6;
  border: none;
  color: white;
  padding: 15px 32px;
  text-align: center;
  text-decoration: none;
  display: inline-block;
  font-size: 16px;
  margin: 4px 2px;
  cursor: pointer;
  border-radius: 10px;
}
a:hover{
  color: white;
  background-color:rgba(8, 136, 249, 0.797);
}
/* .my-image {
  position: relative;
  left: 280px;
  top:-17px;
  border: 2px solid black;
  box-shadow: 10px 10px 10px #36454F;

} */

</style>

</head>

<body style = "background-attachment:fixed;background: linear-
gradient(to bottom,#33ccff 0%,#ff99cc 100%);background-repeat:
repeat;background-size:cover;">

  <center> <h1 style = "color: rgb(88, 10, 10);">A Gesture-Based
Tool For Sterile Browsing Of Radiology Images</h1></center>
  <center><a href="login.html">Login Page</a></center><br>
  <center><a href="register.html">Register Page</a></center><br>
  <center><a href="about.html">About</a></center>
  <center><a href="dashboard.html">Predict</a></center>

```

</body>

</html>

LOGIN.HTML:

```
<!DOCTYPE  
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=1.0">
```

```
<link
```

```
href="https://cdn.jsdelivr.net/npm/bootstrap@5.0.2/dist/css/boot  
strap.min.css" rel="stylesheet" integrity="sha384-
```

```
EVSTQN3/azprG1Anm3QDgpJLIm9Nao0Yz1ztcQTwFspd3yD  
65VohhpuuCOMLAsjC" crossorigin="anonymous">
```

```
<link rel="icon" type="image/x-icon" href="{ {url_for('static',  
filename='img/login.png')}}">
```

```
<title>Login</title>
```

```
<body style = "overflow:hidden;background-image:  
'About.jpg';background-repeat:no-repeat;background-  
size:cover;">
```

```
<div style = "border-right-width:50px;margin:50px  
370px;padding:138px;border-radius:10px;background-  
image:linear-gradient(to bottom,#e8cbc0 0%,#636fa4 100%);">
```

```
<center><h1 style = "color: aliceblue;">Login</h1><br>
```

```
<div class="container">
```

```
<form method="POST" action="">
```

```
<div class="form-group row">
```

```
<div style = "padding-bottom:12px;color: rgb(219,  
226, 233);"class="col-xs-4">
```

```
<label for="validationCustom01" class="form-  
label">username</label>
```

```

        <input type="text" class="form-control"
id="validationCustom01" >
        <div class="invalid-feedback">
            Please enter your username
        </div>
    </div>
    <div style = "padding-bottom:12px;color: rgb(219,
226, 233);" class="col-xs-4">
        <label for="validationCustom02" class="form-
label">Password</label>
        <input type="text" class="form-control"
id="validationCustom02" >
        <div class="invalid-feedback">
            Please enter your password
        </div>
        <div class="d-grid gap-2 d-md-block">
            <button class="btn btn-primary"
type="submit">Submit</button>
            <a href="home.html" class="btn btn-primary btn-lg-
active" role="button" aria-pressed="true">Next</a>

        <div style = "padding-bottom:12px"class="col-xs-4">

        </div>
        <div style = "padding-bottom:12px" class="col-xs-
4">

    </div>
    <div class="d-grid gap-2 d-md-block">

    </div>
</form>

</div><br>

    <a style = "color:white;" href="{ { url_for('register') } }">Don't
have an account? Sign Up</a>
</center>
</div>
</body>

</html>

```

REGISTER.HTML:

```
<!DOCTYPE
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=1.0">
  <link rel="stylesheet" href="{ { url_for('static',filename
='css/styles.css') } }">
  <link
href="https://cdn.jsdelivr.net/npm/bootstrap@5.0.2/dist/css/boot
strap.min.css" rel="stylesheet" integrity="sha384-
EVSTQN3/azprG1Anm3QDgpJLIm9Nao0Yz1ztcQTwFspd3yD
65VohhpuuCOMLAsjC" crossorigin="anonymous">
  <link rel="icon" type="image/x-icon" href="{ { url_for('static',
filename='img/signup.png') } }">
  <title>Signup</title>
  <style>

  </style>
</head>

<body style = "overflow:hidden;background-color: linear-
gradient(to bottom,#e8cbc0 0%,#636fa4 100%);background-
repeat:no-repeat;background-size:cover;">
  <div style = "border-right-width:50px;margin:50px
370px;padding:138px;border-radius:10px;background-
image:linear-gradient(to bottom,#e8cbc0 0%,#636fa4 100%);">
    <center><h1 style = "color: aliceblue;">Signup</h1><br>
    <div class="container">
      <form method="POST" action="">
        <div class="form-group row">

          <div style = "padding-bottom:12px;color:
aliceblue;"class="col-xs-4">
            <label for="validationCustom01" class="form-
label">username</label>
```

```

        <input type="text" class="form-control"
id="validationCustom01" >
        <div class="invalid-feedback">
            Please enter your username
        </div>
    </div>
    <div style = "padding-bottom:12px;color: aliceblue;"
class="col-xs-4">
        <label for="validationCustom02" class="form-
label">Password</label>
        <input type="text" class="form-control"
id="validationCustom02" >
        <div class="invalid-feedback">
            Please enter your password
        </div>
    </div>
    <div class="d-grid gap-2 d-md-block">
        <button class="btn btn-primary"
type="submit">Submit</button>
        <a href="home.html" class="btn btn-primary btn-lg-
active" role="button" aria-pressed="true">Next</a>
    </div>
</form>

</div><br>

    <a style = "color:white;" href="login.html">Already have an
account? Log In</a>
</center>
</div>
</body>

</html>

```

7.3 DATABASE SCHEMA:

```

SELECT
* FROM
user;

```

```

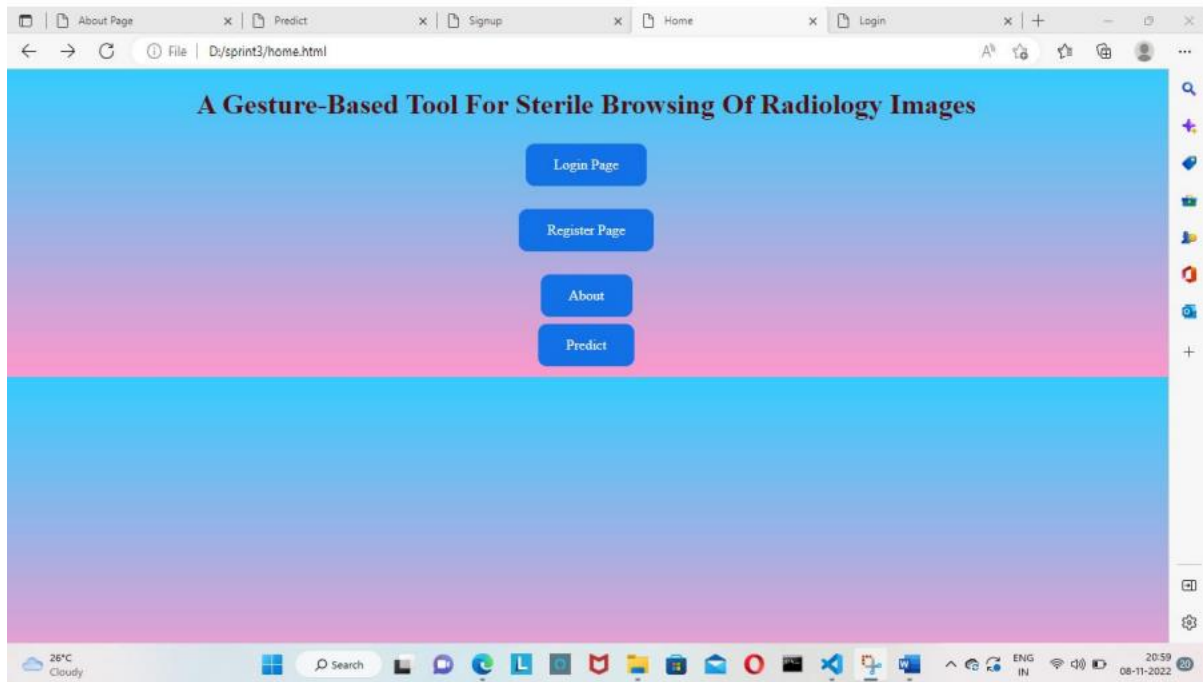
ALTER TABLE user add COLUMN phoneno int(10);
update user set phoneno = 1234567898 WHERE id = 2;

```

8.TESTING

8.1 Test cases:

HOME.HTML:

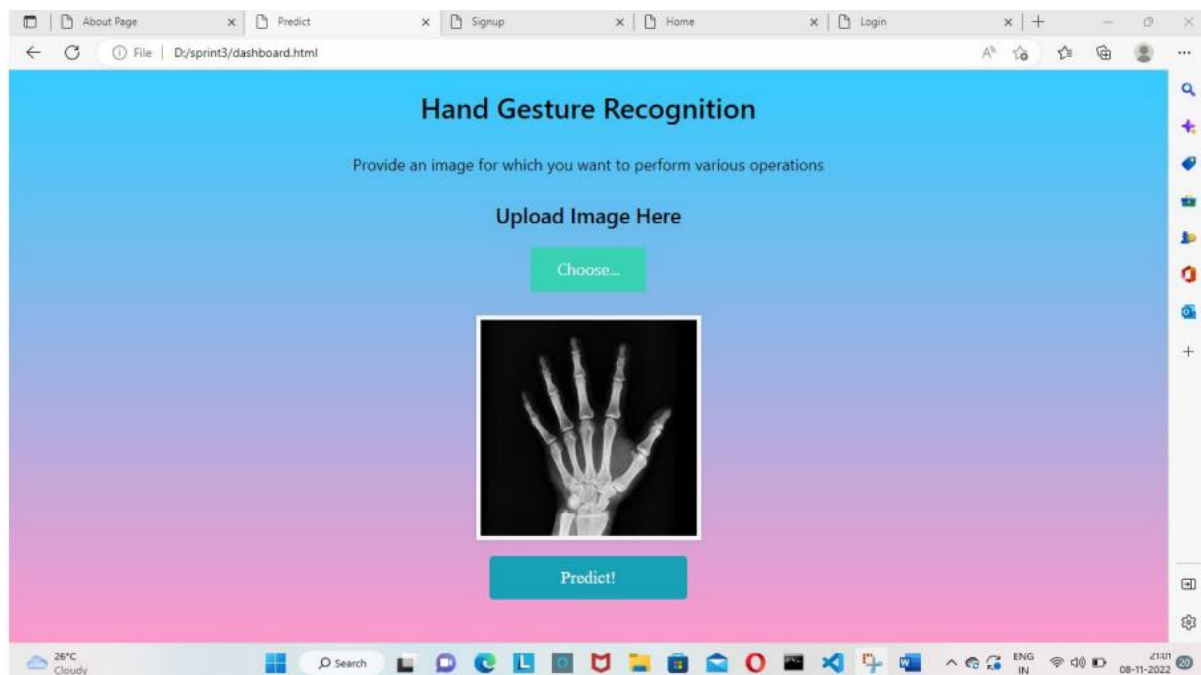


ABOUT.HTML:

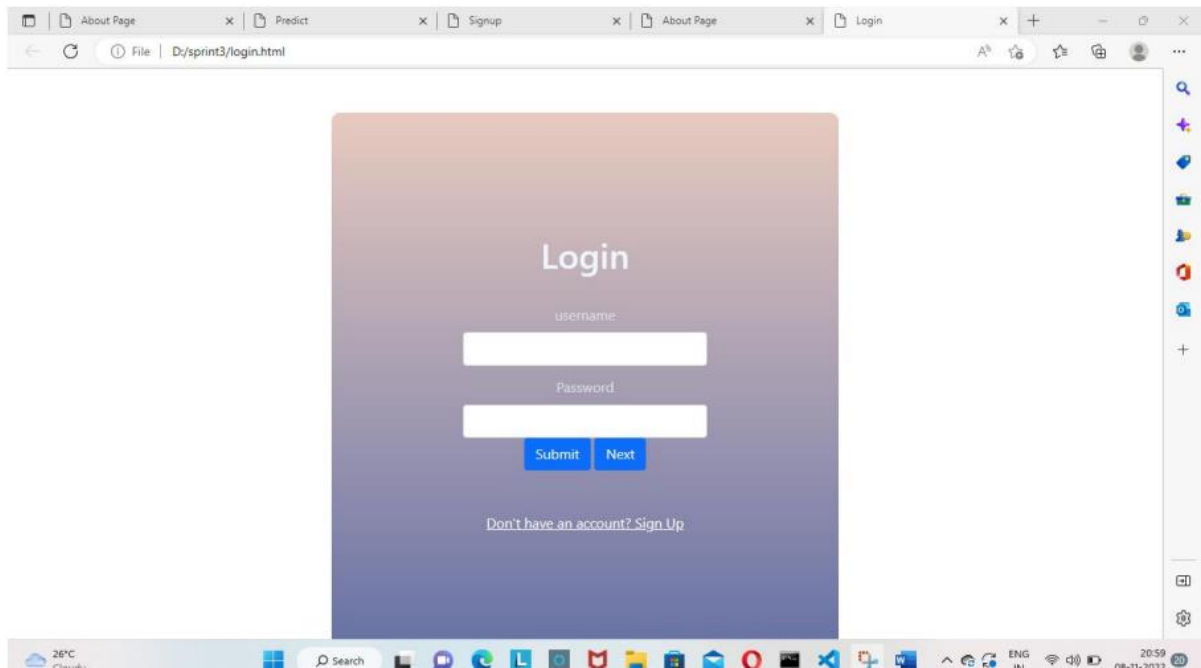




LAUNCH.HTML:



LOGIN.HTML:



Browser tabs: About Page, Predict, Signup, About Page, Login

Address bar: File | D:/sprint3/login.html

Page Content:

Login

username

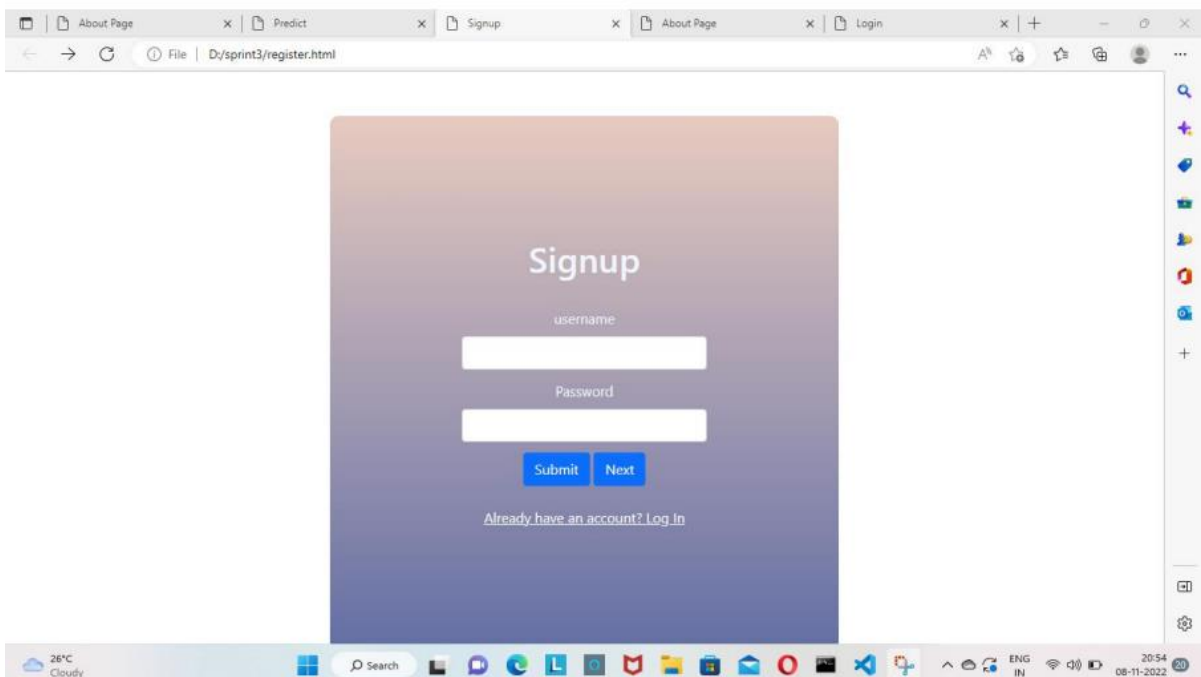
Password

[Submit](#) [Next](#)

[Don't have an account? Sign Up](#)

Taskbar: 26°C, Search, Windows icons, System tray: ENG, 20:59, 08-11-2022

REGISTER.HTML:



Browser tabs: About Page, Predict, Signup, About Page, Login

Address bar: File | D:/sprint3/register.html

Page Content:

Signup

username

Password

[Submit](#) [Next](#)

[Already have an account? Log In](#)

Taskbar: 26°C Cloudy, Search, Windows icons, System tray: ENG IN, 20:54, 08-11-2022

8.2 User Acceptance Testing:

REQUIREMENTS:

```
python==3.7
    asgiref==3.5.0
    bcrypt==3.2.0
    cffi==1.15.0
    click==8.1.2
    dnspython==2.2.1
    email-validator==1.1.3
    Flask==2.1.1
    Flask-Bcrypt==1.0.1
    Flask-Login==0.6.0
    Flask-SQLAlchemy==2.5.1
    Flask-WTF==1.0.1
    greenlet==1.1.2
    idna==3.3
    importlib-metadata==4.11.3
    itsdangerous==2.1.2
    Jinja2==3.1.1
    MarkupSafe==2.1.1
    pycparser==2.21
    six==1.16.0
    SQLAlchemy==1.4.35
    sqlparse==0.4.2
    Werkzeug==2.1.1
    WTForms==3.0.1
    zipp==3.8.0
```

9.RESULTS

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

9.1 Performance Metrics:

S.No.	Parameter	Values	Screenshot
1.	Model Summary	-	<pre> In [28]: model.summary() Model: "sequential" _____ Layer (type) Output Shape Param # ----- conv2d (Conv2D) (None, 62, 62, 32) 320 max_pooling2d (MaxPooling2D) (None, 31, 31, 32) 0 conv2d_1 (Conv2D) (None, 29, 29, 32) 9248 max_pooling2d_1 (MaxPooling2D) (None, 14, 14, 32) 0 flatten (Flatten) (None, 6272) 0 dense (Dense) (None, 512) 3211776 dense_1 (Dense) (None, 6) 3078 Total params: 3,224,422 Trainable params: 3,224,422 Non-trainable params: 0 </pre>
2.	Accuracy	<p>Training Accuracy – 0.9882</p> <p>Validation Accuracy – 0.9333</p>	<pre> Epoch 20/25 200/200 [=====] - Loss: 0.0271 - accuracy: 0.9882 - val_loss: 0.4183 - val_accuracy: 0.9333 </pre>

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 to 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 capture images and process it.

11.CONCLUSION

In this project we developed a tool which recognises 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...

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 useability 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.

PROJECT REFERANCE:

Research papers:

[A Gesture-based Tool for Sterile Browsing of Radiology Images - PMC \(nih.gov\)](#)

[\(PDF\) A Gesture-based Tool for Sterile Browsing of Radiology Images \(researchgate.net\)](#)

[A gesture-based tool for sterile browsing of radiology images - PubMed \(nih.gov\)](#)

13.APPENDIX

GITHUB LINK:

[IBM-EPBL/IBM-Project-41879-1660645770: A Gesture-based Tool for Sterile Browsing of Radiology Images \(github.com\)](https://github.com/IBM-EPBL/IBM-Project-41879-1660645770)

DEMO VIDEO LINK:

DRIVE LINK:

https://drive.google.com/file/d/1CNUr-L8x0h9n5VbS7mPv3sxl7nFQFamR/view?usp=share_link

YOUTUBE LINK:

<https://youtu.be/KKZZ9am4Gzk>

OUTPUT:

