### A GESTURE – BASED TOOL FOR STERILE BROWSING OF RADIOLOGY IMAGES

**NALAIYA THIRAN PROJECT BASED LEARNING**

**on**

**PROFESSIONAL READINESS FOR INNOVATION, EMPLOYABILITY AND ENTREPRENEURSHIP**

**A PROJECT REPORT**

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Approved by AICTE, New Delhi, Accredited with ‘A’ Grade by NAAC

**(An Autonomous Institution, Affiliated to Anna University, Chennai)**

**COIMBATORE – 641 032**

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**INDUSTRY MENTOR**

*Pradeepthi*

***IBM***

November 2022

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# Abstract

The use of doctor-computer interaction devices in the operation room (OR) requires new modalities that support medical imaging manipulation while allowing doctors' hands to remain sterile, supporting their focus of attention, and providing fast response times. 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. In the in vivo experiment, this interface prevented the surgeon's focus shift and change of location while achieving a rapid intuitive reaction and easy interaction. Data from two usability tests provide insights and implications regarding human-computer interaction based on nonverbal conversational modalities.

# 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 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.

In this work 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.

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.

# CHAPTER 2

## OBJECTIVE

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.

**CHAPTER 3: IDEATION PHASE**

* 1. **Literature Survey**

Paper 1:

Bacterial contamination of computer keyboards in a teaching hospital.

Author : Schultz M, Gill J, Zubairi S, Huber R, Gordin F <https://pubmed.ncbi.nlm.nih.gov/12725363/>

We tested 100 keyboards in 29 clinical areas for bacterial contamination. Ninety five were positive for microorganisms. Streptococcus, Clostridium perfringens, Enterococcus (including one

|  |  |  |  |
| --- | --- | --- | --- |
| vancomycin-resistant | Enterococcus), | Staphylococcus aureus, | fungi, and |
| gram-negative | organisms | were | isolated. |
| Paper 2: |  |  |  |

Face Mouse: A Novel Human-Machine Interface for Controlling the Position of a Laparoscope

Author : Nishikawa A, Hosoi T, Koara K, Negoro D, Hikita A, Asano S, Kakutani H, Miyazaki F

<https://ieeexplore.ieee.org/document/1236756>

Robotic laparoscope positioners are now expected as assisting devices for solo surgery among endoscopic surgeons. In such robotic systems, the human-machine (surgeon-robot) interface is of paramount importance because it is the means by which the surgeon communicates with and controls the robotic camera assistant. We have

designed a novel human-machine interface, called "FAce MOUSe", for controlling the position of a laparoscope.

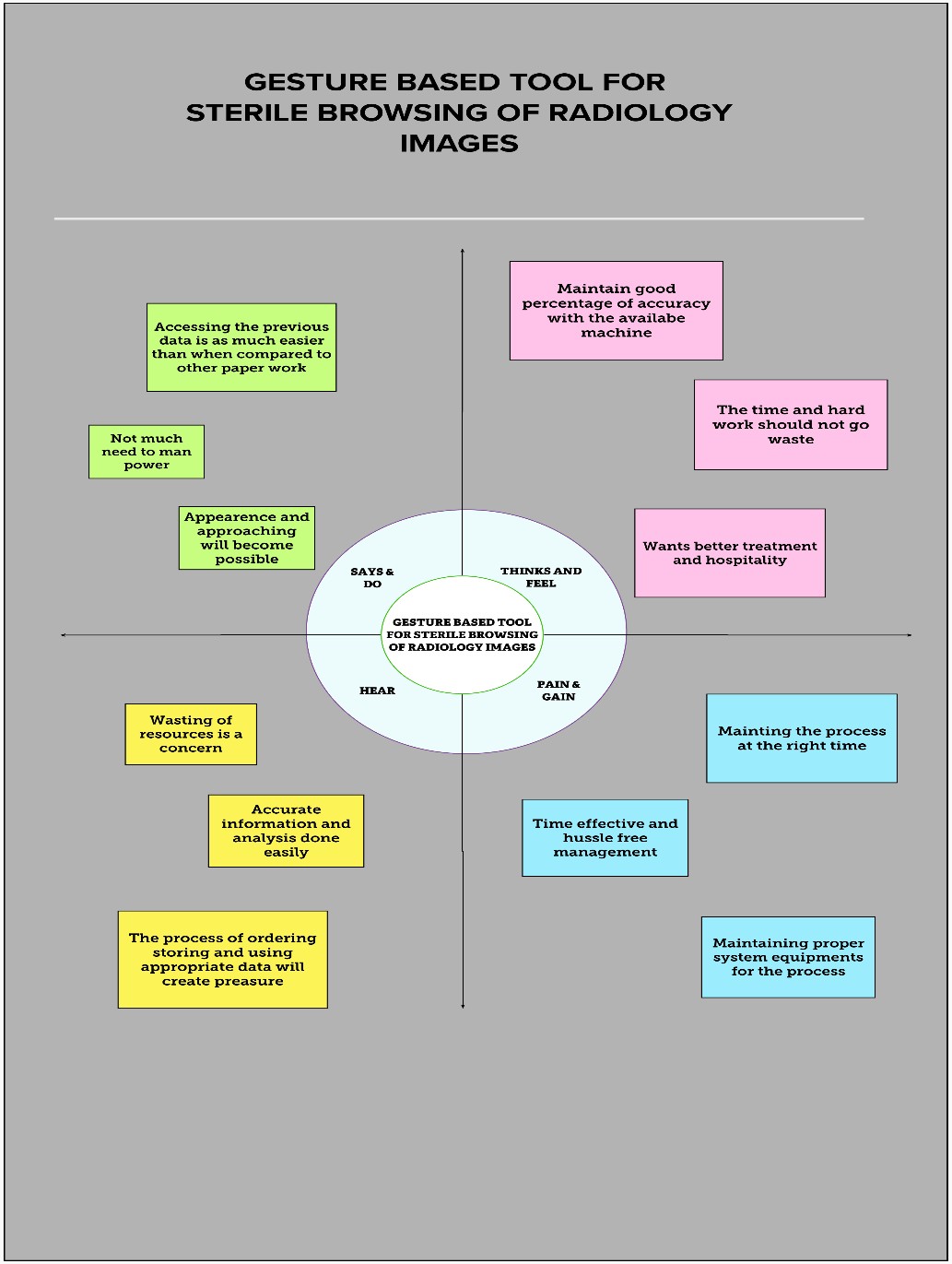
Paper 3:

The NeuroStation- a highly accurate, minimally invasive solution to frameless stereotatic neurosurgery

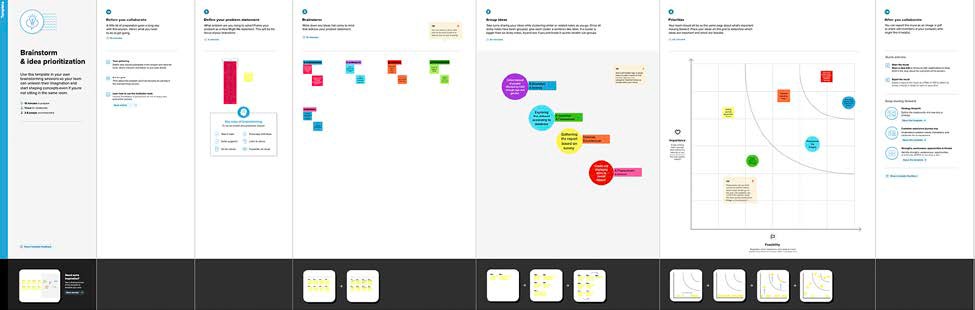
Author : Smith KR, Frank KJ, Bucholz RD <https://pubmed.ncbi.nlm.nih.gov/7923044/>

The NeuroStation is an image-guided neurosurgery workstation designed to deliver frameless stereotaxy within an ergonomic, integrated surgical environment. Generally, stereotaxy can provide the neurosurgeon with important intra-operative localization information using diagnostic images such as computerized tomography (CT) or magnetic resonance imaging (MRI). To date, however, stereotaxy has not been widely accepted by neurosurgeons due to the procedural difficulties of incorporating conventional stereotaxy.

* 1. **Empathy Map**



**3.2 Ideation**



**3.2 Problem Statement**

|  |  |
| --- | --- |
| Date | 19 September 2022 |
| Team ID | PNT2022TMID10032 |
| Project Name | Project - A Gesture-based Tool for Sterile Browsing of Radiology Images |
| Maximum Marks | 2 Marks |
| **Who does the problem affect?** | Different gestures can be predicted by this problem whose sterile images are uploaded and needed for the output. |

|  |  |
| --- | --- |
| **What are the boundaries of the problem?** | Several health conditions, your lifestyle, and your age and family history can increase your risk for heart disease. |
| **What technology used to solve the issue?** | Supervised and Un-supervised machine learning, Data mining, Computer vision with OpenCV, Python web application interface - Flask, Jupyter Notebook, IBM Cloud. |

|  |  |
| --- | --- |
| **Why is it important that we fix the problem?** | Predict if the patient suffers from different disease. The health professional enters the input values from the patient's health report. The data is fed into model which predicts different hand gestures based on the input values entered. |

1. **Project Design Phase-I**
   1. **Proposed Solution** - A Gesture-based Tool for Sterile Browsing of Radiology Images

**Project Design Phase-I Proposed Solution**

|  |  |
| --- | --- |
| Date | 02/11/2022 |
| Team Id | PNT2022TMID10032 |
| Project Name | Visualizing and Predicting Heart Diseases with an Interactive Dashboard |
| Maximum Marks | 2 Marks |

**Proposed Solution Template:**

|  |  |  |
| --- | --- | --- |
| **S.No.** | **Parameter** | **Description** |
| 1. | Problem Statement (Problem to be solved) | To replicate sterile browsing skill in computers using image capture technology and classification techniques |
| 2. | Idea / Solution description | A video based hand gesture capture and recognition system used to manipulate MRI within a graphical user interface |

|  |  |  |
| --- | --- | --- |
| 3. | Novelty / Uniqueness | By tracking the navigation and other gestures and translate to commands based on the temporal trajectories through video capture |
| 4. | Social Impact / Customer Satisfaction | Doctors can analyse the image by having non-verbal communication |
| 5. | Business Model (Revenue Model) | The business model of this system extracts intension and attention cues from the surgeon’s behaviour. Hence, it is useful for the doctors and surgeons from any domain or region all over the world |
| 6. | Scalability of the Solution | By adding few more gestures for manipulating the MRI images which are most essential for sterile browsing by doctors |

## Problem – Solution Fit

|  |  |
| --- | --- |
| Date | 05/11/2022 |
| Team ID | PNT2022TMID10032 |
| Project Name | Project - Visualizing and Predicting Heart Diseases with an Interactive Dashboard |
| Maximum Marks | 2 Marks |

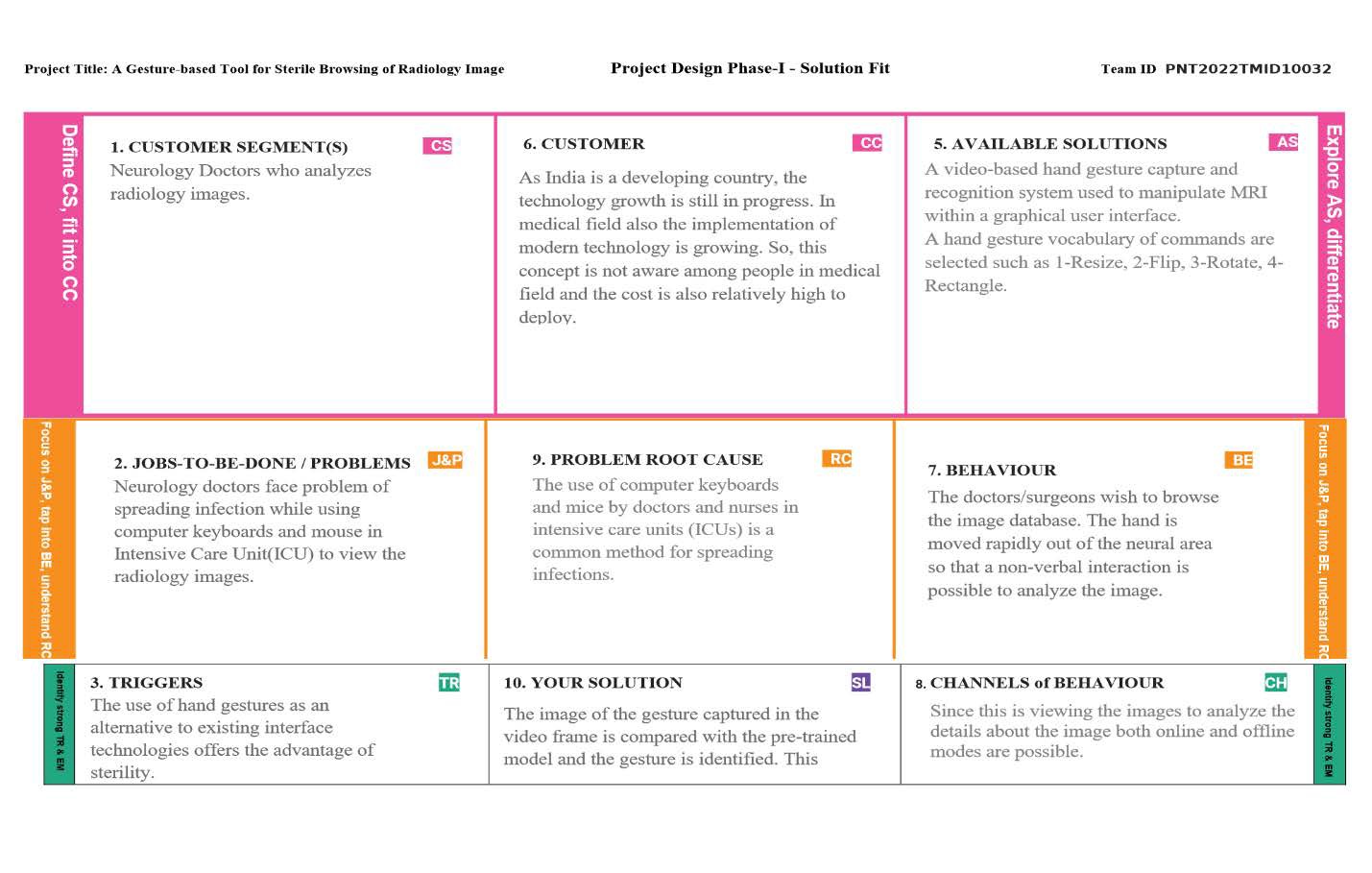
## Problem – Solution Fit Template:

The Problem-Solution Fit simply means that you have found a problem with your customer and that the solution you have realized for it actually solves the customer’s problem. It helps entrepreneurs, marketers and corporate innovators identify behavioural patterns and recognize what would work and why.

**Purpose:**

* + - Solve complex problems in a way that fits the state of your customers.
    - Succeed faster and increase your solution adoption by tapping into existing mediums and channels of behaviour.
    - Sharpen your communication and marketing strategy with the right triggers and messaging.
    - Increase touch-points with your company by finding the right problem- behaviour fit and building trust by solving frequent annoyances, or urgent or costly problems.

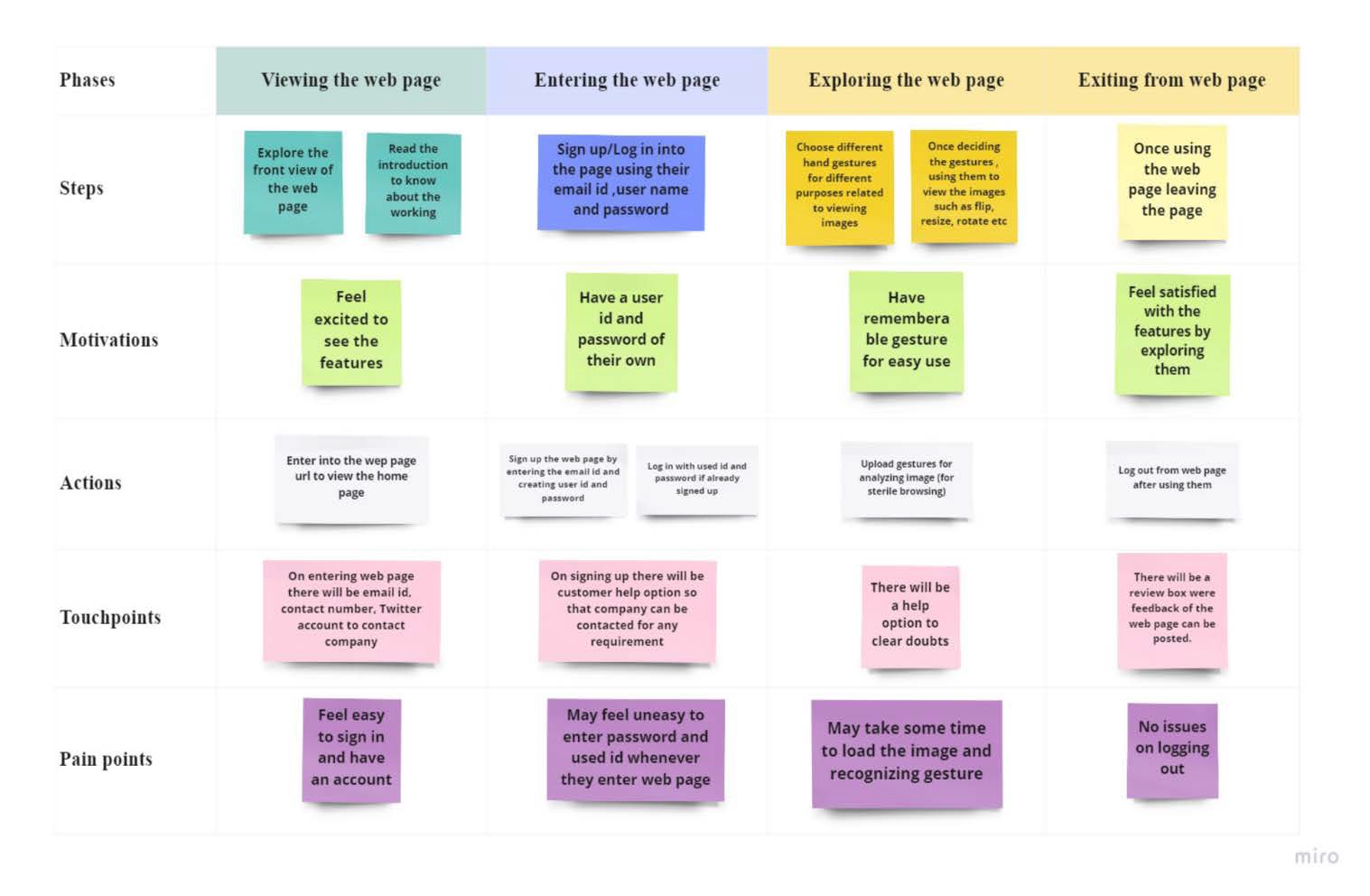
**Understand the existing situation in order to improve it for your target group.**

1. **PROJECT DESIGN PHASE 2**
   1. **Customer Journey Map** - A Gesture-based Tool for Sterile Browsing of Radiology Images

|  |  |
| --- | --- |
| Date | 07/11/2022 |
| Team ID | PNT2022TMID10032 |
| Project Name | Visualizing and Predicting Heart Diseases with an Interactive Dash Board |

## Customer Journey Map:

The customer journey map is a visual representation of the steps a customer takes to complete a specific action, such as signing up for a product trial or subscribing to a newsletter. The more steps involved to complete the specific action, the more detailed the customer journey map will be.



* 1. **Solution Requirements**

**Project Design Phase-II**

**Solution Requirements (Functional & Non-functional)**

|  |  |
| --- | --- |
| Date | 23/10/2022 |
| Team ID | PNT2022TMID10032 |
| Project Name | A Gesture-based Tool for Sterile Browsing of Radiology Images |
| Maximum Marks | 4 Marks |

**Functional Requirements:**

Following are the functional requirements of the proposed solution.

|  |  |  |
| --- | --- | --- |
| **FR**  **No.** | **Functional Requirement (Epic)** | **Sub Requirement (Story / Sub-Task)** |
| FR- 1 | User Registration | Registration through Gmail. |
| FR- 2 | User Confirmation | Confirmation via Email. |
| FR- 3 | User Sign up | Sign up using Gmail, user ID and password. |
| FR- 4 | User Login | Login using user ID and password. |
| FR- 5 | User Input | Setting unique hand gestures for easy and nonverbal communication. |
| FR- 6 | User Application | Input during usage of application to analyse the image via gestures. |

**Non-functional Requirements:**

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

|  |  |  |
| --- | --- | --- |
| **NF R**  **No.** | **Non-Functional Requirement** | **Description** |
| NF R-1 | **Usability** | User friendly as the instructions are displayed to the user when they enter the home page. The page will load in a short duration. |
| NF R-2 | **Security** | The user can only login with their user ID and password. The data will be protected from the unauthorized user |
| NF R-3 | **Reliability** | The application will perform up to 80% without failure (in predicting the gesture) |
| NF R-4 | **Performance** | The application will respond within short duration provided the reasonable network speed. |
| NF R-5 | **Availability** | The application will be available as a web page. Like other websites this can be accessed with the domain name. This is available as free service |
| NF R-6 | **Scalability** | The application can be able to support the workload provided by the user to resize the image to their convenience. By adding few more gesturing for manipulation the MRI images which are most essential for sterile browsing by doctors |

* 1. **Data Flow Diagrams and User Stories** - Visualizing and Predicting Heart Diseases with an Interactive Dash Board

**Data Flow Diagrams: Project Design Phase-II**

**Data Flow Diagram & User Stories**

A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored.

|  |  |
| --- | --- |
| Date | 23/10/2022 |
| Team ID | PNT2022TMID10032 |
| Project Name | Project – A Gesture Based tool for sterile  browsing of radiology images |
| Maximum Marks | 4 marks |

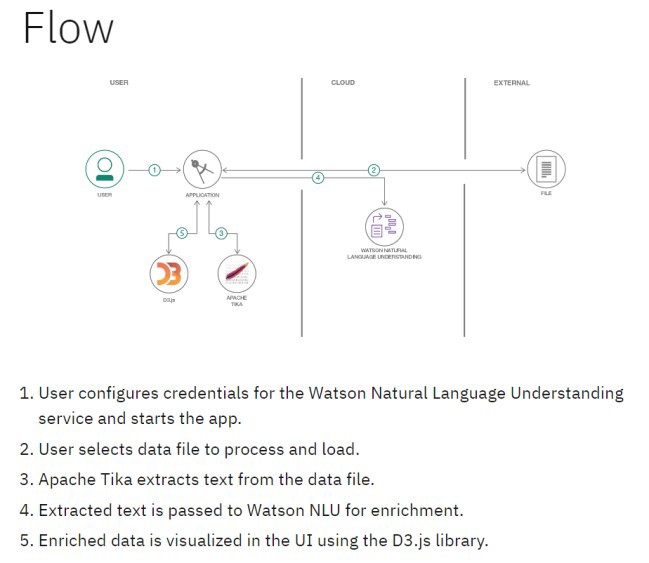
**Flow:**

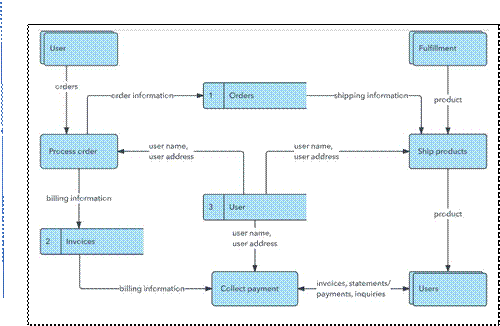
1. User creates an account in the application.
2. User enters the medical records in the dashboard.
3. User can view the visualizations of trends in the form of graphs and charts for his/her medical records with the trained dataset.
4. User can view the accuracy of probability of occurrence of heart disease in the dashboard.

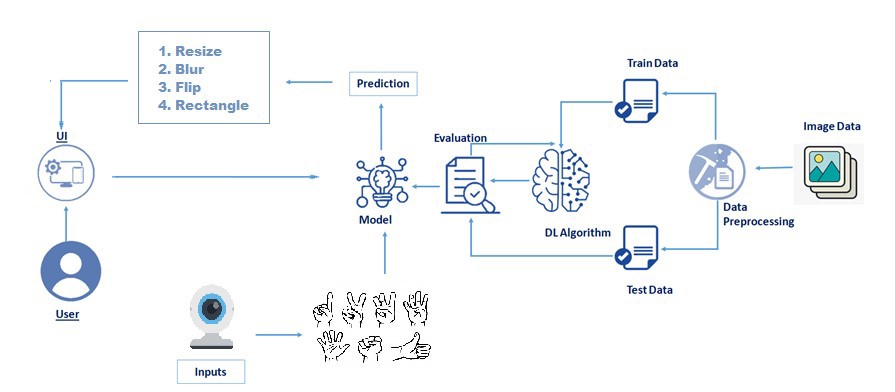
**Data Flow Diagram:**

|  |  |
| --- | --- |
| Date | 23/10/2022 |
| Team ID | PNT2022TMID10032 |
| Project Name | A Gesture-based Tool for Sterile Browsing of Radiology Images |
| Maximum Marks | 4 Marks |

A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is

stored





### User Stories:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **User Type** | **Functional Requireme nt (Epic)** | **User Story Numbe**  **r** | **User Story / Task** | **Acceptanc e criteria** | **Priorit y** | **Releas e** |
| Custome r (Doctor) | Medical image manipulatio n | USN-1 | As a user, I can make use of medical image manipulati on and providing faster reponses at critical  times | I can access the image manipulati on data faster  as before | High | Sprint- 1 |
|  |  | USN-2 | As a user, This model has best ease of use— the system allows me to use just my hands  as | I can achieve the set target in short span of time with ease of use | High | Sprint- 1 |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  | a natural work tool |  |  |  |
| Custome r (Surgeo n) | Gesture commands operation in  real- time | USN-1 | As a user, this prevents my focus shift and change of location while achieving a rapid intuitive reaction and easy  interaction. | I can use the browsing of data with sterile postures | High | Sprint- 1 |
|  |  | USN-2 | As a user, this model responds to the surgeon's gesture commands in real-time (intuitive  and fast) | I can access the manipulate d images very fast and intuitive | High | Sprint- 1 |

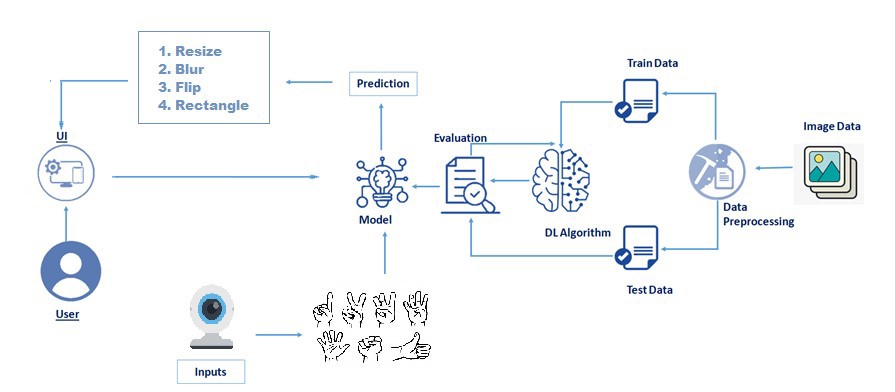
### 5.3 Technology Stack

|  |  |
| --- | --- |
| Date | 23/10/2022 |
| Team ID | PNT2022TMID10032 |
| Project Name | A Gesture-based Tool for Sterile Browsing of Radiology Images |
| Maximum Marks | 4 Marks |

The architectural diagram of the model is as below and the Technology used is shown in table1 & table 2

**A Gesture- based tool for sterile browsing of Radiology Images**

**References:** https[://www.](http://www.researchgate.net/publication/351035037_Creating_domain_speci)res[earchgate.net/publication/351035037\_Creating\_domain\_speci](http://www.researchgate.net/publication/351035037_Creating_domain_speci) fic\_chatbot\_using\_IBM\_Watson



**Table-1 : Components & Technologies:**

|  |  |  |  |
| --- | --- | --- | --- |
| **S.No** | **Component** | **Description** | **Technology** |
| 1. | User Interface | How user interacts with  application e.g. Web UI.. | HTML, CSS,  JavaScript. |
| 2. | Application Logic- 1 | Upload image in an application | Python |
| 3. | Cloud Database | Database Service on Cloud | IBM DB2, IBM  Cloudant etc. |
| 4. | Machine Learning Model | Purpose of Machine Learning Model | Object Recognition  Model, etc. |
| 5. | Infrastructure (Server / Cloud) | Application Deployment on Local System / Cloud  Local Server Configuration: Cloud Server  Configuration : | Local, Cloud Foundry, Kubernetes, etc. |
| 6. | Convolutional Neural Network | Initialize the model | CNN Layer |

**Table-2: Application Characteristics:**

|  |  |  |  |
| --- | --- | --- | --- |
| **S.No** | **Characteristics** | **Description** | **Technology** |
| 1. | Open-Source Frameworks | List the open-source frameworks used | Tensor flow,Theano,  RNN, pyTorch, Flask |
| 2. | Scalable Architecture | Justify the scalability of architecture (3 – tier, Micro-services) | Firewall and other security related softwares |
| 3. | Availability | Justify the availability of application (e.g. use of load balancers, distributed servers etc.) | Data, models, operate at size, speed, consistency and  complexity |
| 4. | Performance | The system responds to the user in a second and the hardware and software works well | Image and facial recognition, speech recognition and  real time captioning |

**References:** [**https://www.ibm.com/cloud/architecture**](https://www.ibm.com/cloud/architecture)

1. **PROJECT PLANNING**
   1. **Milestone and Activity List**

|  |  |
| --- | --- |
| Date | 23/10/2022 |
| Team ID | PNT2022TMID10032 |
| Project Name | A Gesture-based Tool for Sterile Browsing of Radiology Images |

**Activities:**

|  |  |  |  |
| --- | --- | --- | --- |
| **S. No:** | **Milestone** | **Activities** | **Team Members** |
| **01.** | Data Collection | Download the Dataset | Vignesh K Pugazhendhi N |
| **02.** | Data Collection | Image Pre-processing | Venkadesh R Praison Solomon V |
| **03.** | Data Collection | Import the Image Data Generator Library | Pugazhendhi N Venkadesh R |
| **04.** | Data Collection | Configure Image Data Generator  Class | Vignesh K  Praison Solomon V |
| **05.** | Data Collection | Apply Image Data Generator | Vignesh K Venkadesh R |

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | Functionality to Trainset and Test set |  |
| **06.** | Model Building | Import the Model Building  Libraries | Pugazhendhi N Praison Solomon V |
| **07.** | Model Building | Initializing the Model | Pugazhendhi N Praison Solomon V |
| **08.** | Model Building | Adding CNN Layers | Vignesh K Pugazhendhi N |
| **09.** | Model Building | Adding Dense Layers | Venkadesh R Praison Solomon V |
| **10.** | Model Building | Configure the Learning Process | Pugazhendhi N Venkadesh R |
| **11.** | Model Building | Train The Model | Vignesh K Venkadesh R |
| **12.** | Model Building | Save the Model | Vignesh K  Praison Solomon V |
| **13.** | Model Building | Test Model | Vignesh K Pugazhendhi N Venkadesh R  Praison Solomon V |
| **14.** | Application Building | Create HTML Pages | Vignesh K Pugazhendhi N Venkadesh R Praison Solomon V |
| **15.** | Application Building | Build Python code | Vignesh K Pugazhendhi N  Venkadesh R |

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  | Praison Solomon V |
| **16.** | Application Building | Run the Application | Vignesh K Pugazhendhi N Venkadesh R  Praison Solomon V |
| **17.** | Train The  Model on IBM | Register for IBM Cloud | Vignesh K Pugazhendhi N Venkadesh R  Praison Solomon V |
| **18.** | Train The  Model on IBM | Train Model on IBM | Vignesh K Pugazhendhi N Venkadesh R  Praison Solomon V |

* 1. **Sprint Delivery Plan**

|  |  |
| --- | --- |
| Date | 23/10/2022 |
| Team ID | PNT2022TMID10032 |
| Project Name | A Gesture-based Tool for Sterile Browsing of Radiology Images |
| Maximum marks | 8 Marks |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sprint** | **Functional Requirement (Epic)** | **User Story Number** | **User Story / Task** | **Story Points** | **Prior ity** | **Team Members** |
| **Sprint**  **-1** | **Data Collection** | USN-1 | Download the Dataset | 10 | High | Venkadesh R Praison  Solomon V |
| **Sprint**  **-1** |  | USN-2 | Image Pre- processing | 10 | High | Vignesh K Pugazhendhi  N |
| **Sprint**  **-1** |  | USN-3 | Import and Configure the Image Data Generator Library and  Class | 10 | High | Venkadesh R Praison Solomon V |
| **Sprint**  **-1** |  | USN-4 | Apply Image Data Generator | 10 | High | Venkadesh R Praison  Solomon V |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  | Functionality  to Train-Set and Test-Set |  |  |  |
| **Sprint**  **-2** | **Model Building** | USN-5 | Import the Model Building Libraries and Initializing  the Model | 10 | High | Vignesh K Pugazhendhi N |
| **Sprint**  **-2** |  | USN-6 | Adding CNN Layers and Dense Layers | 10 | High | Venkadesh R  Vignesh K |
| **Sprint**  **-2** |  | USN-7 | Configure the Learning Process | 10 | High | Pugazhendhi N  Praison Solomon V |
| **Sprint**  **-2** |  | USN-8 | Train the Model, Save the Model and Test the  Model | 10 | High | Praison Solomon V Pugazhendhi N |
| **Sprint**  **-3** | **Application Building** | USN-9 | Create Web Application using HTML, CSS,  JavaScript | 10 | High | Venkadesh R Praison Solomon V |
| **Sprint**  **-3** |  | USN-10 | Build Python code | 10 | High | Venkadesh R  Praison Solomon V |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sprint**  **-4** | **Train The Model on IBM** | USN-11 | Register for IBM Cloud | 10 | High | Vignesh K Pugazhendhi N |
| **Sprint**  **-4** |  | USN-12 | Train the Model and Test the Model and its Overall  Performance | 10 | High | Pugazhendhi N  Venkadesh R |

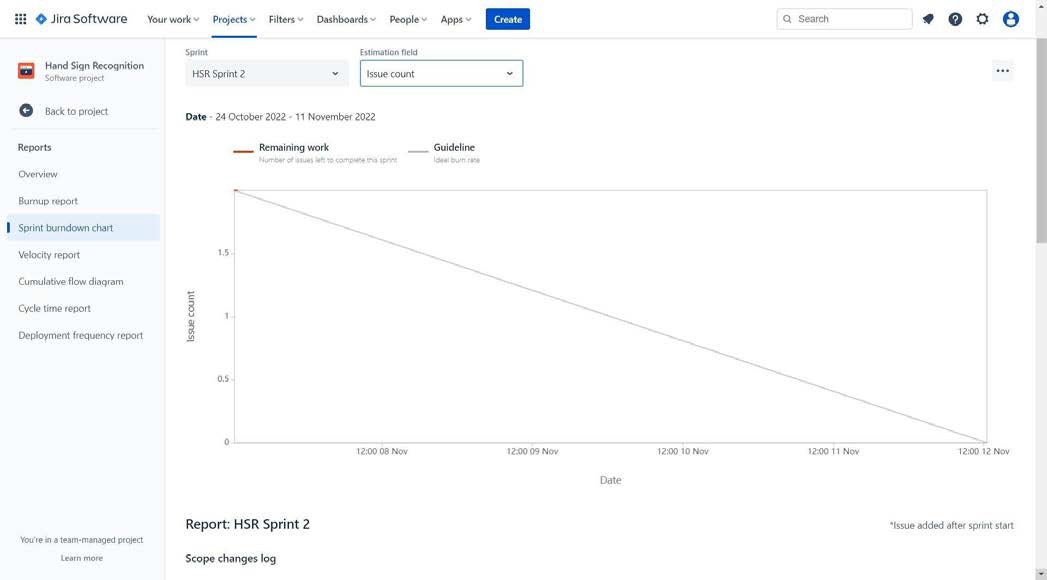
### Project Tracker, Velocity & Burndown Chart: (4 Marks)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sprint** | **Total Score 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 |

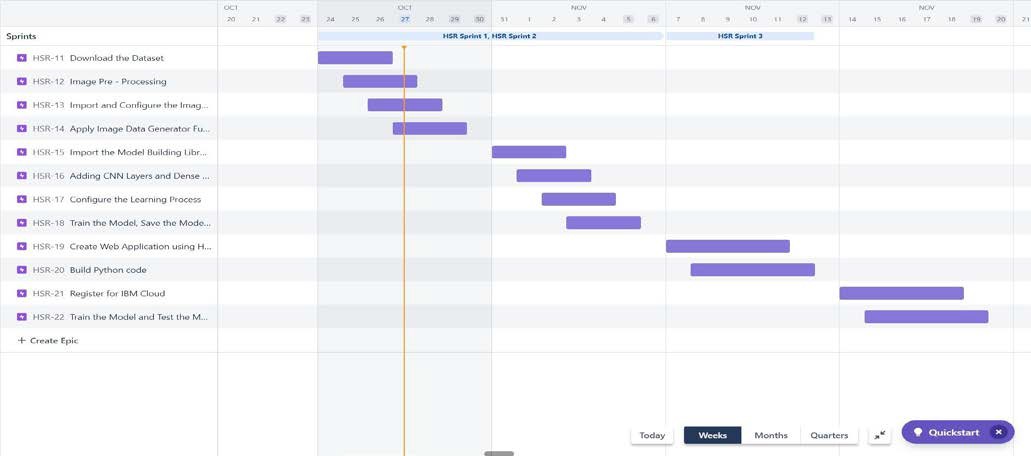
### Velocity:

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) .

**Burndown Chart:**

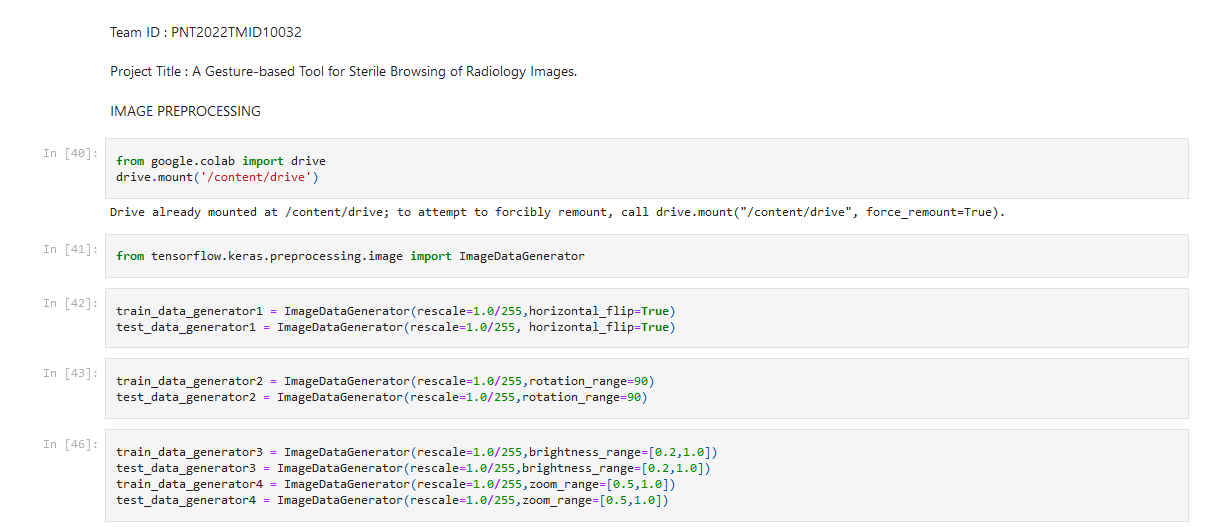


**Road Map:**

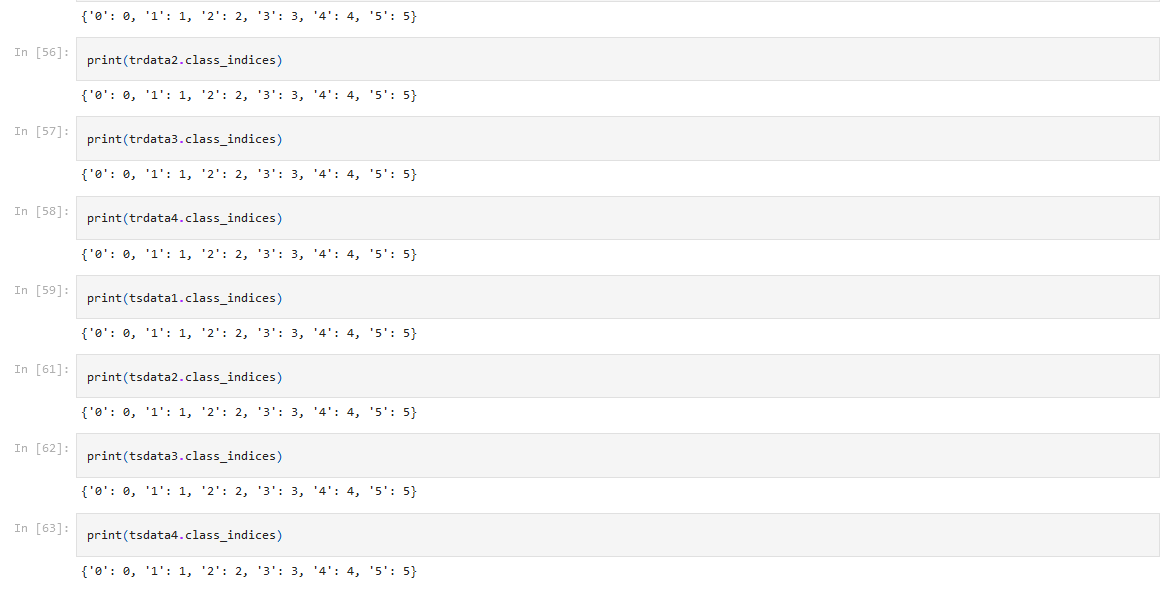


1. **PROJECT DEVELOPMENT PHASE**
   1. **Project Development - Delivery of Sprint - 1**

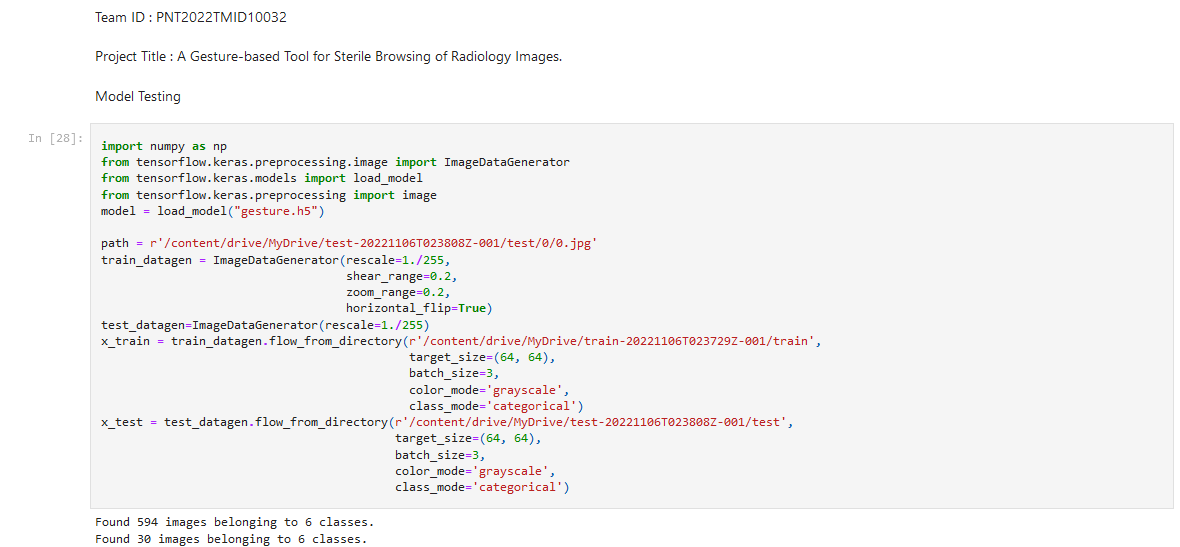
**Image Pre-processing**

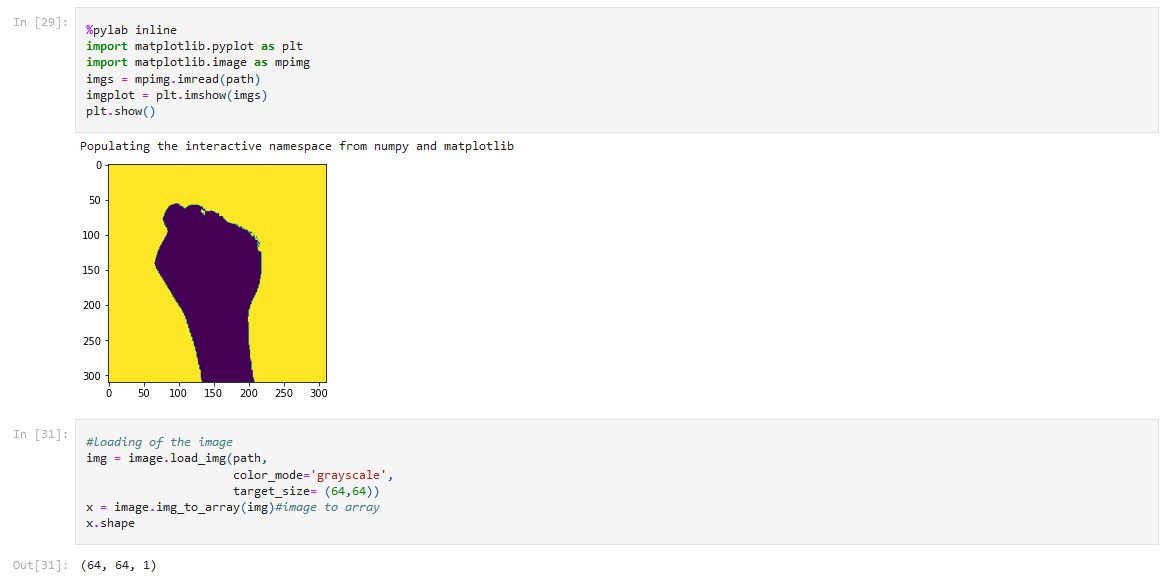


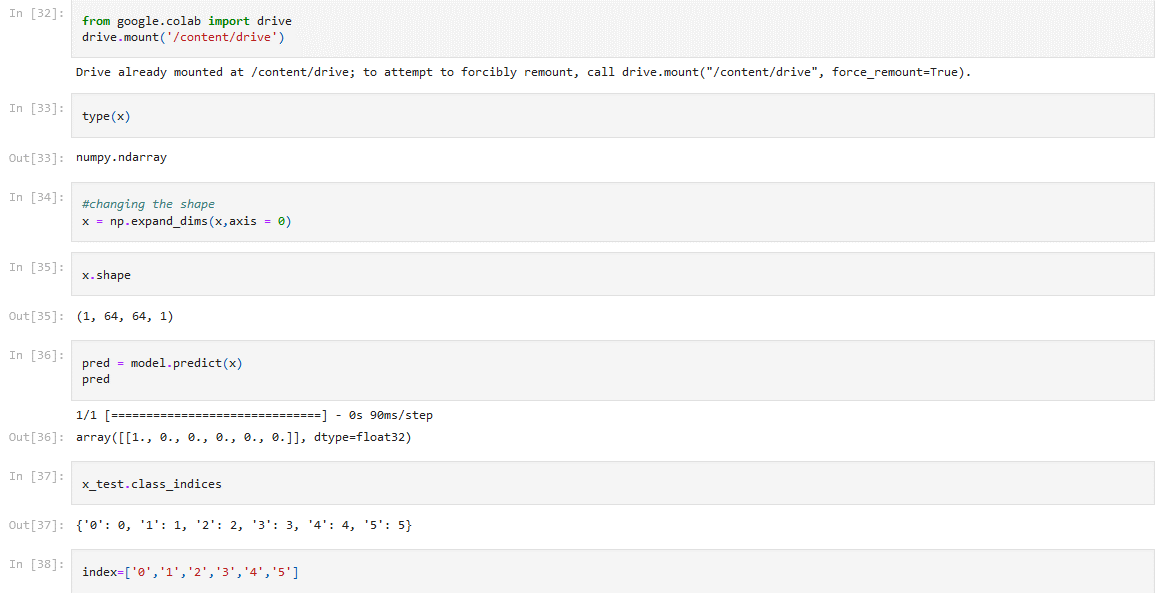




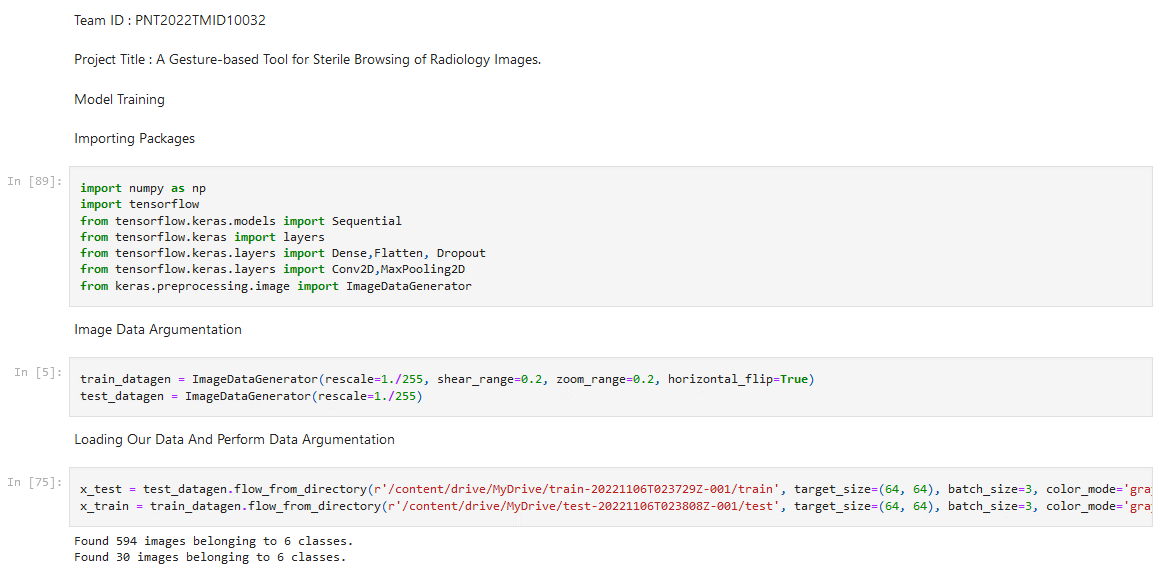
**Model Testing**

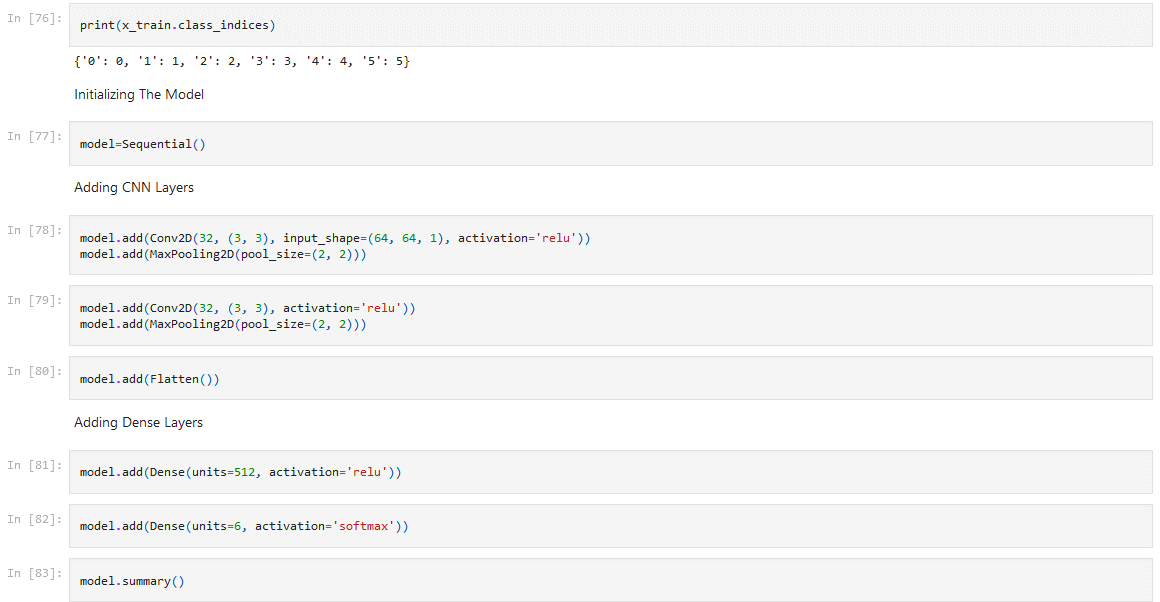


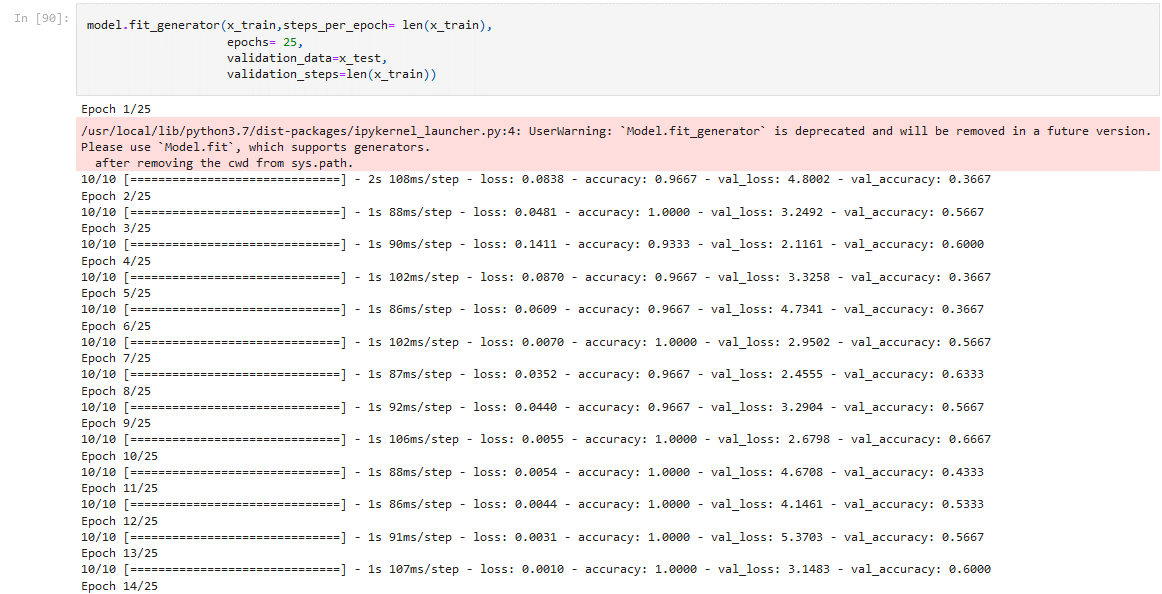


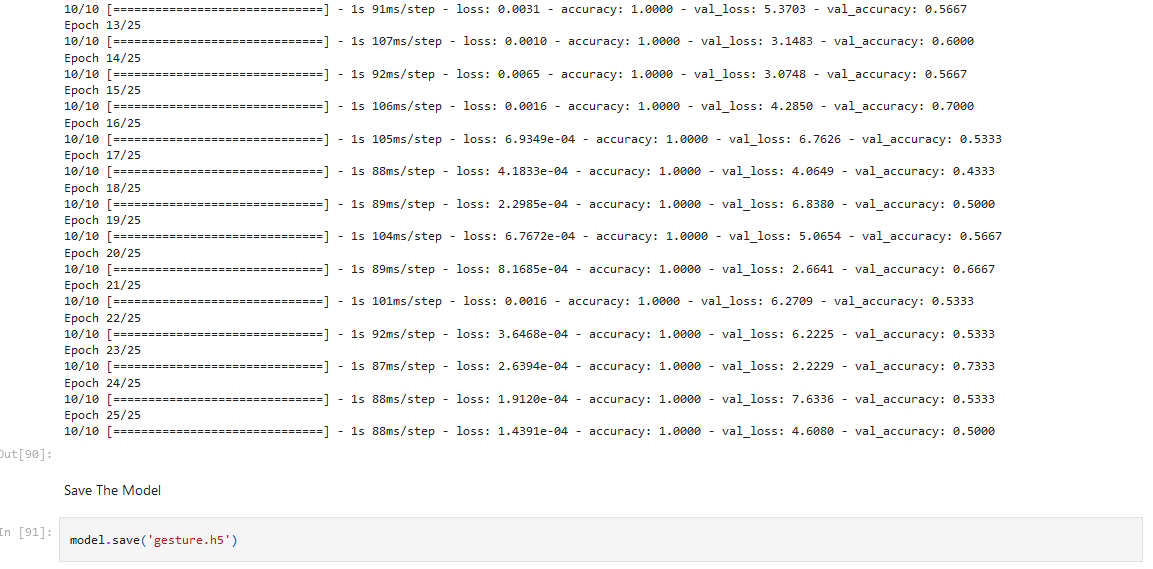


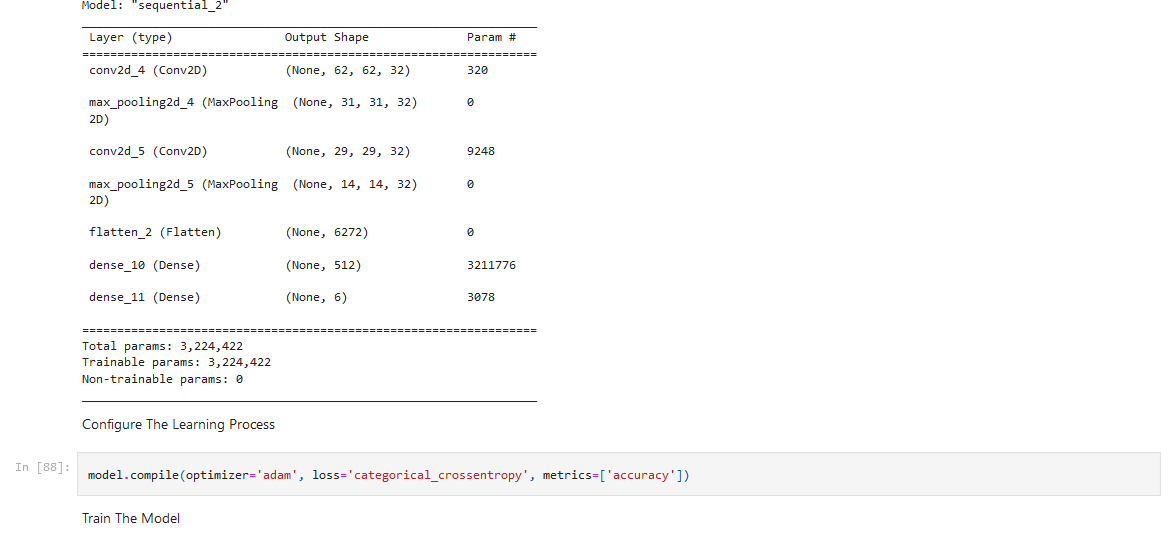
**MODEL BUILDING**











* 1. **Project Development - Delivery of Sprint - 2 Templates:**

**Home:**

<!DOCTYPE html>

<html lang="en">

<head>

<meta charset="utf-8">

<meta name="viewport" content="width=device-width, initial-scale=1, shrink-to- fit=no">

<meta name="description" content="Start your development with Creative Design landing page.">

<meta name="author" content="Devcrud">

<title>Hand Gesture Recognition</title>

<link rel="stylesheet" href="../static/vendors/themify-icons/css/themify-icons.css">

<link rel="stylesheet" href="../static/css/creative-design.css">

<style>

.header {

background: #efefef url(../static/imgs/3.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>

<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="home.html">Home</a>

</li>

<li class="nav-item">

<a class="nav-link" href="intro.html">Introduction</a>

</li>

<li class="nav-item">

<a class="nav-link" href="index6.html">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 -->

## Index:

<!DOCTYPE html>

<html lang="en">

<head>

<meta charset="utf-8">

<meta name="viewport" content="width=device-width, initial-scale=1, shrink-to- fit=no">

<meta name="description" content="Start your development with Creative Design landing page.">

<meta name="author" content="Devcrud">

<title>Hand Gesture Recognition</title>

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<link rel="stylesheet" href="../static/css/creative-design.css">

<style>

.header {

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</div>

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<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>

<button class="btn btn-outline-light">Upload Image</button>

</div>

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

**Intro:**

<!DOCTYPE html>

<html lang="en">

<head>

<meta charset="utf-8">

<meta name="viewport" content="width=device-width, initial-scale=1, shrink-to- fit=no">

<meta name="description" content="Start your development with Creative Design landing page.">

<meta name="author" content="Devcrud">

<title>Hand Gesture Recognition</title>

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<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>

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<li class="nav-item">

<a class="nav-link" href="index6.html">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 Sterile Browsing of Radiology Images</h3>

<h4> Hand Gesture recognition system provides us with an innovative, natural, user-friendly way of interacting with the computer which

is more familiar to human beings. In our project, the hand region is extracted from the background by using the Region of interest. Then, we will be predicted

the labels based on the CNN-trained model weights of hand gestures using that predicted labels we apply if conditions to control some of the actions like reshaping, blurring, and flip of the given image. <h4>

</div>

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

<!DOCTYPE html>

<html lang="en">

<head>

<meta charset="utf-8">

<meta name="viewport" content="width=device-width, initial-scale=1, shrink-to- fit=no">

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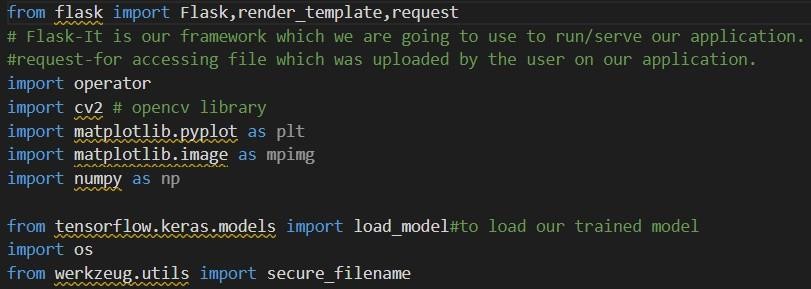
the labels based on the CNN-trained model weights of hand gestures using that predicted labels we apply if conditions to control some of the actions like reshaping, blurring, and flip of the given image. <h4>

</div>

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

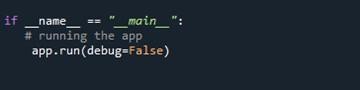
## Project Development - Delivery of Sprint – 3 Build Python Code

* + - Build flask file ‘app.py’ which is a web framework written in pythonfor server-side scripting.
    - 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



**Run the Application:**

At last, we will run our flask application



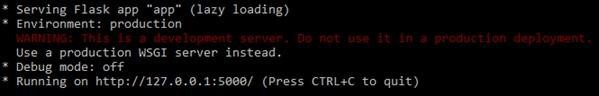
Run The app in local browser

* Open anaconda prompt from the start menu
* Navigate to the folder where your python script is.
* Now type “python app.py” command

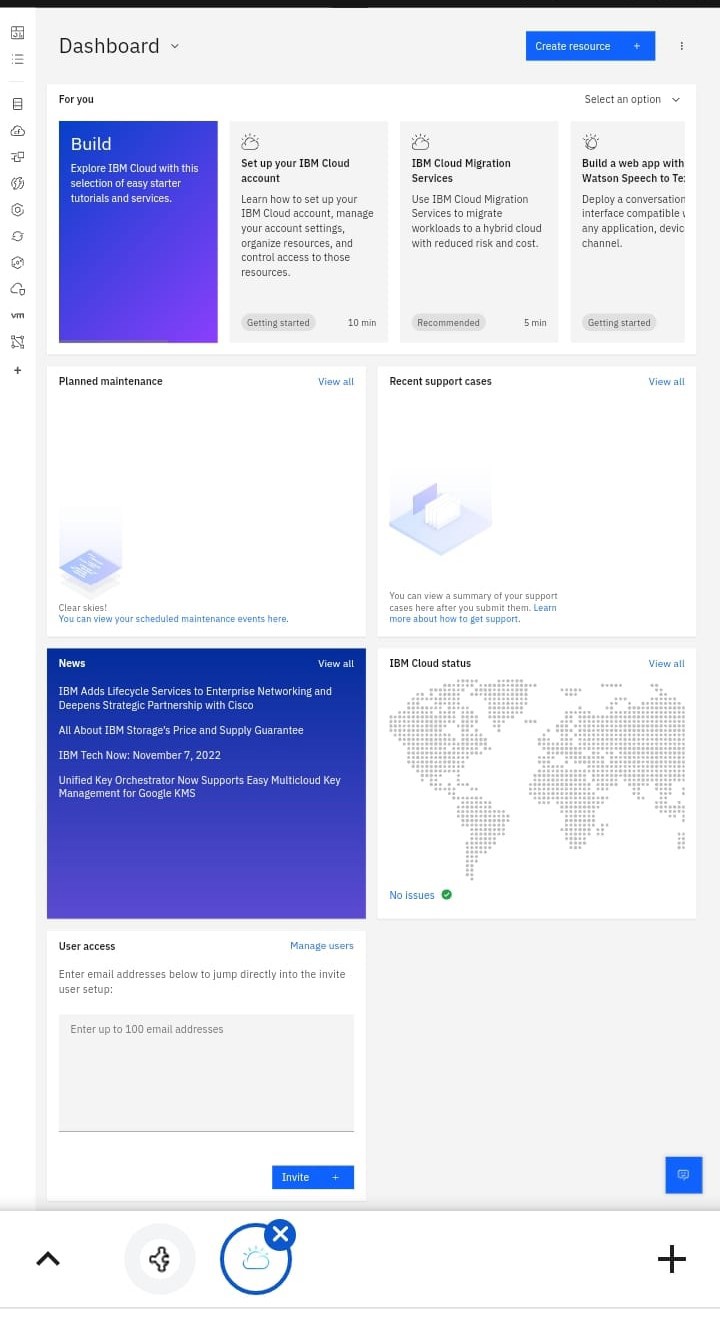
Navigate to the localhost where you can view your web page



Then it will run on localhost:5000



* 1. **Project Development - Delivery of Sprint - 4**



## Train Model On IBM:

import os, types

from ibm\_watson\_machine\_learning import APIClient import pandas as pd

from botocore.client import Config import ibm\_boto3

from io import BytesIO import zipfile

#Due to privacy concerns, I've not mentioned the API Keys and Endpoints Here def iter (self): return 0

cos\_client = ibm\_boto3.client(service\_name='s3', ibm\_api\_key\_id=<api\_key>, ibm\_auth\_endpoint=<end\_point>, config=Config(signature\_version='oauth'), endpoint\_url=<end\_point\_url>')

bucket = <bucket\_name> object\_key = <object\_key>

streaming\_body\_1 = cos\_client.get\_object(Bucket=bucket, Key=object\_key)['Body']

unzip=zipfile.ZipFile(BytesIO(streaming\_body\_1.read()),'r') filepaths=unzip.namelist()

for path in filepaths: unzip.extract(path)

train\_datagen = ImageDataGenerator( rescale=1./255,

rotation\_range=10., width\_shift\_range=0.1, height\_shift\_range=0.1, zoom\_range=0.2, horizontal\_flip=True

)

train\_gen = train\_datagen.flow\_from\_directory( r'/home/wsuser/work/Finger Dataset/train', target\_size=(128,128),

color\_mode='grayscale', batch\_size=32, classes=['0','1','2','3','4','5'],

class\_mode='categorical'

)

test\_datagen = ImageDataGenerator( rescale=1./255 ) test\_gen = test\_datagen.flow\_from\_directory(

r'/home/wsuser/work/Finger Dataset/test', target\_size=(128,128), color\_mode='grayscale',

batch\_size=32, classes=['0','1','2','3','4','5'],

class\_mode='categorical'

)

model=Sequential() model.add(BatchNormalization(input\_shape = (128,128,1)))

model.add(Convolution2D(32, (3,3), activation ='relu', input\_shape = (128, 128, 1))) model.add(MaxPooling2D(pool\_size=2)) model.add(Convolution2D(filters=6,kernel\_size=4,padding='same',activation='relu')) model.add(MaxPooling2D(pool\_size=2)) model.add(Convolution2D(filters=128,kernel\_size=3,padding='same',activation='relu')) model.add(MaxPooling2D(pool\_size=2)) model.add(Convolution2D(filters=128,kernel\_size=2,padding='same',activation='relu')) model.add(MaxPooling2D(pool\_size=2))

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

model.compile(optimizer='adam', loss = 'categorical\_crossentropy',metrics = ['accuracy']) model.fit\_generator(train\_gen,

epochs=20, steps\_per\_epoch=18000//32, validation\_data=test\_gen,

verbose = 1,validation\_steps=3600//32) model.save('gesture.h5')

wml\_credentials={

"url":'https://us-south.ml.cloud.ibm.com',

"apikey":'on6wVLLy-ERS74JlvyDrFdJ35GRaHzaCtKxejqR7euwG'

}

client=APIClient(wml\_credentials)

def guid\_from\_space\_name(client,space\_name): space=client.spaces.get\_details() return(next(item for item in space['resources'] if

item['entity']['name']==space\_name)['metadata']['id'])

space\_uid=guid\_from\_space\_name(client,'Gesture\_Deploy') client.set.default\_space(space\_uid)

software\_spec\_uid=client.software\_specifications.get\_uid\_by\_name('tensorflow\_rt22.1- py3.9')

!tar -zcvf gesture\_based\_tool.tgz gesture.h5 model\_details=client.repository.store\_model(model='gesture\_based\_tool.tgz',meta\_props

={

Tool",

client.repository.ModelMetaNames.NAME:"Gesture Based client.repository.ModelMetaNames.TYPE:"tensorflow\_2.7",

client.repository.ModelMetaNames.SOFTWARE\_SPEC\_UID:software\_spec\_uid

}

)

model\_id=client.repository.get\_model\_id(model\_details) Footer

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API

Training

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import os, types

from ibm\_watson\_machine\_learning import APIClient import pandas as pd

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"apikey":'on6wVLLy-ERS74JlvyDrFdJ35GRaHzaCtKxejqR7euwG'

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={

Tool",

client.repository.ModelMetaNames.NAME:"Gesture Based client.repository.ModelMetaNames.TYPE:"tensorflow\_2.7",

client.repository.ModelMetaNames.SOFTWARE\_SPEC\_UID:software\_spec\_uid

}

)

model\_id=client.repository.get\_model\_id(model\_details)

## 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.

**References:**

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7. Wachs JP, Stern HI, Edan Y, et al. “Real-Time Hand Gesture Interface for Browsing Medical Images” Int. J Intel. Comp. Med. Sci. Image Proc 2007;1(3):175-185. [[Google Scholar](https://scholar.google.com/scholar_lookup?journal=Int.%2BJ%2BIntel.%2BComp.%2BMed.%2BSci.%2BImage%2BProc&amp;author=JP%2BWachs&amp;volume=1&amp;publication_year=2007&amp;pages=175)]
8. Lewis JR. Psychometric evaluation of an after scenario questionnaire for computer usability studies: The ASQ SIGCHI Bulletin 1991;23:78-81. [[Google Scholar](https://scholar.google.com/scholar_lookup?journal=SIGCHI%2BBulletin&amp;author=JR%2BLewis&amp;volume=23&amp;publication_year=1991&amp;pages=78)]

**Demonstration Link:** <https://youtu.be/Iiu90IDvp7U>

**Github Repo Link:** https://github.com/IBM-EPBL/IBM-Project-36502-1660295611