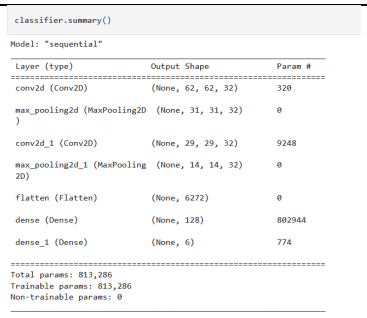
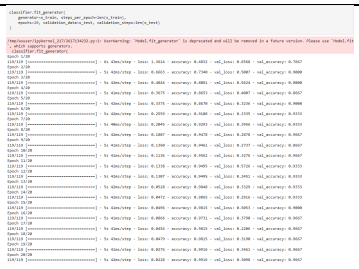
Project Development Phase
Model Performance Test

Date	10 November 2022
Team ID	PNT2022TMID52351
Project Name	A Gesture-based Tool for Sterile Browsing of Radiology Images
Maximum Marks	10 Marks

Model Performance Testing:

Project team shall fill the following information in model performance testing template.

S.No.	Parameter	Values	Screenshot
1.	Model Summary	conv2d (Conv2D) - 320 max_pooling2d (MaxPooling2D) - 0 conv2d_1 (Conv2D) - 9248 max_pooling2d_1 (MaxPooling2D) - 0 flatten (Flatten) - 0 dense (Dense) - 802944 dense_1 (Dense) - 774 ================================= Total params: 813,286 Trainable params: 813,286 Non-trainable params: 0	
2.	Accuracy	Training Accuracy - 99.16% Validation Accuracy – 96.67%	
3.	Confidence Score (Only Yolo Projects)	Class Detected - Confidence Score -	NA

Screenshots:

1. Model Summary:

```
classifier.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 (MaxPooling  (None, 14, 14, 32)       0
 2D)

 flatten (Flatten)           (None, 6272)              0

 dense (Dense)               (None, 128)               802944

 dense_1 (Dense)             (None, 6)                 774

=================================================================
Total params: 813,286
Trainable params: 813,286
Non-trainable params: 0
_________________________________________________________________
```

2. Accuracy:

```
classifier.fit_generator(
    generator=x_train, steps_per_epoch=len(x_train),
    epochs=20, validation_data=x_test, validation_steps=len(x_test)
)
```

```
/tmp/wsuser/ipykernel_217/2617134232.py:1: UserWarning: `Model.fit_generator` is deprecated and will be removed in a future version. Please use `Model.fit
`, which supports generators.
  classifier.fit_generator(
Epoch 1/20
119/119 [==============================] - 6s 43ms/step - loss: 1.3614 - accuracy: 0.4832 - val_loss: 0.6568 - val_accuracy: 0.7667
Epoch 2/20
119/119 [==============================] - 5s 42ms/step - loss: 0.6663 - accuracy: 0.7340 - val_loss: 0.5007 - val_accuracy: 0.9000
Epoch 3/20
119/119 [==============================] - 5s 42ms/step - loss: 0.4844 - accuracy: 0.8081 - val_loss: 0.5624 - val_accuracy: 0.8000
Epoch 4/20
119/119 [==============================] - 5s 41ms/step - loss: 0.3675 - accuracy: 0.8653 - val_loss: 0.4007 - val_accuracy: 0.8667
Epoch 5/20
119/119 [==============================] - 5s 42ms/step - loss: 0.3375 - accuracy: 0.8670 - val_loss: 0.3236 - val_accuracy: 0.9000
Epoch 6/20
119/119 [==============================] - 5s 42ms/step - loss: 0.2559 - accuracy: 0.9108 - val_loss: 0.3335 - val_accuracy: 0.9333
Epoch 7/20
119/119 [==============================] - 5s 40ms/step - loss: 0.2045 - accuracy: 0.9293 - val_loss: 0.3956 - val_accuracy: 0.9333
Epoch 8/20
119/119 [==============================] - 5s 42ms/step - loss: 0.1807 - accuracy: 0.9478 - val_loss: 0.2878 - val_accuracy: 0.9667
Epoch 9/20
119/119 [==============================] - 5s 41ms/step - loss: 0.1360 - accuracy: 0.9461 - val_loss: 0.2737 - val_accuracy: 0.8667
Epoch 10/20
119/119 [==============================] - 5s 41ms/step - loss: 0.1136 - accuracy: 0.9562 - val_loss: 0.3276 - val_accuracy: 0.9667
Epoch 11/20
119/119 [==============================] - 5s 41ms/step - loss: 0.1338 - accuracy: 0.9495 - val_loss: 0.5726 - val_accuracy: 0.9333
Epoch 12/20
119/119 [==============================] - 5s 42ms/step - loss: 0.1307 - accuracy: 0.9495 - val_loss: 0.2451 - val_accuracy: 0.9333
Epoch 13/20
119/119 [==============================] - 5s 42ms/step - loss: 0.0528 - accuracy: 0.9848 - val_loss: 0.3329 - val_accuracy: 0.9333
Epoch 14/20
119/119 [==============================] - 5s 42ms/step - loss: 0.0472 - accuracy: 0.9865 - val_loss: 0.2916 - val_accuracy: 0.9333
Epoch 15/20
119/119 [==============================] - 5s 41ms/step - loss: 0.0496 - accuracy: 0.9815 - val_loss: 0.5053 - val_accuracy: 0.9000
Epoch 16/20
119/119 [==============================] - 5s 41ms/step - loss: 0.0866 - accuracy: 0.9731 - val_loss: 0.3790 - val_accuracy: 0.9667
Epoch 17/20
119/119 [==============================] - 5s 41ms/step - loss: 0.0454 - accuracy: 0.9815 - val_loss: 0.2206 - val_accuracy: 0.9667
Epoch 18/20
119/119 [==============================] - 5s 43ms/step - loss: 0.0479 - accuracy: 0.9815 - val_loss: 0.3190 - val_accuracy: 0.9667
Epoch 19/20
119/119 [==============================] - 5s 41ms/step - loss: 0.0276 - accuracy: 0.9916 - val_loss: 0.3461 - val_accuracy: 0.9667
Epoch 20/20
119/119 [==============================] - 5s 42ms/step - loss: 0.0228 - accuracy: 0.9916 - val_loss: 0.3098 - val_accuracy: 0.9667
```

Submitted by:

Gesture Based Tool for Sterile Browsing of Radiology Images

TEAM ID: PNT2022TMID52351

P.AKALYA,N.VINOTHINI,M.DEEPA,R.SUBI

1.INTRODUCTION

Overview

In this project we use gestures to browse radiology images. Gestures refer to non-verbal form of communication.

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 common method of human—computer interaction. However, the use of computer keyboards and mouse by doctors and nurses in intensive care units (ICUs) is a common method for spreading infections.

Humans can 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 0 - then images is converted into rectangle, 1 - image is Resized , 2 - image is rotated, 3 - image is blurred.

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.LITERATURE SURVEY

A Gesture-based Tool for Sterile Browsing of Radiology Images - research paper by nationallibrary 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.

The "*Gibson*" image browser is a 3D visualization medical tool that enables examination of images, such as: MRIs, CT scans and X-rays. The images are arranged over a multiple layer 3D cylinder. The image of interest is found through rotating the cylinder in the four cardinal directions. To interface the gesture recognition routines with the "*Gibson*" system, information such as the centroid of the hand, its size, and orientation are used to enable screen operations in the "*Gibson*" graphical user interface.

Fig 2. Radiology image browsing using hand gesture in hospital

3.THEORITICAL ANALYSIS

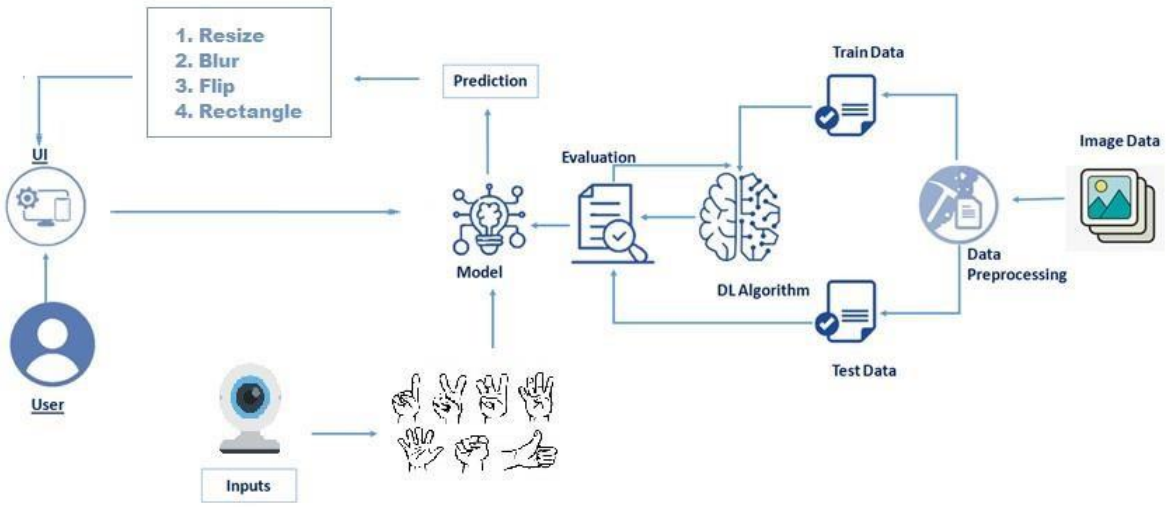


Fig 3. Architecture of Gesture Based Tool for Sterile Browsing of Radiology Images

4.EXPERIMENTAL INVESTIGATIONS

We found that many hospitals rely on mouse and keyboard to browse the images that are obtained during different surgeries, scans, etc. This can contaminate the environment with various infections thus compromising the sterility.

Various technologies have been developed to overcome this issue and one such technology was called 'Gestix'.

This hand gesture system for MRI manipulation in an EMR image database called "*Gestix*" was tested during a brain biopsy surgery. This system is a real-time hand-tracking recognition technique based on color and motion fusion. In an in vivo experiment, this type of interface prevented the surgeon's focus shift and change of location while achieving rapid intuitive interaction with an EMR image database. In addition to allowing sterile interaction with EMRs, the "*Gestix*" hand gesture interface provides:

1. ease of use—the system allows the surgeon to use his/her hands, their natural work tool;
2. rapid reaction—nonverbal instructions by hand gesture commands are intuitive and fast
3. an unencumbered interface—the proposed system does not require the surgeon to attach a microphone, use head-mounted (body-contact) sensing devices or to use foot pedals
4. distance control—the hand gestures can be performed up to 5 meters from the camera and still be recognized accurately.

5.FLOWCHART

● User interacts with the UI (User Interface) to upload the image as input.

● Depending on the different gesture inputs different operations are applied to the input image.

● Once model analyses the gesture, the prediction with operation applied on image is showcased on the UI. To accomplish this, we have to complete all the activities and tasks listed below:

● Data Collection.
    - Collect the dataset or Create the dataset

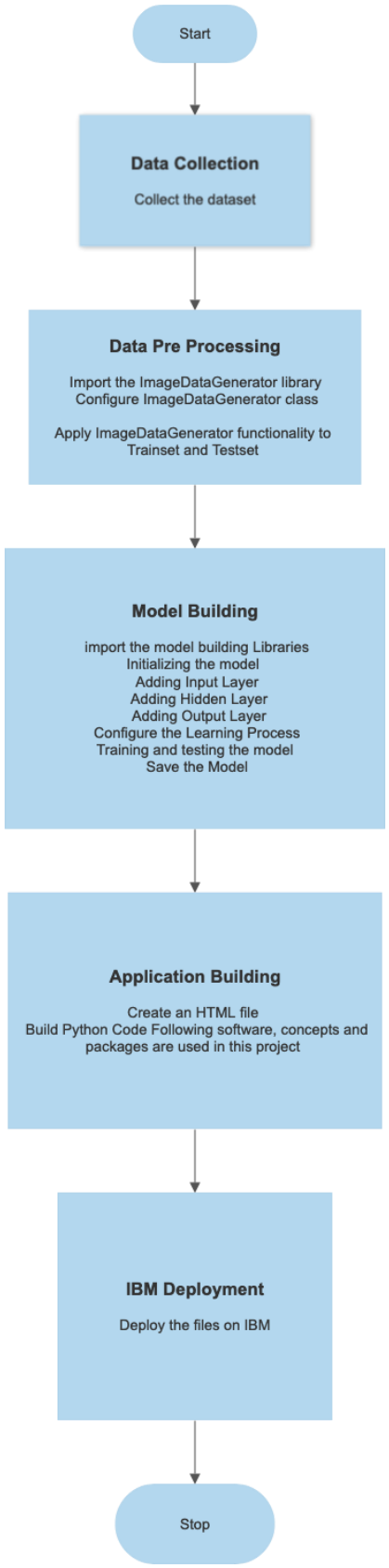
● Data Pre processing
    - Import the ImageDataGenerator library
    - Configure ImageDataGenerator class
    - Apply ImageDataGenerator functionality to Trainset and Testset

● Model Building
    - Import the model building Libraries
    - Initializing the model
    - Adding Input Layer
    - Adding Hidden Layer
    - Adding Output Layer
    - Configure the Learning Process
    - Training and testing the model
    - Save the Model

● Application Building
    - Create an HTML file
    - Build Python Code Following software, concepts and packages are used in this project

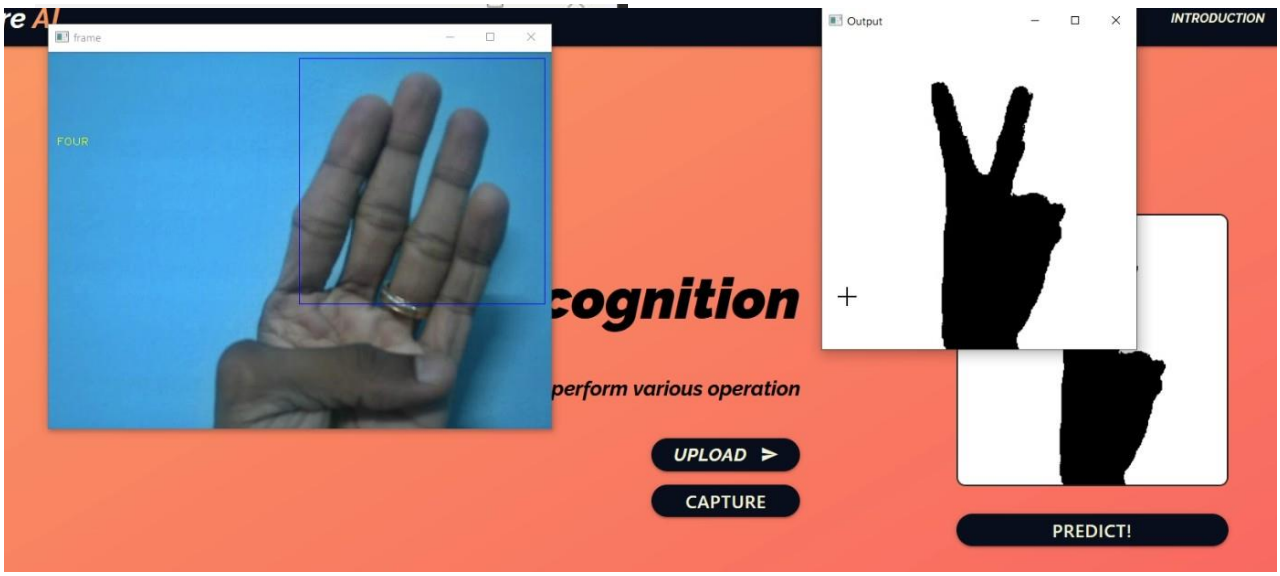
● Anaconda navigator

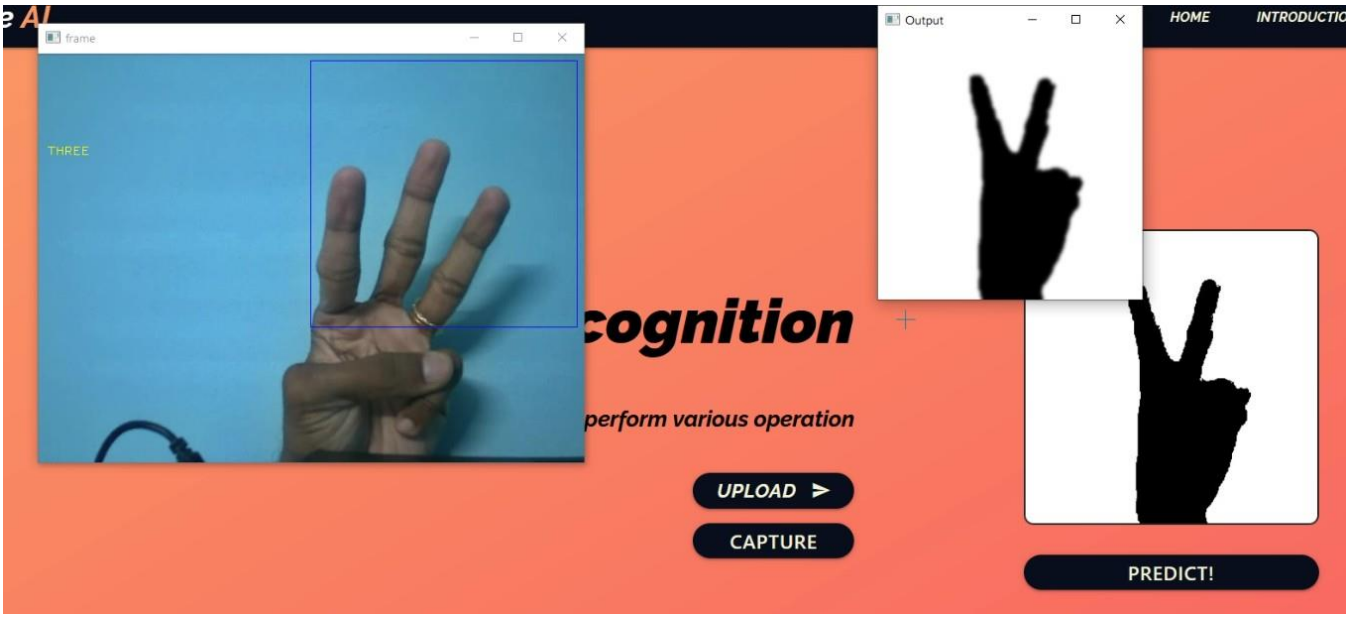
● Python packages:
    - open anaconda prompt as administrator
    - Type “pip install TensorFlow” (make sure you are working on python 64 bit)
    - Type “pip install opencv-python”
    - Type “pip install flask”

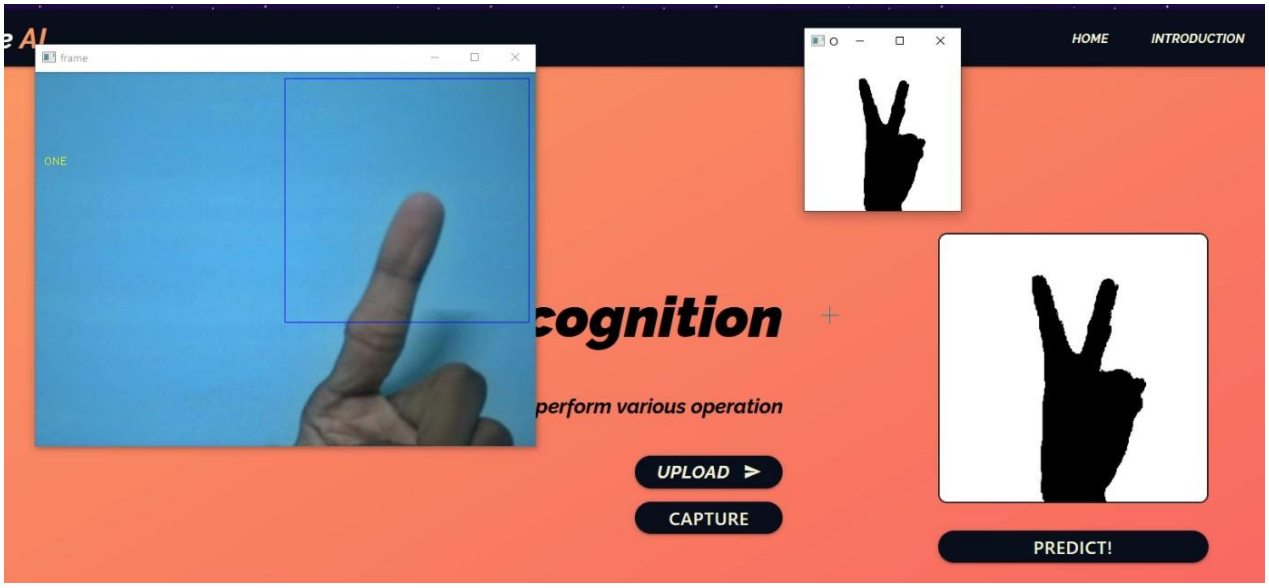

Start
Data Collection
Collect the dataset
Data Pre Processing
Import the ImageDataGenerator library
Configure ImageDataGenerator class
Apply ImageDataGenerator functionality to
Trainset and Testset
Model Building
import the model building Libraries
Initializing the model
Adding Input Layer
Adding Hidden Layer
Adding Output Layer
Configure the Learning Process
Training and testing the model
Save the Model
Application Building
Create an HTML file
Build Python Code Following software, concepts and
packages are used in this project
IBM Deployment
Deploy the files on IBM
Stop

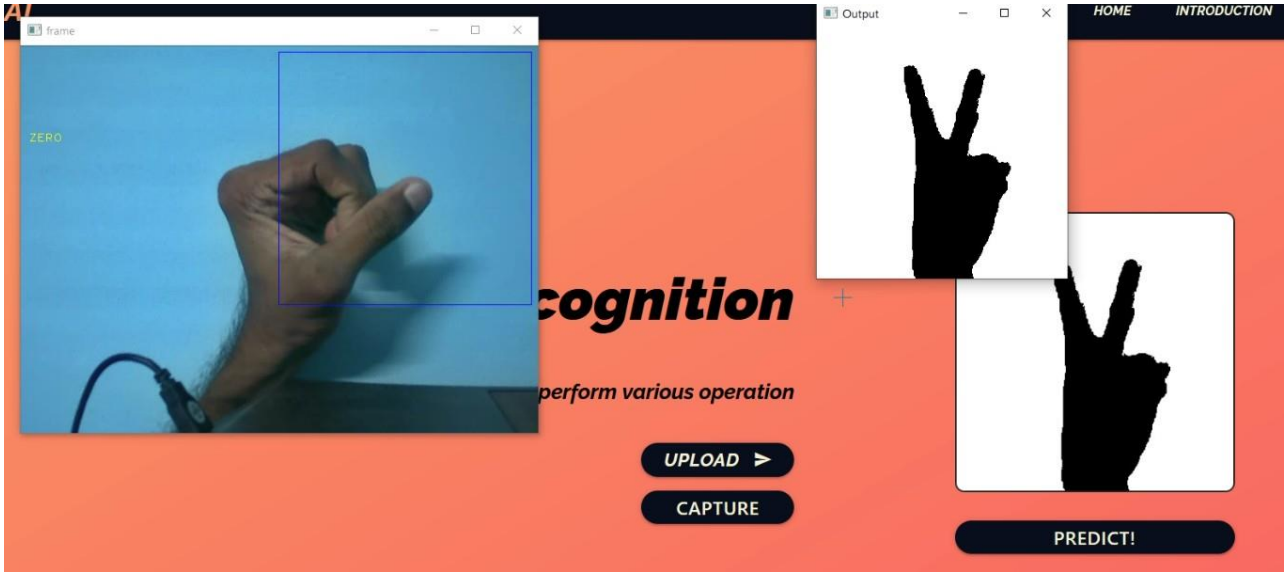
6.RESULT

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









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

7.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.

8.APPLICATIONS

- This hand based gesture tool developed can be mainly used in the medical industry to browse images without compromising the sterility.
- However it can also be used in different industries while presenting certain ideas, during meetings, and can be used by teachers while teaching.

9.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.

10. 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.

11. REFERENCE

1. Qing Chen Nicolas, D. Georganas, and Emil M. Petriu "Hand Gesture Recognition Using Haar-Like Features And A Stochastic Context-Free Grammar" IEEE ,Vol. 57, No. 8, August 2008

2. Anupam Agrawal, Rohit Raj and Shubha Porwal "Vision-based Multimodal HumanComputer Interaction using Hand and Head Gestures" IEEE Conference on Information and Communication Technologies ICT 2013

3.Kenji Oka and Yoichi Sato "Real-Time Fingertip Tracking and Gesture Recognition" IEEE proceeding on Computer Graphics and Applications Nov/Dec 2002

4. S. Ioffe and C. Szegedy, "Batch normalization: Accelerating deep network training by reducing internal covariate shift," in International Conference on Machine Learning, 2015, pp. 448–456.

5.Juan Wachs, Helman Stern, Yael Edan, Michael Gillam, Jon Handler, Craig Feied, Mark Smith

6.Professor. Juan P. Wachs,

7.Professor. Benjamin Fritsch

11. Appendix

source code

https://github.com/IBM-EPBL/IBM-Project-47323-1660798230

Acceptance Testing
UAT Execution & Report Submission

Date	03 November 2022
Team ID	PNT2022TMID26953
Project Name	Project - A gesture-based tool for sterile browsing of radiology images
Maximum Marks	4 Marks

1. Purpose of Document

The purpose of this document is to briefly explain the test coverage and open issues of the gesture-based tool for sterile browsing of radiology images project at the time of the release to User Acceptance Testing (UAT).

2. Defect Analysis

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

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	3	2	1	0	6
Duplicate	1	0	0	0	1
External	2	3	0	2	7
Fixed	3	2	1	0	6
Not Reproduced	0	0	1	1	2
Skipped	0	0	0	1	1
Won't Fix	0	2	1	0	3
Totals	9	9	4	4	26

3. Test Case Analysis

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

Section	Total Cases	Not Tested	Fail	Pass
Print Engine	6	0	0	6
Client Application	16	0	0	16
Outsource Shipping	3	0	0	3
Exception Reporting	2	0	0	2
Final Report Output	7	0	0	7
Version Control	2	0	0	2

First stages(conceot) are crucial for propagation

Design project is a sequence of phase/ stages

Technical areas know

What do they THINK AND FEEL?

what really counts
major preoccupations
worries & aspirations

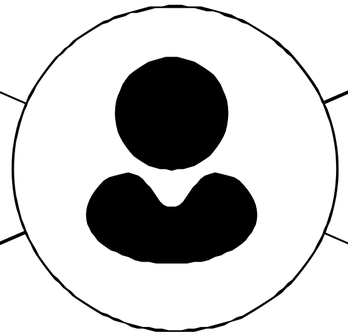
What do they HEAR?

what friends say
what boss say
what influencers say

priorities between projects are dynamic

You must be sure the project scope is achieved

Practice what you learn



Project directory

Different approaches and practices

Successes of other people

What do they SEE?

environment
friends
what the market offers

Weekly project meeting

We must cover the checklist

Assignments

What do they SAY AND DO?

attitude in public
appearance
behavior towards others

PAIN

fears
frustrations
obstacles

Lack of leisure time...

Stressed about dead lines

Limitation on the equipment used

GAIN

“wants” / needs
measures of success
obstacles

Project deadlines and scope

Greater vision of the project

More knowledge

IDEATION

I. In order to provide surgeons with a more efficient, comfortable, precise, and sterile interaction technique, the hands can be an effective means of accomplishing this goal in comparison to other modalities, such as voice or eye interaction . Touch-less gesture interaction is an option to interact with imaging systems, displays, and controllers without breaking the sterility barrier. The system utilizes nothing but a camera with good quality and can follow the hand of the user in 2 dimensions and identify up to four mouse-defined hand motions.

II. Recent progress in artificial intelligence provides innovative opportunities for motion tracking and human-machine interaction. In the field of healthcare, sensors like Microsoft Kinect has been used for detecting postures. And using electromyography technology to capture gesture instead of the camera, therefore it is less affected by the external factors such as light and obstruction.

III. Voice command is another type of touchless communication but its commands are discrete rather than hand gestures which are able to perform analog commands. On the other hand, voice command has other disadvantages such as its low accuracy due to existence of noise in surgery rooms and accents.

LITERATURE SURVEY

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.

Introduction

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.

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.

Tracking Algorithm

After a short calibration process, where a probability colour model of the doctor's hand is built, images of the surgeon's hand gesturing are acquired by video-camera and each image is back-projected using a colour model. The hand is then tracked by an algorithm which segments it from the background using the colour model back-projection and motion cues.[7] This is followed by black/white thresholding, and a sequence of opening and closing morphological operations resulting in a set of components (blobs) in the image. The location of the hand is represented by the 2D coordinates of the centroid of the biggest blob in the current image.

“Gibson” Image Browser

The “*Gibson*” image browser is a 3D visualization medical tool that enables examination of images, such as: MRIs, CT scans and X-rays. The images are arranged over a multiple layer 3D cylinder. The image of interest is found through rotating the cylinder in the four cardinal directions. To interface the gesture recognition routines with the “*Gibson*” system, information such as the centroid of the hand, its size, and orientation are used to enable screen operations in the “*Gibson*” graphical user interface.

Hand Tracking and Operation Modes

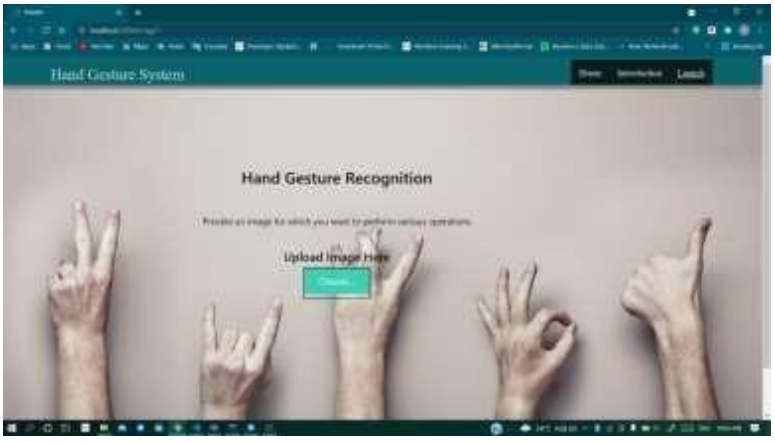
Gesture operations are initiated by a calibration mode in which a skin colour model of the user's hand or glove, under local lighting, is constructed. In a browse mode, superimposed over the image of the camera's scene is a rectangular frame called the “neutral area.” Movements of the hand across its boundary constitute directional browser commands. When a doctor/surgeon wishes to browse the image database, the hand is moved rapidly out of the “neutral area” toward any of four directions, and then back again. When such a movement is detected, the displayed image is moved off the screen and replaced by a neighbor image.

To evoke a zoom mode, the open palm of the hand is rotated within the “neutral area” clockwise/counter clockwise (zoom-in/zoom-out). To avoid the tracking of unintentional gestures, the user may enter a “sleep mode” by dropping the hand. To re-arouse the system the user waves the hand in front of the camera. The selection of these gestures was designed to be intuitive, expressing the “natural” feeling of the user. For example, the left/right/up/down gestures evoke the actions used to turn pages in a book left/right, or flip notepad pages up/down. The rotation gesture (zoom-in/zoom-out commands) reminds one of a radio knob to increase or decrease volume.

Home page

Introduction page

Model Launch Page



Predicting results using random image

Real time example

In this project we have used Convolutional Neural Network to first train the model on the images of different hand gestures, like showing numbers with fingers as 0,1,2,3,4,5. Then we made a web portal using Flask where user can input any image on which he wants to perform the operations. After uploading the image, our portal uses the integrated webcam to capture the video frame using OpenCV. The gesture captured in the video frame is compared with the Pre-trained model and the gesture is identified. If the prediction is 0 - then images is converted into rectangle, 1

- image is Resized into (200,200), 2 - image is rotated by -45°, 3 - image is blurred , 4 - image is Resized into (400,400) , 5 - image is converted into grayscale.

References

1) 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*
2) Graetzel C, Fong TW, Grange S, Baur C. “A non-contact mouse for surgeon-computer interaction,” *Technol Health Care*
3) Smith KR, Frank KJ, Bucholz RD. “The NeuroStation- a highly accurate, minimally invasive solution to frameless stereotatic neurosurgery,” *Comput Med Imaging Graph*

Project Title: A Gesture-based Tool for Sterile Browsing of Radiology Image **Project Design Phase-I - Solution Fit Template** **Team ID:** PNT2022TMID52331

Define CS, fit into CC

1. CUSTOMER SEGMENT(S) CS

Who is your customer?
i.e. working parents of 0-5 y.o. kids

Surgeons, Doctors and Patients

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.

Multiple hands detected within same frames
Connectivity issues between devices
Inconsistency in focus and concentration of surgeon
Availability of devices

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

Wearable devices can be used to detect hand gestures
Voice commands can be used to manipulate radiology images
Manually manipulating radiology images

Explore AS, differentiate

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

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.

Monitoring patients scan images
Restricting the operations performed on images
Maintaining sterility

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.

Background noise
Difficulty in maintaining sterility
Inability to handle various images by manual key press

7. BEHAVIOUR BE

What does your customer do to address the problem and get the job done?
i.e. directly related: find the right solar panel installer, calculate usage and benefits; indirectly associated: customers spend free time on volunteering work (i.e. Greenpeace)

When the customer is not aware or unclear about the gestures provided as an input in an effective manner in order to get the desired accuracy

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

3. TRIGGERS TR

What triggers customers to act? i.e. seeing their neighbour installingsolar panels, reading about a more efficient solution in the news.

The need to switch between patient and device is not required

Ease of equipment interaction during surgery

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 inthe canvas and come up with a solution that fits within customer limitations, solves a problem and matches customer behaviour.

To make use of hand gestures to manipulate radiology

8. CHANNELS of BEHAVIOUR CH

ONLINE

What kind of actions do customers take online? Extract online channels from #7

Perform various image manipulation operations on the scan during surgery and training periods

OFFLINE

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.

Before: To move away from patients and towards the devices for manipulating the scans

After: Easy to focus and concentrate on the surgery without the need to switch between patients and device for manipulating the scans

images
To maintain sterility during surgery
To make simple UI that manipulates the scan using hand gestures

What kind of actions do customers take offline? Extract offline channels from #7and use them for customer development.

Perform image manipulation techniques on already available scans in database to train the AI model

Identify strong TR & EM

Project Design Phase-I
Proposed Solution Template

Date	19 September 2022
Team ID	PNT2022TMID25369
Project Name	A Gesture-based Tool for Sterile Browsing of Radiology Images
Maximum Marks	2 Marks

Proposed Solution Template:

Project team shall fill the following information in proposed solution template.

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	Hand Gesture tool to do sterile navigation of radiology images
2.	Idea / Solution description	Use artificial intelligence technology to assist doctors by taking hand gestures as input and perform necessary actions on radiology images
3.	Novelty / Uniqueness	These Gestures helps to manipulate the radiology images and helps to stay focused for surgeons.
4.	Social Impact / Customer Satisfaction	The proposed system should provide a good manipulation of radiology images for surgeon during surgery supporting their focus of attention, and providing fast response times.
5.	Business Model (Revenue Model)	A Hand-based Gesture Recognition System used for detecting any kind of Gestures which when the given input Gesture matches with the trained image.
6.	Scalability of the Solution	The proposed approach allows the learning of new gestures with no need of recording real subjects.

Project Design Phase-I
Solution Architecture

Date	16 october 2022
Team ID	PNT2022TMID52351
Project Name	A Gesture-based Tool for Sterile Browsing of Radiology Images
Maximum Marks	4 Marks

Solution Architecture:

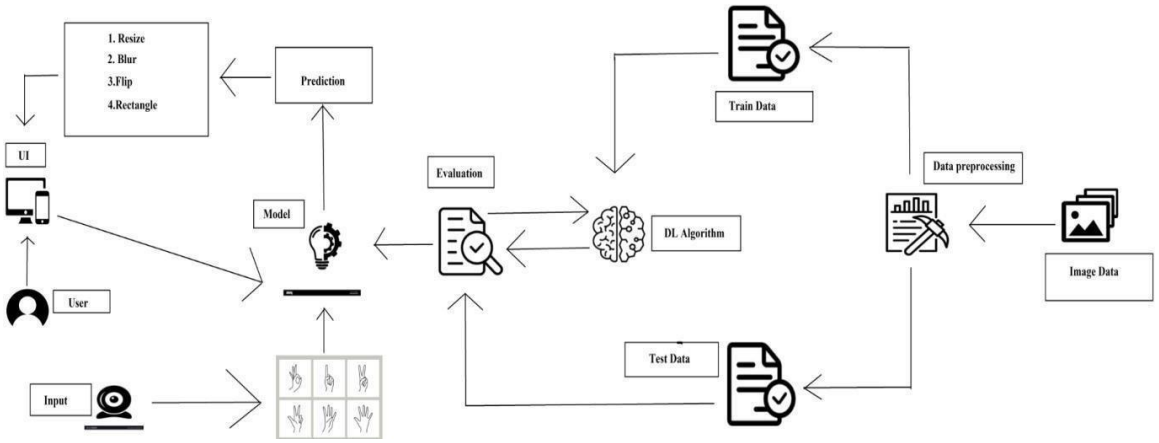
Solution architecture is a complex process – with many sub-processes – that bridges the gap between business problems and technology solutions. Its goals are to:

- Find the best tech solution to solve existing business problems.
- Describe the structure, characteristics, behavior, and other aspects of the software to project stakeholders.
- Define features, development phases, and solution requirements.
- Provide specifications according to which the solution is defined, managed, and delivered.

Solution architecture for A Gesture based tool for sterile browsing of radiology images.

1. User (Doctor/Surgeon) is giving hand gestures as input to perform the certain actions such as zoom in, zoom out the image of the patients during the surgery.
2. In this project Gesture based project, First the model is trained, pre trained on the images of different hand gestures,
3. 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.

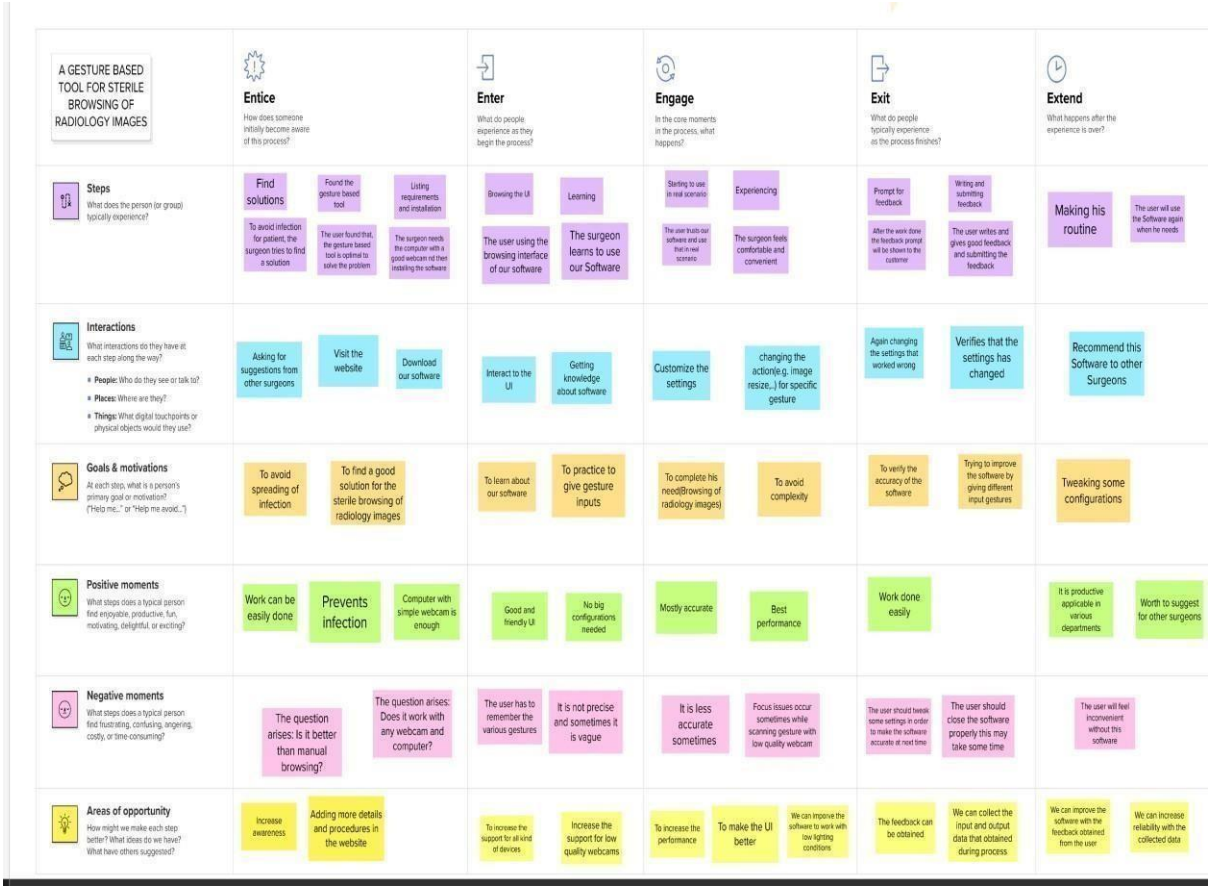
4. If the gesture predicate is 1 then images is blurred;2, image is resized;3, image is rotated etc.



PROJECT DESIGN PHASE – II

CUSTOMER JOURNEY MAP

DATE	15 OCTOBER 2022
TEAM ID	PNT2022TMID52351
PROJECT NAME	A GESTURE BASED TOOL FOR STERILE BROWSING OF RADIOLOGY IMAGES
MAXIMUM MARKS	4 MARKS



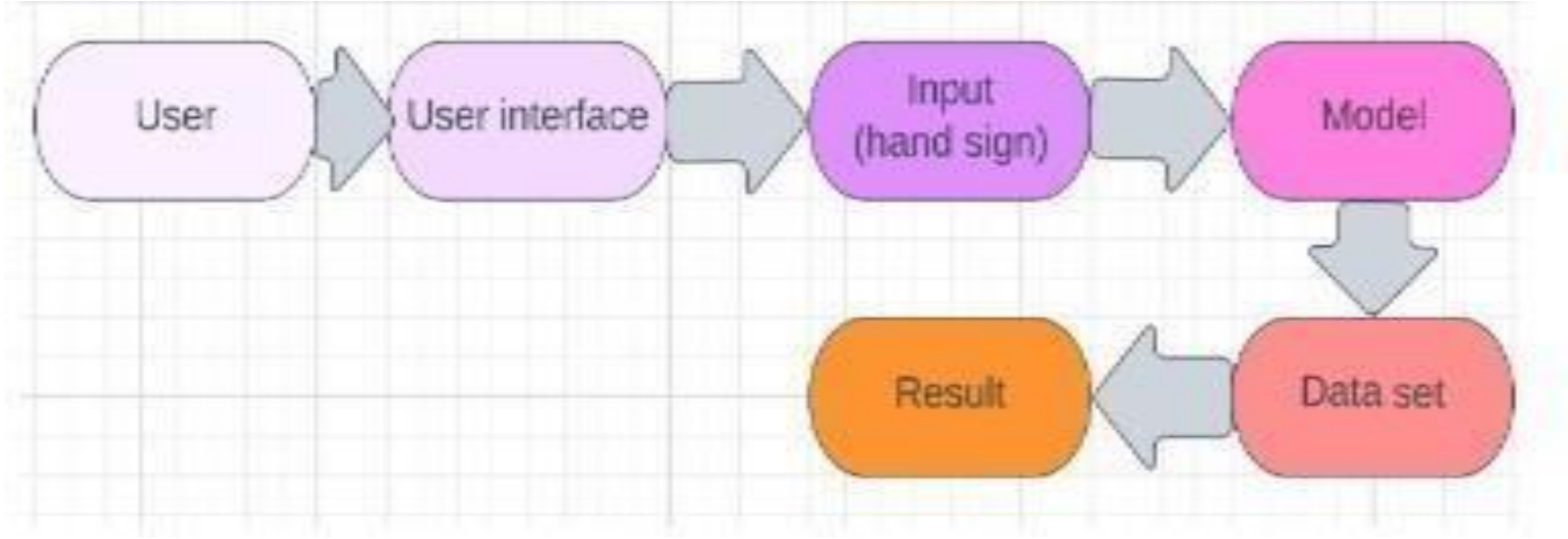
Project Design Phase-II
Data Flow Diagram &User Stories

Date	16October 2022
Team ID	PNT2022TMID52351
Project Name	A Gesture-based Tool for Sterile Browsing of Radiology Image
Maximum Marks	4 Marks

Data Flow Diagrams:

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.

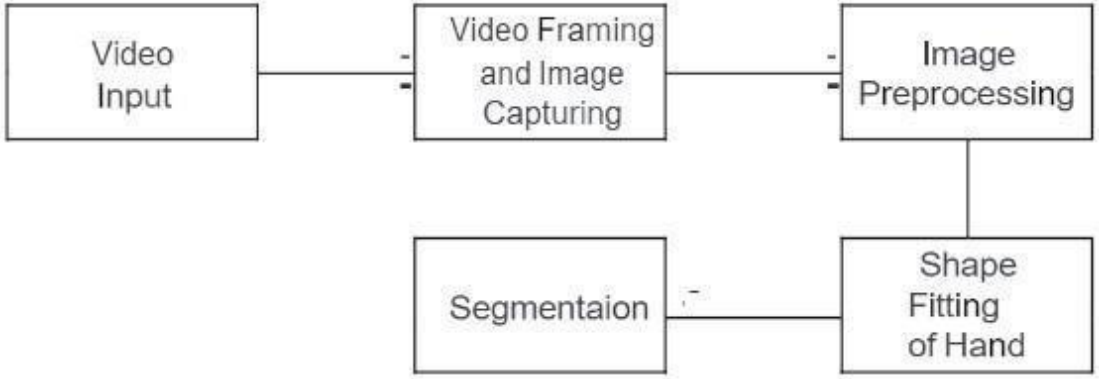
Simplified:



Data Flow Diagram - Level 0

Data Flow Diagram - Level 1

Data Flow Diagram - Level 2



User Stories

Use the below template to list all the user stories for the product.

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer [Doctor/Surgeon] (Web user)	Launch	USN-1	As a user I can launch the webpage to upload and manipulate the scan images	I can access the webpage	High	Sprint-4
		USN-2	As a user I can use different web browsers	I can access the webpage using different web browsers	High	Sprint-1
Administrator	IBM Cloud	USN-1	Access the database	Database Management	High	Sprint-3
		USN-2	Server crash, database recovery	Resolve the errors/ issue, recover the lost data from database	High	Sprint-5
Customer care executive	Availability	USN-1	Interpret and recognize gesture inaccurately	Webcam detection	Medium	Sprint-5
		USN-2	When the website is unresponsive or an internal error occurs in the website	Webpage is unresponsive	Medium	Sprint-4

Project Design Phase-II
Solution Requirements (Functional & Non-functional)

Date	16 October 2022
Team ID	PNT2022TMID52351
Project Name	A Gesture-based Tool for Sterile Browsing of Radiology Image
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	Hand detection	Filtering of hand from video capturing device
FR-2	Filtered object detection	Reads and filters by recognizing clusters of skin coloured objects
FR-3	Gesture control	Hand gestures recognition for commands
FR-4	Hand calibration	Perform according to the adjustment of user's dominant hand
FR-5	Model rendering	When the user uploads/gives the gestures, the algorithm should start processing its task.
FR-6	Launching the model	Launch the application either from cloud where it is deployed or by installation but with a stable internet connectivity

Non-functional Requirements:

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

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	Usability is easy for all users. It is understandable for non technical users with minimal instructions
NFR-2	**Security**	Accessible only in secure networks with administrative permissions, so there is less chance of security breach
NFR-3	**Reliability**	It is operable under all conditions, regardless of user's operating environment
NFR-4	**Performance**	Minimize the number of calculation to perform hand gesture and to improve image resolution quality

NFR-5	**Availability**	When the gesture is available then only the application works. This application is only available in surgery rooms
NFR-6	**Scalability**	Model is scaled by CNN with help of data augmentation and gesture recognition using OpenCV, Tensorflow, Keras

Project Design Phase-II
Technology Stack (Architecture & Stack)

Date	16 October 2022
Team ID	PNT2022TMID52351
Project Name	A Gesture-based Tool for Sterile Browsing of Radiology Image
Maximum Marks	4 Marks

Technical Architecture:

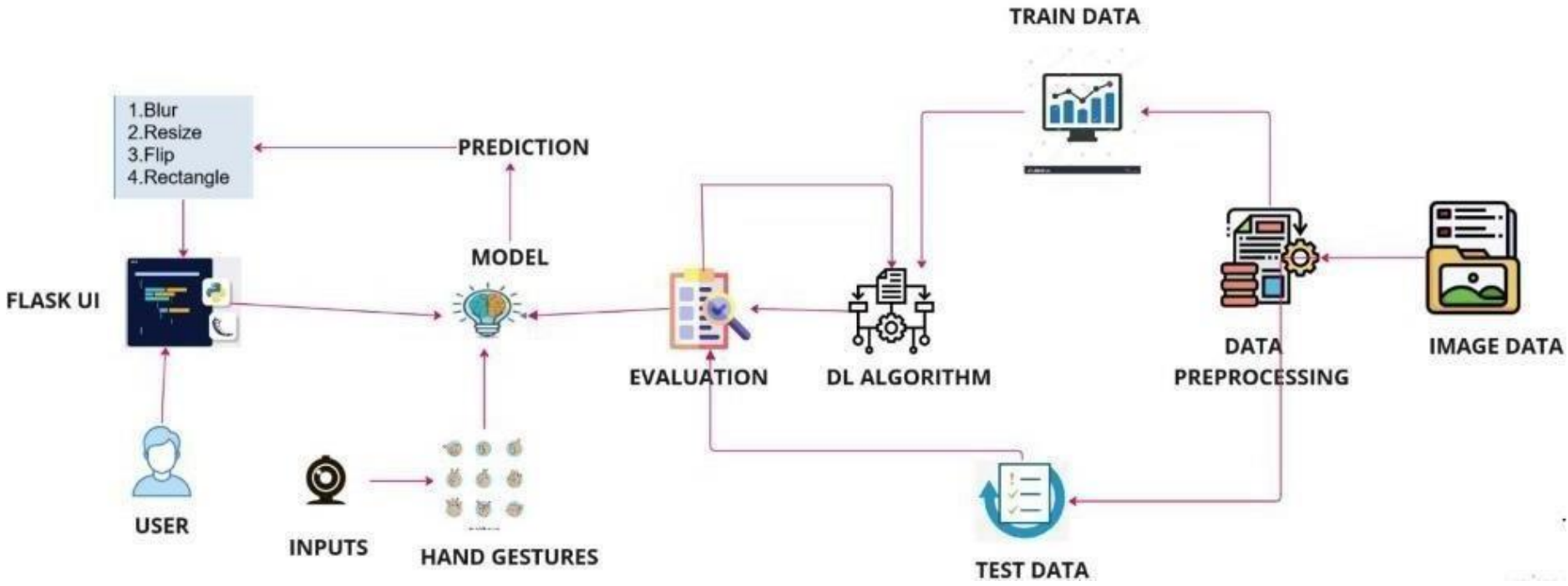


Table-1 : Components & Technologies:

S.No	Component	Description	Technology
1.	User Interface	Web UI	HTML, CSS, JavaScript
2.	Application Logic-1 Image Pre-processing	Input image is pre-processed with the help of library files available in Python like opencv, numpy, scikit-image	Python, OpenCV, Numpy, Scikit-image
3.	Application Logic-2 Building model	Building CNN model to interpret and recognize the gesture with the help of library files available in Python like Keras, Tensorflow	Python, Keras, Tensorflow
4.	Application Logic-3 Creation of app	App is built to obtain gesture as input and to provide corresponding output for that manipulated images	HTML,CSS, JavaScript,Python,Flask
5.	Dataset	Hand gesture dataset with various position for the same hand gesture	From IBM.
6.	Cloud Database	User input image is stored in the cloud	IBM Cloudant DB
7.	File Storage	File storage contains dataset and source code	Local File system
8.	Machine Learning Model	CNN model is used to interpret and recognize the pre-processed image either by image capturing or by video segmenting	CNN Model by Python, Keras, Tensorflow

Table-2: Application Characteristics:

S.No	Characteristics	Description	Technology
1.	Open-Source Frameworks	Open-source framework software is used for application development, model training and version control	**Editors:** Visual Studio Code, Atom **Languages and Libraries:** Python, Tensorflow, Keras, JavaScript, OpenCV, HTML, CSS, Numpy, Scikitimage **Framework:** Flask **Version control:** GitHub, GitLens
2.	Robustness	Hand gestures can be captured at different angles and under varied conditions	Scikit-image, OpenCV
3.	Scalability	The system limits the number of user requests to one per second, serve each request on a separate thread	Python
4.	Availability	The application is deployed on a highperformance, reliable server	IBM Cloud
5.	Performance	Light-weight SOTA deep learning model with low inference time	Tensorflow, Keras

Project Planning Phase

Date	16October 2022
Team ID	PNT2022TMID52351
Project Name	A Gesture Based Tool For Sterile Browsing of Radiology Images

SI. NO	MILESTONE	ACTIVITIES	DATE
1	Preparation Phase	Pre-requisites	24 Aug 2022
		Prior knowledge	25 Aug 2022
		Project Structure	23 Aug 2022
		Project Flow	23 Aug 2022
		Project Objectives	22 Aug 2022
		Registrations	26 Aug 2022
		Environment Set-up	27 Aug 2022
2	Ideation Phase	Literature Survey	29 Aug 2022 – 03 Sept 2022
		Empathy Map	5 Sept 2022 – 7 Sept 2022
		Problem Statement	8 Sept 2022 – 10 Sept 2022
		Ideation	12 Sept 2022- 16 Sept 2022
3	Project Design Phase -I	Proposed Solution	19 Sept 2022 – 23 Sept 2022
		Problem Solution Fit	24 Sept 2022 – 26 Sept 2022
		Solution Architecture	27 Sept 2022 – 30 Sept 2022
4	Project Design Phase -II	Customer Journey	3 Oct 2022 – 8 Oct 2022
		Requirement Analysis	9 Oct 2022 – 11 Oct 2022
		Data Flow Diagrams	11 Oct 2022 – 14 Oct 2022
		Technology Architecture	15 Oct 2022 – 16 Oct 2022
5	Project Planning Phase	Milestones & Tasks	17 Oct 2022 – 18 Oct 2022

		Sprint Schedules	19 Oct 2022-

			22 Oct 2022

6	Project Development Phase	Sprint-1	24 Oct 2022 – 29 Oct 2022
		Sprint-2	31 Oct 2022 – 05 Nov 2022
		Sprint-3	07 Nov 2022 – 12 Nov 2022
		Sprint-4	14 Nov 2022 – 19 Nov 2022

Project Planning Phase

Project Planning Template (Product Backlog, Sprint Planning, Stories, Storypoints)

Date	16 october 2022
Team ID	PNT2022TMID52351
Project Name	A Gesture-based Tool for Sterile Browsing of Radiology Image
Maximum Marks	8 Marks

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

Use the below template to create product backlog and sprint schedule

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Application/Software Launch	USN-1	As a user, I can launch the developed application/software	1	Medium	Pooja S Priyanga L Vanitha B Sowjanya S
Sprint-1	Accessing the User Interface (UI)	USN-2	As a user, I can interact with software and operate the application with the help of UI	1	Medium	Pooja S Priyanga L Vanitha B Sowjanya S
Sprint-2	Launching the webcam/camera	USN-3	As a user, I can open the webcam/camera from the application to perform gestures	1	Low	Pooja S Priyanga L Vanitha B Sowjanya S
Sprint-2	Upload images from local system for manipulation	USN-4	As a user, I can upload images to the application from local system for manipulation	2	Low	Pooja S Priyanga L Vanitha B Sowjanya S
Sprint-3	Manipulating images through gestures	USN-5	As a user, I can perform various gestures with respect to system specification to manipulate the images	2	Medium	Pooja S Priyanga L Vanitha B Sowjanya S

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-4	Display the result/output	USN-6	As a user, I can see the sterile browsed/manipulated image on the screen with respect to the gesture performed	2	High	Pooja S Priyanga L Vanitha B Sowjanya S

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

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	05 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	12 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	19 Nov 2022

Velocity:
Here it is a 6-day sprint duration, and the velocity of the team is 20 (points per sprint). The team's average velocity (AV) per iteration unit (story points per day) is

$$AV = \text{sprint duration}/\text{velocity} = 20/6 = 3$$

Burndown 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 such as Scrum. However, burn down charts can be applied to any project containing measurable progress over time.

https://www.visual-paradigm.com/scrum/scrum-burndown-chart/

https://www.atlassian.com/agile/tutorials/burndown-charts

Reference:

https://www.atlassian.com/agile/project-management

https://www.atlassian.com/agile/tutorials/how-to-do-scrum-with-jira-software

https://www.atlassian.com/agile/tutorials/epics

https://www.atlassian.com/agile/tutorials/sprints

https://www.atlassian.com/agile/project-management/estimation

https://www.atlassian.com/agile/tutorials/burndown-charts