Gesture Based Tool for Sterile Browsing of Radiology Images

-Gayathri R,Jenitta Raja Kumari.P,Mereshiya J M,Kavya P

ABSTRACT

In this application we have used gestures to browse images that have been obtained during radiology. Gestures refer to non-verbal form of communication that have been defined using hands.

A major challenge involved in this approach is to provide doctors with efficient, intuitive, accurateand safe means of interaction without affecting the quality of their work. Keyboards and pointingdevices, such as a mouse, are today's principal 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 thatwereformed 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 themodel is trained pre trained on the images of different hand gestures, such as a showing numberswith fingers as 1,2,3,4. This model uses the integrated webcam to capture the video frame. isResized into (400,400), 5 - image is converted into grayscale etc.

CHAPTER 1

1.1.INTRODUCTION

Recent developments in computer software and related hardware technology have provided a value added service to the users. In everyday life, physical gestures are a powerful means of communication. They can economically convey a rich set of facts and feelings. For example, waving one's hand from side to side can mean anything from a "happy goodbye" to "caution". Use of the full potential of physical gesture is also something that most human computer dialogues lack .The task of hand gesture recognition is one the important and elemental problem in computer vision. With recent advances in information technology and media, automated human interactions systems are build which involve hand processing task like hand detection, hand recognition and hand tracking.This prompted my interest so I planned to make a software system that could recognize human gestures through computer vision, which is a sub field of artificial intelligence. The purpose of my software through computer vision was to program a computer to "understand" a scene or features in an image.A first step in any hand processing system is to detect and localize hand in an image. The hand detection task was however challenging because of variability in the pose, orientation, location and scale. Also different lighting conditions add further variability.

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. The image of the gesture captured in the video frame is compared with the Pre-trained model and thegesture is identified. If the gesture predicts 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. In two brain surgeries at the Neurosurgery, 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 wallto discuss and browse through the patient’s MRI images.

1.3.SCOPE

The scope of this project is to build a real time gesture classification system that can automatically detect gestures in natural lighting condition. In order to accomplish this objective, a real time gesture based system is developed to identify gestures. This system will work as one of futuristic of Artificial

Intelligence and computer vision with user interface. Its create method to recognize hand gesture based on different parameters. The main priority of this system is to simple, easy and user friendly without making any special hardware. All computation will occur on single PC or workstation. Only special hardware will use to digitize the image (Digital Camera).

1.4.MOTIVATION

Biometric technologies make use of various physical and behavioral characteristics of human such as fingerprints, expression, face, hand gestures and movement. These features are then processed using sophisticated machines for detection and recognition and hence used for security purposes. Unlike common security measures such as passwords, security cards that can easily be lost, copied or stolen; these biometric features are unique to individuals and there is little possibility that these pictures can be replaced or altered.Among the biometric sector hand gesture recognition are gaining more and more attention because of their demand regarding security for law enforcement agency as well as in private sectors such as surveillance systems.In video conferencing system, there is a need to automatically control the camera in such a way that the current speaker always has the focus. One simple approach to this is to guide the camera based on sound or simple cues such as motion and skin color.Hand gestures are important to intelligent human and computer interaction to build fully automated systems that analyze information contained in images, fast and efficient hand gesture recognition algorithms are required.

1.5.OBJECTIVES

First objective of this project is to create a complete system to detect, recognize andinterpret the hand gestures through computer vision

Second objective of the project is therefore to provide a new low-cost, high speed andcolor image acquisition system for operations in hospitals.

1.6.SYSTEM REQUIREMENTS

we propose a vision-based approach to accomplish the task of hand gesture detection. As discussed above, the task of hand gesture recognition with any machine learning technique suffers from the variability problem. To reduce the variability in hand recognition task we assume the following assumptions**:**

- Single colored camera mounted above a neutral colored desk.
- User will interact by gesturing in the view of the camera.
- Training is must.
- Hand will not be rotated while image is capturing.

The real time gesture classification system depends on the hardware and software.

Hardware requirements:

- Minimum 2.8 GHz processor Computer System or latest
- 52X CD-ROM drive Web cam (For real-time hand Detection)

Software requirements:

- Windows 2000(Service Pack 4),XP, Vista or Windows 7
- Matlab 8.0 or latest (installed with image processing toolbox)
- Vcapg2.dll (Video Capture Program Generation 2)
- DirectX 9.0 (for supporting Vcapg2)

CHAPTER 2

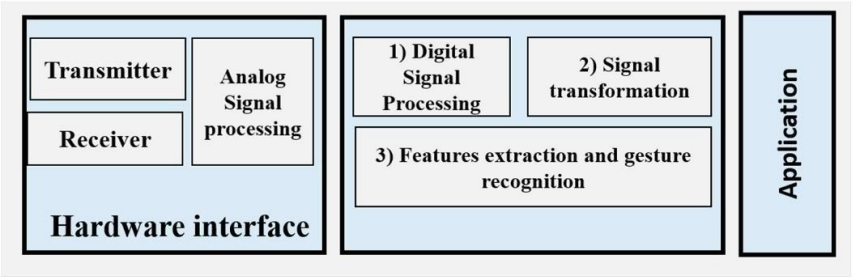
LITERATURE REVIEW

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

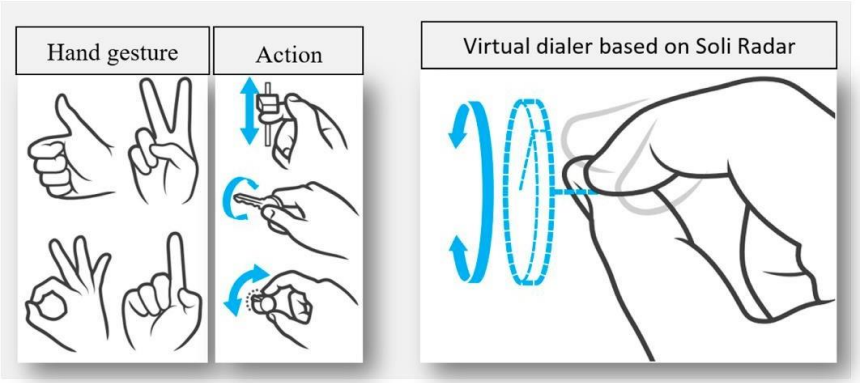
The hand gesture control system "*Gestix*" developed by the authors helped the doctor to remainin place during the entire operation, without any need to move to the main control wall since allthe commands were performed using hand gestures.The sterile gesture interface consists of a Canon VC-C4 camera, 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 IIvideo-capturing device is used.



(a)



(b)

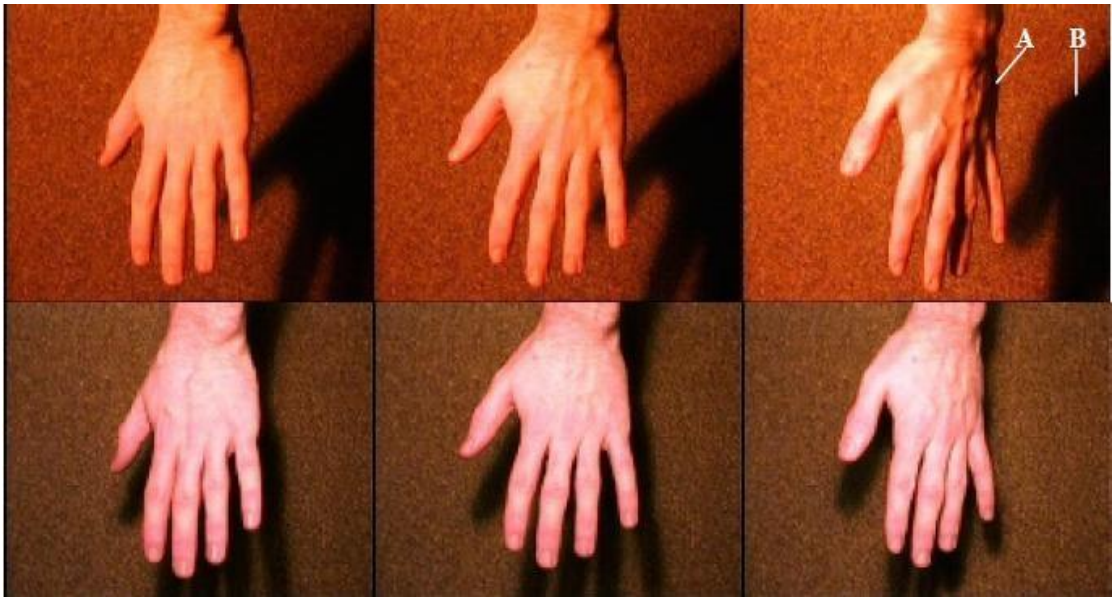
The "*Gibson*" image browser is a 3D visualization medical tool that enables examination of images, such as: MRIs, CT scans and X-rays. The images are arranged over a multiple layer 3Dcylinder. The image of interest is found through rotating the cylinder in the four cardinal directions. To interface

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.

CHALENGES IN CREATING A GESTURE RECOGNITION SYSTEM:

2.1.LIGHTING

The task of differentiating the skin pixels from those of the background is made considerably easier by a careful choice of lighting. According to Ray Lockton, if the lighting is constant across the view of the camera then the effects of self-shadowing can be reduced to a minimum [25]. (See Figure 2.1)



The top three images were lit by a single light source situated off to the left. A self- shadowing effect can be seen on all three, especially marked on the right image where the hand is angled away from the source. The bottom three images are more uniformly lit, withlittle self-shadowing. Cast shadows do not affect the skin for any of the images and therefore should not degrade detection. Note how an increase of illumination in the bottom three images results in a greater contrast between skin and background .The intensity should also be set to provide sufficient light for the CCD in the camera. However, since this system is intended to be used by the consumer it would be a disadvantage if special lighting equipment were required. It was decided to attempt to extract the hand information using standard room lighting. This would permit the system tobe used in a non-specialist environment .

2.2.CAMERA ORIENTATIONS AND DISTANCE

It is very important to careful about direction of camera to permit easy choice of background. Two good and more effective approaches are to point the camera towards wallor floor. Lighting was

standard room; intensity of light would be higher and shadowing effects lower because camera was pointed downwards. The distance of the camera from thehand should be such that it covers the entire gesture mainly. There is no effect found on theaccuracy of the system if the image is a zoomed one or not; the principle is to cover the entire hand area majorly.

2.3.BACKGROUND SELECTION

Another important aspect is to maximize differentiation that the color of background must be different as possible from skin color. The floor color in the work used was black. It was decided to use this color because it offered minimum self-shadowing problem as comparedto other background colour

CHAPTER 3

EXISTING AND PROPOSED SYSTEM

3.1.CHALENGES IN EXISTING SYSTEM:

Hand gesture recognition system confronts many challenges as addressed in , these challenges are: Variation of illumination conditions; where any change in the lighting condition affects badly on the extracted hand skin region . Rotation problem: this problem arises when the hand region rotated in any direction in the scene . Background problem; refers to the complex background where there is other objects in the scene with the hand objects and these objects might contain skin like color which would produce misclassification problem. Scale problem; this problem appears when the hand poses have different sizes in the gesture image. Finally, Translation problem; the variation of hand positions in different images also leads to erroneous representation of the features

3.2.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 wascalled ‘Gestix’.

This hand gesture system for MRI manipulation in an EMR image database called “*Gestix*” wastested 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 stillbe recognized accurately.

There have been numerous researches in this field and several methodologies were proposed like Principle Component Analysis (PCA) method, gradient method, subtraction method etc. PCA relates to Linear transformation consist on statistical approach. This givesus powerful tool for pattern recognition and data analysis which mostly used in image processing techniques for data (compression, dimension and correlation). Gradient method is also another image processing technique that detect colour patches applying low pass filters is also known as edge detection method. Subtraction method is very simple that subtract input image pixel to another image or constant value to provide output. I have also studied different approaches to hand gesture recognition and came to know thatimplementation of such techniques like PCA and Gradient method is complicated, we can produce same output as these techniques gives us by simple and easy implementation. So, Ihave tried four different algorithms and finally selected the one, which was most efficient

i.e. diagonal sum algorithm. This algorithm is able to recognize maximum gestures correctly.

3.3.PROPOSED SYSTEM:

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 database. Navigation and other gestures are translated to commands based on their temporal trajectories, through video capture. "Gestix" was tested during a brain biopsyprocedure. 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 fromtwo usability tests provide insights and implications regarding human-computer interaction based on nonverbal conversational modalities.

This paper presents a method to improve the navigation and manipulation of radiological images through a sterile hand gesture recognition interface based on intentional contextual cues. Computer vision algorithms were developed to extract intention and attention cues from the surgeon's behavior and combine them with sensory data from a commodity depth camera. The developed interface was tested in a usability experiment to assess the effectiveness of the new interface. An image navigation and manipulation task wasperformed, and the gesture recognition accuracy, false positives and task completion times were computed to evaluate system performance. Experimental results show that gesture interaction and surgeon behaviour analysis can be used to accurately navigate, manipulate and access MRI images, and therefore this modality could replace the use of keyboard and mice-based interfaces

3.4.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.

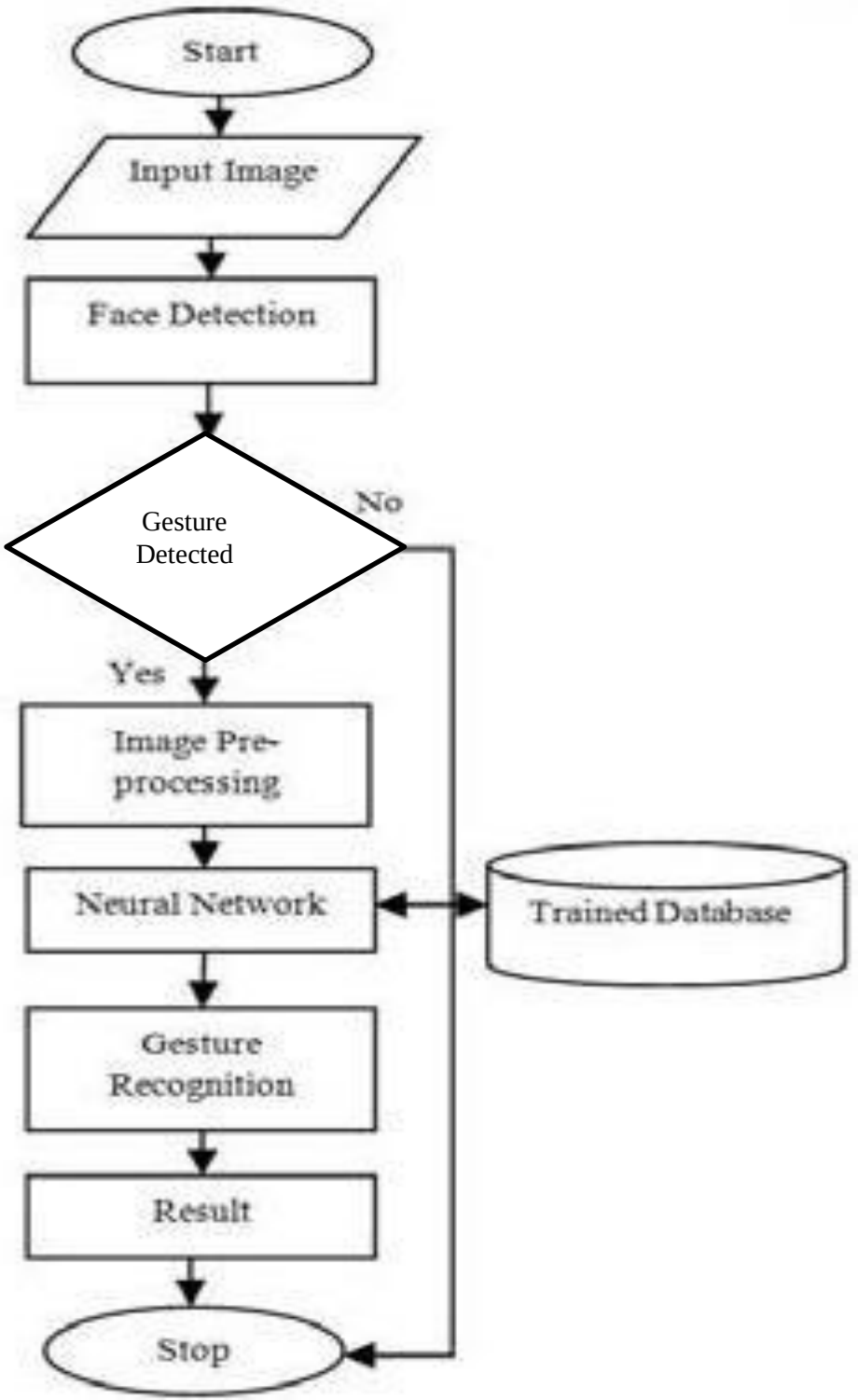
Disadvantages:

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

CHAPTER 4

FLOWCHART AND ARCHITECTURE

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

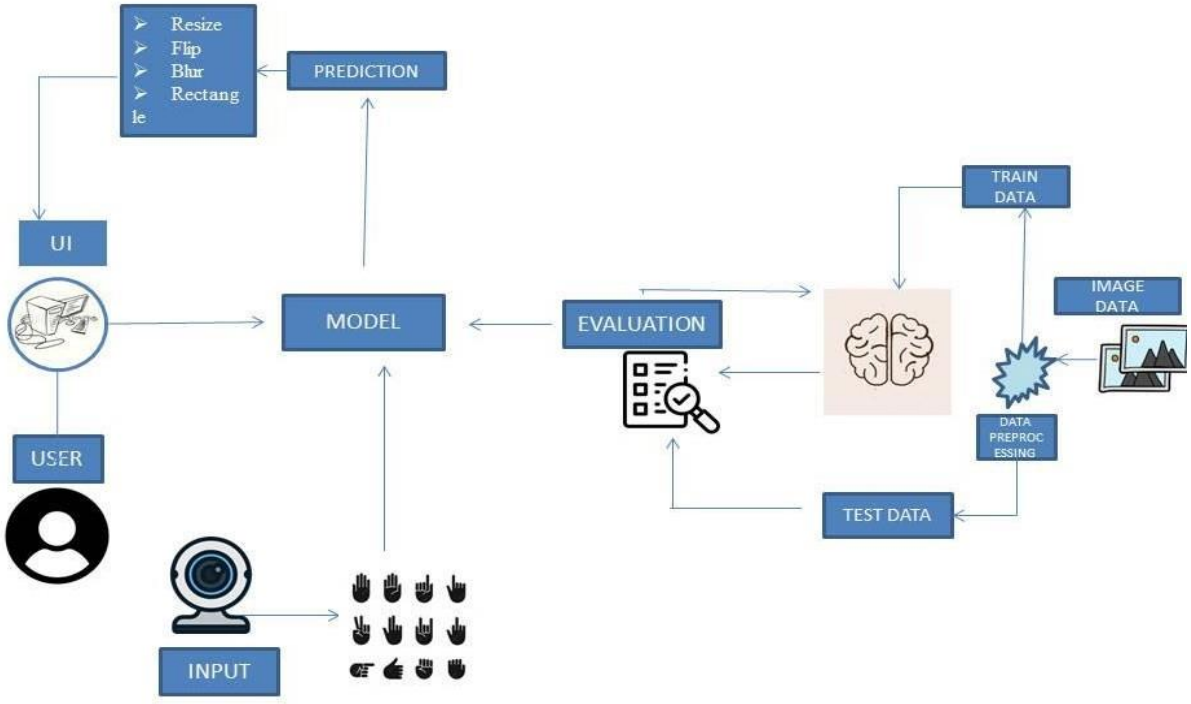
- Application Building
    - Create an HTML file

- 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”

ARCHITECTURE DIAGRAM:



5.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, etc by using hand gesture tools to browse the images obtained.

6.APPLICATIONS

This hand based gesture tool developed can be mainly used in the medical industry to **browseby sterility**.However it can also be used in different industries while presenting certain ideas, during meetings, and can be used by teachers while teaching.

7.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.

Hand Gesture Recognition is a concept of Image Processing that can be successfully used to interact with the computer in a simpler and more effective manner. The proposed work makes such interactions between the human and the computer easier and effective. Also, keeping in mind the comfort it provides to the users the proposed system is an operative one. By experimenting the subjects and taking reviews it is proved that the system is easy to use and does not require any prior knowledge about gesture recognition systems and image processing. Also, the dwell time and execution rates of the system are faster and not a lot of time is wasted in either training the subjects or getting the output. The effectiveness and self-effacing structure of the gesture recognition system makes it soother to use

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.

8.FUTURE SCOPE

The system could also be made smart to be trained for only one or two gestures rather than all and then made ready for testing. This will require only a few changes in the current interface code, which were not performed due to the shortage of time.

One time training constraint for real time system can be removed if the algorithm is made efficient to work with all skin types and light conditions which seems impossible by now altogether. Framing with COG (Centre of gravity) to control orientation factor could make this system more perfect for real application. The system’s speed for preprocessing could be improved if the code is developed in VC/VC.Net. Tracking of both hands can be added to

increase the set of commands. Voice commands can also be added to further increase the functionality.

9.BIBILOGRAPHY

Research papers: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2410001/
https://pubmed.ncbi.nlm.nih.gov/18451034/
https://www.researchgate.net/publication/5401674_A_Gesture-based_Tool_for_Sterile_Browsing_of_Radiology_Images

Smartinternz Website: https://smartinternz.com/Student/guided_project_workspace/

10.Appendix

SOURCE CODE:

https://github.com/smartinternz02/Gesture-based-Tool-for-Sterile-Browsing-of-Radiology-Images-Using-IBM-Watson