Project Design Phase-I
Proposed Solution

Date	16 October 2022
Team ID	PNT2022TMID51374
Team Size	4
Project Name	A gesture-based tool for sterile browsing of radiology images
Maximum Marks	2

Proposed Solution:

S.No:	Parameter	Description
1	Problem Statement (Problem to be solved)	Interaction between doctor-computer inside the operation room. Keyboard and pointing devices such as mouse are today's method of human computer interaction. However, the use of computer keyboard and mouse by doctors and nurses in intensive care units is a common method of spreading infections
2	Idea / Solution description	In this project, we use hand gestures as an alternative to existing interface techniques, offering the major advantage of sterility.
3	Novelty / Uniqueness	We are using Convolutional Neural Network to first train the model on the images of different hand gestures, like showing numbers with fingers as 0, 1, and 2,3,4,5. Then we made a web portal using Flask where user can input any image on which one 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 grey scale.
4	Medical Gesture Interfaces	Stealth Station is a free-hand stereo-tactic pointing device, in which a position is converted into its corresponding location in the image space of a high-performance computer monitor. In a setting like the OR, touch screen displays are often used, and

		must be sealed to prevent the build-up of contaminants. They should also have smooth surfaces for easy cleaning with common cleaning solutions. These requirements are often overlooked in the busy OR environment.
5	"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.
6	Hand Tracking /Operation modes	Gesture operations are initiated by a calibration mode in which a skin color 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 neighbour 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.
7	Usability Tests	Three different types of usability tests were conducted with the “*Gestix*” system in the OR: (i) a contextual interview; (ii) an individual interview; and (iii) a subjective satisfaction questionnaire. The main result of the contextual interview which was based on watching and listening to the users while they work indicated that the main surgeon had to remain sterile, close to the patient, and avoid distractions (change in focus of attention), which could be life threatening. The main issues found in a 20 minute interview of the main surgeon were; (a) the need of replacing the plastic adhesive cover from the touch-screen monitor for every new surgery in order to keep it sterile; (b) the delay caused by frequent visits of the surgeon to the main control wall and to return to the patient's side; and (c) the surgeon preferred hand gesture control since it is based on interaction with hands, in which he/she is most proficient. At the end of the entire operation procedure, the main surgeon filled in a questionnaire to measure overall satisfaction about usability.
8	Business Model(Revenue Model)	Can collaborate with diagnosis centres and hospitals. It can also collaborate with government health awareness camps.
9	Social Impact / Customer Satisfaction	Contributing the corporate social responsibility by providing better solutions to the healthcare and to patients.
10	Scalability of the solution	The use of doctor-computer interaction devices in the operation room supports medical imaging manipulation while allowing doctors' hands to remain sterile, supporting their focus of attention, and providing fast response times.