Hand Gesture Controlled Presentation Viewer with AI Virtual Painter

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Abstract

Online teaching has been encouraged for many years but the COVID-19 pandemic has promoted it to an even greater extent. Teachers had to quickly shift to online teaching methods and processes and conduct all the classroom activities online. The global pandemic has accelerated the transition from chalk and board learning to mouse and click - digital learning. Even though there are online whiteboards available for teaching, teachers often find it difficult to draw using a mouse. A solution for this would be to get an external digital board and stylus but not everyone would be able to afford it. The Hand-Gesture Controlled Presentation Viewer With AI Virtual Painter is a project where one can navigate through the presentation slides and draw anything on them just like how one would on a normal board, just by using their fingers. This project aims to digitalise the traditional blackboard-chalk system and eliminate the need for using a mouse or keyboard while taking classes. Hand-Gesture controlled devices especially laptops and computers have recently gained a lot of attraction.

This system works by detecting landmarks on one's hand to recognise the gestures. The project recognises five hand gestures. It uses a thumb finger for moving to the next slide, a little finger for moving to the previous slide, two fingers for displaying the pointer, one finger for drawing on the screen and three fingers for erasing whatever has been drawn. The infrastructure is provided between the user and the system using only a camera. The camera's output will be presented on the system's screen so that the user can further calibrate it.

Keywords: Hand Gestures, Gesture Detection, Virtual Painter.

1. Introduction

Hand gesture technology is applied in many different fields in today's world of automation, including medical applications, industry applications, IT hubs, banking sectors, and so on. This idea is based on the common notion of using hand gestures to manage a laptop or computer. Hand Gestures are another unique means of communicating with devices such as robots or computers. This project addresses the challenges of using gestures to control computer applications that include both static symbols and dynamic motions. Instead of using numerous devices such as keyboards, mouses, joysticks, and so on, hand gestures are simply utilised to control the functionalities like moving back and forth through the slides, drawing on the screen, erasing etc. Recognition takes place in real-time, with only a tiny amount of processing time and memory required. The motions that are appropriate, how to recognise them, and which orders they should control are investigated. Myriads of technological advancements are occurring in today's society, such as natural language processing, biometric authentication, and face detection, which can be found in our tablets, iPads, computers, and smartphones. The AI Virtual Painter enables one to draw on the screen simply by using their finger which is comparatively much easier than drawing using a mouse.

2. Literature Review

2.1. Gesture Detection

There has been an increasing demand for a more active and interesting viewing experience. The need to constantly move to change slides while one is taking a presentation session can often be distracting and time-consuming and can make the audience or students less engaged in the sessions or classes. The hand gesture detection system enables one to perform different functions simply by using hand gestures. The Human Machine Interface (HMI) is a hardware and software system that aids in communicating and exchanging information between the human and the machine. As part of HMI devices, we commonly employ numerous indicators such as LEDs, Switches, Touch Screens, and LCDs. Hand Gestures are another uniques means of communicating with devices such as robots or computers. Each gesture is modelled using either static model information or a dynamic system that is linear in parameters. The recognition takes place in real-time. Hand Movement Identification was a modern form of Human-Machine Interconnection, in which the system is controlled simply by placing one's finger in front of the computer's or laptop's web camera.

2.2. Virtual Painter

The traditional method or most commonly used method till now for drawing on a computer or laptop screen is by using the mouse. But this method does not offer a smooth drawing experience and people often find it difficult or unable to express the pictures or the pictorial concepts properly using a mouse. Another way is to get an external digital board and a stylus to draw on it. The cost of the device might vary and not everyone will be able to afford it. The Virtual Painter allows one to draw on the screen by simply using one's fingers. This is a low-cost and effective alternative to drawing using a mouse or digital board and stylus and possesses many other advantages as well. The virtual painting technology gives one the same experience as that of drawing on an actual board. The virtual painter is in where we can draw by just capturing the motion of a coloured marker with a web camera. One coloured object at the tip of the finger is mainly used as the marker.

3. Material and Methods

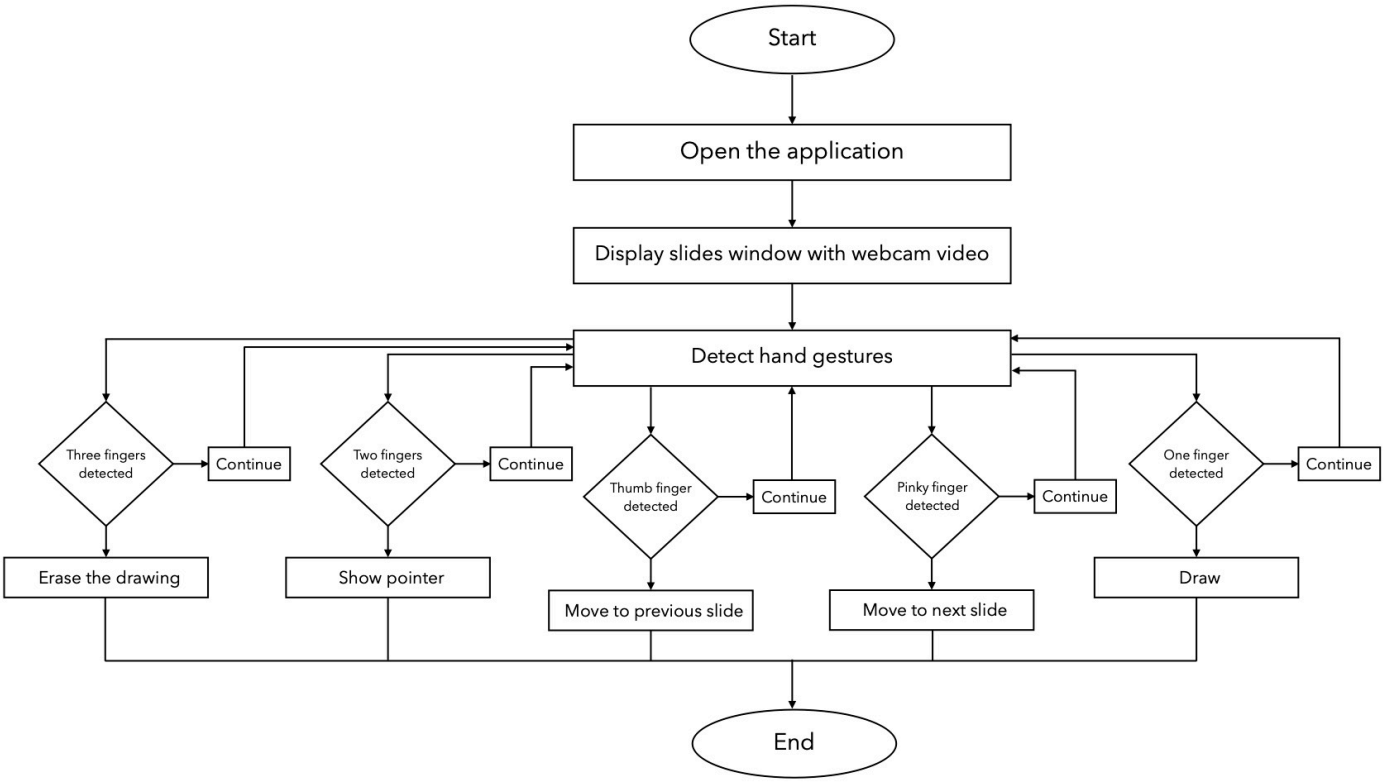
3.1. Software Development

The Hand Gesture Controlled Presentation Viewer with AI Virtual Painter is developed using Python programming language and Python libraries such as CVZone, MediaPipe etc. CVZone is a computer vision package which further consists of several other libraries such as OpenCV, Numpy etc. Given the real-time webcam data, this application uses these libraries to track the fingers and allows the user to navigate through the slides as well as draw on the screen by moving the fingers and showing the defined hand gestures.

3.2. Testing

The system was tested thoroughly to ensure the smooth working of the application. A line of separation has been placed in the webcam window to avoid the unwanted detection of hand gestures during presentation sessions. The navigation gestures are detected only when it is shown above the line of separation. No bugs were encountered during the testing of the application.

3.3. Methods



Activity Diagram

The diagram shows the working of the system with different functions. The system will first take the input from the web camera. It will detect which finger is up and which finger is down. A particular gesture has specific functionality. The various functions and conditions used in the system are explained in the flowchart.

The system is designed in such a way that the user can control and manage the slides easily while viewing themselves in the displayed window. The slides are displayed along with the webcam video. The webcam video is placed as a small window on top of the slides window. A line of separation is displayed on the webcam video to avoid the unwanted detection of gestures. The navigation gestures are detected only when it is shown above the line of separation. This ensures the smooth functioning of the system. It is important to keep in check that the gestures are visible within the webcam. Otherwise, the system would fail to detect the gestures as it isn’t visible to it. The drawing can be done using the index finger. The drawing does not remain on the slide if we navigate to another slide. It will be erased

automatically. The eraser function uses the index, middle and ring finger to erase whatever that has been drawn on the screen. It erases the drawn figures according to the recent drawing activity. The figure that was drawn recently will be the first one to be erased and the figure that was drawn first will be the last one to be erased and so on.

4. Results and Discussion

Several facilities and various modes are available for providing input to any application in the present environment. With the ever-increasing smart environments and corresponding input technologies, there are still not many applications that are available which are controlled using the current and smart facility of providing input, which is by hand gesture. With the help of this application, the user can interact with the virtual objects using hand gestures instead of any other physical input devices. The application performs five different functionalities for five specific hand gestures.

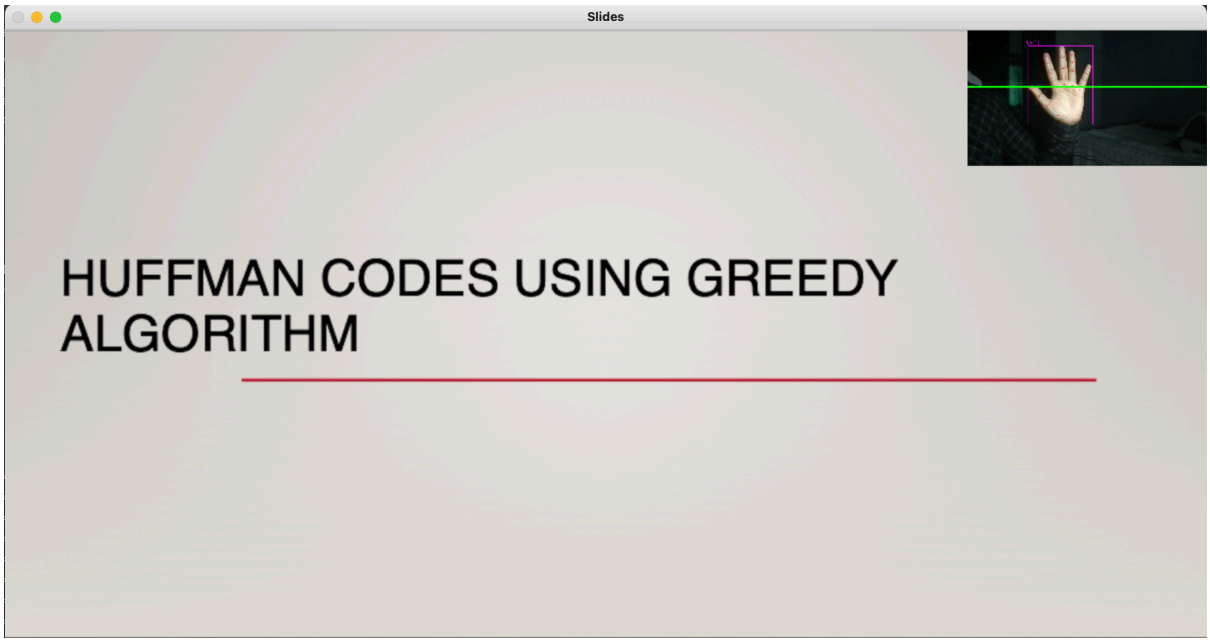


Fig 1. Palm Detection

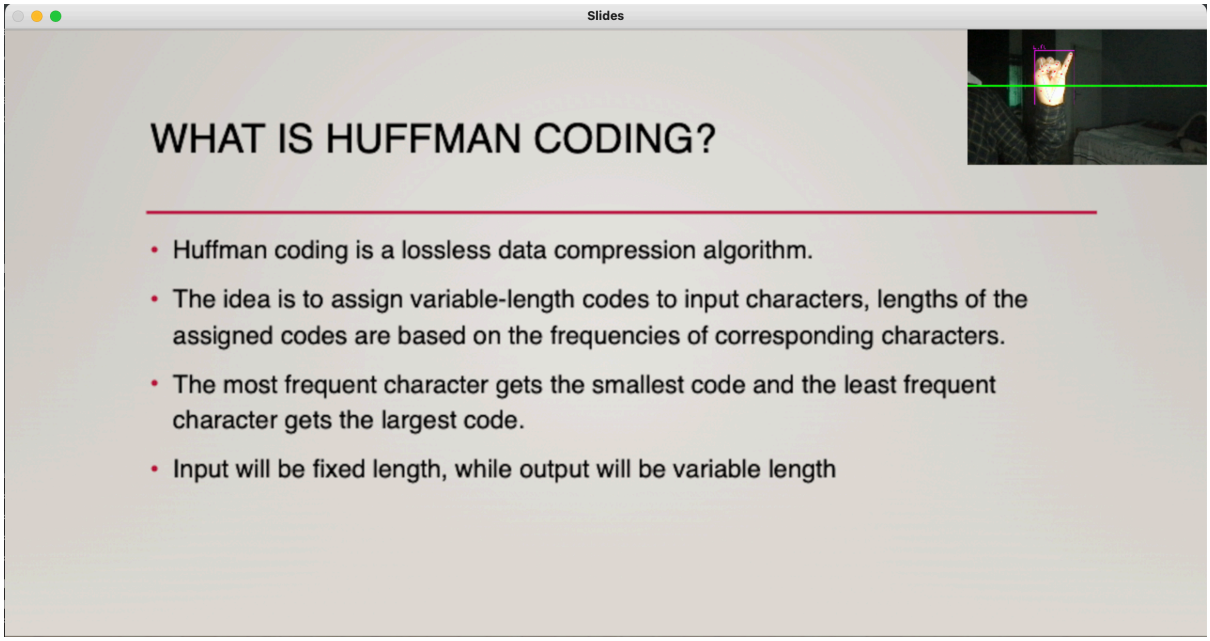


Fig 2. Move to the next slide

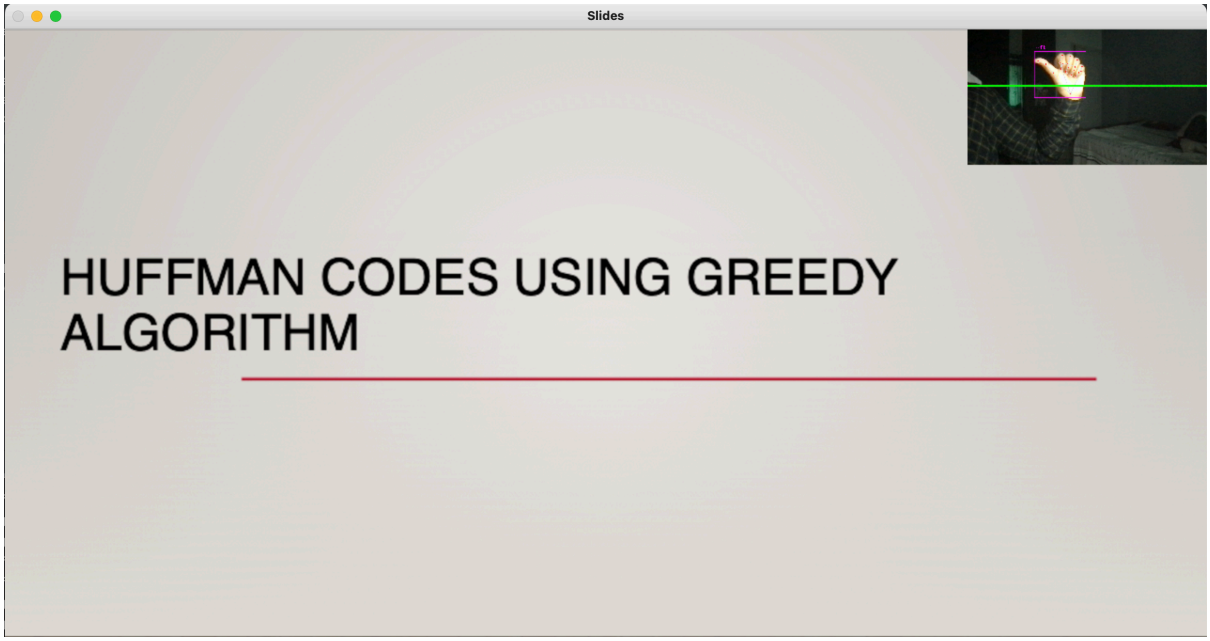


Fig 3. Move to the previous slide

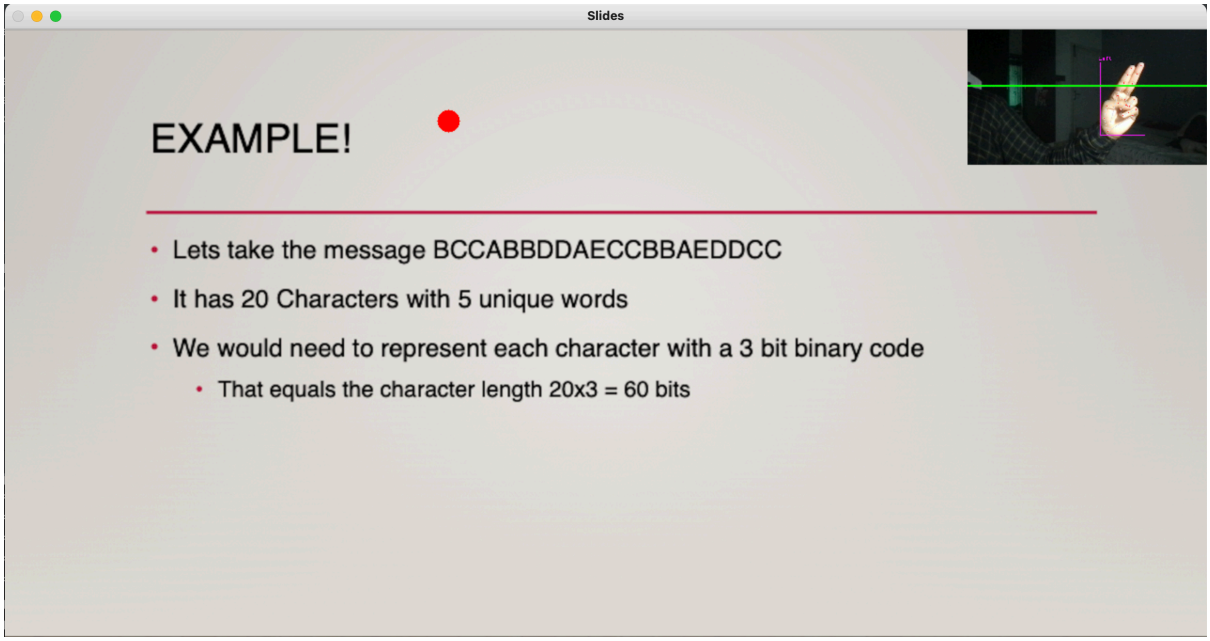


Fig 4. To show Pointer

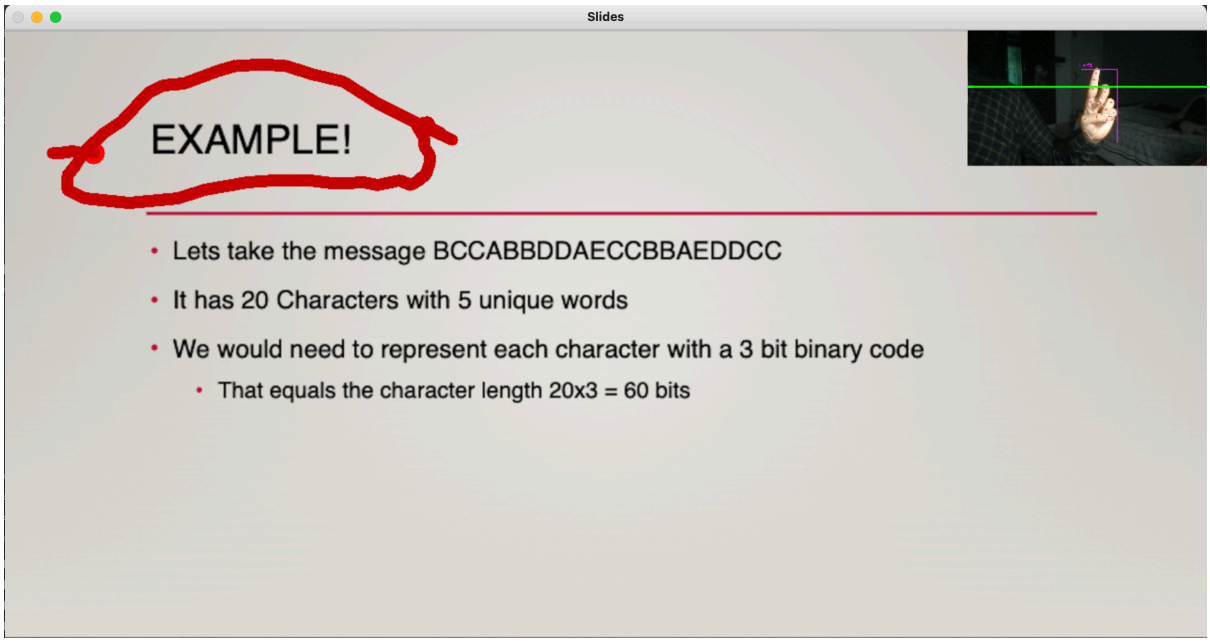


Fig 5. To draw on the slides

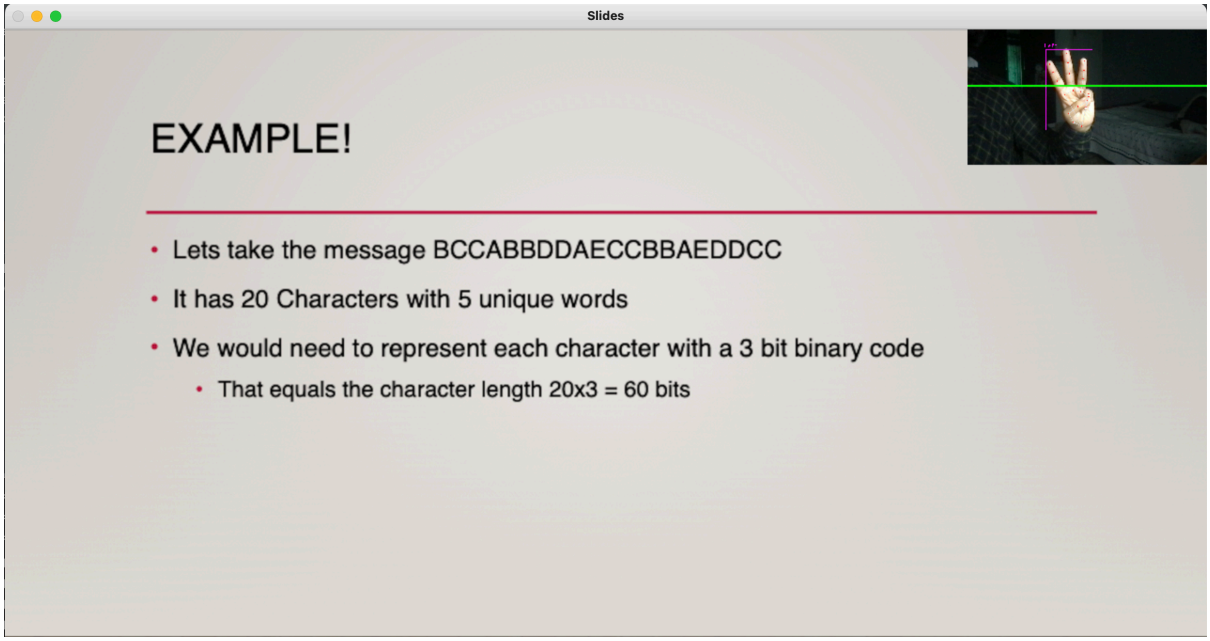


Fig 6. To erase the drawing

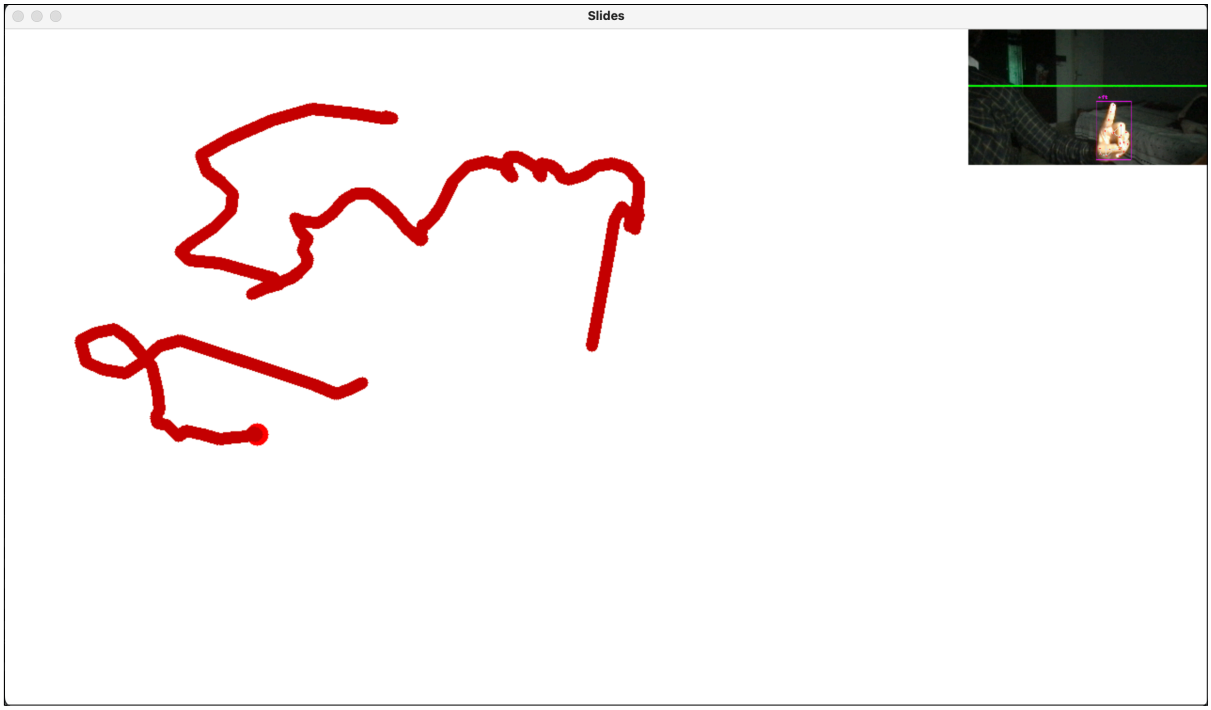


Fig 7. Whiteboard

5. Conclusion

The desire to give effective presentations has been the driving force for the invention of Visual aids. The digital slide shows had improved the effectiveness of the presentation and the audience size, but the need to be next to the keyboard or mouse created a vacuum for innovations. There was a need for some form of wireless control of the movement of the slides. The purpose of this system was to design a controller that would change the slides remotely, without contact with the computer keyboard or mouse. The controller would allow the presenter to change the slides without being a captive to the keyboard or mouse. The presenter would have improved contact with his or her audience due to increased freedom of movement. The Hand Gesture Controlled Presentation Viewer with AI Virtual Painter is an excellent alternative to the traditional presentation viewing system. The most important advantage of the usage of hand gesture-based input modes is that using this method the user can interact with the application from a distance without using the keyboard or mouse. The application of manipulating objects through hand gestures in a virtual environment is being proposed to provide a suitable efficient and user-friendly human-computer interface. The application provides flexibility to the users and specifically physically challenged users to define the gesture according to their feasibility and ease of use. Many teachers faced problems while teaching due to the sudden shift to the online mode as many of them weren't quite familiar with it. The Hand Gesture Controlled Presentation Viewer with AI Virtual Painter is an application that can be used by anyone, including people who have no knowledge of operating a computer system. This system has many advantages in terms of cost, time and efficiency. The importance of gesture recognition lies in building efficient human-machine interaction. It reduces the effort and the need to constantly use a mouse to change slides, making it easier to navigate during sessions. The virtual painter and pointer that comes with the system make it easier to draw and point on the screen. The system currently supports only PNG and JPEG formats. It can further be enhanced to include even more capabilities and functionalities by supporting different file formats. Gesture recognition promises wide-ranging applications in many fields.

5. References

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