

Cursor Control Using Hand Gestures

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Abstract

Abstract This paper introduces an innovative vision-based cursor control system that utilizes a webcam to capture hand gestures via a color detection technique. With this system, users can navigate the computer cursor by moving their hands adorned with colored caps or tapes. It also enables various cursor functions, such as right and left clicks, double clicks, and scrolling, by recognizing different hand gestures. This system relies solely on a low-resolution webcam as a sensor, tracking the user's hand with colored caps in two dimensions and interpreting up to five distinct hand gestures, which correspond to mouse functions.

KEYWORDS:

The key aspects of this work revolve around Cursor Control (CC), Human-Computer Interaction (HCI), and Human-Robot Interaction (HRI), with the use of Hue Saturation Value (HSV) for color detection. NUI (Natural User Interaction), MHI (Motion History Image).

1. Introduction

With the relentless evolution of computer technology, there's a growing fascination with increasingly compact electronic devices. This trend underscores our heightened awareness of the significance of human-computer interaction (HCI), especially in the realms of vision-based gesture and object recognition. In our paper, we propose a novel approach that uses a video device to control the mouse system (Mouse functions). The remarkable capability of gesture recognition empowers individuals to directly engage with machines (HMI), fostering a seamless and natural interaction devoid of any mechanical intermediary. Using the concept of gesture recognition, it is possible to point a finger bearing color caps at the computer screen so that the cursor will move accordingly to the movement of the color caps. This paper proposes a novel vision based cursor control system, using hand gestures bearing color caps on the fingertip captured from a webcam[10].

Today we are using mouse or a touchpad to control the computer mouse which required physical contact with the devices. In this paper, we are using hand gestures which are required no physical contact other than color caps with any device and we can operate it from a large distance. Employing hand gestures for mouse control offers a remarkably comfortable and novel approach, introducing an entirely fresh and innovative concept for computer cursor manipulation. The cursor control using hand gesture system can be implemented in MATLAB. The system was able to control the movement of a cursor by tracking the user's hand bearing color caps. Cursor functions were performed by using different hand gestures. This system has the potential of being a viable replacement for the computer mouse, however due to the constraints encountered- it cannot be completely replace the computer mouse. The primary limitation of

this system lies in its requirement for a well-illuminated environment, which serves as the key factor preventing it from being a full-fledged replacement for the traditional computer mouse. This limitation becomes especially evident as computers are frequently used in outdoor settings with suboptimal lighting conditions. lighting condition [4].

2. Problem Statement

To design color caps acts as an object which the web camera senses. The camera's strategic positioning enables it to detect the movement of fingertips adorned with color caps, subsequently triggering mouse operations. The application of a virtual mouse proves particularly advantageous in scenarios where space is at a premium or when mobility is a consideration. This virtual mouse relies on recognizing hand gesture patterns rather than relying on a physical mouse, utilizing colored tips that are captured by the webcam for detection.

3. Literature Survey

As we know that most laptops today have a built-in webcam, which are mainly used for video conferencing. The envisioned application holds the potential to significantly broaden the capabilities of a webcam, enabling cursor control to a degree where it could potentially obviate the necessity of a physical computer mouse. HCI using hand gestures is very interesting and effective technique for one to one interaction with computers and it provides a Natural User Interface (NUI). There has been extensive research towards novel devices and techniques for cursor control using hand gestures using color detection technique In addition to its role in HCI, hand gesture recognition plays a pivotal role in sign language recognition, further amplifying the importance and widespread adoption of this technology.

Hardware Requirements:

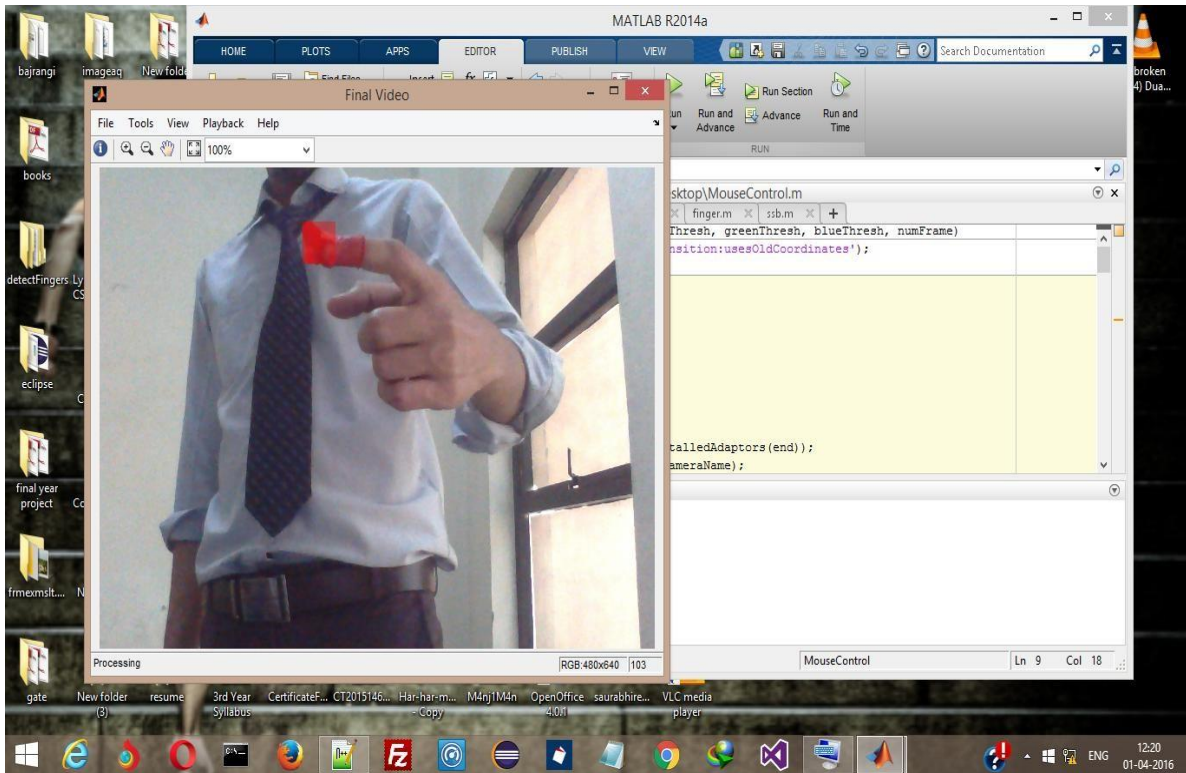
1. **System : Intel I5 Processor.**
2. **Hard Disk : 40 GB.**
3. **Monitor : 15.**
4. **Ram : 16**

Software Requirements:

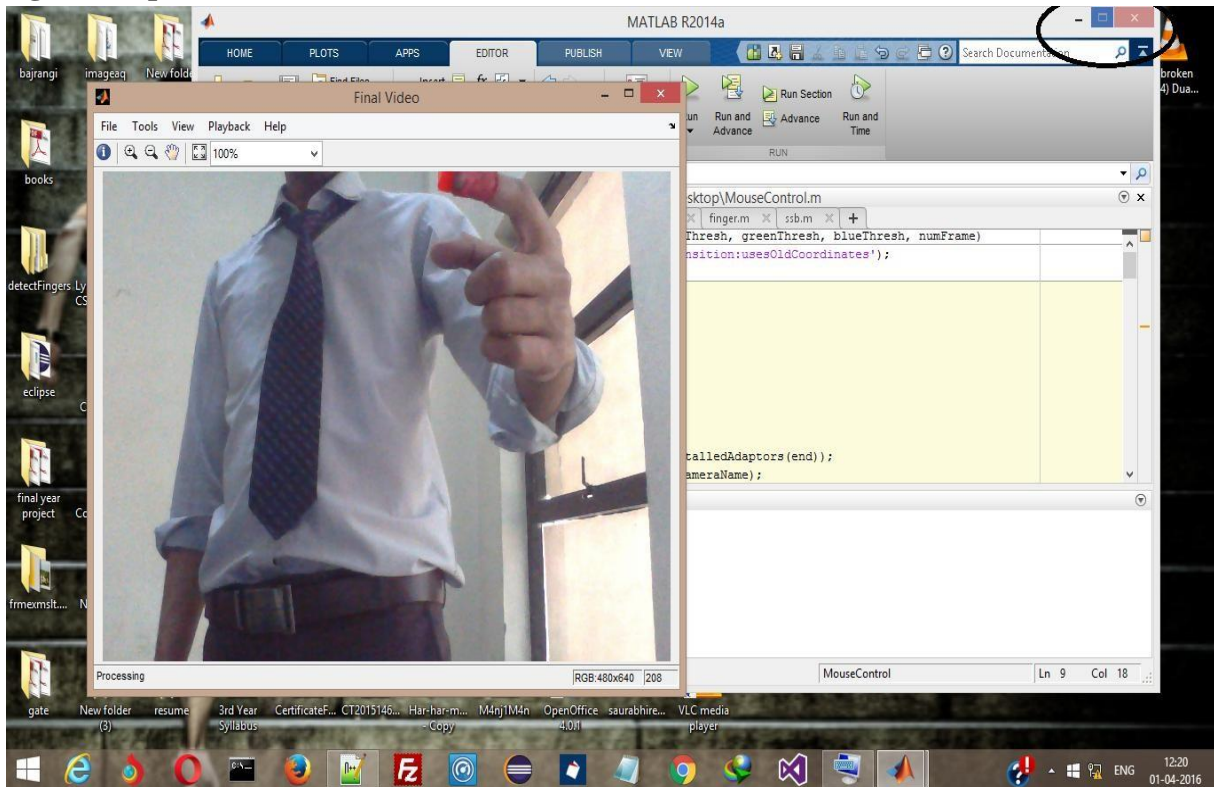
- **Operating system : Windows 11.**
- **Software Requirements :**
- **Coding Language :Python.**
- **IDE : Spyder.**

4. System Architecture:

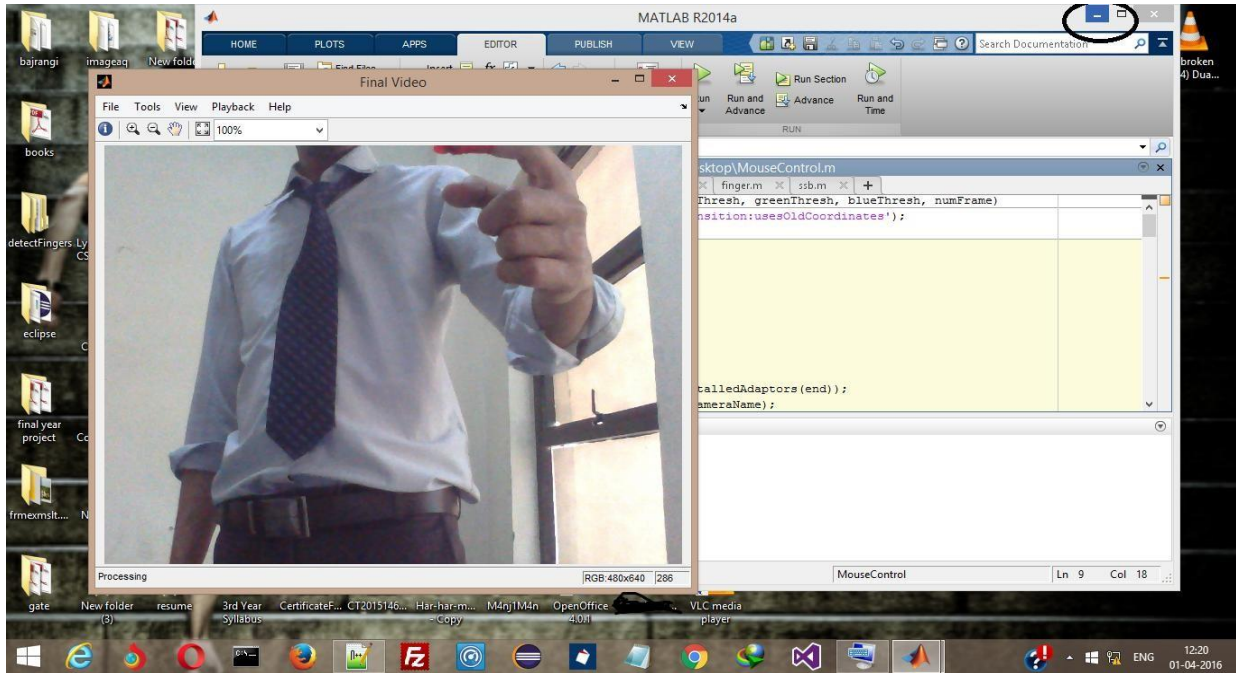
Detecting red color for tracking mouse pointer



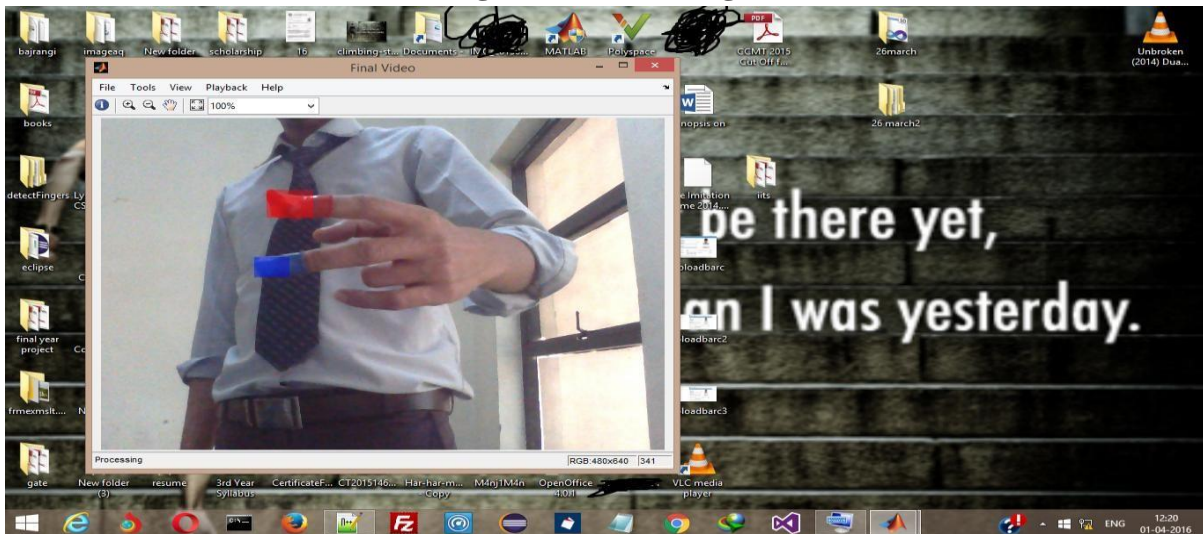
Moving cursor pointer



Moving cursor to minimization point



Minimizing the window using blue color



5. Conclusion:

A new technique has been proposed to increase the adaptability and response time of the system. We have developed a system to control the mouse cursor and implement its function using a real time camera. Implementation of all the mouse tasks such as left and right clicking, double clicking and scrolling up & down, starting the applications using the gestures like notepad, paint, command prompt etc. This system is developed in such a way that the user, new to the system will just have to install the set up and not run the whole project. In this system, an object tracking based virtual mouse application has been developed and implemented using a webcam. The proposed system has been implemented in MATLAB environment using MATLAB Image Processing Toolbox, Open cv library.

6. References:

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