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Mouse Cursor Control System Based on Hand Gesture

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Abstract

The apparition on market of the low-cost webcams with, at least, satisfactory qualities open up new directions regarding the implementation of human computer interaction (HCI) interfaces. The paper presents a HCI interface for mouse cursor control. The purpose of the implemented solution is to control the mouse cursor by user hand gestures captured through a webcam. For improving the gesture recognition based on the fluctuation of illuminance levels the finger strips color detection was used. The results reveal the good behavior of the system in low light condition.

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Keywords: mouse control; hand gesture; human computer interaction.

1. Introduction

The evolution of the User Interface (UI) witnessed the development from text based UI based on keyboard to graphical UI based on mice. In current virtual environments applications, keyboards, mice, and joysticks are still the most popular and dominant devices. However, they are inconvenient and unnatural.[1] Research in Human Computer Interaction (HCI) primarily deals with the design, implementation, and assessment of new interfaces for improving the interaction between humans and machines so that it become natural without the use of any mechanical devices.[7] The next few recently studies may be enough to encourage the research projects in the field of HCI. Khundam introduce in [6] an interactive hand gesture system for control steering and speed for movement in virtual reality (VR). The system is based on the hand palm direction and distance from user using Oculus Rift and Leap Motion devices for VR. In [11] the authors propose a human-3DTV interaction method via the use of a virtual

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3D interface. Based on simple gestures (captured via the Kinect sensor), the user can manipulate 3DTV fasters and more accurate than an existing product they used for performance comparison. A 3D hand tracking using two common webcams is proposed in [3]. For a better hand detection in the segmentation step the authors use an adaptive hue skin color filter combined with a template filter. In [7] the authors are focused in finding some points on the hand contour which can be used in hand gesture control application. The paper highlights the definition of the hand points of interest, the general algorithm used for their finding and some preliminary results. In [8] implemented a natural user interface based on hand detection and tracking using a webcam. Because of the low quality camera their purpose was quite complex, so that their algorithms become quite complex, combining a number of different techniques and algorithms such as: skin detector based on histograms, background subtraction and a clustering algorithm, an open hand detector and a modified particle algorithm. In [10] is proposed a method for two hands gesture detection using a Kinect sensor. Their algorithm starts with L*a*b* color skin segmentation (for finding the hands) continue, if in image are two hand, with K-means clustering (for separating the hands) and finish with the finding of the fingertips based on the hands convex hull finding through the so-called by the authors, the Graham algorithm. The practical tests used by the authors reveal the robustness and the effectiveness of their method.

2. The system architecture

The aim of the implemented system is to control the windows mouse cursor using the human hand gestures. The system (Fig. 1a) is composed by: (1) computer; (2) external webcam (Genius FaceCam 320); (3) hand pad. Following the block diagram from Fig. 1b, the software application, which runs on the computer, takes an image (a captured frame/image) of the hand pad area (where the user uses his hand as a mouse) through the external webcam and process it regarding the tracking of the user hand and recognition of the hand gesture. The position of the hand on the image will be converted in the position of the mouse cursor on the computer display. The recognized hand gesture is converted in a mouse event as: left click, right click or double click. The considered gestures corresponding to the mouse events above mentioned are presented in Fig.2b, Fig.2c and Fig. 2d. A hand gesture is considered as recognized if is detected the corresponding colored strip/strips. In Fig. 2a is presented the default gesture used for mouse pointer control. The center of the red button is considered the position of the hand.

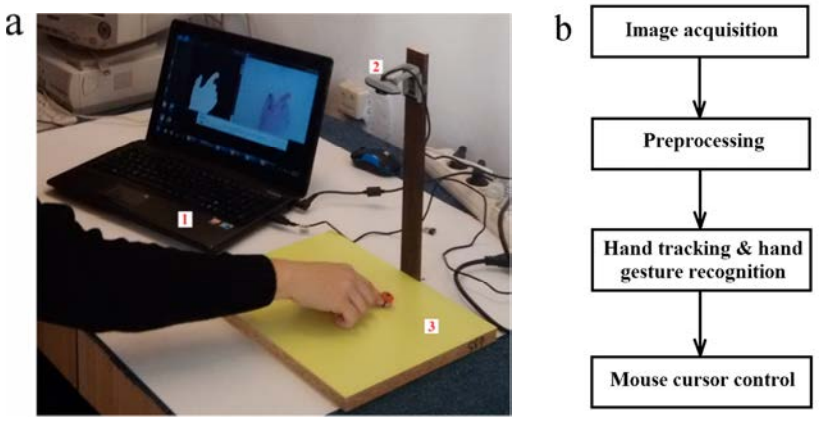

Fig. 1. (a) System overview; (b) Block diagram of the application [5].