

一個基於紅外線攝影機之低成本眼控滑鼠

A Low-Cost Eye Pointer System based on an Infrared Webcam

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摘要

電腦與網路在近幾年的發展相當迅速，藉由人機介面，將人類的想法轉換為電腦指令，近年來新穎的人機介面，包括語音輸入、手勢辨識、觸控螢幕……等，而眼動控制在近幾年來成為具有吸引力的研究，將是未來人機介面科技的新趨勢，因此本論文以眼控系統做研究。不同於外界使用昂貴的設備，本論文使用平價的網路攝影機(webcam)，並在攝影機旁裝紅外線 LED，固定於頭罩式耳機上，利用攝影機擷取眼球影像，將擷取之影像計算瞳孔中心位置，並使用射影轉換法(projective transformation) 轉換至螢幕上的實際座標，此轉換法的優點是可計算出兩個不規則四邊形之間的轉換關係，四組對應點即可決定轉換矩陣。擷取影像後執行下列步驟 (1)將影像二值化處理，使用形態學取得瞳孔區域 (2)投影法來找尋瞳孔中心座標位置 (3)將所得瞳孔座標轉換至螢幕上的實際座標 (4)連結滑鼠，並達到即時人機介面。

關鍵字: 眼動控制、影像處理、投影法、座標轉換、人機介面

Abstract

Computers and computer networks have been rapidly developed in recent years. With the aid of Human-Machine Interfaces, the humans can transform their ideas into computer instructions. Novel Human-Machine Interfaces include speech recognition, gesture recognition, and touch panel, etc. Eye movement control became an attractive research in recent years. It will be the new trend of human-machine interface technology in the future. Therefore, we focus on eye control systems in our research. Without using costly device, in this research we mounted an Infrared LED on a low cost webcam and placed them on a headphone. We capture images of the eye by the webcam and calculate the location of the pupil center. The projective transformation is used to convert the coordinates on the eye image to the actual coordinates on the screen. The benefit of using this transformation is that only four sets of corresponding points are needed to determine a transformation matrix. After capturing images of the eye, we execute the following steps: (1) Processing images by banalization and use the morphologic algorithm to get the pupil area. (2) Find out the coordinate of the pupil center by the projection function. (3) Convert the pupil center coordinates to the actual coordinates on the screen. (4)

Connect mouse to control PC.

Keywords: eye control, image processing, projection function, transformation of coordinates, human computer interface