EYE RECOGNITION AND HAND GESTURE IDENTIFICATION FUSION SYSTEM

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Abstract-In this paper, an individual human computer interface system using eye motion and hand gestures is introduced. Traditionally, human computer interface uses mouse, keyboard as an input device. This paper presents interface between computer and human. This technology is intended to replace the conventional computer screen pointing devices for the use of disabled. The paper presents a novel idea to control computer mouse cursor movement with human eyes and hand gestures. Hand gesture is used as a mechanism for interaction with the computers.

Keywords- Eye tracking, mouse movement, Eye-blinking detection, Hand gesture recognition, Hand tracking

1. Introduction

Recently there has been a growing interest in developing natural interaction between human and computer. Several studies for human-computer interaction in universal computing are introduced. [1] The vision-based interface technique extracts motion information without any high cost equipments from an input video image. Thus, vision-based approach is taken into account an effective technique to develop human computer interface systems. For vision-based human computer interaction, eye tracking is a hot issue. Eye tracking research is distinguished by the emergency of interactive applications. However, to develop a vision-based multimodal human computer interface system, an eye tracking and their recognition is done. Real-time eye input has been used most frequently for disabled users, who can use only their eyes for input.

Hand gesture has been one of the most common and natural communication media among human being. The keyboard and mouse are currently the main interfaces between man and computer. Hand gesture recognition research has gained a lot of attentions because of its applications for interactive human-machine interface and virtual environments. Most of the recent works related to hand gesture interface techniques [1] has been categorized as: glove-based method [2, 3] and vision-based method. There are many vision-based techniques, such as model-based [4] and state-based [5] for locating objects and recognizing gesturers. Recently, there have been an increasing number of gesture recognition researches using vision-based methods. This paper introduces an eye and hand gesture recognition system to recognize 'dynamic gesture'.

2. Literature Review

2.1. EYE RECOGNITION

"Design and implementation of human computer interface tracking system based on multiple eye features". For human eye (Iris) detection, batch mode is employed. Iris tracking technique is implemented on static images. This technique simply works when the direction of iris is left, right or center. If the position of iris is up or down, it does not work. The system not works in real time. It is not expert to handle blinks and close eyes. [6]

This paper is aimed for designing and implementing a human computer interface system that tracks the direction of the human eye. The particular motion as well as direction of the iris is employed to drive the interface by positioning the mouse cursor consequently. The location of the iris is completed in batch mode. This means that the frames are stored in a permanent storage device and are retrieved one by one. Each of the frames is processed for finding the location of the iris and thereby placing the mouse cursor consequently. Such a system that detects the iris position from still images provides an alternate input modality to facilitate computer users with severe disabilities.

"Statistical models of appearance for eye tracking and eye blink detection and measurement".[7,8] Active Appearance Model (AAM) a proof-of- concept model for the eye region is created to determine the parameters that measure the degree of eye blinks. After developing an eye model, a blink detector is projected. The main advantage of using AAM technique is that the detailed description of the eye is obtained and not just its rough location. The main drawback of AAM technique is that it is designed to work for a single individual and additionally the blink parameters have to be identified in advance.

"Simultaneous eye tracking and blink detection with interactive particle filters". [9] Eye position is found using eye recognition algorithm. Then these filters are used for eye tracking and blink detection. For describing state transition, auto regression models are used. A statistical active

appearance model (AAM) is developed to track and detect eye blinking. The model has been designed for variations of head pose or gaze. During this paper, the model parameters which encode the variations caused by blinking are analyzed and determine. This international model is further extended using a series of sub-models to enable independent modeling and tracking of the two eye regions. Many techniques to enable measurement and detection of eye-blink are proposed and evaluated. The results of various tests on completely different image databases are presented to validate each model.

"Communication via eye blinks- Detection and duration analysis in real-time" [10] Initial eye blink is employed to find the eyes. The algorithm detects the eye blinks. The "Blink link" prototype can be used in order to get in touch with the device. Simply by considering the motion information among two consecutive frames and determining that if this motion is caused by blink, eyes are tracked and monitored constantly. This system is a real-time system. The disadvantage of this system is that it can only handle long blinks and is not able to handle short blinks. In case of short blinks it just simply avoids the blinks.

"MouseField: A Simple and Versatile Input Device for Ubiquitous Computing". [11] "MouseField" is a individual personal laptop or human computer interaction system that uses RFID reader and motion sensor. Especially the vision based face and hand motion tracking and gesture recognition is an attractive input mode for better human-computer interaction. Human gesture information has been variously employed in the game, virtual reality and other applications. Such gesture information is classified into the static gesture which uses spatial information only and the dynamic gesture which uses the spatial information and time information together. Since, the dynamic gesture can presents various expressions and it is considered as a natural presenting technique. Such motion information can be acquired by both using device-based interface and vision-based interface. The device-based interface technique gets motion information by motion capture devices and marker. However, the vision-based interface technique extracts motion information from input video image without any high cost equipments. Thus, vision-based approach is considered an effective technique to develop human computer interface systems. For vision-based human computer interaction, eye and hand tracking is hot issue. Eye tracking search is distinguished by the emergence of interactive applications.

Although various interaction technologies for handling information in the present computing atmosphere have been proposed, some techniques are too easy for performing human computer interaction, and others require special expensive equipments to be set up everywhere, and cannot quickly be accessed in our daily environment. In this, a new simple and versatile input device called the MouseField that enables users to control various information appliances easily without large amount of expenses. [11] MouseField consists of an identification recognizer and motion sensors that can detect an object and its movement after the object is placed on it. The system can easily translate the user's actions as a command to control the flow of information. A robust and versatile input device called the MouseField that can be used at almost any place for controlling information appliances. MouseField is a device that combines ID reader and motion sensing devices into one package.

HAND GESTURE IDENTIFICATION

Glove-based gesture interfaces require the user to wear a device, and generally carry a load of cables that connect the device to a computer.

Huang et al. [12] use 3D neural network method to develop a Taiwanese Sign Language (TSL) recognition system to recognize 15 different gestures. This paper presents sign language recognition system which consists of three modules: model-based hand tracking, feature extraction, and gesture recognition using 3D Hopfield neural network (HNN).

David and Shah [13] propose a model-based approach by using a finite state machine to model four qualitatively distinct phases of a generic gesture. Hand shapes are described by a list of vectors and then matched with the stored vector models. The seven gestures are representatives for actions of Left, Right, Up, Down, Grab, Rotate, and Stop.

Darrell and Pentland [14] propose space-time gesture recognition method. This paper presents a method for learning, tracking, and recognizing human gestures using a view-based approach to model both object and behavior. Signs are represented by using sets of view models, and then are matched to stored gesture patterns using dynamic time warping.

Starner et al. [15] describe an extensible system which uses one color camera to track hands in real time and interprets American Sign Language (ASL). They use hidden Markov models (HMMs) to recognize a full sentence and demonstrate the feasibility of recognizing a series of complicated series of gesture. Instead of using instrumented glove, they use vision-based approach to capture the hand shape, orientation and trajectory. The vision-based method selects the 3-D input data as the feature vectors for the HMM input, other HMM-based [16, 17] hand gesture recognition systems have also been development. Liang et al. [118] develop gesture recognition of TSL by using Data-Glove to capture the flexion of 10 finger joints, the roll of palm and other 3-D motion information.

Cui and Weng [19] develop a non-HMM-based system which can recognize 28 different gestures in front of complex backgrounds. Nishikawa et al. [20] propose a new technique for description and recognition of human gestures. The proposed method is based on the rate of change of gesture motion direction that is estimated using optical flow from monocular motion images.

Nagaya et al. [21] propose a method to recognize gestures using an approximate shape of gesture trajectories in a pattern space defined by the inner-product between patterns on continuous frame images. Heap and Hogg [22] present a method for tracking of a hand using a deformable model, which also works in the presence of complex backgrounds. The deformable model describes one hand posture and certain

variations of it and is not aimed at recognizing different postures.

Zhu and Yuille [23] develop a statistical framework using principal component analysis and stochastic shape grammars to represent and recognize the shapes of animated objects. It is called flexible object recognition and modeling system (FORMS). Lockton et al. [24] propose a real-time gesture recognition system which can recognize 46 ASL letter spelling alphabet and digits. The gestures that are recognized by [25] are 'static gestures' of which the hand gestures do not move. Different from [25], this paper introduces a hand gesture recognition system to recognize 'dynamic gesture'.

3. Goal of the system:

1. Facilitating the handicapped in using the computer
2. Controlling the mouse pointer through eye and hand gesture
3. Human computer interaction provides real time eye tracking and hand gesture estimation

4. Objectives of the system:

1. Easy interaction with computer without using mouse
2. Limitation of stationary head is eliminated.
3. Pointer of the mouse will move on screen where the user will be looking & the clicks will be performed by blinking.

5. Proposed System

Controlling mouse cursor by using eye and hand fusion technique. Chess playing is an application of this system.

VARIOUS GESTURE

 = Move the **Knight** Right two step and then up

 = Move the **Knight** Right two step and then down

 = Move the **Knight** Left two step and then up

 = Move the **Knight** Left two step and then down

 = Move the **Knight** Up two step and then right

 = Move the **Knight** Up two step and then left

 = Move the **Knight** down two step and then left

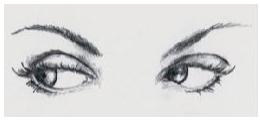
 = Move the **Knight** Down two step and then right

 = Move **Pawn** Upward

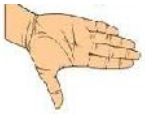
 = Move **Pawn** diagonally Right to kill

 = Move **Pawn** diagonally Left to kill

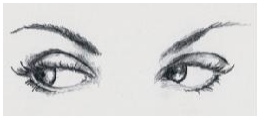
 = Move **Bishop** diagonally leftward - UP

 +  = Move

Bishop diagonally rightward - UP

 +  = Move

Bishop diagonally leftward - down

 +  = Move

Bishop diagonally rightward - down

 +  = Move

Rook left

 +  = Move

Rook Right

 +  = Move

Rook Up

 +  = Move

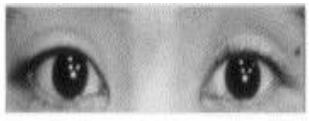
Rook Down

 +  = Move

Queen Right

 +  = Move

Queen Left

 +  = Move

Queen Up

 +  = Move

Queen Down

 +  = Move

King Right

 +  =

Move **King** Left

 +  =

Move **King** Up

 +  = Move

King Down

	START / STOP
	Move piece by one space
	Move piece by two space

	Move piece by three space
	Move piece by four space

6. CONCLUSION

This paper focused on the analysis of the development of PC using human eyes and hand gesture. The mouse pointer is operated using eye and hand gesture. The most unique aspect of this system is that it does not require any wearable attachments. This makes the interaction more efficient and enjoyable. A user interface is the system by which human interact with a computer.

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