Eye Gaze Interaction System for Disabled People

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Abstract- *The system has been developed to provide computer access for the people with motor disabilities (A software based solution). The system captures the user's eye movements with a web/video camera and translates them into the movements of mouse pointer on the screen.*

Even though various input devices are available in modern computer world, researchers are trying to find a Easier way of Interaction. Human computer interaction using eye gaze is the effective method than others and also one of the Easier way to Interact with Computer is using Image based Eye Tracking Technique. Using Webcam, images are obtained and processed to locate its iris center. This is used to estimate the eye gaze. The cursor can be moved in desired direction on the screen based on the estimated eye gaze.

Keywords- Eye-gaze, image processing, OpenCv

I. INTRODUCTION

Typical Human-computer Interface consists of Devices for presenting output and recognization of input data. Traditionally a keyboard and mouse are used as the input Device. Input devices mentioned above are useless in case of paralyzed persons as result of serious diseases or accidents. Fortunately, persons with motor dysfunction can still vocalize their feelings and demands. It is extremely important for comfort of their live.

Human computer performance and popular use of webcam is common to construct Human computer Interaction Systems by using video processing and computer vision techniques. All the systems used currently have some separate hardware components and few electronic components.

The proposed system has been developed to provide computer access for the people with motor disabilities. The system captures the user's eye movements with a web/video camera and translates them into the movements of mouse pointer on the screen. Even though various input devices are available in modern computer world, researchers are trying to find a Easier way of Interaction. Human computer interaction using eye gaze is the effective method than others and also one of the Easier way to interact with Computer is using Image based Eye Tracking Technique. Using Webcam, images are obtained and processed to locate its iris center. This is used to estimate the eye gaze. The cursor can be moved in desired direction on the screen based on the estimated eye gaze.

II. LITERATURE SURVEY

Tomasz koecjko says that a real time day light based eye gaze tracking system.The proposed solution consists of two cameras,IR markers and few Electronic components.In dual camera one camera is used for eye tracking while second one controls position of head relative to the screen and there are some limitations Two detection algorithm have been detected and developed.the proposed system requires a specific hardware setup with few electronic components.setting up these requirements in all the environments is not possible.the detection algorithms has complex computational steps[1].

Shrikant kulkarani,manojh and suman david says that Webcam can be used for gesture recognition and tracking of gestures, but the performance of the system gets degraded when various illuminous environments are used while gesture recognition. This system proposes a technique for improving the performance of the gesture reogintion system by reducing the error rate of system in various illuminated environments.
The system uses an algorithm known as K-nearest Neighbour algorithm. This algorithm calculates the similarity between two neighboring pixels and classifies the pixels accordingly. The webcam captures the frames of images from the environments and illumination of the environment is done for reducing unwanted noise. Motion and skin is detected using the frames from the webcam. The face is segmented and relative motion of the eye alone is tracked from the skin detected frame. According to the relative location of the eye, the gesture recognition system issues the control signals to the syste. these control signals move the cursor to the relative coordinates on the screen. This movement of mouse cursor can be utilized or explained to control the computer system.

K-nearest neighbor algorithm involves many calculations for detecting the skin from the background noises. This redues the performance of the system but provides more accuracy when it comes to various illuminated environments[2].

Dong yung hoo, myung jin chung says that The proposed system consists of five light sources and two cameras and the direction of the users and the direction of the users eye gaze can be computed by the projective property without computing the geometrical relation among the eye, the cameras and the monitor in 3d space.

The proposed system requires a specific hardware setup with few electronic components such as IR LEDs. setting up these requirements in all the environments is not possible. The detection algorithms has complex computational steps. junghoon park, taeyoung jung, kangbim yim says that the paper proposes a modified pupil central corenal reflection(PCCR) hardware method to improve the system accuracy. The modified PCCR eye gaze tracking system supplemented by the relation between IR LED position and the distance from the eye gaze tracking accuracy within one degree. The system also suggests a circuit that can be do power control adaptively between the minimum and maximum power. A specific hardware prototype is required to be set. Setting up these requirements in all environments is not possible. It incurs additional hardware cost[3].

III. METHODOLOGY

A. Face Detection and Eye Detection

Object Detection using Haar feature-based cascade classifiers is a object detection method propose .It is a machine learning based approach where a cascade function is trained from a lot of positive and negative images. It is then used to detect objects in other images.

OpenCV comes with a trainer as well as detector. If you want to train your own classifier for any object like car, planes etc. Here we will deal with detection. OpenCV already contains many pre-trained classifiers for face, eyes, smile etc. Those XML files are stored in openCv/data/haarcascades/ folder

First we need to load the required XML classifiers. Then load our input image (or video) in grayscale mode. then we find the faces in the image. If faces are found, it returns the positions of detected faces as Rect(x,y,w,h). Once we get these locations, we can create a ROI for the face and apply eye detection on this ROI (since eyes are always on the face !!!).

B. Iris detection and center point localization

The iris and pupil boundary is localized using Circular Hough Transformation. Opencv provides Hough Circles function to find circles in the capturing frames using Hough circle Transform. A circle is drawn around the iris. From the detected circle in ROI of eyes(right eye) we can able to find the center point of the iris. The size, orientation and other attributes of iris also can be derived from the drawn circle.

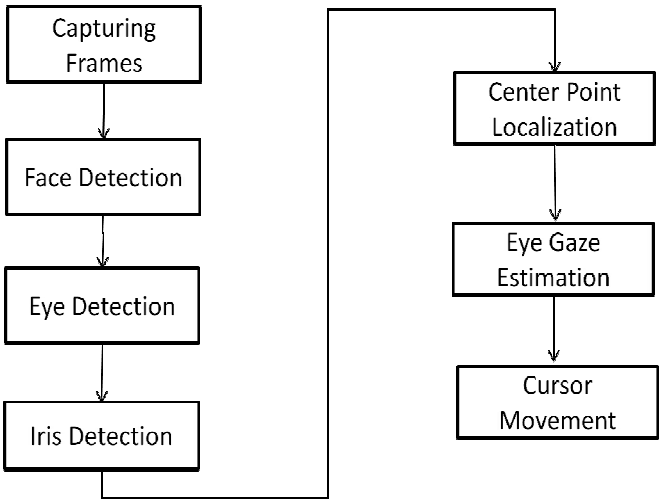
C. Track Motion & Gaze Estimation

Motion of the detected center point of the iris tracked by template matching method. OpenCV provides this in a function, match Template().It returns the location of template in the subframes to be tracked with min Max locations. By mapping the movements of this template around the ROI of face with the screen coordinates, the appropriate gaze point on the screen can be detected.

D. Cursor movements and events

Estimated gaze point will be replaced by the cursor movements. Click events can be done by dwell time(time spent in the same position).Windows provides mouse handling methods such as GetCursor Pos(),SetCursor Pos().

a) Functional flow



IV. IMPLEMENTATION

A. Microsoft Visual Studio

Microsoft Visual Studio is an integrated development environment (IDE) from Microsoft. It is used to develop computer programs for Microsoft Windows, as well as web sites, web applications and web services. Visual Studio uses Microsoft software development platforms such as Windows API, Windows Forms, Windows Presentation Foundation, Windows Store and Microsoft Silverlight. It can produce both native code and managed code. Visual Studio includes a code

editor supporting IntelliSense (the code completion component) as well as code refactoring. The integrated debugger works both as a source-level debugger and a machine-level debugger. Other built-in tools include a forms designer for building GUI applications, web designer, class designer, and database schema designer.

It accepts plug-ins that enhance the functionality at almost every level—including adding support for source-control systems (like Subversion) and adding new toolsets like editors and visual designers for domain-specific languages or toolsets for other aspects of the software development lifecycle (like the Team Foundation Server client: Team Explorer).Visual Studio supports different programming languages and allows the code editor and debugger to support (to varying degrees) nearly any programming language, provided a language-specific service exists. Built-in languages include C, C++and C++/CLI(via VisualC++), VB.NET(via Visual Basic .NET), C# (via Visual C#), and F#(as of Visual Studio 2010). Support for other languages such as M, Python, and Ruby among others is available via language services installed separately.

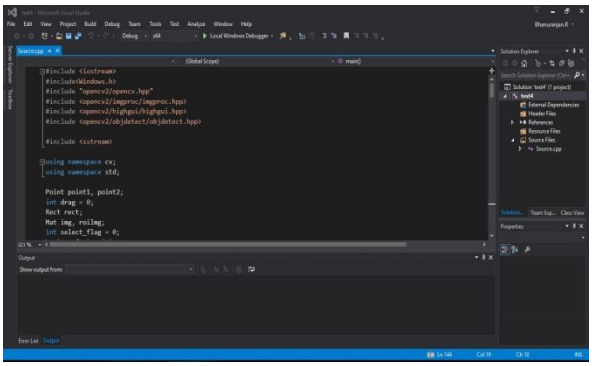
It also supports XML/XSLT, HTML/XHTML, JavaScript and CSS. Java (and J#) were supported in the past. Before Visual Studio 2015, Commercial versions of Visual Studio were available for free to students via Microsoft's Dream Spark program, when only commercial versions supported plugins. Starting with Visual Studio 2015, Microsoft provides "Community" editions of its Visual Studio at no cost to anyone. The Community edition supports installing plugins.

B. OpenCV

OpenCV is a library of programming functions mainly aimed at real-time computer vision, originally developed by Intel's research center in Nizhny Novgorod (Russia), later supported by Willow Garage and now maintained by Itseez. The library is cross-platform and free for use under the open-source BSD license.

OpenCV is written in C++ and its primary interface is in C++, but it still retains a less comprehensive though extensive older C interface. There are bindings in Python, Java and MATLAB/OCTAVE. The API for these interfaces can be found in the online documentation. Wrappers in other languages such as C#, Perl, Ch, and Ruby have been developed to encourage adoption by a wider audience.

b) Implementation in Visual Studio

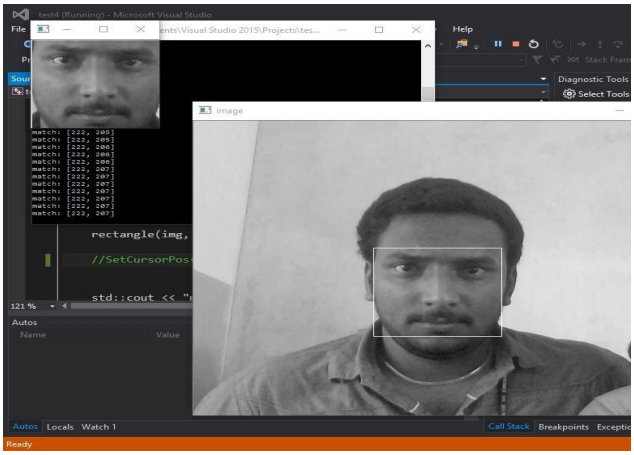


V. CONCLUSION

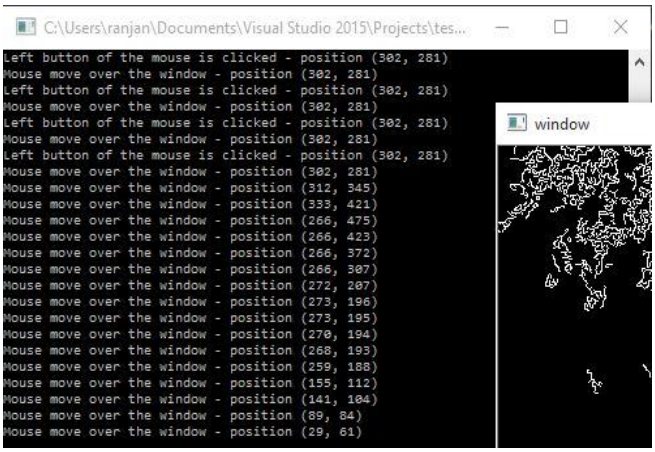
We have implemented the system in windows environment using visual studio IDE with Opencv library. We tracked the human eyes using template matching to provide computer access for the disabled people.

APPENDIX

c) Face detection



d) Cursor Movements using Template matching



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