Face and Voice Enabled Human Computer Interaction System For Disabled

Jessica Dias¹, Brinzel Rodrigues²

¹,²Information Technology, St. John College of Engineering and Management

Abstract—Face and Voice based system for better human-computer interaction is used for realtime tracking of a human head. This system uses an uncomplicated yet effectual face tracking algorithm and speech recognition. The objective of this system is to create an alternative user interface unambiguously using real time video of the user’s face acquired using a web-camera or using the voice commands for improved interaction with the computer system. The orientation of the head is tracked and regenerated into two-dimensional coordinates on a computer screen. Also it is supposed to identify an intentional blink which can be considered as a command from a user for the selection of a file or a program. Speech recognition module deals with giving voice commands to perform operations like click, double click etc. through the voice. This system helps in increasing the effectiveness of human-computer interaction as well as making it easier for disabled persons to communicate with the computer through face or voice.

Keywords—eye tracking mouse, assistive technology, voice commands, human-computer interaction

I. INTRODUCTION

There are various systems that help users in communicating with the ICT devices[1]. The most common category of devices in use clinically are voice-activated designs, mouth sticks, head gears, eye-trackers, and sip-and-puff or other mechanical switch designs. These systems can be physically or mentally tiring to the user, inappropriate for people with physical disabilities, or expensive [5]. Brain-controlled devices using electroencephalography (EEG) are convenient to individuals with a wide range of disabilities, but are very slow for practical use and not commercially available.

This paper presents a simple and effective low cost optical system for implementing mouse operations using processed head motion for people who are physically challenged and disabled. The system consists of several basic, off the shelf components including a web-cam, a headset and a computer. Images from the web-cam are analyzed using a combination of software in order to determine the position of the user’s head. This head position data is then transformed using a non-linear transformation into a corresponding screen position that is used to control the mouse pointer. Clicking operations can be accomplished either using the voice commands or the still Face position.

II. LITERATURE SURVEY

Several face enabled mouse system have been researched and implemented by other researchers. A brief survey of the following was made and these aggregated together which lead to proposed system.

In [1] they have researched that numerous intelligent devices, embedded into the home environment, can provide the resident with both movement assistance and 24-h health monitoring. The paper presented a simple and effective low cost optical system for implementing mouse operations using processed head motion. The author analyzed the building blocks of smart houses, with particular
attention paid to the health monitoring subsystem as an important component, by addressing the
basic requirements of various sensors implemented from both research and clinical perspectives.

The authors in [2] have discovered a technology that translates real time head movements of user
into corresponding cursor movement, and also performs clicks accordingly and provides a virtual
keyboard that can type words according to head motions as well as according to speech recognition
which both are very useful for the armless people. It also provides a way to access computer through
giving commands using Speech Recognition technology.

In [3] we came across a technology to replace the conventional mouse with the human face as a
novel way to interact with computer. Human face is a dynamic object and has a high degree of
unevenness. Using human face enabled mouse will help physically handicapped/Disabled people who
are suffering from a lot of problems in communicating with computer through their voluntary
movements like eyes and nose movements.

The paper[4] that introduces a new camera mouse driven by 3D model based visual human face
tracking technique. The facial movement was disintegrated into rigid and non-rigid movement. The
authors introduced this visual face tracking system that can robustly and accurately acquire the
motion parameters from video at realtime. After calibration, the acquired head location can be used
to navigate the mouse cursor, and the detection of head movement can be used to initiate mouse
events.

In [6], Nayel Al-Zubi et.al. developed a system that grants human access to computer in more natural
way than using hands. This new method allowed small head movements and eye blinks. This
method introduced a new horizon that replaced the traditional method of controlling computer. The
recommended solution not only offered a natural control method, but also allowed paralytic masses
to have an effortless and full control of computer. The proposed method investigated the power to
utilize facial expression for broader access.

III. IMPLEMENTATION

Face/eye enabled mouse for disabled is a system that can be used by people who are
physically challenged and not able to use the computer. This system will easily permit the disabled
people to perform functions of a computer mouse by just accomplishing head and eye movements.
This system can be integrated with other applications where mouse operations play a major role.
Also, for normal people, this system has a great advantage. Normal users can perform their precision
work with their hands while operating the mouse with their face. Artificial markers are used as
feature points.

This paper also expands the system to normal as well as physically challenged user who can
give voice commands for performing operations like click, double click, browsing and predefined
commands for opening some useful application. For example, the phrase “My Computer” will open
my computer interface for the user.

Fig.1 explains the proposed architecture of our system. User will be provided a User Interface
in which the user will be able to initiate various functions & view the real time streaming of video
from the web camera. Also users can set various parameters from this interface so as to run the
system under various constraints.

The user interface will give a native call to the core application written in c++. Here we
would first enable the hardware device drivers for the Web Camera & Microphone. After this we
will capture the live video from the camera.
The video captured will be processed. The details of the first frame will be captured and stored in a temporary file. This will be compared with the next frame & the details of the Face transition / movement will be stored & provided to the mouse scaling module.

At the Mouse scaling module, the position of the head would provide the coordinate value for the mouse cursor. Any transition to the head position would provide us with the mouse movement.

Figure 1: Architecture of the system

The second part of this system consists of Audio enabled navigation. Speech / Voice Commands are used for performing Clicks. The voice recognized is being mapped with the best matched commands and the necessary operation is performed. Basic commands like left clicks & right clicks can be performed by pronouncing the words “Left”, “Right” and also predefined commands for opening some useful application are set in the system.

The interpreter analyzes the input received from the system either by Video Stream or Audio Stream and then performs the necessary mouse pointer movements or button clicks as initiated by the user.

IV. RESULTS AND DISCUSSIONS

In Figure 2, system starts face tracking to perform mouse operations. After starting the tracker, video capturing source is selected as shown in Fig.3. Camera can be externally attached web-cam or PC Camera.

Figure 2: Opening the tracker
Figure 3: Opening the web-cam for facial recognition

Figure 4: Loading Faces

Figure 5: Feature Extraction
After the initialization of camera, Face is detected and feature extraction is done to get the steady position. This position is then taken as the starting point and then any change in the position of head leads to the change in the position of mouse cursor on the desktop.

![Opening the speech recognition window](image1)

*Figure 7: Opening the speech recognition window*

![Opening “This PC” using voice command](image2)

*Figure 8: Opening “This PC” using voice command*

After giving the command “This PC”, the window opens for further navigation.
V. CONCLUSION AND FUTURE WORK

In this system, we presented a system that will help the disabled people to perform mouse operations easily by using their face movements and/or voice with the help of easily available components and devices like web-camera and head-set.

The future work in our project will include the application of this system in various gaming applications which will include mouse operations that involves just head movements. Also, enhanced voice commands can be added to the system which will make this system more optimized.

REFERENCES


IV. Jilin Tu; T. Huang; Hai Tao, “Face as mouse through visual face tracking,” The 2nd Canadian Conference on Computer and Robot Vision, 2005, IEEE.
