ISSN: 2366-1313

HUMAN-COMPUTER INTERACTION BASED EYE CONTROLLED MOUSE

[1]K. SRILATHA, [2]K. AKHIL, [3]V. SRINATH, [4]P. VIKAS

[1]Assistant Professor, Dept.of CSE, Teegala Krishna Reddy Engineering College, Meerpet, Hyderabad,

kumbamsrilatha@tkrec.ac.in

[2]BTech student, Dept.of CSE, Teegala Krishna Reddy Engineering College, Meerpet, Hyderabad,

akhilindiago@gmail.com

[3]BTech student, Dept.of CSE, Teegala Krishna Reddy Engineering College, Meerpet, Hyderabad,

vislavatharinath25@gmail.com

[4]BTech student, Dept.of CSE, Teegala Krishna Reddy Engineering College, Meerpet, Hyderabad,

pathlavathvikas1999@gmail.com

Abstract: *With advanced technologies in this digital era, there is always scope for development in the field of computing. Hands-free computing is in demand today it addresses the needs of quadriplegics. This paper presents a Human-computer interaction (HCI) system that is of great importance to amputees and those who have issues with using their hands. The system built is an eye-based interface that acts as a computer mouse to translate eye movements such as blinking, gazing, and squinting towards the mouse cursor actions. Moving the pointer along with the screen using a computer mouse or by moving one's finger has become fairly common in today's technology. Every movement of the mouse or finger is detected and mapped to the movement of the pointer by the system. Because their arms are not functioning, certain people, known as "amputees," will be unable to use the present technology to use the mouse. If the amputee's eyeball and facial features, as well as the direction in which their eye is staring, can be recorded, the movement of the facial features may be transferred to the cursor, allowing the amputee to move the cursor at whim. An 'eye-tracking mouse' is a gadget that tracks the user's eye movements. The project relies on mapping facial traits to the cursor to recognize and capture them in the video. When the camera is opened, the application must extract all of the video's frames. Since the video's frame rate is typically around 30 frames per second, every frame will be processed in about 1/30th of a second.*

Keywords: *Human-computer interaction, Eye-tracking mouse, OpenCV.*

I. INTRODUCTION

ISSN: 2366-1313

With the proceeding of computer science and technology, the usage of computers has brought about significant facilitation in every aspect of society. However, the common computer input devices are usually designed for normal capable users, instead of elderly and disabled ones. The use of computers requires a mouse, a touchpad, a keyboard, or other external devices. Users with upper limb disabilities are incapable of controlling the mouse or keyboard easily, which makes it extremely difficult for them to use a computer. For common computer users, the long-term usage of conventional input devices causes chronic soreness in hands, shoulders, or neck, and greatly increases the risk of getting cervical or vertebral spondylosis.

In order to facilitate the disabled use of computers, extensive work has been carried out and two kinds of solutions are presented. The first solution is to use contact-type auxiliary equipment, e.g., infrared sensors and infrared reflectors, to detect the user's movements to control a computer. Takami et al. invented a special kind of eyeglasses with three light-emitting diodes. By sitting in front of a computer with eyeglasses, the user's image will be captured by the camera, and the head movements are judged, so as to operate the computer. Evans et al. used infrared light-emitting diodes and photodetectors as auxiliary equipment to determine the user's head position to operate a computer. Chen et al. produced a mouse and a keyboard that can detect infrared signals.

The computer mouse or moving the finger has been a very common approach to moving the cursor along the screen in the current technology. The system detects any movement in the mouse or the finger to map it to the movement of the cursor. Some people, who do not have their arms to be operational, called 'amputees' will not be able to make use of the current technology to use the mouse. Hence, if the movement of their eyeball can be tracked and if the direction towards which the eye is looking can be determined, the movement of the eyeball can be mapped to the cursor and the amputee will be able to move the cursor at will. An 'eye tracking mouse' will be of a lot of use to an amputee.

to make use of the present technology to use the mouse. Hence, if the movement of their eyeball is tracked and if the direction towards which the attention is observed may be determined, the movement of the eyeball is often mapped to the cursor and therefore the amputee is ready to move the cursor at will. An 'eye tracking mouse' is going to be of plenty of use to an amputee Currently, the attention tracking mouse

ISSN: 2366-1313

isn't available at an outsized scale, and only some companies have developed this technology and have made it available. We will prepare a watch tracking and facial landmarks-based mouse where most of the functions of the mouse are available, so the user can move the cursor using his face. We try and estimate the 'gaze' direction of the user and move the cursor along the direction along which his face is trying to move and click on operations are done by closing the proper or left eye.

Moving the pointer along with the screen using a computer mouse or by moving one's finger has become fairly common in today's technology. Every movement of the mouse or finger is detected and mapped to the movement of the pointer by the system. Because their arms are not functioning, certain people, known as "amputees," will be unable to use the present technology to use the mouse. If the amputee's eyeball and facial features, as well as the direction in which their eye is staring, can be recorded, the movement of the facial features may be transferred to the cursor, allowing the amputee to move the cursor at whim. An 'eye-tracking mouse' is a gadget that tracks the user's eye movements. The project relies on mapping facial traits to the cursor to recognize and capture them in the video. When the camera is opened, the application must extract all of the video's frames. Since the video's frame rate is typically around 30 frames per second, every frame will be processed in about 1/30th of a second. The application then goes through a series of steps to identify and map the characteristics of the video to the point. After the frame has been retrieved, the face areas must be identified. As a result, the frames will go through a set of image-processing routines to appropriately analyze the frame, allowing the algorithm to distinguish things like eyes, mouths, and noses.

II. LITERATURE SURVEY

This chapter discusses the application of eye movements to user interfaces, both for analyzing interfaces (measuring usability) and as an actual control medium within a human-computer dialogue. For usability analysis, the user's eye movements are recorded during system use and later analyzed retrospectively; however, the eye movements do not affect the interface in real-time. As a direct control medium, the eye movements are obtained and used in real-time as input to the user-computer dialogue.

A survey on head-based Human-Computer Interaction which centers highlights, for example, head following, face and look acknowledgment, eye following, and

ISSN: 2366-1313

motion acknowledgment HCI is introduced by Porta (2002) and Turk (2004).

If the user sees the monitor, the center of a pupil is always in a polygon that is made by the glints. Consequently, the direction of the user's eye gaze can be computed without computing the geometrical relation between the eye, the camera, and the monitor in 3D space. Our method is comparatively simple and fast. We introduce the method and show some experimental results

The system consists of a standard electric wheelchair with an onboard computer, sensors, and a graphic user interface run by the computer. On the other hand, this eye-control method can be applied to handle graphical interfaces, where the eye is used as a mouse computer. Results obtained show that this control technique could be useful in multiple applications, such as mobility and communication aid for handicapped persons

The aim and scope of the journal are to emphasize research, development, and application within the fields of Scientific Research Engineering &Technology that support high-level of learning, teaching, development, and research. It is an international journal that aims to contribute to constant research and training to promote research in the relevant field.

A dream-based human PC connection point is introduced in the paper. The point of interaction distinguishes intentional eye squints and deciphers them as control orders. The utilized picture handling techniques incorporate Haar-like elements for programmed face location, and layout matched on eye following and eye-squint discovery. Interface execution was tried by 49 clients (of which 12 were with actual inabilities). Test results show interface helpfulness in offering an elective mean of correspondence with PCs. The clients entered English and Polish text (with the normal season of under 12s per character) and had the option to peruse the Internet. The connection point depends on a scratch pad outfitted with a common web camera and requires no additional light sources. The point of interaction application is accessible online as open-source programming.

The past frameworks utilized complex calculations. They depended on the biometric recognizable proof procedures. Some expected to mount gadgets on the client like Lasers which was not practical. Subsequently, our point is to devise an application that will be savvy and not be subject to biometrics but rather to the element arrangements of the client. It

ISSN: 2366-1313

ought to utilize less equipment and less difficult calculations. The goal is to utilize such a framework that will help the upper appendage crippled who can't utilize the conventional mouse or console. Inconveniences of Existing System:

The current framework is restricted to the biometric recognizable proof. To upgrade this, we have utilized the component arrangement strategy.

III. PROPOSED METHODOLOGY

Implementation is the system in which the theoretical concept will become a functioning device. a load of resistance and the impact on cutting-edge tactics is shifting to the purchaser branch at this factor. If the implementation procedure isn't always planned and controlled, it will result in confusion, consequently, the maximum crucial stage in the improvement of a new gadget and the user ought to believe that the brand new gadget will work and be affective. The technique of the usage of the constructed gadget is known as implementation. This includes all operations for the usage of the brand-new software. the principal challenge inside the corporation is to make sure that the structures' tactics are strolling efficiently as soon as the making plans is entire. Such specifications should be met earlier than the implementation process.

FUNCTIONALITIES USED

The project stage known as implementation is where a theory concept is put into practice. The user department now has the primary task, the biggest uprising, and the most impact on the present system. If the implementation is not adequately planned and supervised, this could result in confusion and uncertainty. All the tasks necessary to transfer the old system to the new one are part of the implementation. The new system could be a substantial upgrade to an existing system or it could completely replace an existing human or automated system. An effective framework that satisfies the needs of the company requires proper execution. Even though the company may not get better if the new system is implemented correctly, it will avoid improper installation. In the phase of implementation, the following activities are involved: -

- Towards careful planning
- System and constraints investigation
- Design of change-making methods
- The personnel in the changeover phase are being trained
- Assessment of the method of change.

ISSN: 2366-1313

The process of implementation and the timeline are initially established. The program is then thoroughly examined, and users are instructed in the most recent methods. The final installation of the program in its intended context, user satisfaction, and device activity are all included in software deployment. In many organizations, someone who does not operate the software project will be commissioned. Those who are not persuaded that the software will make their jobs easier. They first have doubts about the program, but we must ensure that they do not grow as one must assure that

- The active user must know how the system works

IMPLEMENTATION:

The objective of execution is to make a code that is not difficult to peruse and comprehend. This is the most essential stage in procuring productive programming or a system and giving the client a positive that the new programming or the structure is practical and gives convincing results. The source code should be clear with the end goal that the investigating, testing, and adjustments can undoubtedly finish. As they consume a huge piece of programming spending plans. In exact execution manages the nature of code, blunder expulsion, and execution. This stage includes coding styles procedures, norms, and rules.

In this phase, the designs are translated into code. Computer programs are written using a conventional programming language or an application generator. Programming tools like Compilers, Interpreters, and Debuggers are used to generate the code. Different high-level programming languages like PYTHON 3.6 and Anaconda Cloud are used for coding. With respect to the type of application, the right programming language is chosen.

In this phase, the system is tested. Normally programs are written as a series of individual modules, this subject to a separate and detailed test. The system is then tested as a whole. The separate modules are brought together and tested as a complete system. The system is tested to ensure that interfaces between modules work (integration testing), the system works on the intended platform and with the expected volume of data (volume testing) and that the system does what the user requires (acceptance/beta testing).

Inevitably the system will need maintenance. The software will definitely undergo change once it is delivered to the customer. There are many reasons for the change. The change could happen because of some unexpected input values into the

ISSN: 2366-1313

system. In addition, the changes in the system could directly affect the software operations. The software should be developed to accommodate changes that could happen during the post-implementation period.

Currently, for face detection, perhaps deep learning models perform the best. But face detection was there before the emergence of deep learning as well. Earlier, classical feature descriptors and linear classifiers were a really good solution for face detection. And the Dlib library provides one such classical solution for face detection. That is, HOG and Linear SVM.

This is based on the **HOG** (Histogram of Oriented Gradients) feature descriptor with a **linear SVM** machine learning algorithm to perform face detection.

HOG is a simple and powerful feature descriptor. It is not only used for face detection but also it is widely used for object detection like cars, pets, and fruits. HOG is robust for object detection because object shape is characterized using the local intensity gradient distribution and edge direction.

Step1: The basic idea of HOG is dividing the image into small connected cells

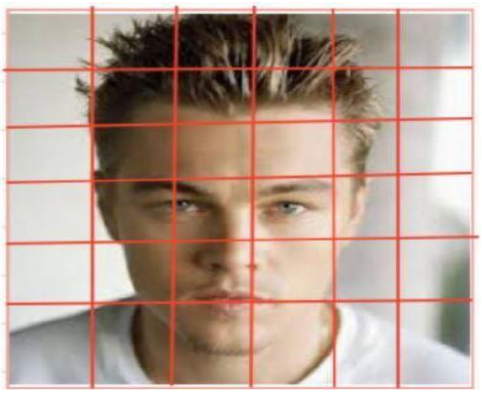


Fig.1 Dividing an image into cells

Step2: Computes histogram for each cell

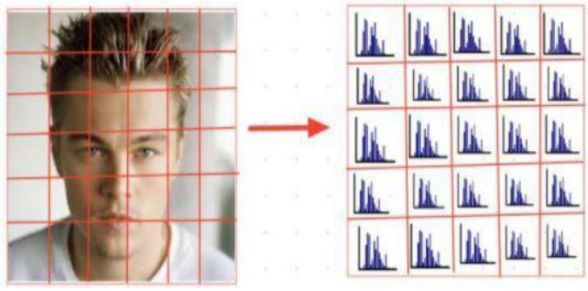


Fig.2 Cell to Histogram

Step3: Bring all histograms together to form feature vector i.e., it forms one histogram from all small histograms which is unique for each face

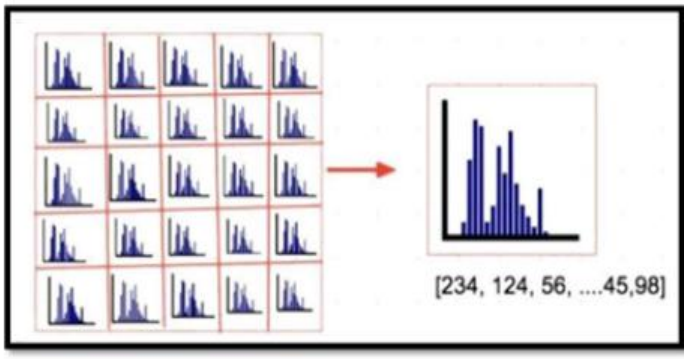


Fig.3 Histogram to feature vector

Steps:

- Record Video

ISSN: 2366-1313

- Convert Video into Frames
- Convert frame into Grayscale
- Find Counter and Edges in the image
- Load Facial Landmark Dataset
- Identify Eye and Mouth in the Frame
- Find Aspect Ratio of Eye and Mouth
- Eye Blink and Head Moment Detection
- Handling Mouse Operations
- Handling Mouse Operations

SYSTEM ARCHITECTURE

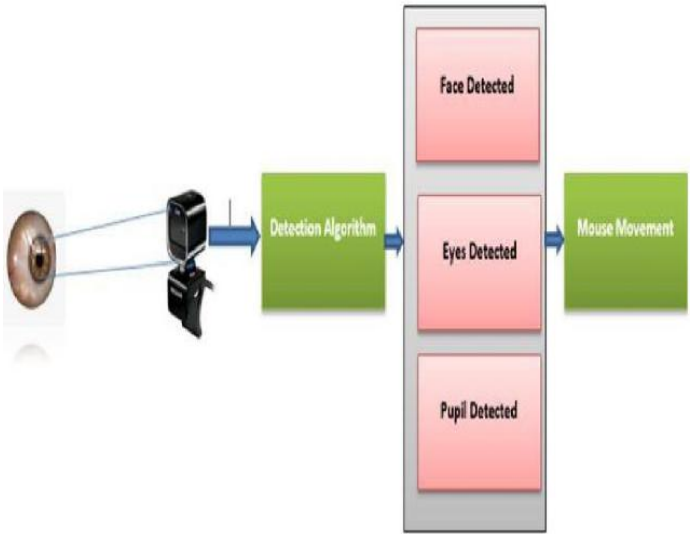
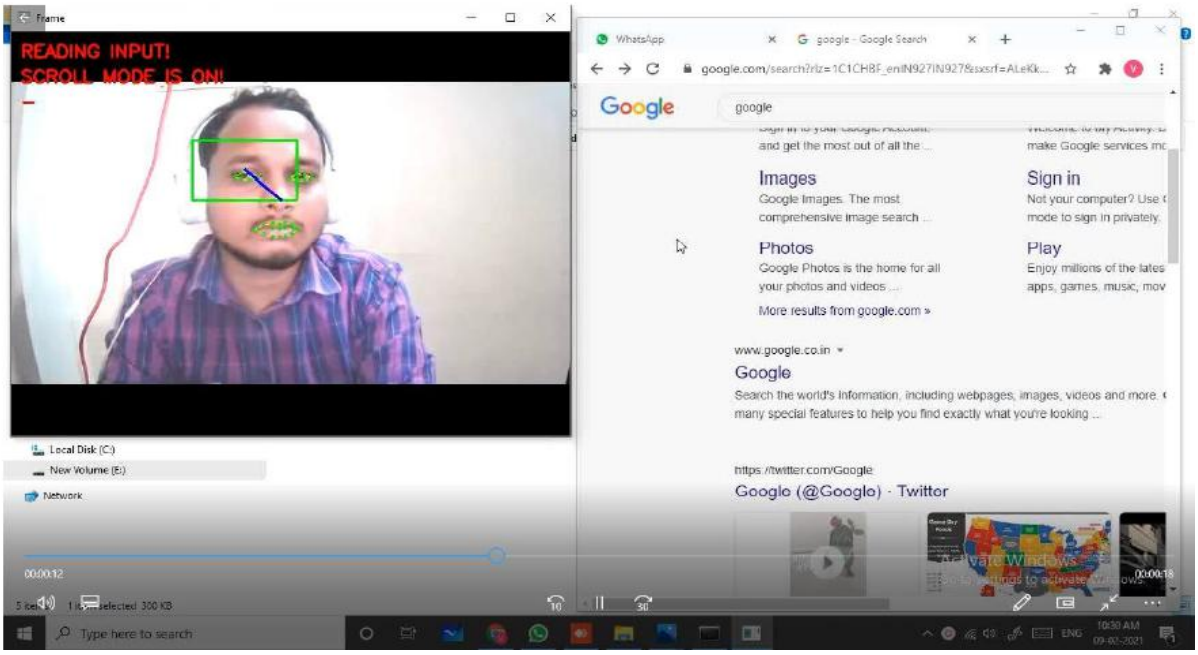
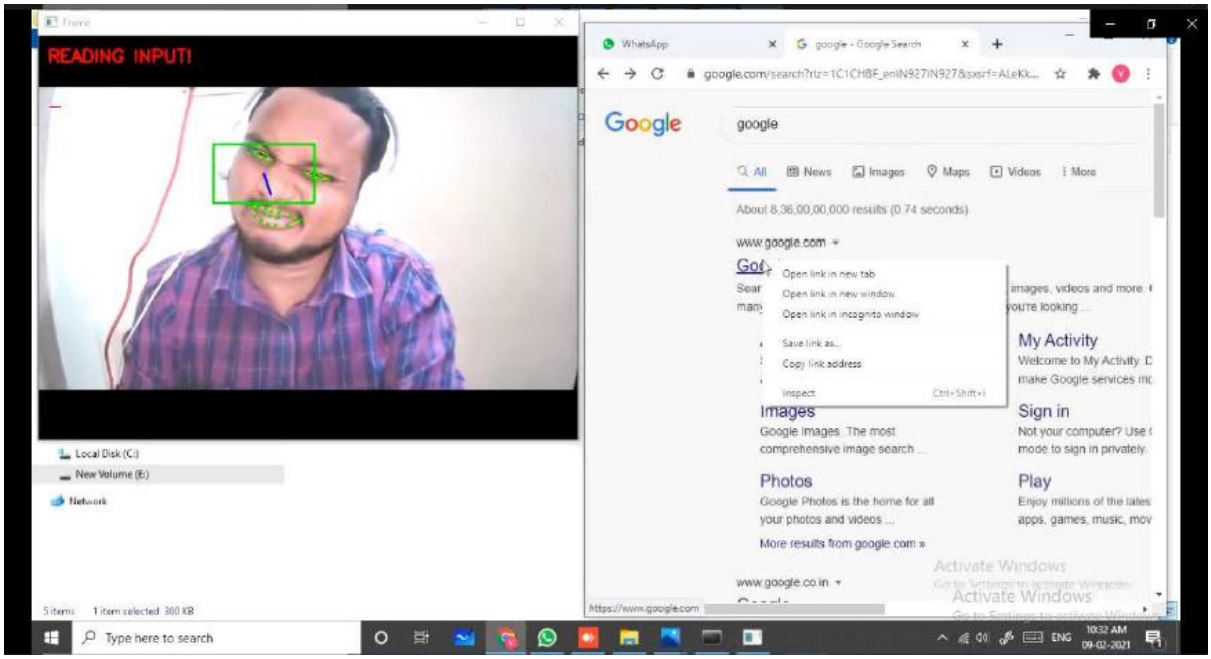


Fig.4 System architecture.

IV. RESULTS AND DISCUSSIONS



ISSN: 2366-1313



V. CONCLUSION

This work can be extended to improve the speed of the system by using better-trained models. Also, the system can be made more dynamic by making the change in the position of the cursor, proportional to the amount of rotation of the user's head, i.e., the user can decide, at what rate he wants the position of the cursor to change.

Also, future research work can be done on making the ratio more accurate, since the range of the values is the result of the aspect ratios, which are usually small. Hence, to make the algorithm detect the actions more accurately, there can be some modifications in the formulae for the aspect ratios used. Also, to make the process of detection of the face easier, some image processing techniques can be used before the model detects the face and its features of the face.

REFERENCES

1. Alex Poole and Linden J. Ball, "Eye Tracking in Human-Computer Interaction and Usability Research: Current Status and Future Prospects," in Encyclopedia Human-Computerter Interaction (30 December 2005) Key: citeulike:3431568, 2006, pp. 211-219.
2. D. H. Yoo, J. H. Kim, B. R. Lee, and M. J. Chung, "Non-contact Eye Gaze Tracking System by Mapping of Corneal Reflections," in Fifth IEEE International Conference on Automatic Face and Gesture Recognition (FGR02), 2002, pp. 94-99.
3. Rafael Barea, Luciano Boquete, Manuel Mazo, and Elena Lpez,

ISSN: 2366-1313

"System for assisted mobility using eye movements based on electrooculography," IEEE TRANSACTIONS ON NEURAL SYSTEMS AND REHABILITATION ENGINEERING, vol. 10, no. 4, pp. 209-217, DECEMBER 2002.

4. H. Singh and J. Singh, "A Review on Electrooculography," International Journal of Advanced Engineering Technology, vol. III, no. IV, 2012.
5. K. Irie, B. A. Wilson, and R. D. Jones, "A laser-based eye-tracking system," Behavior Research Methods, Instruments, & Computers, vol. 34, no. 4, pp. 561-572, 2002.
6. P Ballard and George C. Stockman, "Computer operation via face orientation," in Pattern Recognition, 1992. Vol.I. Conference A: Computer Vision and Applications, Proceedings., 11th IAPR International Conference on, 1992, pp. 407-410.
7. T. Horprasert, Y. Yacoob, and L.S. Davis, "Computing 3-D head orientation from a monocular image sequence," in Second International Conference on Automatic Face and Gesture Recognition, 1996, pp. 242-247.
8. K. Arai and M. Yamaura, "Computer Input with Human Eyes-Only Using Two Purkinje Images Which Works in a Real-Time Basis without Calibration," CSC Journals, vol. 1, no. 3, pp. 71-82, 2010.
9. D. Back, "Neural Network Gaze Tracking using Web Camera.," Linkping University, MS Thesis 2005. [10] R. Gonzalez and R. Woods, Digital Image Processing, 3rd ed.: Pearson Education, 2009.
10. P. Viola and M. Jones, "Rapid Object Detection using a Boosted Cascade of Simple Features," in COMPUTER VISION AND PATTERN RECOGNITION, 2001