Locomotor Disability Dexterity Interface

Abhishek Kumar Saw

Assistant Professor, Department of Computer Science & Engineering, Shri Shankaracharya Institute of ProfessionalManagement and Technology, Raipur, Chhattisgarh, India

ak.saw@ssipmt.com

Kashika Parmar

B. Tech (Scholar), Department of ComputerScience & Engineering, Shri Shankaracharya Institute of ProfessionalManagement and Technology, Raipur, Chhattisgarh, India

kashika.parmar@ssipmt.com

Aayush Mishra

B. Tech (Scholar), Department of ComputerScience & Engineering, Shri Shankaracharya Institute of ProfessionalManagement and Technology, Raipur, Chhattisgarh, India

aayush.mishra@ssipmt.com

Saurabh Kansara

B. Tech (Scholar), Department of ComputerScience & Engineering, Shri Shankaracharya Institute of ProfessionalManagement and Technology, Raipur, Chhattisgarh, India

saurabh.kansara@ssipmt.com

***Abstract*— Disability is a public health issue which is defined as the limitation or inability to accomplish a task or activity within the parameters thought to be typical for humans, in locomotive disability a person loses their ability to perform motor functions or in other words partial or complete paralysis, every human being today requires the help of a computer system which requires the ability of fingers. The target of this project is to create a interface which can help the disabled person interact with the operating system through their eyes, Here we are taking the help of the language python which provides us many libraries one of which is OpenCV, which provides us the feature of face detection and eye tracking.**

***Keywords*— Python, OpenCV, Face Detection, Eye Tracking**

I. INTRODUCTION

A regular person uses a computer with the help of conventional mouse and keyboard, using a mouse to control the cursor and keyboard for typing purposes. A mouse uses a sensor to track the movement across the surface and mimic the movement on the computer and a keyboard has all the alphanumeric keys, which when pressed, types that character as input to the computer. However, both the devices require the use of one's finger to operate, which is not possible in case of a locomotor disabled person. So, our project aims to solve this issue by removing the need of any physical device to give input to the computer. Similar to Stephen Hawking, our project will make use of one's facial dexterity to calculate mouse and keyboard inputs.

Locomotive Disability Dexterity Interface is a boon to the society which basically helps the person with locomotor disability to interact with the technologies present and keep up pace with the current world. This is an initiative of making a GUI interface that will interact with the human and their working senses will interact with the interface to produce a required outcome.

The proposed interface's objective is to make a virtual mouse system which basically identifies retina of the Eyes and administer the mouse operations for an OS, and this can be attained by the help of a webcam that seize the gestures captured and then processes these frames so as to perform definite mouse functions such as left click, right click, and scrolling function.

The project will be made using OpenCV. It is Platform independent and we can develop real time computer vision applications. It aspires to focus on image and video process and can extend an arm to throw lights on face detection and real time image and video processing.

The interpretation of 2D images into 3D models is done by Computer vision using remodeling algorithms. employing gear and software in computers to clone human visionaries.

II. Literature Review

Eyes are the most important of our senses it helps gather information and knowledge about the external world. So vision are important part of the whole body, the way we gaze through our eyes, the way we move our eyes or track a object throw our vision is associated with how we pay attention of our environment [1]. HCL used a method for eye gaze tracking which was proposed by Kyualg Nam Kim and S.R. Ramakrishnan by which eye gazing can be taken as input for the efficient use of computer interface, movements of the eyes where the focus of the research paper [2]. Ware and Mikaelian researchers presented some experiment for HCL, where some simple operation like positioning of the cursor and target selection were achieved, there are many techniques being used today by the industry for eye tracking [3]. OpenCV is platform independent means it can be used in any operating system like Windows, Linux, MacOS and etc. Concluding it means it is multi-platform framework, OpenCV has many capabilities and features if one can understand its working correctly, its functionality are many some of which are face detection and eye tracking [4]. OpenCV library is used in a research by the author Vandna Singh to apply Haar cascade classifier, to detect a face using Haar cascade classifier author uses two features of Haar i.e. firstly a image containing light background with slightly affected by illumination while the second one is majorly affected by illumination with complex background, Author used the default frontal face [5]. Using OpenCV for real-time face detection research paper by the author Mamta S.Kalas used three different algorithms for face detection that are Haar cascade, adaboost, template matching. The paper also describes about the applications of face detection [6]. The research paper on facial detection by Shervin Emami and Valentin Petrut Suciu used an open source computer vision, OpenCV, and the.NET framework to create an application that grants users access to equipment based on a thorough analysis of human facial motions. [7]. Facial detection and recognition is a application of image analysis and algorithm based calculations it is not only area of computer science or machine learning it has became a part of neuro-scientific and psychological studies to provides insights on how a human brain works [8]. Fabian Timm and Erhardt Barth in their paper Accurate Eye Centre Localization by Means of Gradients stated that many computer vision method fails in detecting eyes because of low resolution, low contrast or occlusions. So, they used the idea of image gradients which works simple objective function only consisting of dot products [9]. Gesture Recognition Based Mouse Events by author Rachit Puri states that recognizing gestures is a complex task which involves task like motion modeling, motion analysis, pattern recognition and machine learning [10]. V. Upasana, M. Joseph and Kanchana Venkatasubbaiah author states in their paper Virtual Mouse with RGB colored tapes that the application developed by them using Human-Computer Interaction approach seeks to perform or control mouse cursor tasks using a camera and computer vision technologies like gesture recognition. [11]. Eye movement is the subject of research in this field because eye-gaze is an input that has the potential to create an effective computer interface, a small 2D mark is employed as a reference to compensate for this movement [12].

III. Proposed Methodology and Algorithm

LDDI is an integration of computer vision and GUI programming OpenCV is FOS machine learning and computer vision software library. Computer vision is a field which is derived from Deep Learning (DL) and Artificial Intelligence (AI). It allows the computer to interpret important information from data such as films, videos, images, etc. Just like AI gives a machine the ability to think, Computer Vision gives the machine the ability to see, interpret, and visualise the given data.

Computer vision gives head drive to the field of AI by using image and videos to extract useful and informative data. There are a lot of similarities between how a computer processes an image and how a human eye processes an image. The context of computer is saved but you can’t really depend on humans brain.

Just like a human's eye performs these tasks by making use of the retina and other components of the eye, a computer program built using Computer Vision makes use of algorithms, previous data, and cameras. Nowadays, these

computers are built to perform multiple processes simultaneously, and error detection and debugging has now become fairly easy, surpassing human capabilities can now be seen feasible..

The algorithm of the project is defined in the following steps:

A. We will turn on the system and the web cam will start capturing live visuals of the environment, to achieve this proper lighting should provided to prevent any type of intrusion of the live visuals.
B. The facial key point detector will determine the face and the eyes using the predefined ideal coordinates of the face, this method is highly accurate and speed is not an issue for live tracking.
C. Specific ideal coordinate will be stored to identify the retina position of both eyes so to have a normalized position of the retina, let the coordinate of the eyes be x and y when the retina will move towards right side it will increment the points travelled in the x and when the retina will move towards left it will decrement the point travelled in x.
D. Similarly, when the retina of the eyes will move upwards it will increment the y coordinates and when the retina of the eyes will move in downward direction it will decrement the coordinates of y this way our project will be able to determine or track the position of the retina in every point through coordinates
E. Now for left or right blinking if the OpenCV doesn't capture any retina or eye movement for 2-3 second means the eyes are closed if the user shut the right eyes it will be taken as right blinking and similarly for the left it will be taken as left blinking
F. The live coordinates or the track of the retina will be given as the value live to the virtual mouse or the cursor and the left/right blink will be given as the value for right/left click, hence the user will be able to interact with the operating system through eyes.

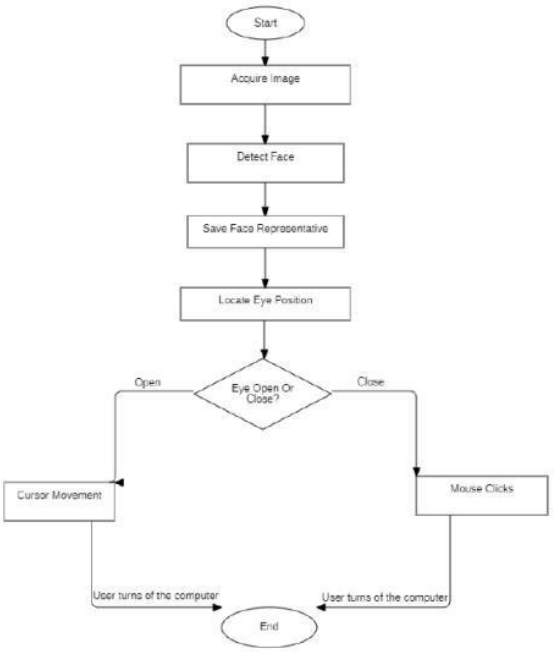

Fig 1: Flow Chart

In Fig.1 the flow chart starts by acquiring the image through web cam or any live image capturing device it detects the face through the algorithms then save the image representative.

Basically it saves the structure of the face and generates coordinates around it.

Then it locates the position of the eye with the help of those coordinates more importantly it locates the coordinates of the retina of the eyes.

Then in the fig.1 flow it decides whether the eyes are open or closed by determining the input of the coordinates are there or not.

If it's there then the eyes are open so it will provide the live coordinates to the mouse cursor

If it's not then the eyes are blinking so it will generate the mouse clicks on the basis of right/left blink.

Fig 2: Demonstration

IV. Limitations and Future Scope

So far we aim to improve the usability of our project with the help by adding more functionalities like, mouse control should not be limited to eyes retina it could work with the entire face, add functionality of voice recognition and control, add functionality of on screen keyboard and optimize the whole system we can also provide a GUI using python to choose between all these functionalities. The limitations encountered in this project is web cam quality and lighting of the visuals if the web cam capturing resolution is low it wouldn't be able to capture live visuals also the lighting will also enhance the resolution of the visuals.

V. Result and Conclusion

Modern society strives to make its world smart. The ability to use a computer is a skill that every individual has a right to achieve. This project will help anyone and everyone with locomotor disability to easily use a computer system and increase their productivity without the need of any physical input device the interface will use facial dexterity such as eye movements, and blinking to perform mouse control actions such as cursor movement and mouse clicks as shown in the fig. 2 OpenCV will detect the retina coordinates and give it as a value to the cursor. The end user will only need a good quality camera to make use of the interface to browse the computer

.

References

[1] . Face Detection For Beginners – Towards Data Science

[2] . Kriti Mishra, V. Siddharth The Prevalence Pattern of Locomotor Disability and its Impact on Mobility, National Library of Medication, May-June 2019, PMCID: PMC6737803

[3] . Real Time Eye Tracking Using OpenCV and Dlib – Towards Data Science

[4] . Rupali S. Parte, Gaus Mundkar, A Survey On Eye Tracking and Detection, Octiber 2015, ISSN : 2319-8753

[5] . Pramodini punde, Mukti Jadhav, Mukti Jadhav, A Study of eye tracking technology and its applications, October 2017, ICISIM: 8122153

[6] . MAMATA S. KALAS, Real time face tracking using OpenCV, Proceedings of IRF International Conference, 5th & 6th February 2014, Pune India. , ISBN: 978-93-82702-56-6, Page no.1

[7] . Manav Bansal, Sohan Garg, Facial Detection & Recognition Using Open CV library, Proceedings of 2Sir Chhotu Ram Institute of Engg. and Tech., CCS University, Meerut, Uttar Pradesh, India, ISSN : 0976-8491,Facial Detection & Recognition Using Open CV library – ijcst

[8] . Fabian Timm and Erhardt Barth, Accurate Eye Centre Localisation By Means Of Gradients,Institute for Neuro- and Bioinformatics, University of Lubeck, RatzeburgerAllee 160, D-23538 L¨ubeck, Germany

[9] . Shervin EMAMI, Valentin Petruț, SUCIU, Facial Recognition using OpenCV, Journal of Mobile,

Embedded and Distributed Systems, 2012, ISSN: 2067-4074

[10] . Rachit Puri, Gesture Recognition Based Mouse Events, ResearchGate International Journal of Computer Science and Information Technology, January 2014

[11] . V. Upasana, M. Joseph, Kanchana Venkatasubbaiah, Virtual Mouse with RGB colored tapes, International Journal of Applied Engineering Research: 5767-5771, January 2016

[12] . Kyungnam Kim, R.S. Ramakrishna, Vision-Based Eye-Gaze tracking for human computer interface, Systems, Man, and Cybernetics, 1999. February 1999