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Assisting System for Paralyzed Patients Using Eye Gesture

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ABSTRACT

Paralysis is a loss of muscle function in a part of your body. It can be localized or generalized, partial or complete, and temporary or permanent. Paralysis can affect any part of your body at any time in your life. HCI process is completed by applying a digital signal processing system which takes the analog input from the disabled people by using dedicated hardware with software. Face and eye detection algorithm is used to identify and recognize the user input using web camera. The predefined pattern matching is initialized for detecting a face from the USB camera feed. Pattern matching algorithm is used to compute the pattern related to the mouse movement. Supervised learning with back propagation is used to identify the input type and click operation on the particular action event. When the position of the user is sufficiently constant, the system for detecting and analysing blinks and mouse movements is initialized automatically, depending on the involuntary blink of the user. This approach is efficient for paralyzed patients.

Keywords : HCI, Iris tracking

I. INTRODUCTION

Human-computer interaction (HCI) is a multidisciplinary field to focusing on the design of computer technology and, in particular, the interaction between humans and computers. The motion capturing system can able to create this human computer interaction. Assistive Computer Technology is any piece of equipment that is customized to make life easier for a person who has a disability. In human-computer interaction, computer accessibility refers to the accessibility of a computer system to all people, regardless of disability or severity of impairment, examples include web accessibility guidelines. Many people with disabilities face a variety of challenges in terms of providing computer input, interpreting output and reading documentation. Disability management is a critical task since it is caused by employing a digital system to assist the physically disabled people. This process is completed by applying a digital signal processing system which takes the analog input from the disabled people by using dedicated hardware with software, and then the raw data is converted it into informative data in the form of digital signal. After converting digital signals, the input processing system

classifies the signal and performs the specified tasks, which equates to the prerequisite of the disabled people. In the work, the cognitive based knowledge processing system is designed to get the feedback and improve the tone of the neural schema. The processing system is carried out in four phases: Observing the iris movement, Identification of input operation, Based on the input operation the prediction of task to be performed, Executing the task and produce the output. The system identifies the user input based on their eye contact and generates the notification to the caretaker in terms of voice reporting and message notification.

II. RELATED WORK

Michelle Alva et al. [1] (2017) discussed about **"An Image Based Eye Controlled Assistive System For Paralytic Patients"** proposed a system which considers the use of a simple webcam of the computer system to detect the face of the patient. The system will provide the patient information with a grid of images of daily activities. The patient looks at a web camera for a few seconds to select it. The system tracks the point of gaze of the patient and selects the image accordingly after a confirmation from the patient.

Heena Joshi et al.[2] (2017) explained about "**Detection of Finger Motion using Flex Sensor for Assisting Speech Impaired"** in this they proposed a real time vision based system for hand gesture recognition for human computer interaction in many applications. The system can recognize 35 different hand gestures given by Indian and American Sign Language or ISL and ASL at faster rate with virtuous accuracy. RGB-to-GRAY segmentation technique was used to minimize the chances of false detection. Authors proposed a method of improvised Scale Invariant Feature Transform (SIFT) and same was used to extract features. The system is model using MATLAB. To design and efficient user friendly hand gesture recognition system, a GUI model has been implemented.

Mukul Singh Kushwah et al.[3] (2017) explained about **"Language Interpretation Using Pseudo Glove"** they developed an application that helps the deaf and dumb person to communicate with the rest of the world using sign language. The key feature in this system is the real time gesture to text conversion. The processing steps include: gesture extraction, gesture matching and conversion to speech. Gesture extraction involves use of various image processing techniques such as histogram matching, bounding box computation, skin colour segmentation and region growing. Techniques applicable for Gesture matching include feature point matching and correlation based matching. The other features in the application include voicing out of text and text to gesture conversion.

Quiapo et al.[4] (2016) explained about **"Development of a Sign Language Translator Using Simplified"** in this research they cover the various prevailing methods of deaf-mute communication interpreter system. The two broad classification of the communication methodologies used by the deaf – mute people are - Wearable Communication Device and Online Learning System. Under Wearable communication method, there are Glove based system, Keypad method and Handicom Touch-screen. All the above mentioned three sub-divided methods make use of various sensors, accelerometer, a suitable micro-controller, a text to speech conversion module, a keypad and a touch-screen. The need for an external device to interpret the message between a deaf –mute and non-deaf-mute people can be overcome by the second method i.e online learning system. The Online Learning System has different methods. The five subdivided methods are- SLIM

module, TESSA, Wi-See Technology, SWI_PELE System and Web-Sign Technology .

Abhinandan Das et al.[5] (2016) proposed **"Smart Glove for Sign Language Communications"** in this ISLR system is considered as a pattern recognition technique that has two important modules: feature extraction and classification. The joint use of Discrete Wavelet Transform (DWT) based feature extraction and nearest neighbour classifier is used to recognize the sign language. The experimental results show that the proposed hand gesture recognition system achieves maximum 99.23% classification accuracy while using cosine distance classifier.

III. METHODOLOGY

The proposed system methodology is clearly shown in the following fig 3.1.

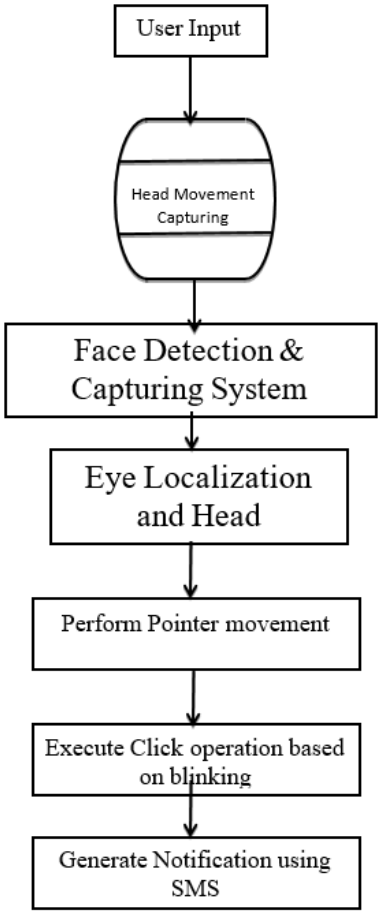

Fig 1 : Flow diagram

IV. SYSTEM IMPLEMENTATION

The proposed system is implemented with the following modules.

- Capturing the video feed and identifying the human face region
- Determining the Region of Interest (ROI) and mapping the human eye and iris movement
- Creating the User interface for assistance service and displaying the options.
- Enabling the Pointer option and selection of requires service based on eye/iris movement.
- Identification of selected assistance service and generating the notification to the caretaker.

4.1 LIVE VIDEO FEED CAPTURING

Embedded systems using input capture will record a timestamp in memory when an input signal is received. It will also set a flag indicating that an input has been captured. This allows the system to continue executing without interruption while an input is being received while still having the capability to trigger events based on the exact time when the input was received. The corresponding capability to trigger an output at a specified time, based on a timestamp in memory, is called output compare.

There are many programmable interrupt controllers that provide dedicated input capture pins and a programmable counter along with it. These pins generate interrupts to the controller, which then executes an interrupt service routine. The interrupts can be programmed to occur at the rising or falling edge of the input signal, depending on requirements.

An image sensor or imaging sensor is a sensor that detects and conveys the information that constitutes an image. It does so by converting the variable attenuation of waves (as they pass through or reflect

off objects) into signals, the small bursts of current that convey the information. The waves can be light or other electromagnetic radiation. Image sensors are used in electronic imaging devices of both analog and digital types, which include digital cameras, camera modules, medical imaging equipment, night vision equipment such as thermal imaging devices, radar, sonar, and others. As technology changes, digital imaging tends to replace analog imaging.

Fig 2: Live video feed capturing

4.2 ROI AND PATTERN EXTRACTION

The user input is captured by camera. The input image undergoes image enhancement technique to extract the iris movement. The enhancement technique includes the operations such as sharpening and segmentation. Sharpening is done to neglect the background of the image this in turn gives the accurate pixel value of iris. Second technique is segmentation this is done for grouping similar pixels this in turn helps to split the iris from the input image. Then the image is given to the motion sensor. Motion sensor is used to detect the movement of iris. It will detect only pixel point and it's coordinate. Using this coordinates the movement of iris is calculated.

Fig 3: ROI and Pattern extraction

4.3 USER INTERFACE FOR ASSISTANCE SERVICE

Gesture recognition enables humans to communicate with the machine (HMI) and interact naturally without any mechanical devices. Using the concept of gesture recognition, it is possible to point a finger at the computer screen so that the cursor will move accordingly. This could potentially make conventional input devices such as mouse, keyboards and even touch-screens redundant.Gesture recognition can be conducted with techniques from computer vision and image processing. The ability to track a person's movements and determine what gestures they may be performing can be achieved through various tools. Although there is a large amount of research done in image/video based gesture recognition, there is some variation within the tools and environments used between implementations.

The interaction applications and significant internal intellectual property relating to algorithms, methods for performing and implementing robust, consistently accurate and cost-efficient eye tracking. This intellectual property has been developed through long years of internal development using a multitude of approaches to eye tracking. Gestures can originate from any bodily motion or state but commonly

originate from the face or hand. Current focuses in the field include emotion recognition from face and hand gesture recognition. Gesture recognition can be seen as a way for computers to begin to understand human body language, thus building a richer bridge between machines and humans than primitive text user interfaces or even GUIs (graphical user interfaces), which still limit the majority of input to keyboard and mouse.

Fig 4 : User interface for Assistance service

4.4 IRIS MOVEMENT UPDATION

The absolute difference is less than difference of coordinates then the user is reading the same line. If the absolute difference is greater than difference coordinate then scroll operation has to be performed. The obtained pattern has to be matched with pre-defined pattern. Then the required action has to be performed. Then the task has to be executed. The output is obtained. After that the feedback has to be collected from the user. if the feedback is positive, the process is continued. If it is negative, the entire system has to be remodeled. If it is neutral, additional features have to be added to the system.

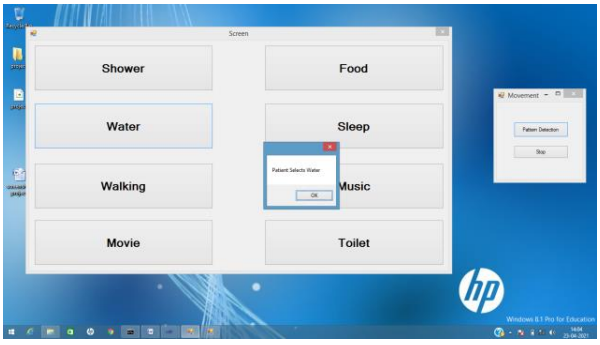

Fig 5 : Iris movement updation

4.5 USER NOTIFICATION

Patient interaction screen is a computer access method that allows those with disabilities to navigate and control their computer with their eyes, similarly as an everyday computer user uses a mouse to control their computer. Gaze interaction only requires the movement of the eye itself—the movement of other muscles is not required, making it a perfect solution for those with rehabilitative disabilities. Once the system detects the patients need then it immediately send the notification to care taker in terms of SMS and voice notification.

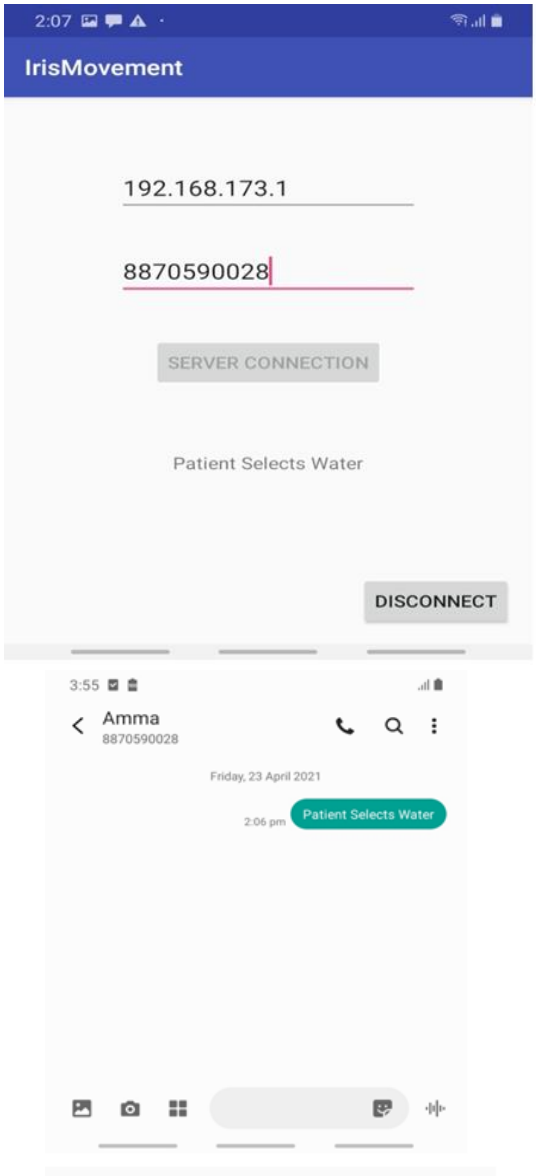

Fig 6 : User notification

V. CONCLUSION

Eye movement can be regarded as a pivotal real-time input medium for human-computer communication, which is especially important for people with physical disability. The proposed system focuses on providing a simple and convenient interactive mode by only using user's eye. Based on the face and eye movement, the user input in mouse can be generated and the same is used to generate the notification to the user.

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