Smart Eye Technology

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ABSTRACT: The project's sophisticated eye tracking technology is designed with the elderly and the disabled in mind.This research aims to use eye movement and rotations to control all appliances, wheelchairs, and communicate with carers.The wheelchair control module, imaging processing module,appliance control module, and SMS management module are the four parts that make up this system.The image processing module consists of a webcam and image processor developed in C++. The Raspberry Pi microprocessor receives the recorded image of the eye movement and processes it using OpenCV to ascertain the eyeball's coordinates.On the screen of the Raspberry Pi, the coordinate of the eyeball is used to operate the pointer.This method combines eye blinking in addition to eye movement, much like when you hit the Enter key on a computer, to enter orders. The wheelchair-controlled module consists of a cradle with two servos that can be moved in two dimensions and that can also be customised to work with different wheelchair joysticks.This system also enables remote management of a few appliances as well as text messaging communication with the carer.

KEYWORDS: Eye tracking, wheelchair, people with disabilities, elderly people, Raspberry Pi, image processing.

INTRODUCTION: We have seen speech recognition, touch control, and motion detection all combined in common electronic gadgets. Another significant technological advancement in recent years is observing the user's eyes and assessing their attention, engagement, and interest, just as individuals would undoubtedly do while engaging with one another. Eye tracking technology, which measures either the point of gaze (where one is looking) or the motion of an eye towards the point of contact, makes this possible**.** Eye tracking technology, which is based on the optical monitoring of corneal reflections, enables the analysis of eye movements and gaze locations in both 2D and 3D environments by recording the position and movement of the eyes. In order to develop interactive and diagnostic apps, it is helpful to research how people receive visual information.

Recent years have seen a tremendous advancement in eye tracking technology, with advances in stability, accuracy, and sample rates. Eye tracking companies are progressively being acquired by big businesses, and various eye tracking tools and software are also becoming more readily available. In order to enhance the technology and create an immersive experience, VR headset manufacturers have made considerable expenditures in eye tracking research. After acquiring the eye tracking companies Eye Tribe and Eyefluence, respectively, Facebook and Google are expected to integrate the technology in their next products. "Fove" is the brand name of the first virtual reality (VR) headset with built-in eye-tracking that was funded by a kickstarter project. Due to investments in new startups and business acquisitions, demand for eye tracking technology is rising.

Two key advantages of the sensors used in eye tracking technology are mentioned by Oscar Werner, vice president of Tobii Technology. First of all, it informs a gadget about the user's current interests, according to him. Second, it adds another option to interact with the information without taking away from it in any way. This indicates that it broadens the user-device communication bandwidth. Finding out how consumers typically interact with websites and the Internet is one of the most popular uses of eye tracking technology today. A greater comprehension of this may assist businesses and brands in optimising their fluence on a user and in creating the most seamless experience possible.

APPLICATIONS:

❖ ***Marketing and advertising:*** Smart eye technology may be used to detect a viewer's gaze while they are seeing advertisements or other marketing materials, allowing firms to optimise their designs and layouts for maximum effect.

❖ ***Human-computer interaction*** **:** By just gazing at specific portions of the screen, smart eye technology may be utilised to control gadgets or communicate with computers.

❖ ***Medical diagnosis and treatment:*** Eye-tracking technology can help doctors detect diseases including autism, ADHD, and schizophrenia. It may also be used to help persons with physical limitations control their surroundings and communicate more effectively.

❖ **Automotive industry:** Drivers can be monitored using smart eye technology to identify indicators of sleepiness, attention, or impairment. It can also help with driving activities like adjusting mirrors and regulating the radio.

❖ **Education and research:** Eye-tracking technology may be used to improve teaching techniques and educational materials by studying how people learn and process information.

❖ **Gaming:** Smart eye technology may be used to deliver more immersive gaming experiences by recognising a player's vision and adjusting the game's content accordingly.

RESEARCH METHODS:

1. **Experimental Research*:*** This method entails designing and carrying out experiments to evaluate the effectiveness and accuracy of Smart Eye Technology. Researchers can experiment with variables such as lighting, camera angles, and distances to see how they affect the technology's performance.

2. **Survey Research:** Researchers can conduct surveys to gather data on user experiences and perceptions of Smart Eye Technology. Surveys can be designed to ask questions about the ease of use, effectiveness, and overall satisfaction with the technology.

3. **Case Study Research:** Case study research entails an in-depth examination of a specific case or scenario. This method can be used by researchers to investigate how Smart Eye Technology has been implemented in various industries and how it has impacted safety, efficiency, and user experience.

4. **Observational Research:** Researchers can observe how users engage with Smart Eye Technology to see how it is used in real-world settings. This strategy can provide details on how technology is being used and how it might be improved.

5. **Focus Group Research:** Focus groups entail gathering a number of people to talk about their opinions and experiences using smart eye technology. This approach can be used by researchers to collect qualitative information about user preferences and experiences.

THE TECHNOLOGY BEHIND EYE TRACKING

1. **Video-based eye tracking*:*** With the use of a camera, this device can take pictures of the eye and monitor its motions. The camera may be placed directly in front of the user's eyes or put on a headset or pair of eyeglasses.

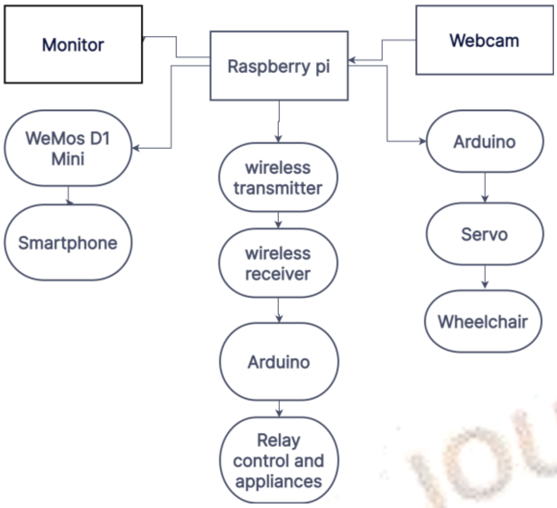
2. **Infrared eye tracking*:*** Infrared light is used in this technology to monitor how the cornea and pupil reflect light. Based on the location of the reflection, the pupil's location can be followed.

3. **Magnetic eye tracking*:*** This device tracks the movement of a tiny magnet linked to the eye using a magnetic field.

4.Electrooculography *(EOG):*

The electrical activity of the ocular muscles is monitored using this technology. It can be used to determine where the eye is looking and which way it is moving.

FLOWCHART:



EYE TRACKING DEVICES:

SCREEN BASED

GAZEPOINT GP3 HD EYE TRACKER

A machine-vision camera serves as the brain of the image and processing system in the research-grade eye tracker known as the GP3 HD. Affordable eye tracking with high performance. precision of the viewing angle by 0.5 to 1.0 degrees. 150 or 60 Hz sampling frequency calibrating at 5 or 9 points.

VPS 13

VPS13 proteins serve as bridges at the points where organelles come into touch with one another, allowing lipids to travel bulkily and in one direction between organellar membranes .Through interacting with receptors, such as peripheral and integral membrane proteins, VPS13s are anchored between membranes.

Varjo VR-3

Varjo VR-3 is the highest-performance virtual reality headset for professionals.
With human-eye resolution, the broadest field of vision in the sector, and integrated eye and hand tracking, it establishes a new benchmark for naturally immersive computing.

ALGORITHM FOR SMART EYE TECHNOLOGY

Capture image: Use a camera or other image capture device to take a picture of the eye.

Preprocess *the* image*:* Use image processing techniques such as noise reduction, contrast enhancement, and image normalization to prepare the image for analysis.

Detect *the iris:* Use algorithms such as Hough transforms or machine learning models to detect the iris in the image.

Extract features*:* Use feature extraction techniques to extract features from the iris such as the size, shape, texture, and color.

Compare features*:* Compare the extracted features to those stored in a database to identify the person.

Authenticate*:* If a match is found, authenticate the person's identity. If not, deny access.

Update the database*:* If the person's identity is authenticated, update database with the time and location of the access.

Repeat*:* Continue capturing images and authenticating identities as needed.

MERITS:

❖ Data-driven approach

Unlike the more subjective practise of merely seeing where someone is looking, an optical tracker gives objective information. It provides impartial data that are accurate, removing the element of speculation or evidence of the location the person is looking at. The instructor, for instance, no longer needs to rely on the pilot's recall of their scanning patterns during pilot training since eye tracking data would offer a precise response as to where and when the pilot was looking. This provides a more detailed knowledge of how humans and/or people and machines interact.

❖ Fixations and scan patterns

A subject's fixation locations may reveal information about their attentional focus in addition to their scan patterns. Fixation and scan patterns are indicators of cognitive processes. When someone pauses at a certain time, it could indicate focused attention and potential cognitive processing.

❖ Analyse areas of interest

By studying where a person looks, researchers can learn more about how people perceive and interact with their surroundings. Outlining specific areas of interest can provide information on how frequently and when a certain area is seen, for how long it is watched, and how many people visited that site.

DEMERITS:

❖ Equipping a lab with a good eye tracker is expensive. Even the richest company in the world, Google, has only furnished one of its several labs. It costs money to teach individuals to utilise the equipment in addition to the money spent on the equipment itself, which is an expensive endeavour.

❖ Not all participants can successfully use an eye tracker. People with a range ofcharacteristics are automatically excluded from eye tracking, depending on the technology. Long eyelashes and contact lenses might also prevent the gadget from operating correctly.

❖ Eye movements must be carefully understood to prevent unintended reactions to user activities because they are frequently unintentional, much like other passive and non-command inputs. We refer to this as the "Midas Touch" issue in terms of eye movement. The drawback of using an eye tracker interface is that people are not used to using their eyes to control technology.

CONCLUSION:

An extensive review of the literature was done to find out more about the usage of eye-tracking technology as a type of assistive technology for ALS patients. The main finding of the systematic literature review is that eye-tracking technology has made notable contributions to a number of research areas, especially those in the domains of healthcare, education, and industry. When it comes to human-computer interface, eyetracking is a useful tool that has been able to significantly aid those with severe disabilities. One of the limitations of employing commercial eye-trackers in research is their cost, which has also been mentioned as a negative. The study presents inexpensive but yet practical alternatives as well as open-source eye-tracking software. Another finding confirms that eye tracking and gamification can Additionally, eye-tracking can provide a much-needed substitute for the ability to regulate gaming components, which might be useful for people with severe disabilities. In the calibration sector.When it comes to event detection, NN and ML outperform the current detection methods. As the demand for support for persons with severe disabilities rises, eye-tracking research in assistive technology for people with motor neuron illnesses is becoming more and more crucial. In addition to looking at some of the most widely used software and hardware in the field, this review also looks at eye-tracking methods, their limitations, and cutting-edge technology like machine learning algorithms that potentially advance the field. Additionally, certain study gaps were found. This finding will therefore be helpful to future researchers who want to advance eye-tracking technologies.

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