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MACHINE LEARNING APPROACH FOR VIRTUALLY ACCESSING THE KEYBOARD USING EYE MOVEMENTS

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Abstract *:* Countless individuals with incapacities depend on assistive innovations to speak with their families, utilize web-based entertainment, and have a public activities. Notwithstanding a huge increment of novel assistive advancements, powerful, harmless, and reasonable arrangements ought to be proposed and improved in about actual capacities of the clients. A solid and strong distinguishing proof of purposeful visual orders is a significant issue in the improvement of eye-developments-based UIs. The discovery of an order with an eye global positioning framework can be accomplished with a stay time. However, an enormous number of individuals can utilize basic hand motions as a chance to choose an order. We propose a new virtual keyboard using eye movement. The study achieved its goal of providing a system for the differently-abled to text by monitoring the eye movement. The study provides a method to be used by target audience with great efficiency. In light of the consequences of the examination, the comparation proportion between span of typical composition and composing involving framework for two words is 1:13 second. With those two words that was composed in this framework, client can give a data obviously enough. This concentration most certainly presents as an achievement for future headways and comparative examinations and exploration.
***IndexTerms* – eye movement, virtual keyboard, accuracy, disabilities,efficiency**

I. INTRODUCTION

Correspondence is something vital in human existence to associate and make communication with others. Be that as it may, certain individuals couldn't do correspondence very well since they have a handicap to do [1]. For instance, somebody who couldn't talk and whose motoric capability couldn't work ordinarily will make them couldn't to convey quite well. Since certain individuals who have a handicap in their motoric capability, particularly in their grasp couldn't do a development to make gesture-based communication.

However, in the growth of eye-tracking, they were primarily used in laboratory investigations to examine the fauna of human eye actions rather than as a control middling inside a human-computer interface (HCI) [2]. A decade ago, eye trackers were too costly for use in actual user-computer interfaces, costing around 30,000 each. As eye-tracking equipment becomes less expensive, it is evident that new applications based on eye-tracking in HCI are starting to emerge [3].

Traditional user interfaces deliver far greater bandwidth from the processer to the operator, such as graphics, cartoons, movies, and other media that may swiftly produce massive volumes of data. At the same time, there are almost no methods for people to submit comparable enormous volumes of data. The goal of HCI is to expand the bandwidth between an operator and a processer via more usual and easy message methods [4]. About 80 to 90% of information about the external environment is received via the anthropoid eye [5]. For hypermedia connection between operator and processer, eye actions are a crucial real-time input channel, particularly significant for motor disabilities (such as individuals with Amyotrophic Adjacent Sclerosis). Eye-tracking method research in user-computer conversation focuses on including natural eye actions in hypermedia computer messages [6].

In most cases, the most natural way to include eye actions in user-computer communication would be to replace an eye tracker with a physical participation device, such as a mouse. By fixing an eye tracker and using its harmonized production stream as a computer-generated mouse, the movement of the operator's gaze would origin the mouse pointer to interchange directly. However, the regular hand movement of a mouse and the eye movement required to handle a virtual mouse is very unlike. When creating an eye-tracking-based control structure for user-computer communication, substantial discrepancies between the mouse and eye positions must be addressed. Several enhanced eye-tracking-based control methods have been created to offer suitable communication. The team has developed an eye-tracking mouse that enables people to interact with a processer through operational flexibility, such as eye or nose actions [7]. Missimer and Betke have designed an ahead movement system to regulate the mouse pointer and replicate the left-click and right-click by flashing monocularly to the left or right [8].

1.1 Different Types of Keyboards

Since its debut, the layout of keyboards has altered little. The most typical alteration has been the addition of new keys that give greater functionality. These are the most prevalent keyboards:

- 101-key Improved keyboard
- 104-key Windows keyboard
- 82-key Apple typical keyboard
- 108-key Apple Protracted keyboard The keyboards of transferrable computers, such as laptops, are frequently customized and feature a somewhat different key layout than a regular keyboard [10]. In addition, several system makers provide specialized buttons in the conventional configuration.

A standard keyboard has 4 fundamental kinds of keys:

- Typing keys
- Numeric keypad
- Function keys
- Control keys

The typing keys are the area of a keyboard containing the letter keys, often arranged similarly to typewriters. The numeric keypad is a result of the progress of technology described above. A bunch of 17 keys was fitted to the keyboard since a substantial portion of the data was numerical. To assist the transfer to a computer for clerks familiar with adding machines and calculators, these keys are arranged similarly to those on most adding apparatuses and computers. With the inclusion of function and control keys in 1986, IBM expanded the primary keyboard [11]. The current program or the operating system might assign the function keys, positioned in a row at the uppermost of the keyboard, with particular instructions. The control keys allowed pointer and display management. Four keys set in an overturned T shape between the typing keys and numeric keypad enable the user to transfer the pointer in tiny increments on display.

1.2 Applications

Eye-tracking methods are used in several fields, including cognitive discipline, psychology (particularly psycholinguistics, the graphic ecosphere model), human-computer interaction (HCI), marketing study, and medical study (neurological analysis). Detailed applications comprise tracking eye measures in linguistic interpretation, music understanding, human action appreciation, awareness of promotion, and game playing. Uses comprise:

- Cognitive Educations
- Medical Study
- Laser refractive operation
- Computer Serviceability
- Translation Process Examine
- Vehicle Simulants
- In-vehicle Study
- Training Simulants
- Fatigue Recognition
- Virtual Genuineness
- Marketable eye tracking (web serviceability, advertising, automotive, etc.)
- Message structures for disabled
- Enhanced image and video infrastructures
- Worker training

II System Architecture

In this work, we have devised a system that enables writing without a pen or pencil. Users will be able to write visually. We must utilize a camera to record live footage for the system's construction. The technology will identify face and eye from a video using facial landmarks [17]. The system will consist of various components, including face discovery, eye discovery, eye gaze and measure recognition, eye blinking discovery, a computer-generated keyboard on the screen, the ability to choose the left and right portions of the keyboard, and the ability to write by blinking the eyes. Figure depicts the system's general pattern.

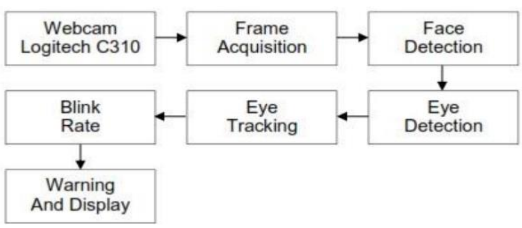

Fig 01: Architecture of the system

The suggested eye tracking-based control structure is a package program that operates on inexpensive eye trackers. The program recognizes the users ' gaze with an eye tracker's "mouse cursor control" feature. The mouse cursor control feature enables users to reroute the pointer to their gaze location. As a result, based on the mouse pointer's location, we will determine where the user is looking. The gadget would create the necessary events after a few seconds of staring at the place. Thus, users can pick and click the appropriate functions.

III Methodology

Our approach offers a human-computer interaction based on vision. The interface detects and interprets eyeblinks as controls, in addition to gaze detection techniques. We used image processing techniques such as haar-like characteristics for automated face identification, eye tracking, and blink detection based on landmarks. The technology for detecting a user's gaze facilitates mouse control.

Involving regular eye developments in virtual conditions requires the advancement of fitting association procedures. In this review, we fostered a communication procedure that joins elements of eye developments and non-order based connections in a virtual climate. Our goal is to empower clients to cooperate with eye developments, without unequivocal orders where conceivable. In any case, we ought to likewise keep away from the Midas Touch issue, i.e., undesirable enactment of orders each time the client takes a gander at something [9]. Our methodology here was for the PC to answer the client's looks about the virtual climate with constant, steady changes. Envision a histogram that addresses the gathering of eye obsessions with every conceivable objective item in the VR climate. As the client continues to take a gander at an item, the histogram worth of the item increments consistently, while the histogram upsides of any remaining articles gradually decline. At any second we consequently have a profile of the client's "ongoing interest" in the different shown objects. Following are some steps that we followed for accessing keyboard virtually,

3.1Eye detection

3.2 Detecting the blinking

3.3 Gaze Detection

3.4 Computer-generated Keyboard

3.5 Light up letters each ten frames

3.6 Eye cropping and resizing

3.7 Data Augmentation and Training

IV. RESULTS AND DISCUSSION

4.1 Discussions and Outcomes

Construction of distinct feature sets. The latest approach interpretation sessions for each theme out of ten are chosen as the testing information. The residual seven data points serve as training information. From this data, many attributes are retrieved. The dimensions of the training and testing datasets are provided in **Table 1.**

Table 01: Dimensions of training and testing data for different feature Extraction Methods

Feature extraction methods	Dimensions	
	Training data	Testing data
Statistical parameters	120x20	80x20
Parametric Power Spectral Density (PSD) features	120x130	80x130

The training trajectories are used to train an artificial neuronal network (ANN) and support vector machine (SVM) classifiers, while testing vectors are used to assess the accuracy and effectiveness of the learned models. An evaluation of ANN and SVM with proposed approach, the effectiveness of classifiers, is examined topic by subject. Utilizing testing precision and training duration, comparison and performance assessment are offered. The classification precision is computed as the percentage of true positives that were expected to be positive [2].

Where D represents the number of experiments with accurate predictions, and NF is the number of incorrect ones. Based on the outcomes through 8, both classifiers generate comparable results when fed the identical set of feature data as input.

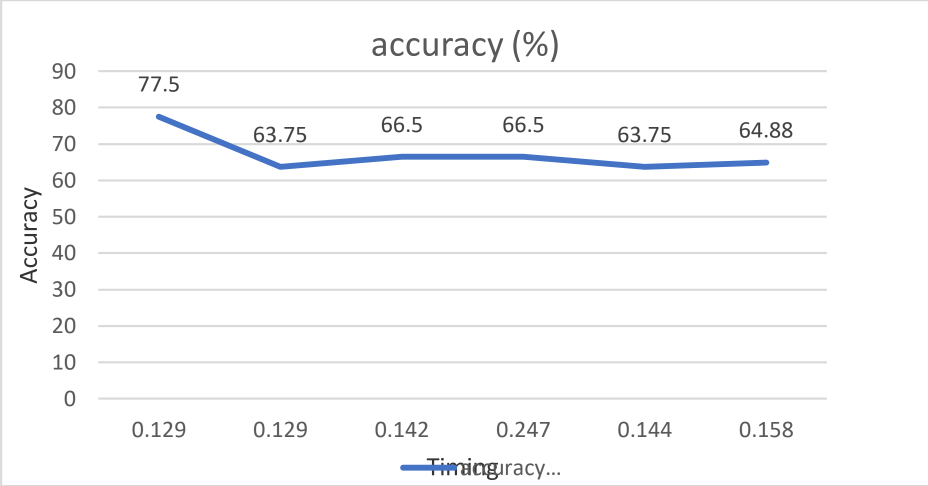

Fig 02: Performance analysis using ANN

Note:

Downa represents event in which eyes move center-down-up. Upb represents event in which eyes move center-up-down.Leftc represents event in which eyes move center-left-right. Rightd represents event in which eyes move center-right-left.

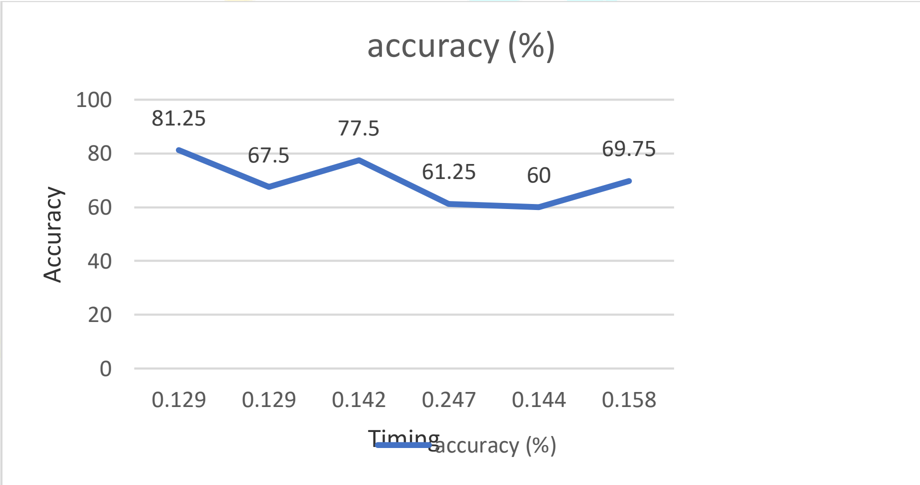

Fig 03: Performance analysis using SVM

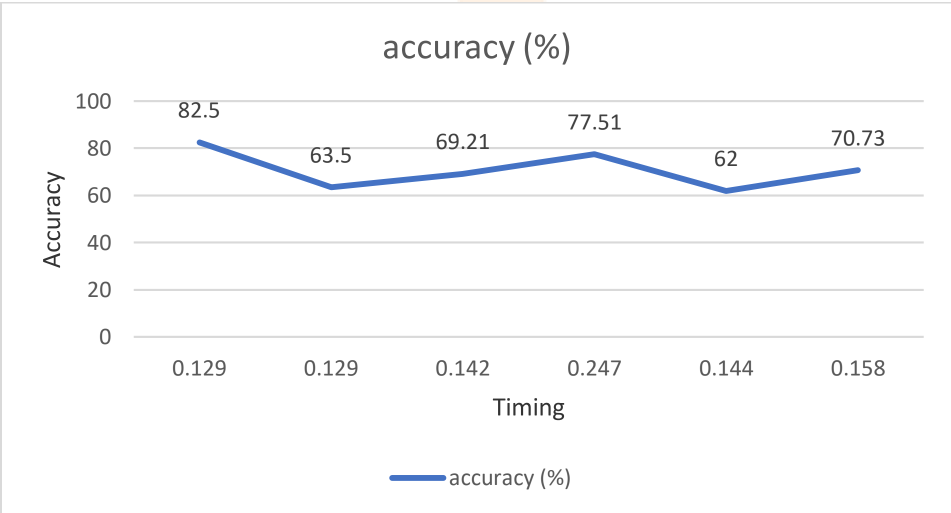

Fig 04: Performance analysis using Proposed approach

Consequently, it decreases the number of operations required to calculate a prototypical (not all geographies vector is involved). In contrast to the Proposed the core concept of SVM & ANN is to totality linear mixtures of all participation information and bias values in each neuron and then prototypical the yield as a nonlinear function of these summary values, which rises the number of operations as well as computing complication and expense.

4.2 Advantages

The following are some of the most common comments made about performance when our method is implemented in practice:

- "Letter assignment was a simple and fast process. Eye movement is superior to the other two because it was significantly more precise."
- "I am used to using a virtual keyboard. Offset Menu was efficient and exact, and the whole keyboard was necessary for Letter Assignment. Clear gaze and click."
- "Gaze-and-click with an exact eye tracker would outperform the other two."

- "Occasionally, it is difficult to reach the target while using the "gaze and click" method. However, the focus shift between the keyboard and the display is not optimal."

V CONCLUSION

Gaze & click does not assist users in precisely clicking links; consequently, we anticipated it to be the least precise click choice, but not the slowest. Stimulatingly, contributors often opted for one of two distinct strategies. One was to tick links rapidly irrespective of whether their gaze location was steady over the correct link, and the supplementary was to take a long time to stabilize their gaze location over the correct link prior to pressing the hotkey. The first method was often quicker than the mouse, but the second method may take 10 seconds. Contributors were instructed to "click links as quickly and precisely as possible," thus choosing between speed and accuracy since it was impossible to do both simultaneously.

Observations indicate that participants struggled to deactivate the Offset Menu when none of the supplied alternatives was accurate. Two factors caused this. The 200 ms de-selection standard was not communicated to consumers in advance. The second issue was that some users gazed too far away from the screen, breaking the gaze tracker's line of sight. This often resulted in the fixation of the eyes on a menu selection. When the user releases the key, the choice will remain chosen in both circumstances.

Observations indicate that Letter Assignment was challenging for participants since the letter allocated to a link was not always what they anticipated. For instance, the links "Citizenship" and "Countries" were frequently positioned adjacent and given the same letter. The 'C' key would be allocated to "Citizenship," whereas the 'O' key would be assigned to "Countries." Frequently, participants would choose "C" to get to "Countries." For most of the period, the allocated letter was the one the contributors were anticipating; thus, it would confuse them when it was not.

Compare the offered gaze & key click replacements to other gaze-based click replacements. It is not easy to compute the outcomes of research using varying techniques. However, other research use hyperlink-clicking responsibilities like the one described here, so at least a debate is conceivable. Multiple Check Click seems to be slower than Letter Task and Offset Menu, which is not unexpected given the absence of physical buttons. Multiple Check also looks more precise, perhaps because it is more difficult to tick wrong (and right) links. EyePoint appears quicker than Letter Task and Offset Menu but less precise than Offset Menu. This may be because Offset Menu, unlike EyePoint, provides an unambiguous indication about the clickable target.

Potential Future Improvements: -

- -Improve gaze detection accuracy and resolution of detection.
- -Implement mouse control with the help of gaze detection.

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