Password Authentication using Brain Signals

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***Abstract*—This paper proposes a plan for a painless (EEG-based) cerebrum controlled Password validation has been created for use by totally incapacitated patients. The universe most complex design is the human mind. To break down its qualities, many examinations and clarification have been completed in a legitimate and orderly way. There are individuals enduring by deadened of their body parts, they can't move, talk and certain individuals can't move even their head. Typically Password confirmation is expected for a few applications like locking, bank logins, and so on, Password verification can likewise have the option to utilized by Paralyzed individuals by means of Mind wave portable and through eye blink.Mind wave versatile deals with the rule of BCI (Brain Computer Interface) which screens EEG waves from the Brain. It gains mind cues and makes an interpretation of them into orders that are handed-off to yield gadgets that do the ideal activity. Eye squint is additionally utilized with the assistance of edge voltage. The gamma waves from the human cerebrum are acquired utilizing Neuroskymindwave versatile and the eye flicker strength is recognized. Contingent on the EAR and number of casings it goes through to enter the pin number. Subsequent to entering the right secret word then it is approved.**

Keywords—Password Authentication, Brain Controlled Interface, Gamma Waves, NeuroskyMindwave mobile, Eye Aspect Ratio

I.INTRODUCTION

In normal, everyday internet usage across the world has led all users to adapt and create several accounts for utilizing services that are offered online. The mere amount of username and password a user must remember for every signed-up service is immense. These services rely on methods such as passwords, pin numbers, and security questions for user authentication. Given the need to memorize extensive amounts of login information, many users are known to use identical login credentials for multiple services. Such poses a definitive risk to the user because a single security breach has the potential to reveal confidential information from user's other several services. It is essential to note that data breaches are becoming common by occurring frequently and in a large scale. With the advancement of technology, nowadays researchers have been able to make human brain interaction with computer more efficiently than before. Human brain emits electron signals called brain waves. Developed devices (EEG Headset) that can receive those brain waves and send it to the computer for further research. The brain wave signals are known as Electroencephalography (EEG) signals. The Electroencephalography (EEG) signals are generated in the brain through the voltage difference of ions moving through the neurons. There are thousands of neurons in a human brain. Each specific neuron generates some specific frequency for some specific command. The EEG signals are nothing but the brain activity in the form of electro-voltaic waves. Mostly the signals are used to monitor the brain activity of people. But nowadays EEG contains a fully developed sector which is known as BCI or Brain Computer Interaction. Through BCI, people can control computer and other devices just by thinking phases. In the previous researches, many researchers used EEG headset to collect the brain waves and then converted them to digital signals, some of them also used additional amplifiers that increase frequencies of the wave to get improved output. Then the signals went through an AI system which converts them into executable commands. Currently, electrophysiological signals used in BCI can be described into three categories: specific frequency components of EEG produced spontaneously during mechanism of brain thinking, such as alpha waves, beta waves and so on; second category is brain evoked Event-Related Potentials (ERP), i.e. neural electrical activity of cerebral cortex induced by specific sensory stimulus or event operation and third category is the electrical activity signals of neurons in group directly acquired from electrode implanted into the specific region of the brain cortex. Using these waves BCI applications have been made possible. EEG signals have mostly four wave patterns, i.e. Alpha, Beta, Gamma, Theta and Delta. Alpha waves are produced during a person is thinking about

anything consciously. Beta waves are generated when a person feels anxious, worried or angry, mostly when the user's state of mind changes and Delta waves are generated subconsciously by a person. And finally, theta waves and some delta waves are generated when user is having a dream.

A credible and robust authentication system ought to prioritize a certain set of attributes. The system must continuously maintain acceptable high accuracy for all authorized users to authenticate without multiple failed login attempts. Similarly, the system must minimize any unauthorized user from being authenticated into the system. Granting system access to an unauthorized user poses a greater risk than denying access to an authorized user.

Brain computer interface provides a connection between the human brain and computer which allows the control of various devices through mental activities instead of neuromuscular activities. Thus BCI proves to have a crucial impact in the field of medicine, it can help people with neuromuscular disorders to carry out their day to day activities. BCI can be separated into three classes based on the method used to acquire brain signals; Non-Invasive, Semi-invasive and Invasive. In non-invasive method, the electrical potentials generated by the brain are measured by the sensors which are placed on the scalp. Among noninvasive BCI methods, EEG is the most commonly used method because it has low cost, is simple to use and is capable to be implemented in portable devices. In semi-invasive method, the brain's exposed surface is where the electrodes are placed . In invasive method, the activity of a single neuron is measured by placing micro-electrodes directly into the cortex. The first step is the acquisition of EEG data from human brain. In the second step feature extraction of the acquired signal takes place. Finally the output from the classification step generates the commands which are propagated to various devices. In this paper a method to classify the EEG signal for BCI application has been described. Classification of single and double blinking of eyes in the EEG data has been performed using various classification techniques. The output can be used to generate control commands for BCI application i.e. various devices can be controlled like home appliances, robotic arm or wheelchair movement and for unlocking any personal electronic devices. The methodology consists of data acquisition with the help of NeuroSkyMindWave headset. Pre-processing and feature extraction are performed after the data acquisition step, and finally various classification methods are used to detect single and double blinks in the EEG signal. Eye blinks-based authentication refers to finding the eye blinks and calculating the eye aspect ratio and finding EAR across sequential image frames, and generating the PIN. This project presents a real-time application to avoid shoulder surfing and thermal tracking attacks.Python, Dlib, Secure authentication of PIN.

Simple password authentication offers an easy way of authenticating users. In password authentication, the user must supply a password for each server, and the administrator must keep track of the name and password for each user, typically on separate servers.

In this paper we are mainly focusing on Numeric password authentication as an initial step. Password authentication used for Paralyzed people. who can have authentication system to enter password based on the command hearing input from the system for theselected numbers.

II. Related Work

A. *BRAIN SIGNALS*

Brain signals are preprocessed by implementing temporal filters to select the specific EEG sub frequency bands carrying the neuro signals of interest. Brain signals are preprocessed by implementing temporal filters to select the specific EEG sub frequency bands carrying the neuro signals of interest.Brain signals are classified into 5 types, are shown in table2.1

Frequency Band	Frequency	Brain States
Gamma (γ)	>35 Hz	Concentration
Beta (β)	12–35 Hz	Anxiety dominant, active, external attention, relaxed
Alpha (α)	8–12 Hz	Very relaxed, passive attention
Theta (θ)	4–8 Hz	Deeply relaxed, inward focused
Delta (δ)	0.5–4 Hz	Sleep

Gamma Waves:- Gamma mind waves are delivered when different pieces of the cerebrum are in fixation mode, dynamic and imparting. High gamma cerebrum wave movement uplifts the faculties Increased gamma mind wave action capacities as an energizer; individuals enduring wretchedness regularly have lower gamma action. The recurrence of this waves is in excess of 35 hertz.

Beta waves:- Beta waves are created when the cerebrum is in consideration, nervousness and loosened up mode. The recurrence scope of somewhere in the range of 12.5 and 30 Hz (12.5 to 30 cycles each second). Beta waves can be parted into three segments: Low Beta Waves (12.5-16 Hz, "Beta 1"); Beta Waves (16.5-20 Hz, "Beta 2"); and High Beta Waves (20.5-28 Hz, "Beta 3").

Alpha waves:- Alpha happens during attentiveness, where there is loose and easy sharpness. It permits complete fixation and synchronization of the left and right minds. This is the appropriate state for perusing, tuning in and different types of data input. The recurrence will goes from 8 to 12Hz.

Theta waves:- Theta Waves Theta waves known as the 'suggestible waves'. Theta has a recurrence between 3.5 to 7.5 Hz. Classed as sluggish action is related with imagination, instinct, staring off into space, and

fantasizing. This specific brainwave is solid during inward concentration, petition, contemplation, and otherworldly mindfulness. As you probably are aware, these things are imperative for indication.

Delta waves:- Delta waves are high sufficiency brain motions with a recurrence somewhere in the range of 0.5 and 4 hertz. Delta waves, as other mind waves, can be recorded with electroencephalography (EEG) and are normally connected with the profound stage 3 of NREM rest , otherwise called sluggish wave rest (SWS), and help in portraying the profundity of rest.

B.IMAGE PROCESSING

The examination and control of a digitized picture, particularly to work on its quality. Picture handling is the method involved with changing a picture into a computerized structure and playing out specific tasks to get some valuable data from it. The picture handling framework as a rule regards all pictures as 2D signs while applying specific foreordained signal handling techniques. There are five principal sorts of picture handling:

i.Visualization - Find protests that are not apparent in the picture

ii.Recognition - Distinguish or identify objects in the picture

iii.Sharpening and reclamation - Create an upgraded picture from the first picture

iv.Pattern acknowledgment - Measure the different examples around the items in the picture

v.Retrieval - Browse and search pictures from a huge information base of computerized pictures that are like the first picture.

C.PASSWORD AUTHENTICATION

A secret phrase is a straightforward use of challenge-reaction validation, utilizing a verbal, composed or composed code to fulfill the test demand. The request and assortment of characters are in many cases what decides the trouble, or security strength, of a given secret word. There are multiple methods of secret key validation technique i.e numeric, alphabetic, unique finger impression, facial acknowledgment, etc.

III. LITERATURE REVIEW

The smartphones are becoming more popular these days because of having moretechnologies in a smaller and slim-sized device. The people can get Internet connectivity and some other facilities, such as communication and storing data, with these smaller devices. It is necessary for securing personal data on smartphone devices with authentication techniques.The continuous authentication technique will authenticate the user periodically with theirs behavioral features. It provide more security for smart phones than other one time based authentication techniques like pattern, password, PIN, face recognition, finger print and so on. The technique proposed in this work uses various features from mobile devices and it is extracted from collected data from the different sensors embed on mobiles and other events such as, touch, key press, pinch, scroll, and stroke. Based on these data the behaviorof every user will be identified by the authentication system.[1]

A new authentication method has been proposed for the Internet of Things (IOT) devices. This method is based on electroencephalography EEG signals, and hand gestures. The proposed EEG signals authentication method used a low price NeuroSkyMindWave headset.NeuroSky's headset for using on authentication method for IOT devices. The difficulty and disadvantage of using EEG signals for authentication are that it is very weak and susceptible to contamination from many artificially created signals.[2]

The digital financial transaction is on a continuous rise and going to be the order of the day. These transactions rely on the entry of the Personal Identification Number (PIN) by the user.the application detects and recognizes the user's face. A dynamic keypad is displayed which prompts the user to provide input PIN via eye blink. User's eye is detected and monitored by the application in order to capture the PIN and verifies the same with the existing PIN in the database. On a successful PIN verification process, the application allows the user to proceed with the transaction. [3]

The Eye Blink Detection is the second layer authentication in the proposed system. Dynamic digital keyboard will be displayed on the screen. The user is prompted to give the PIN. Cursor continuously moves across the digits. The digits will be displayed in a random order for every iteration. User blinks only when the cursor reaches the desired digit. Thelimitation is set if a guardian is sent to the ATM instead of the user. The guardian would be asked to enter the User's account number manually, then the system allows the guardian to proceed giving input PIN via eye blink. If the PIN is found to be correct, the account holder receives an OTP to his/her mobile phone. Guardian types the OTP manually. If the OTP is found to be incorrect, the application should not allow you to perform any transactions. Fewimprovements such as email notifications can be sent to the user so that he/she can have a track of all the transactions performed.[3]

A grown-up mind contains around 100 billion interconnected neurons. Every one of them produces and leads electrical charges while cerebrum works. The amount of this multitude of tiny electrical charges adds to the age of an electric field with fluctuating electrical possibilities around our scalp.

The fluctuating possibilities are normally in the μV range. These variances can be estimated utilizing sensors. The possibilities are estimated between at least two focuses called anodes or sensors, which is put on the scalp at various areas as indicated by a few standard setups. This estimations are called as Electroencephalography (EEG). To that end the term cerebrum waves can likewise be utilized while alluding EEG signals. The framework utilizes battery worked, remote, detecting gadget. A calculation is created for extricating information from got mind cues and decipher it to give verification. A sub-framework is created to give second degree of confirmation utilizing pass key after fruitful cerebrum input condition.[4]

Confirmation not having the option to be refreshed is tackled by incorporating music into the verification instrument. Since the client pay attention to a picked piece of music while EEG information is gathered, we could basically change the music a client listens in light of the fact that EEG signal reaction is reliant upon which music a client is tuning in. This work is novel from existing examination in that there is just a single errand which is for client to just listen self-picked music and that of chosen different members. Besides, the whole investigation convention, as indicated later, is totally adaptable to oblige quite a few members and unmistakable from some other available.[5]

Liquor addiction is one of the mind problems that includes in electroencephalogram (EEG) flags and affect EEG based frameworks. Be that as it may, this issue has not been researched. In this paper, we propose an EEG-based cryptographic key age framework utilizing EEG signals and present trials performed on two gatherings of subjects, drunkard and non-alcoholic gatherings in the Alcoholism data set. The enemy is barely to find the biometric and the key in view of the utilization of salt, the hash capacity and encryption calculation which are secure cryptographic natives. This implies that the framework fulfills the security property.[6]

Highlight extraction and order is a subject of expansive and current interest in the mind PC interfaces (BCIs) people group, and stays a difficult undertaking while working with Electroencephalogram (EEG) information, with no settled upon ideal elements set and classifier calculation. In this 75-member lab review, we look at changed highlight extraction strategies and classifiers as we research the connection between clients' impression of the memorability of various passwords and the clients' EEG information gathered utilizing BCIs when given these passwords.This strategy shows that secret word's apparent memorability can be anticipated in view of the gathered EEG signals upon secret word show. Moreover, the outcomes show highlights separated in the time-recurrence space utilizing wavelet change, and brain organizations (NN), brought about the most noteworthy characterization performance.[8]

Mind cue based verification framework is moderately new when contrasted with different sorts of biometric information. This paper depends on Brain-Computer Interface (BCI) method utilizing Electroencephalography (EEG) signs to confirm a framework for incapacitated people. Mind PC interface (BCI) is an immediate correspondence among computer(s) and the human cerebrum. A framework works with the outer gadget control by utilizing the signs estimated from the cerebrum. The brought signs ought to be characterized into the individual categories.These arranged signals are utilized for verification reason. The benefits of this framework over a significant number of the current validation innovations incorporate variability, shoulder-riding opposition, and insurance against robbery and client rebelliousness. On the off chance that the recording and handling of mind cues can be exact and repeatable, this strategy could turn into a suitable and helpful type of authentication[9].

The electroencephalogram (EEG) signal addresses a subject's particular mind movement designs and is considered as an ideal biometric given its predominant intangibility, non-colonality, and non-pressure. To upgrade its materialness in personality validation, a clever EEG-based character confirmation technique is proposed in light of self-or non-self-face quick sequential visual presentation(RSVP).Two different fraud situations were intended to test framework security, which exhibit the capacity of hostile to duplicity. Fifteen clients and thirty frauds partook in the analysis. The mean validation exactness values for the two situations were 91.31 and 91.61%, with 6 s time cost, which delineated the accuracy and constant capacity of the framework. Moreover, to appraise the repeatability and solidness of our worldview, one more information securing meeting is directed for every client. Utilizing the grouping models produced from the past meetings, a mean bogus dismissed pace of 7.27% has been accomplished, which shows the power of our paradigm[10].

The investigation of Electroencephalogram (EEG)- based biometric has acquired the consideration of scientists because of the neurons' exceptional electrical action portrayal of a person. Be that as it may, the down to earth use of EEG-based biometric isn't right now far reaching and there are a few difficulties to its execution. Support vector machine (SVM) was then utilized for classifcation purposes. In the presentation examination, promising outcomes were gotten, where EC convention accomplished an exactness execution of 83.70-96.42% while visual excitement convention achieved a precision execution of 87.64-99.06%. These outcomes have shown the possibility and dependability of our procurement conventions with purchaser grade EEG devices[11].

Countless incommensurable measurements are right now used to report the presentation of cerebrum PC interfaces (BCI) utilized for augmentative and elective correspondence (AAC). Augmentative and elective correspondence (AAC) frameworks are utilized by people with correspondence problems to enhance or supplant discourse or composing. A wide assortment of AAC frameworks exist, going from picture and correspondence sheets to discourse producing gadgets. Proficient examination between both BCI Control and Selection Enhancement Modules, speeding up innovative work of BCI based AAC systems.BCI Control and Selection Enhancement Modules, speeding up the improvement of a commonsense, productive BCI that can be involved by people with serious engine hindrances for the reasons for communication[12].

Mind PC interface (BCI), gives a way to correspondence between a human cerebrum and an outside gadget. It acquires mind cues, plays out a few examination on them and afterward deciphers them into activities that are performed by the result devices.Eye flickering has likewise been utilized to work with the bio-metric verification framework where the pinnacle plentifulness values accomplished during the eyelid opening and the eyelid conclusion in the sign are utilized to group the quantity of squints and afterward the ensuing confirmation framework is planned. The handling techniques included extraction of elements from the FFT and DFT of the crude signal[13].

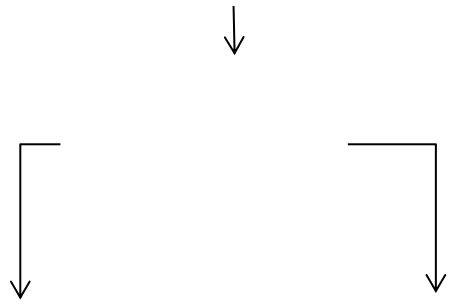
The universes most complex design is the human cerebrum. To dissect its qualities, many examinations and

tests have been completed in a legitimate and deliberate way. From these explores and analyzes, researchers have figure out how to speak with PC utilizing mind and thus, BCI has been created. A Brain Computer Interface (BCI) gives a correspondence way between the human mind and the PC framework. With the progression of data innovation and neuroscience, there has been a progression of interest in transforming fiction into the real world. This exploration examined existing works of BCI with the reason fostering a framework that permits truly moved individuals to speak with different people and assists with communicating with the outside conditions with the assistance of computers.The clamor edge is likewise required to have been gotten to the next level. With additional examination and high level examination, actually handicapped individuals who couldn't walk however just has mind movement may one day have the option to speak with the world like some other ordinary individual with the assistance of Brain-Computer Interface[14].

The subjects in EEG-Brain PC interface (BCI) framework experience challenges while endeavoring to get the reliable presentation of the genuine development by engine symbolism alone. It is important to find the ideal circumstances and upgrades blends that influence the exhibition variables of the EEG-BCI framework to ensure hardware wellbeing and trust through the presentation assessment of utilizing engine symbolism attributes that can be used in the EEG-BCI testing climate. We propose the utilization of this estimating philosophy of a heterogeneous consolidated sign for preparing information and a viewable prompt for test information by the common EEG-BCI calculation on the EEG-BCI framework to accomplish viability regarding consistence, dependability, cost, time, and assets the board without the requirement for an experimentation process[15].

IV. METHODOLOGY

The execution at first beginnings with perceiving the face.The recognition of squinting and the examination of flicker span depend exclusively on perception of the connection scores created by the following at the past step utilizing the internet based layout of the client's eye. As the client's eye closes during the course of a flicker, its similitude to the open eye format diminishes. Moreover, it recovers its comparability to the layout as the flicker closes and the client's eye turns out to be completely open once more. This lessening and expansion in comparability relate straightforwardly to the connection scores returned by the format matching technique.



It catches eye position and perceives the eye development. At the point when the client flickers the eye, it catches the eye squint. At long last, the PIN of the ATM. The PIN entered by the client will be checked by the framework. On the off chance that entered PIN is wrong it will stop.

A. FACE RECOGNITION AND EYE BLINK DETECTION

Hearty continuous facial milestone finders that catch the majority of the trademark focuses on a human face picture, including eye corners and eyelids. The majority of the cutting edge milestone finders plan a relapse issue, where a planning from a picture into milestone positions. To take advantage of cutting edge facial milestone identifiers to restrict the eyes and eyelid shapes. From the milestones distinguished in the picture, we determine the eye perspective proportion (EAR) that is utilized as a gauge of the educational state. Since the per outline EAR may not be guaranteed to perceive the eye flickers accurately, a classifier that considers a bigger fleeting window of an edge is prepared. For each video outline, the eye tourist spots are recognized. The eye perspective proportion (EAR) among level and width of the eye is figured. Everything is finished through PC camera.

$$\mathrm{EAR} = \frac{||\mathrm{P2} - \mathrm{P6}|| + ||\mathrm{P3} - \mathrm{P5}||}{2||\mathrm{P1} - \mathrm{P4}||}$$

B. PASSWORD AUTHENTICATION USING EYE BLINK

The techniques for entering passwords can be made safe enough utilizing most recent strategies, for example, eye following. It implies that utilize your eyes which won't leave prints like when we enter secret key by hands, which can be recovered through silica gel, so there's no point of safe passage of secret phrase. In this way, the eye global positioning framework can be utilized for more secure choices which got numerous strategies in it, here we pick is the technique like flickering of eye for secret phrase confirmation, which won't abandon any prints.

C. HARDWARE AND SOFTWARE REQUIRED

Equipment expected for this work is just PC. Equipment utilization is exceptionally less as it requires just a single thing to finish this undertaking. Eye flicker is recognized through camera in PC in the event that not expansion camera ought to be set up for the PC. Programming required is python 3.6 form (64 bit). As Python 3.6 presents another module, 'insider facts'. This module loans us an approach to dependably produce areas of strength for cryptographically irregular qualities. Utilizing these, we can oversee mysteries like record verification, tokens, thus.

V. IMPLEMENTATON

By this we pronounce that secret word validation utilizing the squinting strategy is the best method to keeps from shoulder surfing, warm assault or some other sort of assaults in present age. This innovation enjoys a larger number of benefits than the wide range of various which can be a danger to the client. This technique is protected that clients need not enter their PIN on the PC and flickering the digits is simple

1. First run the code.
2. Three windows are shown, one is virtual console, another is utilized to take input from client and the other is utilized to show the numbers chosen by the client.
3. In edge window the ongoing of the client is caught and their eyes are recognized.
4. The digits showed on the board windows is utilized to coordinate that with the PIN.
5. In virtual console there are 10 digits (1,2,3,4,5,6,7,8,9,0), E(Enter) and P(Pop).
6. The Pop key will pop the last chosen number.
7. The eyes will be encircled by the red line when eye is open.
8. Whenever the client flickers the eye, the variety changes to green.
9. Whenever the client squints the eye, the variety changes to number is chosen and afterward we need to flicker our eye for few moments.
10. Immediately taking the information the client will hear a signal sound then the client can open the eyes.
11. Subsequent to entering the secret word, in the event that the secret key is coordinated, he/she will be perceived as a verified client else they should pursue another opportunity.

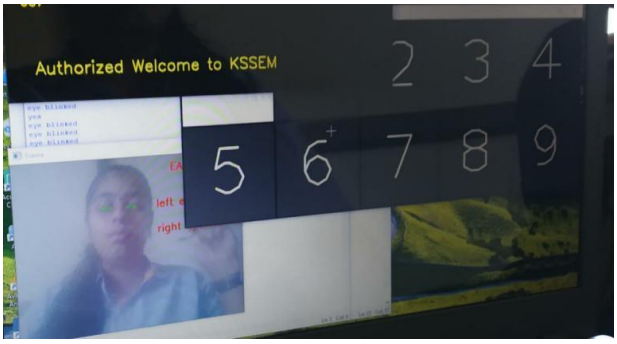


Fig5.1 Authorized user

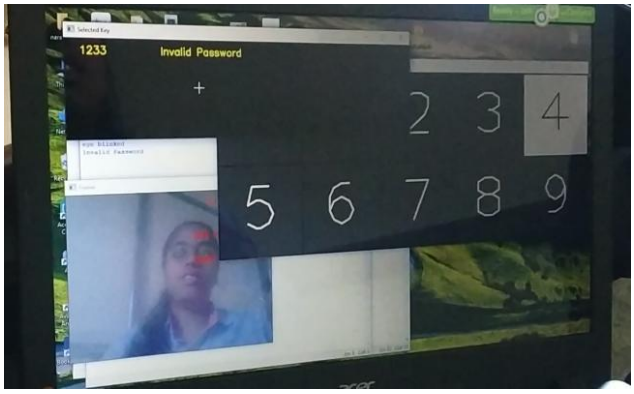


Fig5.2 Unauthorized user

VI. CONCLUSION

The Implementation of Password Authentication framework utilizing Brain signals is a confounded and tedious undertaking. Rather than Brain signals, We utilized Eye flickers which are recognized by the camera in PC to Authenticate the secret key. The secret phrase verification is work through Python language. Subsequent to running the code numeric design will be popup in the screen. White blaze will be giving the numeric numbers from 0 to 9 in a grouping request. The secret key is set to 4 digits, when the blaze shows up on the pin number flicker the eyes to enter that pin all together. In the event that the 4 digits coordinates with the pin, it shows Authorized or probably it shows Unauthorized.

FUTURE WORK

Future work on the Password Authentication with cameras or eye squint sensors of picture handling space is to foster a product or point of interaction this framework to any application. Carrying out alphabetic, and blend of exceptional characters, numeric and alphabetic. To involve a 2 stage confirmation strategies for additional security purposes.

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