Conjugation of Graphical Password by Image Segmentation

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ABSTRACT- A New Approach to GraphicalPassword Authentication by ImageSegmentation. With the inherent problems in traditional text-based password, researchers have been searching for alternative authentication mechanisms. GraphicalPasswords to The Rescue: One of the promising alternatives of passwords is graphical password because we remember images and shapes naturally, even when our textual memory diminishes away. By designing a system that breaks an image intosegments which are possible components of one password. Once a user selects particulararrangement of these segments, and just likethat have in simple words created what we now know as passwords. It makes dictionary and brute force attacks challenging by increasing the password space. The paper describes the authentications ofsegmentation algorithm, user interface design and evaluation system's security & usability through user.

Keywords: Authentication, Encryption,Graphical, Password, Image, Login, Segmentation

I. Introduction

In today's digital age, password-based authentication is still one of the mostregularly utilized ways for safeguarding networks. However, text-based passwords typically have flaws, making themvulnerable to things like brute-forceassaults, phishing, and even somebody looking over your shoulder. Graphical passwords, which employ graphics instead of text, have become an enticing way tohandle these challenges. In this study, we offer a new way to graphical passwords utilizing picture **[1]** segmentation. In thismethod, users generate a password byselecting specified portions of an image in aparticular order. This strategy uses our natural capacity to remember visual information, delivering a more secure and user-friendly solution to preserve critical data.

Keywords: Brute-force attacks, Phishing,Shoulder surfing, Visual memory, Digital security

1. Background

Password-based authentication is a key aspect of keeping our digital lives secure, but standard text-based passwords comewith their share of challenges. They can be subject to assaults like brute-force attempts,phishing scams, or keylogging. Plus, many users choose to create weak passwords or reuse the same ones across many sites, which increases the danger even more. To combat these challenges, graphical passwords have been introduced as an alternative, seeking to increase bothsecurity and convenience of use by tapping into our brain's strength in remembering visuals rather than text. Graphical passwords function in different ways. For example, in recognition-based systems like the Passfaces approach, users are prompted to identify recognizable faces from a grid of photographs. In another alternative, termed the create-A-Secret (DAS) method, users create a unique form on a grid that works as their password. While these systems have their merits, they also face challenges like being simple to forget, complicated to use, or subject to specific sorts of assaults (e.g., patterns being guessed or repeated). A potential way to increase security and usability is to develop graphical passwords utilizing advanced techniques like picture segmentation. Imagesegmentation is a tool from computer visionwhere an image is divided down into multiple sections depending on attributeslike color or texture. In the context of graphical passwords, this technique can be used to enable users chose certain sections of a picture as their password. This strategyadds complexity, making the system tougher to crack, while still making use of the human brain's natural ability to detect and memorize visual patterns

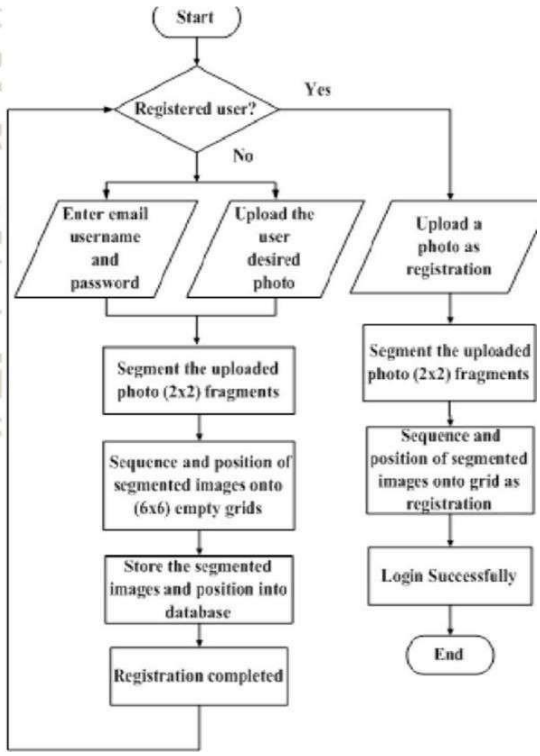


Fig1: working of Graphical password

1.2 Related Work

I. Numerous graphical password systems have been created over the years, each possessing distinct advantages anddisadvantages. This overview examines fundamental principles that haveinfluenced the discipline, highlighting the role of picture segmentation in enhancing system security and user-friendliness. Passfaces, developed by Real user Corporation, is one of the earliest and most recognized graphical password systems. Passfaces operates ona straightforward concept: users are presented with a grid of human faces andmust select the ones they previously designated as their password.

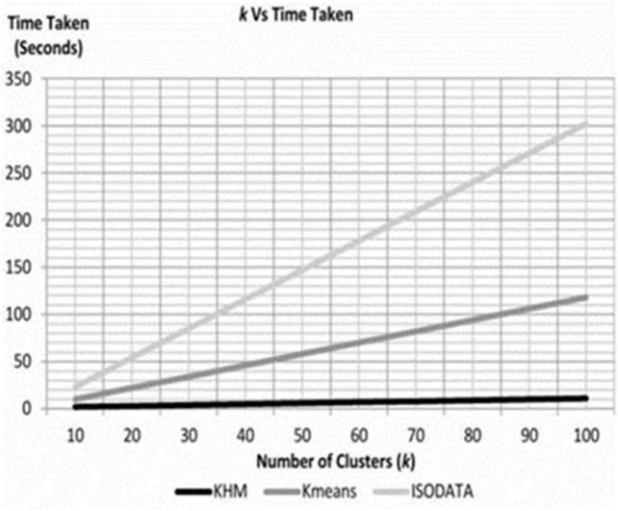


Figure 2: K-means

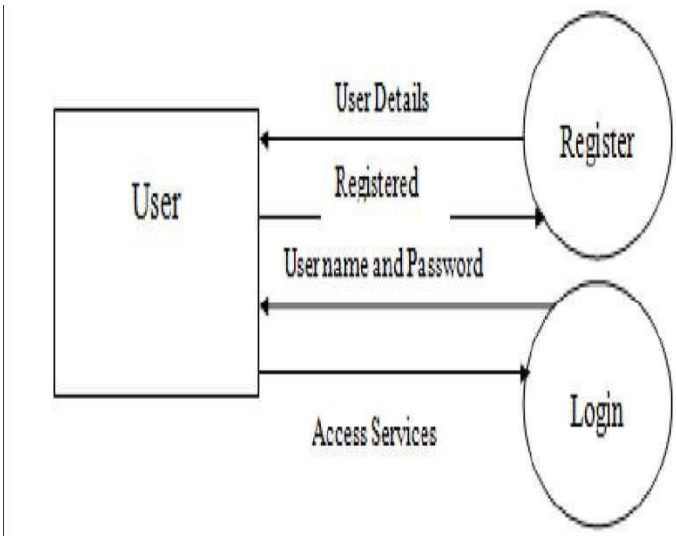


Fig 3: 0-level DFD

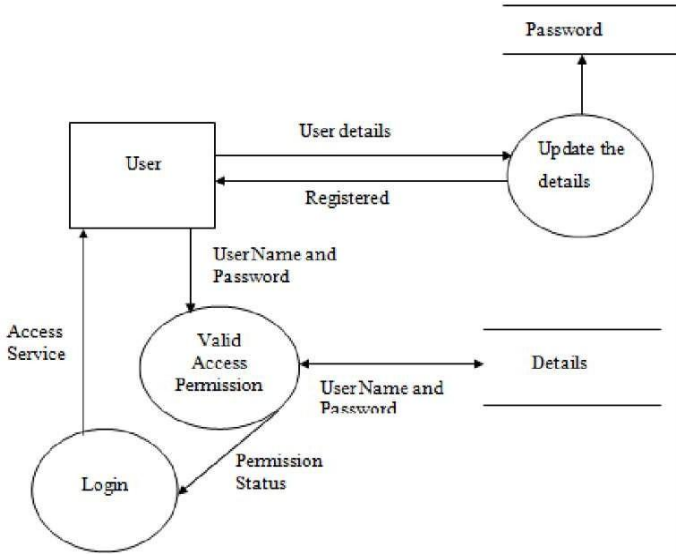


Fig 4: 1-level DFD

II. capitalizes on our superior ability torecall faces compared to arbitrary sequences of text. Although useful in certain instances, Passfaces possesses limits. For instance, if a somebody observes you inputting your password, a practice referred to as "shoulder surfing," they couldreadily discern the characters you select. It necessitates an extensive database of photos to ensure thesystem's security against guessing attempts.

III. Then there's [3] Draw-A-Secret (DAS), a method created in 1999 by Jermyn and colleagues. In DAS, users sketch a shape on a grid, and the system encodes the password based on where the lines connect. The benefit of drawing simplicity iscountered by a significantdrawback: individuals oftenproduce analogous, predictable designs, facilitating password guessing by attackers. Plus, remembering complex formsmight be tough for users, leading to dissatisfaction.

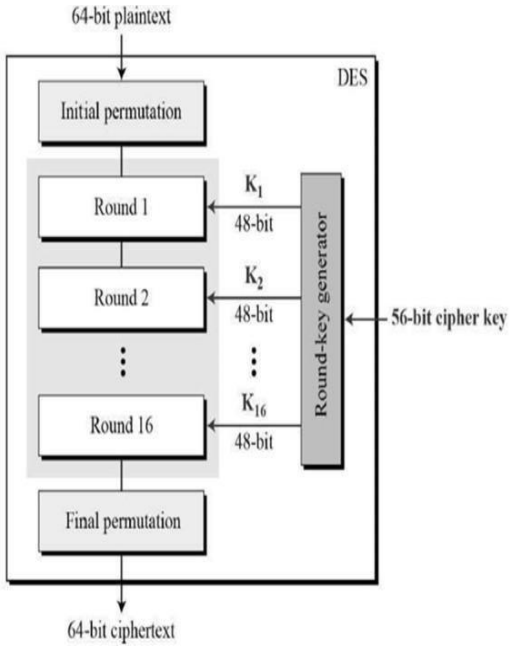


Fig 5: DAS Working

IV. To make graphical passwords more secure and user-friendly, several researchers went to more complex approaches like picture segmentation. This strategyinvolves splitting an image into smaller, significant parts—based on color, texture, or other features— that user can select as their password. For example, in onestudy, researchers studied how segmentation could make password creation both easy for users and tougher for attackers to guess. By selecting a specific section of a picture, users may build more unique passwords that are tough to hackbut also easy to remember.

V. Edge detection and region-based segmentation are two common approaches used in image processing that have also found its way into graphical password systems. Edge detection helps identify the boundaries inside an image, while region-basedsegmentation combinescomparable pixels together. Thesestrategies make it easier for users to pick specific areas of an image their password, minimizing errorsand boosting security by making the selection process moreaccurate.

1.3 Image Segmentation: A NewWay to Create Graphical Passwords

Traditional passwords have been around forever, but let's face it—they have some serious issues. They're easy to forget, and they can be vulnerable to various attacks. That's why graphical passwords, where users pick or interact with images rather than typing a word, have gained attention. Building on this idea, a new approach that uses image segmentation could make thesesystems even more secure and user- friendly. Image segmentation is a fancyterm from computer vision that means breaking an image into smaller, meaningfulparts based on features like color, texture, or edges. Think of it like drawing invisiblelines around different objects or areas in a picture, like separating the sky from the buildings in a cityscape.

This concept can be used in graphical passwords by having users pick specific parts of an image— those segments— as their password.

Fig 6: Original Image

Fig 7: Segmented Image with sequence clue

1.3.1 Working of Password-System:

In an image segmentation-based password system, you would be shown a segmented image—maybe a landscape or an abstract pattern. Instead of remembering a tricky sequence of text or clicking random points on an image, you'd pickcertain segments of that image, like a tree in the background or a specific area of color. The mixture of these chosen segments would form your password.

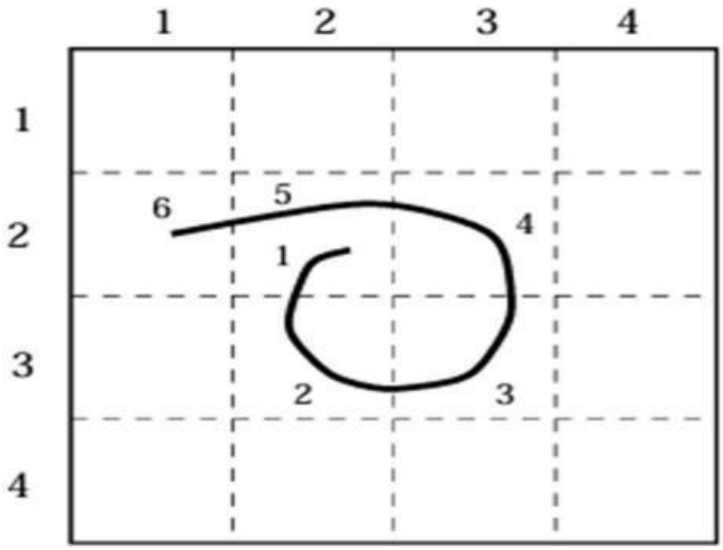


Fig 8: working of password system

Here's what the process might look like:

I. **Image Selection:** You're given an image that's been divided intodifferent parts.

II. **Choosing Segments:** You selectspecific segments, such as itemsor areas in the image (e.g., a car,a mountain, or a bright red section).

III. **Password Creation:** The uniquemix of segments becomes your password. When you log in, you'd the process of selecting those segments in the right order.

II. Discussion

While the suggested approach boosts security and usability, it is not without limitations. For instance, the system's reliance on predetermined images may limit user personalization. Additionally, the intricacy of image segmentation could increase computational cost, impacting system performance. Despite theserestrictions, the system delivers significant advantages in terms of memorability and resistance to typical attack vectors.

2.1 Strengths of the Proposed System:

I. [5]**Enhanced Memorability:** One of the primary advantages of employing photos for password creation is the better memorability. Humans are oftenbetter at recalling visual informationthan to text-based material. In the picture segmentation system, usersselect distinct areas of an image,providing a unique password that iseasier to memorize. This tackles one of the most common concerns with traditional passwords, where users typically forget their complex alphanumeric passwords, leading to undesirable practices like

II. password reuse or simplifying their passwords to make them more remember.

III. **Resistance to Common Attacks:**

The system provides a substantial benefit in terms of security. Graphical passwords, especially when paired with picture segmentation, are resistant to many traditional assaults. Here are several examples:

I. **Brute-force Attacks:** Withtraditional passwords, attackerscommonly utilize brute-force techniques to guess passwords through trial and error. However, with picture segmentation, the sheer number of conceivable combinations of image segments increases thedifficulty of such attacks dramatically.

II. **Phishing:** Since the password is not text-based, phishing attacks, where users are tricked into revealing their password, are less effective.

III. **Shoulder Surfing:** The segmented image makes it harder for an attacker to replicate the exact password just by watching someone log in, as the segments may appear visually similar to the observer but contain subtle differences.

Flexibility in Design: The technique can be applied to numerous sorts of photographs, including landscapes, abstract art, or customized images made expressly for password generating. This adaptability enables for varied applications and perhapsboosts user engagement by allowing them to interact with a wide variety of visual content. tougher for an attacker to duplicate the exact password only by watching someone log in, as the segments may appear visually similar to the observer but contain small changes.

2.1.2 Multifactor Compatibility: The graphical password system can be combined with other authentication methods such as biometrics or traditional passwords to create a [7] multifactor authentication(MFA) system. This offers an additional layer of security,especially in environments where high-level protection is necessary.

2.2 Challenges and Limitations

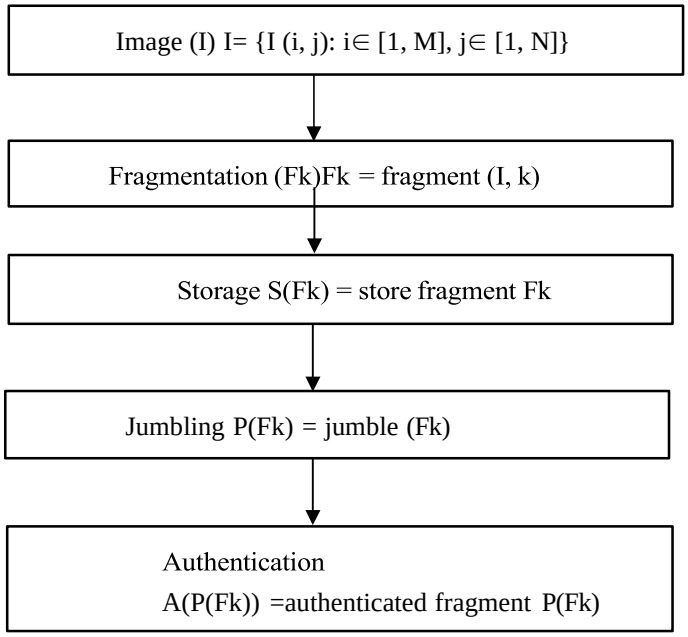
I. **Limited Personalization:** One ofthe key drawbacks of the system is in its dependence on predefined images. Users are frequently more comfortable withcustomization, and the inability tochoose or upload personal photographs could detract from the overall user experience. This constraint may inhibit widespreadadoption, as users can feel constricted by the limited variety of images, leading to disengagement or lower usability

II. **Usability Trade-offs**: While themethod promotes security andmemorability, it could create usability issues for certain users.

III. **Cognitive Load:** For users who are not visually oriented or have trouble recognizing patterns, picking portions from complicated images could become a tedious operation. The segmentation must be straightforward enough to not overwhelm consumers with too many choices or confusing segmentborders.

IV. **Learning Curve:** Users inexperiencedwith graphical password systems may find it challenging to adopt. Training or user onboarding may be essential, whichintroduces friction during initial adoption. Additionally, if users must be taught how to engage with specific portions, this could present accessibility difficulties for individuals with cognitiveor motor disabilities

IV. Proposed work:



V. Framework Plan and Engineering

The main period of the proposed workincludes planning the engineering of the graphical secret word framework. This incorporates:

- **Frontend Advancement:** Making an instinctive and responsive UI (UI) that permits clients to interface with pictures for secret key creation and confirmation. Carrying out picture division, where pictures are separated into more modest fragments orinteractive focuses. Clients canchoose different portions in a particular grouping to frame their secret phrase.

- **Backend Improvement:** Creating secure capacity and handling of graphical passwords. Chosen picture sections or snap directions will be put away safely utilizing encryption and hashing calculations to safeguard against unapprovedaccess.

Planning a productive information base construction to deal with enormous volumesof graphical secret key information without compromising execution.

Picture Division and Determination

The center component of the framework isthe division of pictures for secret word creation:

I. **Picture Division**:

The framework will isolate the chose picture into numerous interactive regions or sections. Each section will have explicit directions or limits that the framework will perceive duringboth secret word creation and confirmation.
The division should be adjusted toguarantee a suitable degree of intricacy: fragments ought to be neither too huge nor too little to even consider adjusting among convenience and security.

II. **Secret phrase Creation**:

Clients will make their passwordsby clicking or choosing a predefined number of portions inside the picture in a specific request. This choice will act as theclient's secret key, with the grouping and area of the snaps putaway safely. A "tick resilience" element will be carried out to permit slight variety in the area ofsnaps during verification, guaranteeing convenience withoutforfeiting security.

1. Secret key Verification Cycle

The validation cycle will expect clients torehash similar choices made during the secret word creation stage:

I. **Signaled Review:**

During validation, the framework will give clients a similar picture utilized for secret phrase creation. Clients should choose similar sections in the specific request forthe framework to check their character. A signaled review system will assist clients with recalling their secret word by involving the visual picture as a brief, decreasing mental burden contrasted with text-based passwords.

II. **Mistake Taking care of and Input:**

The framework will furnish clientswith input assuming they inaccurately select picture sections.In any case, criticism systems will be painstakingly intended to try notto offer a lot of data about the right secret phrase for the sake of security. A predetermined number of confirmation endeavors will be implemented to safeguard against savage power and speculating assaults.

2. Security Improvements

A few security components will be incorporated to address explicit weaknesses and guarantee powerful insurance:

I. **Encryption and Secure Stockpiling**:Secret word information,
including picture fragments and snap arranges, will be hashed and encoded areas ofstrength for utilizing techniques. This will guarantee that regardless of whether the framework is penetrated, the secret phraseinformation stays secured.

II. **Animal Power Opposition:**

To forestall animal power assaults, the framework will guarantee that the graphical secret phrase space is huge,with various conceivable fragment mixes and snap groupings.

The framework will carry outaccount lockout or Manual human test systems after a specific number of fizzled login endeavors to forestall robotized speculating.

III. **Shoulder Surfing andSmirch Assault Moderation**:

Since graphical passwords canbe powerless against shoulder surfing (where aggressors notice the login interaction) and smirch assaults (where aggressors investigate fingerprints or smears left on touchscreens), extra security elements, for example, randomizing the picture or utilizing dynamic picture overlays might be investigated.

5. ***Ease of use and ClientExperience Assessment***

To guarantee that the framework is easy to understand and simple to takeon, convenience testing will be a vitalpart of the proposed work:

I. Client Testing:

A progression of client tests will be ledto assess how instinctive and paramountthe graphical secret key framework is contrasted with conventional text-basedpasswords. Test members will make and confirm their passwords in different situations.

Convenience measurements, for example, task consummation time, achievement rate, and mistake rate will be dissected to distinguish likely regions for development.

II. Memorability Studies:

Studies will be directed to survey the memorability of graphical passwords aftersome time, deciding how effectively clientscan review their graphical passwords aftervarious time periods use.

IV. **Conclusion:**

Graphical passwords using imagesegmentation offer a fresh and promising alternative to traditional text-based passwords, leveraging the human brain'snatural ability to remember and recognize images. By choosing segments of an imageas a password, users can enjoy a more secure and memorable way to protect theiraccounts.

This approach greatly increases thecomplexity of guessing attacks, making it harder for hackers to crack passwords using brute force or common patterns.

The system is not only more secure but alsouser- friendly, as people usually find it easier to remember images than complex text or number combinations. However, difficulties remain. Striking the right balance between security and usability is crucial, as overly complicatedsegmentations may frustrate users, while overly simple ones might risk security. Future work should focus on making the system adaptive, allowing personalized images and [11] dynamic segmentation based on user tastes.

There are still worries about real-world attacks, such as shoulder surfing, wheresomeone could observe the password entry.To counter this, future versions.

V. **Future Work**

The graphical password system employing picture segmentation offers great promise, but there are various ways it might be enhanced and expanded. In the future, there are a number of critical topics to examine tomake the system even more secure, usable, and adaptable to regular users.

I. Personalized Images:

Currently, the system uses set images, but people might connect more with personalphotos that mean something to them. Future versions could allow users to add their own pictures, [9] making the password creation process more personal and engaging. This would not only make the system feel more user- friendly but also build more unique and harder-to-guess passwords.

II. [10] **Smarter Image Segmentation:**Not all photos work the same way when broken into segments.

A family picture might need different processing compared to a landscape or abstract art. Future study could focus on smarter algorithms thatautomatically adjust to different types of images, ensuring that the segments are meaningful and easy for users to remember.

III. User-Customized Segmentation:

People like to have power over their technology. Allowing users to decide how their images are segmentedcould improve their connection to the system and their knowledge of how it works. For example, they could highlight or select parts of the picture that they feel are most memorable or meaningful to them.

IV. Defending Against Real-WorldAttacks:

Even though graphical passwords are more secure than text-basedones, they are still vulnerable to attacks like shoulder surfing(where someone watches you enter your password). Future improvements could include features like randomized image segments that change positions between logins or adding small variations to make it harder foranyone watching to copy.

V. Combining with Other Authentication Methods:

Combining graphical passwords with other security methods, suchas fingerprints or face recognition, could provide an extra layer of security. This would also give users more choices, allowingthem to choose a combination ofmethods that they are most comfortable with could randomizesegments or mix graphicalpasswords with other security methods like biometrics or multi-factor authentication for extra protection

Title	Method	Description	Issues	Key Changes
Brostoff & Sasse (Are Passfaces More Usable Than Passwords? A Field Trial Investigation) (2000)	Passfaces	Users select specific faces from agrid that they previously designated astheir password.	Vulnerable to "shoulder surfing" where observers can see selections.	Introduced face recognition as a password system, leveraging users'ability to remember human faces
Jermyn et al. (The Design and Analysis of Graphical Passwords) (1999)	Draw-A-Secret (DAS)	Users draw a pattern or shape on a grid, which is encoded as a password.	Users often create predictable designs that are easy to guess.	Simplified password input by allowing freeform drawing, although it canlead to common, guessable patterns.
Chiasson et al. (Influencing Users Towards Better Passwords: Persuasive Cued Click-Points) (2009)	Cued Click Points (CCP)	Users click on specific points of an image to form their password, using visualcues for memory retention.	Patterns can be easily observed andguessed if monitored.	Enhanced click-based systems with visual cues, making them more memorable andreducing reliance on text-based passwords.
Gao et al. (Design and Analysis of a Graphical Password Scheme) (2009)	Edge Detection	Uses algorithms to detect edges in images, providing a more accurate segmentatio nprocess.	Sensitive to noise, which can adversely affect segmentatio n quality.	Improved accuracy in identifying distinct regions, enhancing reliability in graphical password systems
[8] Hayashi & Hong (A Diary Study of Password Usage in Daily Life) (2011)	Region-based Segment ation	Segments images based on pixel similarity (color and intensity) tocreate more homogeneou s regions.	High computatio nal cost; potential issues with noise affecting accuracy.	Offers a more accurate segmentation method that enhances the effectiveness ofgraphical passwords based on visual similarity.

Table1: Table of Comparison

II. References:

[1] Biddle, R., Chiasson, S., & Van Oorschot, P. C. (2012). Graphical passwords: Learning from the first twelveyears. *ACM Computing Surveys, 44*(4), 1-41. https://doi.org/10.1145/2333112.2333114

[2] Brostoff, S., & Sasse, M. A. (2000). Are passfaces more usable than passwords? A field trial investigation.

In Proceedings of the British HCI Group Annual Conference* (pp. 405-424).Springer.

https://doi.org/10.1007/978-1-4471-1186-5_27

[3] Chiasson, S., Forget, A., Biddle, R., & Van Oorschot, P. C. (2009). Influencing users towards better passwords: Persuasive cued click-points. In *Proceedings of the British HCI Group Annual Conference* (pp. 121-130). ACM. https://doi.org/10.1145/1572532.1572566

[4] Davis, D., Monrose, F., & Reiter, M. K. (2004). On user choice in graphical password schemes. In

13th USENIX Security Symposium (pp. 11-11). USENIX Association.

https://doi.org/10.5555/1251375.1251376

[5] Dunphy, P., & Yan, J. (2007). Do background images improve "draw a secret" graphical passwords?

In Proceedings of the 14th ACM Conference on Computer and Communications Security*(pp. 36-47). ACM.

https://doi.org/10.1109/ICICIC.2009.219

[6] Gao, H., Liu, X., Dai, R., Wang, S., & Liu, H. (2009). Design and analysis of a graphical password scheme. In *2009 Fourth International Conference on Innovative Computing,Information and Control* (pp. 675-678). IEEE.

https://doi.org/10.1109/ICICIC.2009.219

[7] Goldberg, J., Hagman, J., & Sazawal, V. (2002). Doodling our way to better authentication: Exploring the effect of free-form doodles on authentication performance. In *Proceedings of the ACM Conference on Human Factors in Computing Systems* (pp. 279-280). ACM. https://doi.org/10.1145/503376.503458

[8] Hayashi, E., & Hong, J. I. (2011). A diary study of password usage in daily life. In *Proceedings of the 2011 ACM Conference on Human Factors in Computing Systems* (pp. 2627-2630). ACM. https://doi.org/10.1145/1978942.1979326

[9] Khot, R. A., & Bianchi, A. (2015). Exploring mobile authentication methods: What dousers want? In Proceedings of the ACM Conference on Human Factors in Computing Systems* (pp. 2455-2464). ACM.https://doi.org/10.1145/2702123.2702293

[10] Luo, Y., & Lin, X. (2016). Graphical passwords: A survey. *Journal of Network and Computer Applications,42*, 55-69. https://doi.org/10.1016/j.jnca.2016.04.006

[11] Man, S., Hong, D., & Memon, N. (2004). Password management for draw-a-secret (DAS)schemes. In Proceedings of the 2004 ACM Conference on Computer and Communications Security*(pp. 224- 231). ACM. https://doi.org/10.1145/1041335.1041363

[12] Nelson, D. L., Reed, U. S., & Walling, J. R. (1977). Pictorial superiority effect. *Journal of Experimental Psychology: Human Learning and Memory, 3*(5), 485-497. https://doi.org/10.1037/0278-7393.3.5.485