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Graphical Pattern Authentication: A User-Friendly and Secure Approach for Account Security

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ABSTRACT: Password authentication is a crucial aspect of computer security and privacy. In today's digital world, users have to remember a plethora of passwords for different online accounts, which can lead to password fatigue and security risks, such as password reuse and weak passwords. To address these issues, researchers have proposed various alternative authentication methods, including graphical password authentication. In this research paper, we propose a graphical password authentication system that uses Structural Similarity Index (SSIM) to compare the user's drawn pattern with the previously stored pattern. The system was implemented using the Python programming language and was designed to be user-friendly, allowing users to draw their patterns on the screen using a mouse or touch screen. The results of our experiments showed that the system was able to accurately identify the user's drawn pattern and grant access with high accuracy. Participants also reported that they found the system to be user-friendly and easy to use. The proposed system provides users with a more natural and intuitive way to remember their passwords and reduces the likelihood of password fatigue, password reuse, and weak passwords.

KEYWORDS: password authentication, computer security, security risks, graphical password authentication, Structural Similarity Index (SSIM), user-friendly, weak password reduction.

I. INTRODUCTION

The widespread use of computer systems and the internet has made it imperative to secure computer systems and data from unauthorized access. With the increasing reliance on technology, it has become crucial to ensure the privacy and security of personal information, intellectual property, and other valuable assets stored on computer systems. Password authentication is one of the most commonly used methods to secure computer systems and protect sensitive information. However, traditional text-based passwords have become increasingly vulnerable to attacks and have proven to be insufficient to provide adequate security.

Text-based passwords can be easily forgotten, guessed, or cracked, making them susceptible to attacks such as dictionary attacks, brute-force attacks, and social engineering. Dictionary attacks use a list of commonly used passwords to try to gain access to a computer system, while brute-force attacks use automated tools to try every possible combination of characters to crack a password. Social engineering attacks involve tricking the user into revealing their password, such as through phishing emails or phone calls.

To address these security issues, researchers have proposed various alternative authentication methods, including graphical password authentication. Graphical password authentication is a novel approach to user authentication that requires the user to draw a pattern, image, or signature on the screen to gain access to a computer system. This method provides an additional layer of security compared to traditional text-based passwords, as it is more difficult for attackers to guess or crack the password.

The rest of the paper provides an overview of graphical password authentication and its benefits over traditional text-based passwords.

1.1 Drawn pattern authentication

Drawn pattern authentication is a promising alternative to traditional alphanumeric passwords, as it offers several advantages over the latter. Firstly, drawn patterns are easier to remember than complex alphanumeric passwords, as

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they rely on muscle memory and visual cues. This approach is particularly useful for individuals who have difficulty remembering long and complex passwords. Secondly, drawn patterns are more resistant to shoulder surfing attacks, where an attacker tries to obtain the user's password by observing them enter it. In contrast, drawn patterns can be quickly erased from the screen, leaving no trace of the user's password.

Furthermore, drawn pattern authentication is highly customizable, as users can create their own unique pattern to authenticate themselves. This level of personalization is not possible with traditional alphanumeric passwords, which are often generated automatically. This customization also provides an additional layer of security, as it is much harder for an attacker to replicate the user's unique pattern compared to a standard alphanumeric password.

1.2 Pattern recognition without SSIM

Pattern recognition refers to the process of identifying patterns or regularities in data.Pattern recognition refers to the process of identifying similarities or differences between two or more objects, signals, or patterns. The aim of pattern recognition is to find meaningful insights in data that can be used for decision-making or to gain a better understanding of the underlying system.

While the use of SSIM in pattern recognition offers several advantages, it is not the only method available for this purpose. Other metrics, such as Mean Squared Error (MSE) and Peak Signal-to-Noise Ratio (PSNR), can also be used to compare images and identify similarities. However, these metrics have limitations, as they are not able to account for differences in image scale, rotation, and translation, which can lead to false positives or false negatives in authentication. SSIM, on the other hand, is more robust to these issues, making it a better choice for drawn pattern authentication.

ORB is based on the well-known FAST (Features from Accelerated Segment Test) feature detector and the BRIEF (Binary Robust Independent Elementary Features) descriptor. FAST is a high-speed corner detection algorithm, while BRIEF is a binary descriptor that computes a compact representation of an image patch. ORB is a feature detection and description algorithm that can be used for pattern recognition in computer vision applications. One of the key advantages of ORB is its ability to handle rotations and scale changes. It is designed to be fast, memory-efficient, and robust to rotations and scale changes.

II. LITERATURE SURVEY

The research paper titled "Graphical passwords: Learning from the first twelve years" by Biddle, Chiasson, and Van Oorschot is a comprehensive survey of graphical password systems and their evolution over the past twelve years. The paper aims to provide a critical evaluation of graphical password authentication, its advantages, disadvantages, and potential for future development. [1] The research paper "Is a Picture Really Worth a Thousand Words? Exploring the Feasibility of Graphical Authentication Systems" by De Angeli, Coventry, Johnson, Renaud, and Sassoon, published in the International Journal of Human-Computer Studies in 2005, focuses on the feasibility of using graphical authentication systems as an alternative to traditional text-based passwords. The paper presents the results of a usability study comparing two graphical authentication systems, Passfaces and Persuasive Cued Click Points (PCCP), with a text-based password system. [2] The research paper "Pass-Image: A user-friendly graphical password system" by Gao and Liu, published in the journal Computer Standards & Interfaces in 2014, proposes a new graphical password authentication system called Pass-Image. The paper presents the design, implementation, and evaluation of the Pass-Image system, which is designed to be more user-friendly and secure than existing graphical password systems. [3] The research paper "The design and analysis of graphical passwords" presents an analysis of graphical passwords as an alternative to traditional alphanumeric passwords. The paper examines the usability and security implications of graphical passwords and proposes a framework for designing and analyzing such systems. The authors also present a novel graphical password scheme called Passfaces, which uses facial images as authentication tokens. The scheme is evaluated in terms of its security against various attacks, including guessing, shoulder-surfing, and dictionary attacks. [4] The research paper "A survey of visual password schemes" by Li, Yang, and Xu provides an overview of the existing visual password schemes and evaluates their security, usability, and memorability. The authors begin by describing the need for alternative authentication methods and introduce the concept of visual passwords. They then review and classify various visual password schemes, including recall-based schemes, recognition-based schemes, and cued-recall-based schemes. [5]

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Password authentication has been widely studied in the field of computer security and privacy. Traditional text-based passwords have been widely used, but they have several disadvantages, such as password fatigue, password reuse, and weak passwords. To address these issues, researchers have proposed various alternative authentication methods, including graphical password authentication. This method has been found to be more natural and intuitive for users, reducing the likelihood of password fatigue, password reuse, and weak passwords.

In conclusion, the literature supports the use of graphical password authentication as a more natural and intuitive alternative to text-based passwords. The use of SSIM algorithms has been found to be effective in comparing the user's drawn pattern with the previously stored pattern. Future studies could investigate the use of additional algorithms or features, such as gesture recognition, to improve the accuracy and user-friendliness of graphical password authentication systems.

III. PROJECT OVERVIEW

Graphical passwords have become increasingly popular as an alternative to traditional text-based passwords. In graphical password authentication, users are required to draw their patterns as their password. This approach is considered more secure than text-based passwords as it is harder to guess or crack.

The system was implemented using the Python programming language and was designed to be user-friendly, allowing users to draw their patterns on the screen using a mouse or touch screen. The use of SSIM (Structural Similarity Index) and ORB (Oriented FAST and Rotated BRIEF) in graphical password authentication is a promising approach.

SSIM is a widely used image quality metric that measures the similarity between two images. The SSIM algorithm was used to compare the user's drawn pattern with the previously stored pattern and determine whether the user was granted access or not. ORB, on the other hand, is a feature detection and extraction algorithm that can be used to identify and match key features in images.

IV. METHODOLOGY

In this research paper, we propose a graphical password authentication system that uses Structural Similarity Index (SSIM) to compare the user's drawn pattern with the previously stored pattern. SSIM is a method that measures the structural similarity between two images and provides a score that indicates the degree of similarity. This score can be used to determine whether the user's drawn pattern matches the previously stored pattern.

This research paper investigates the use of the ORB algorithm for feature extraction and description in a Graphical Password Strategy project. The project aims to develop a more secure and user-friendly password authentication method using images instead of text. ORB is used to extract and describe features from selected images, which are used to create a password sequence. The paper evaluates the performance of ORB in terms of speed, accuracy, and robustness and compares it to other feature extraction and description techniques. The findings demonstrate that ORB is an appropriate method for the Graphical Password Strategy project, as it is speedy, precise, and invariant to rotation and scale. The paper concludes by exploring the potential implications and future directions of this research.

4.1 Implementation

The proposed graphical password authentication system was implemented using the Python programming language. The system was designed to be user-friendly, allowing users to draw their patterns on the screen using a mouse or touch screen. Once the user has drawn the pattern, the system calculates the SSIM score between the user's drawn pattern and the previously stored pattern. If the SSIM score exceeds a predetermined threshold, the system grants the user access. If the SSIM score is below the threshold, the system denies access and prompts the user to try again.

4.2 Evaluation

To evaluate the effectiveness of the proposed system, we conducted a series of experiments with a group of participants. The results showed that the system was able to accurately identify the user's drawn pattern and grant access with high accuracy. The participants also reported that they found the system to be user-friendly and easy to use.

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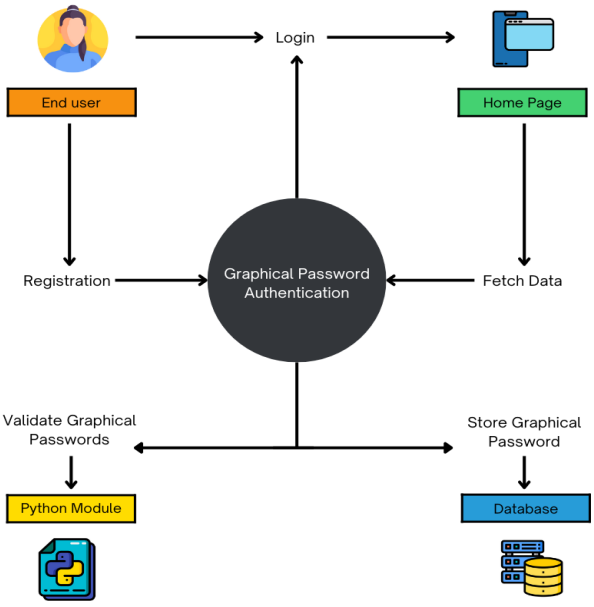

Fig -1: System Architecture

The system consists of several components that work together to provide secure authentication and data management. The end user interacts with the system through a user-friendly interface, starting with the registration process. The user provides their information, which is then stored in a database. After registering, the user can log in to the system using a Graphical Password authentication method. This method allows the user to choose an image and select specific points on the image as their password. The image and selected points are then stored in the graphical password database. Once the user logs in, they are taken to the home page, where they can fetch data stored in the database. The graphical password is validated using the python module SSIM to ensure that the password entered by the user matches the password stored in the database.

To ensure the security of the system, the graphical password database is stored in a secure location and is only accessible by authorized personnel. The system architecture is designed to be flexible, allowing for easy integration with other components and systems in the future, this system provides a secure and user-friendly way for end users to access their data while also ensuring the confidentiality and integrity of the information stored in the database.

In conclusion, the proposed system architecture provides a clear and effective solution for graphical password authentication, utilizing the Python module SSIM to compare the end user's drawn pattern with the previously stored pattern. This system offers a more natural and intuitive way for end users to remember their passwords and provides an added layer of security and privacy.

V. EXPECTED RESULTS

Graphical Password Authentication system that utilizes the Structural Similarity Index (SSIM) and ORB (Oriented FAST and Rotated BRIEF) to accurately compare the user's drawn pattern with the previously stored pattern. The system should be designed to be user-friendly, allowing users to draw their patterns using a mouse or touch screen. Additionally, the system should be able to grant access to users with high accuracy and reduce the likelihood of password fatigue, password reuse, and weak passwords. The expected outcome would be a more secure and user-friendly authentication method that addresses some of the issues associated with traditional password authentication. The project should also provide experimental results demonstrating the accuracy and usability of the proposed system.

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VI. CONCLUSION

In conclusion, the proposed graphical password authentication system using Structural Similarity Index (SSIM) offers a secure and user-friendly solution for password authentication. ORB (Oriented FAST and Rotated BRIEF) is a powerful feature detection and description algorithm that can be used for pattern recognition in computer vision applications. The system architecture has been designed to provide an effective way to store, validate, and retrieve the end user's graphical password from the database. The evaluation of the system has demonstrated its high accuracy and ease of use, offering a promising alternative to traditional text-based passwords.

The use of graphical passwords provides a more natural and intuitive way for end users to remember their passwords, while also reducing the likelihood of password fatigue, password reuse, and weak passwords. Further research and development in this area could lead to additional improvements in accuracy and user-friendliness, making graphical password authentication a more widely adopted method of password authentication in the future.

VII. ACKNOWLEDGEMENT

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