

# PASSMATRIX- An Authentication System to Resist Shoulder Surfing Attacks

Pallavi Shinde<sup>1</sup>, Prof. K. N. Shedge<sup>2</sup>

<sup>1</sup>PGStudent, Computer Engineering Department, SVIT, Nashik, India

<sup>2</sup> Asstt. Professor, Computer Engineering Department, SVIT, Nashik, India

\*\*\*

**Abstract** - Textual passwords are widely used in authentication method. Strong textual passwords are hard to memorize. To address the weakness of textual password, graphical passwords are proposed. Click based or pattern based approaches are widely used techniques for mobile authentication system. Such textual and graphical passwords scheme suffers from shoulder surfing attacks. Attacker can directly observe or can use video recorder or webcam to collect password credentials. This work aims to study existing authentication systems its advantages, limitations and drawbacks. After analysis a concrete authentication system structure is proposed that overcome the disadvantages of existing system.

**Key Words:** Shoulder surfing attack, Authentication system, Graphical Passwords

## 1. INTRODUCTION

Most of the authentication system uses text based passwords. For higher security against brute force attack strong password is generated using combination of upper case and lowercase characters, numerical values and special characters. Strong passwords are randomly generated and not have specific meaning. Such passwords are hard to memorize and recollect. Due to this reason user tried to set easy passwords having some dictionary meaning. As per the article [2] in computer world, 80% user set such easy password and those can be cracked by hackers within 30 seconds.

Based on the Psychological study [3] user is able to memorize images with long terms memory rather than textual words. To overcome the problems of text based passwords, image based passwords techniques are proposed. User can be able to set complex image based password and can be recollect it after long time. But most of the image based password authentication systems are vulnerable to shoulder surfing attack. In shoulder surfing attack, attacker can directly get the information by standing next to the user or indirectly using video recorder or web cam.

Most of the handheld devices uses pattern based password. These patterns based authentication system is vulnerable to shoulder surfing attack as well as the Smudge Attacks. The attacker can easily get the password pattern by observing the smudge left on the touch screen.

Defining bad and easily crack able password and/or login using password in insecure environment mainly causes loopholes in password authentication security. There is a need of secured password authentication system which overcomes the drawbacks of existing text and image based password schemes.

To overcome these problems, biometrical password schemes are introduced. In biometric password authentication system user voice, retina, thumbprint, face are used as a passwords. There are various types of biometric sensors which as able to authenticate user. Such schemes are secured but hardware specific. Special sensor devices are required for authentication. It is impractical to have such authentication system to regular web based resources and such system installation and maintenance is costly.

## 1.1 LITERATURE SURVEY

To provide more secured authentication system external hardware can be used such as: multi-touch monitor, voice recorder, some sensors like vibration sensor, gyroscope sensor, etc.[4][5][6] These systems provide better security than other password authentication system but such system are not affordable to every user. External hardware is required for every authentication and may not be applicable to web based systems. This work mainly focuses on graphical password authentication systems.

Draw-a-Secret (DAS) technique is proposed by Jermyn et al.[7] in 1999. In early days the handheld devices was not graphically strong. The color and pixel quality was weak. DAS system is implemented by considering these limitations. In this scheme, user need to draw the predefined secret password on 2D graphical screen. For this scheme, the whole screen is divided in number of grids. User need to follow the greed selection sequence while drawing the password image.

## 1.2 ANALYSIS AND PROBLEM FORMULATION

In day to day life user uses mobile and web based systems to access their personal email accounts, online money transfer, upload and download personal data on cloud. Due to the internet availability, user accesses such systems anytime and anywhere. The use of such personal service access in public locations may cause security issues. Users personal password may be leaked unconsciously to the unknown

user. People with malicious intent can make misuse of such information.

There is need to provide better security to access such personal services in public environment.

Following are the research problems that need to be addressed:

- 1) Alleviate the shoulder surfing attack in authentication process in public environment.
- 2) How to increase password space than existing PIN system
- 3) How to provide an ease to find desired pass object from set of objects
- 4) How to make password easy to memory and require less computation during authentication.
- 5) How to make the system available for all kind of devices and affordable to every user.

## 2. SYSTEM OVERVIEW

A novel authentication system PassMatrix, based on graphical passwords to resist shoulder surfing attacks is proposed. The proposed system provides a new graphical password authentication system. This is android based system. Multiple images are used to define password. For every login session, user needs to scroll circulative horizontal and vertical bars. A password hint is provided to the user to select desired image password grid. For password selection, password hint to set covering the entire scope of pass-images. Using a one-time login indicator per image, users can point out the location of their pass-square without directly clicking or touching it, which is an action vulnerable to shoulder surfing attacks.

To provide more secured authentication system, The base paper is extended with the following 2 techniques.

- 1) If incorrect password grid is selected then for higher security system can display incorrect image for next pass selection.
- 2) System can Change pass image for every login using: rotation and flipping.

Following fig. 1 shows the system architecture.

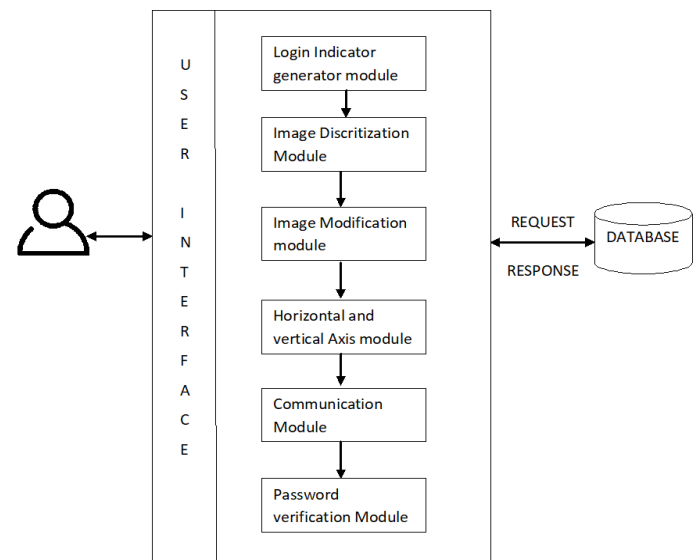


Fig. 1. System Architecture

### A. Algorithms

#### PASSMatrix-Authentication

In registration phase, the user creates an account which contains a username and a password. The password consists of only one pass-square per image for a sequence of n images. It is assume that user will register to the system in secure environment. For log into the passMatrix the user uses his/her username, password and login indicators. System selects user pass images based on the login name and provide a panel to select a password using horizontal and vertical scroll bars. Based on predefined password and generated hint, user can generate a net password for every login session.

#### Algorithm Steps:

Input: Registration details

Username

Output: Authentication result

#### Processing:

- 1) Get pass images by matching the user name
- 2) Generate a random alphabet/ number as an hint and Provide to the user using audio message.
- 3) For every login pass image
- 4) Discretize image in 6 \*6 blocks. Rotate and flip image
- 5) Generate horizontal and vertical scroll bars
- 6) Accept user input
- 7) Check if user input matches to the registration details

- 8) Display next image and flow steps from 4
- 9) Else display incorrect input image to the user as a warning
- 10) If all clicks matches notify user with success message
- 11) If login attempts >3 then lock the system for next 5 min

### 3. IMPLEMENTATION

#### A. Experimental Setup:

A client server architecture is developed. For client end an android application is developed using android studio. The application is developed for android sdk version 5.1 and above. At the server end php application is developed to define web services. To store database mysql database is used.

#### B. Dataset:

For creating pass matrix grid images are required. Images are downloaded from flickr dataset. Random images from these dataset are selected to define password of a system.

#### C. Performance Metric:

For testing 30 different users (15 male, 15 female) are selected. These users test this system for 15 times. First 5 attempts are treated as practice sessions and next 10 sessions are treated as login attempts. The accuracy and usability is calculated using practice sessions and login attempts.

#### 1) Accuracy:

1. Based on the practice sessions, accuracy of the system is calculated as:

$$\text{Practice\_acc} = \frac{\text{successfulpracticeattempts}}{\text{totalpracticeattempts}}$$

2. Based on the login sessions, accuracy of the system is calculated as:

$$\text{Login acc} = \frac{\text{successfulloginattempts}}{\text{totalloginattempts}}$$

#### 2) Usability:

The usability of system measures the users experience.

It includes the total time required for registration and login phase for 3 pass images and 5 pass images.

### 4. CONCLUSIONS

The proposed system provide an authentication system for android devices. This system can resist shoulder surfing attack. This is click based password system. This technique contains pass-matrix. More than one image are used to set the password. This system follows the technique of session password. A password added in one login session can not be applicable for other sessions. In future, the system can be

implemented for desktop application as well as Automated Teller Machine (ATM).

### ACKNOWLEDGEMENT

First of all my special thanks to head of Department of Computer Engineering, SVIT, Chincholi, Nashik Prof. Prof. K. N. Shedge, principal Dr. S. N. Shelke for their kind support and suggestions. It would not have been possible without the kind support. We would like to extend our sincere thanks to all the faculty members the department of Computer Engineering for their help. We are also thankful to colleagues for moral support and encouragement. At the end, We are very much thankful to all for direct and indirect help.

### REFERENCES

1. Hung-Min Sun, Shiuan-Tung Chen, Jyh-Haw Yeh and Chia-Yun Cheng, "A Shoulder Surfing Resistant Graphical Authentication System", IEEE Transactions on Dependable and Secure Computing, Vol.1 PP. 1, Issue: 99, March 2016
2. K. Gilhooly, "Biometrics: Getting back to business," Computerworld, May, vol. 9, 2005.
3. D. Nelson, U. Reed, and J. Walling, "Picture superiority effect," Journal of Experimental Psychology: Human Learning and Memory, vol. 3, pp. 485-497, 1977.
4. Bianchi, I. Oakley, V. Kostakos, and D. S. Kwon, "The phone lock: Audio and haptic shoulder-surfing resistant pin entry methods for mobile devices," in Proceedings of the Fifth International Conference on Tangible, Embedded, and Embodied Interaction, ser. TEI '11. New York, NY, USA: ACM, 2011, pp. 197-200.
5. Bianchi, I. Oakley, and D. S. Kwon, "The secure haptic keypad: A tactile password system," in Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, ser. CHI '10. New York, NY, USA: ACM, 2010, pp. 1089-1092.
6. Oakley and A. Bianchi, "Multi-touch passwords for mobile device access," in Proceedings of the 2012 ACM Conference on Ubiquitous Computing, ser. UbiComp '12. New York, NY, USA: ACM, 2012, pp. 611-612.
7. Jermyn, A. Mayer, F. Monrose, M. Reiter, and A. Rubin, "The design and analysis of graphical passwords," in Proceedings of the 8th conference on USENIX Security Symposium-Volume 8. USENIX Association, 1999, pp. 1-1.
8. S. Wiedenbeck, J. Waters, J. Birget, A. Brodskiy, and N. Memon, "Passpoints: Design and longitudinal

- evaluation of a graphical password system," International Journal of Human-Computer Studies, vol. 63, no. 1-2, pp. 102–127, 2005.
9. M. Martinez-Diaz, J. Fierrez, and J. Galbally, "Graphical passwordbased user authentication with free-form doodles," IEEE Transactions on Human-Machine Systems, vol. PP, no. 99, pp. 1–8, 2015.
  10. V. Roth, K. Richter, and R. Freidinger, "A pin-entry method resilient against shoulder surfing," in Proceedings of the 11th ACM conference on Computer and communications security, ser. CCS '04. New York, NY, USA: ACM, 2004, pp. 236–245.
  11. T. Takada, "fakepointer: An authentication scheme for improving security against peeping attacks using video cameras," in Mobile Ubiquitous Computing, Systems, Services and Technologies, 2008. UBIKOMM' 08. The Second International Conference on. IEEE, 2008, pp. 395–400,.
  12. S. Wiedenbeck, J. Waters, L. Sobrado, and J.-C. Birget, "Design and evaluation of a shoulder-surfing resistant graphical password scheme," in Proceedings of the working conference on Advanced visual interfaces, ser. AVI '06. New York, NY, USA: ACM, 2006, pp. 177–184.
  13. S. Chiasson, P. van Oorschot, and R. Biddle, "Graphical password authentication using cued click points," Computer Security–ESORICS 2007, pp. 359–374, 2007.
  14. L. Wang, X. Chang, Z. Ren, H. Gao, X. Liu, and U. Aickelin, "Against spyware using captcha in graphical password scheme," in 2010 24th IEEE International Conference on Advanced Information Networking and Applications. IEEE, 2010, pp. 760–767.
  15. Aviv, K. Gibson, E. Mossop, M. Blaze, and J. Smith, "Smudge attacks on smartphone touch screens," in USENIX 4th Workshop on Offensive Technologies, 2010.