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AuthCrypt: A Secure Password Manager Built on Flutter

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Abstract- In cloud computing for optimized workflow scheduling, it is crucial to meet user deadlines while minimizing the cost of resources. This paper is a novel approach that compares Ant Colony Optimization (ACO) with the Buddy System in reducing the cost of the resources used for scheduling those workflows. Ant Colony Optimization was inspired by the behavior of ants in their search for food using pheromone chemicals released by them. Thus, the ACO algorithm is employed to find the solution space and then explore it to find the near-optimal solution among them. Meanwhile, Buddy System algorithms efficiently handle the allocation and deallocation of resources in the cloud. In the cloud system, the Buddy System can be used to allocate and deallocate VM (virtual machine) instances.

Keywords- Ant Colony Optimisation (ACO), Buddy System, Cloudsim, Virtual Machine, Workflow Scheduling, Cost optimization.

I. INTRODUCTION

In the digital age, where individuals and organizations rely heavily on a myriad of online services and platforms, managing passwords has become an increasingly complex and crucial aspect of cybersecurity. With the average internet user having dozens, if not hundreds, of accounts requiring unique and secure passwords, the need for efficient and secure password management solutions has never been more pressing. Password managers have emerged as indispensable tools for addressing this challenge, offering users a centralized and secure way to store, generate, and organize their passwords. However, as technology continues to evolve and users increasingly adopt multiple devices and operating systems, the demand for password managers with cross-platform compatibility has grown exponentially.

Cross-platform compatibility in password managers refers to the ability of these tools to seamlessly integrate and synchronize across different operating systems (such as Windows, macOS, Linux, iOS, and Android) and devices (including desktops, laptops, smartphones, and tablets). This means that users can access their password vaults and utilize password management features consistently across all their devices, regardless of the platform they are using. Such compatibility not only enhances user convenience but also ensures uniform security practices across diverse environments.

Cross-platform compatibility has become a key consideration for modern users who seek seamless access to their password vaults across diverse environments, including desktops, laptops, smartphones, and tablets.

A password manager with cross-platform compatibility offers users the flexibility to access their passwords irrespective of the operating system or device they are using. This not only enhances convenience but also ensures consistent password management practices, thereby bolstering overall cybersecurity posture.

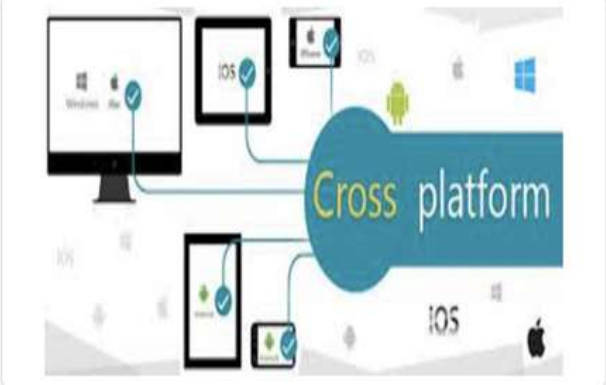

Fig 1: Cross Platform

This paper aims to provide a detailed exploration of password managers with cross-platform compatibility, focusing on their significance, functionalities, benefits, challenges, and implications for cybersecurity. We will delve into the technical aspects of how cross-platform password managers operate, including the encryption algorithms and synchronization protocols employed to safeguard user credentials while ensuring seamless accessibility across different devices and platforms. Furthermore, we will discuss the role of cross-platform password managers in promoting secure password practices, reducing the risk of password-related security breaches, and enhancing overall cybersecurity posture in an interconnected digital ecosystem. Through this comprehensive examination, we seek to provide insights into the critical role of cross-platform compatibility in modern password management solutions and its profound impact on cybersecurity in the digital era.

II. FEASIBILITY STUDY

Preliminary investigation examine project practicability, the chance the system are helpful to the organization. The most objective of the practicability study is to check the Technical, Operational and Economical practicability for adding new modules and debugging previous running system. All system is possible if they're unlimited resources and infinite time. There are unit aspects within the practicability study portion of the preliminary investigation

- Technical Feasibility
- Economical Feasibility
- Social Feasibility

1. Technical Feasibility

- The technical issue typically raised throughout the practicableness stage of the investigation includes the following:
- Does the mandatory technology exist to try to what's suggested?
- Do the planned equipments have the technical capability to carry the infoneeded to use the new system?
- Will the planned system offer adequate response to inquiries, despite the amountor location of users?
- Can the system be upgraded if developed?
- Are there technical guarantees of accuracy, responsibleness, simple access and information security?

Platform Compatibility

The password manager needs to work seamlessly across various platforms such as Windows, macOS, Linux, iOS, Android, and web browsers. This often involves developing separate applications for each platform or using technologies like Electron or React Native for building cross-platform desktop or mobile applications.

Encryption and Security

Security is paramount for password managers. User passwords and other sensitive data must be encrypted both during transmission and storage. Strong encryption algorithms such as AES (Advanced Encryption Standard) are typically used, along with secure hashing algorithms for storing passwords.

Synchronization: Users expect their passwords to be synchronized across all their devices. This requires implementing a robust synchronization mechanism that securely transfers encrypted data beetween devices.

2. Economical Feasibility

Evaluating the economic feasibility of a cross-platform password manager involves analyzing the costs and potential revenue streams associated with

its development, deployment, and ongoing maintenance. Here are some key factors to consider:

Development Costs
Developing a cross- platform password manager involves expenses related to software development, including hiring developers, designers, and testers. The cost may vary depending on factors such as the complexity of features, technology stack, and development time.

Platform Compatibility
Supporting multiple platforms (e.g., Windows, macOS, Linux, iOS, Android) may require additional resources and incur higher development costs compared to building a single-platform application. However, targeting multiple platforms can potentially increase the user base and revenue opportunities.

Infrastructure Costs
If the password manager relies on server-side storage or cloud-based services for synchronization, backup, and other features, there will be ongoing infrastructure costs associated with hosting, data storage, and bandwidth usage.

Security Investments
Ensuring robust security measures, such as encryption, secure data transmission, and protection against cyber threats, is crucial for a password manager. Investing in security technologies and regular security audits may incur additional expenses.

User Acquisition and Marketing
Acquiring users and building brand awareness require investments in marketing and promotional activities. This includes online advertising, content marketing, social media engagement, and partnerships with relevant platforms or organizations.

3. Social Feasibility
Assessing the social feasibility of a cross-platform password manager involves considering how the product aligns with societal values, user needs, and ethical considerations. Here are some aspects to evaluate:

User Convenience
A cross-platform password manager can enhance user convenience by providing a centralized solution for managing passwords across multiple devices and platforms. This can reduce user frustration with remembering and entering multiple passwords, contributing positively to user satisfaction and adoption.

Security and Privacy
Users are increasingly concerned about the security and privacy of their personal data, especially sensitive information like passwords. A password manager must prioritize robust security measures, such as strong encryption, secure storage, and protection against data breaches. Clear communication about security practices and transparent privacy policies can help build trust with users.

Accessibility and Inclusivity
A socially feasible password manager should be accessible to users with diverse needs, including those with disabilities or limited technical proficiency. This involves designing user interfaces that are intuitive, easy to navigate, and compatible with assistive technologies. Providing multilingual support can also enhance inclusivity and reach a broader audience.

Education and Awareness
Many users may not be aware of the importance of using strong, unique passwords or the risks associated with password reuse. A socially responsible password manager can contribute to cybersecurity awareness by educating users about best practices for password security and offering features like password strength analysis and alerts for weak or compromised passwords.

Community Engagement
Engaging with the user community through forums, feedback channels, and support resources can foster a sense of belonging and collaboration. Providing responsive customer support and actively

addressing user feedback demonstrates a commitment to user satisfaction and builds a loyal user base.

III. SYSTEM ANALYSIS

1. System study and Environment System Requirements

Operating System Compatibility

The password manager should be compatible with a range of operating systems including Windows, macOS, Linux, iOS, and Android.

Hardware Requirements

The hardware requirements may vary depending on the platform and the complexity of the application. However, for most modern devices, a standard CPU, RAM, and storage configuration should suffice.

Software Dependencies

The password manager may require certain software dependencies such as encryption libraries, network protocols, and platform-specific development frameworks (e.g., .NET for Windows, Cocoa for macOS).

Study Environment

Quiet and Distraction-Free Space

Creating a dedicated study space free from distractions can enhance focus and productivity. Choose a quiet area with minimal interruptions where you can concentrate on tasks without distractions.

Comfortable Seating

Ensure that your study area has comfortable seating to prevent discomfort and fatigue during long study sessions. A supportive chair and ergonomic desk setup can help maintain good posture and reduce physical strain.

Organized Workspace: Keep your study area organized and clutter-free to minimize distractions and improve workflow.

Use storage solutions such as shelves, drawers, and organizers to keep study materials, books, and supplies neatly arranged.

2. Functional Requirements

User Authentication

- Ability for users to create an account with a master password.
- Support for alternative authentication methods such as biometric authentication (fingerprint, face recognition) where available.

Password Storage and Encryption

- Secure storage of user passwords in an encrypted format.
- Strong encryption algorithms (e.g., AES) to protect stored passwords from unauthorized access.

Password Generation

- Functionality to generate strong, random passwords for new accounts.
- Customizable options for password length, character types, and complexity.

Password Management

- Capability to organize passwords into categories or folders for easy management.
- Option to add additional information to password entries (e.g., username, website URL).
- Search functionality to quickly find specific passwords within the vault.

Autofill and Auto-login

- Integration with web browsers to automatically fill in login credentials on websites.
- Auto-login feature to automatically log users into websites based on saved credentials.

3. Data Management

Encrypted Storage

- Passwords and associated metadata are stored in a centralized vault using strong encryption algorithms (e.g., AES) to ensure data confidentiality.
- Encryption keys are securely managed and stored to prevent unauthorized access to password data.

Cross-Platform Synchronization

- Password data is synchronized across multiple devices and platforms in real- time or on a scheduled basis.
- Synchronization mechanisms ensure that changes made on one device are reflected on all other devices to maintain data consistency.
- Conflict resolution algorithms handle conflicts that may arise when changes are made to the same password on different devices.

Backup and Recovery

- Regular backups of the password vault are created to prevent data loss in case of device loss, failure, or accidental deletion.
- Backup copies may be stored locally on the user's device or in the cloud for added redundancy.
- Users can restore their password vault from a backup using a recovery process that verifies their identity and ensures data integrity.

Data Encryption

- In addition to encrypting password data stored in the vault, data transmission between client applications and server infrastructure is also encrypted using secure communication protocols (e.g., HTTPS).
- End-to-end encryption may be optionally implemented to further enhance data security, ensuring that passwords remain encrypted during transmission.

4. System Advantage and Limitation

Advantages

- **Accessibility:** Users can access their password vaults from any device or platform, providing convenience and flexibility in managing passwords.
- **Synchronization:** Password data is synchronized across all devices in real-time or on a scheduled basis, ensuring consistency and accessibility of passwords across different platforms.
- **Centralized Management:** A centralized password vault allows users to store all their passwords in one secure location, reducing the need to remember multiple passwords for different accounts.
- **Security:** Strong encryption algorithms are used to protect password data both in transit and at rest, ensuring the confidentiality and integrity of sensitive information.

Limitations

- **Security Risks:** Despite strong encryption measures, any system that stores sensitive data online carries inherent security risks. A breach of the system's security could lead to unauthorized access to users' passwords.
- **Dependence on Internet Connectivity:** The system relies on internet connectivity for synchronization and access to password data, which may pose challenges in offline environments or areas with unreliable internet connections.
- **Compatibility Issues:** Ensuring compatibility with various devices, operating systems, and browser versions can be challenging, leading to potential inconsistencies or performance issues across different platforms.
- **User Adoption and Trust:** Some users may be reluctant to trust a third-party service with their sensitive password data, especially if they have concerns about data privacy and security.

5. System Requirement

Following are the software and hardware requirements:

Software Requirement

Language

Dart (the primary language used with Flutter)

Database

SQLite (commonly used for local data storage in Flutter apps) or any other database supported by Flutter's plugins/extensions.

Operating System

Compatible with Windows, macOS, and Linux for development, with the ability to target Android and iOS for deployment.

IDE (Integrated Development Environment)
Any text editor or IDE compatible with Flutter development, such as Visual Studio Code with the Flutter extension, Android Studio, or IntelliJ IDEA with the Flutter plugin.

Front End
Flutter SDK, which includes the Flutter framework and tools for building user interfaces.

Hardware Requirement
Processor
Any modern multi-core processor, such as Intel Core i5 or AMD Ryzen series.

Speed
Recommended minimum 1.8 GHz or higher.

RAM
Minimum 8GB RAM, though 16GB or more is recommended for better performance, especially when running emulators or multiple development tools simultaneously.

IV. SYSTEM DESIGN

1. System Architecture

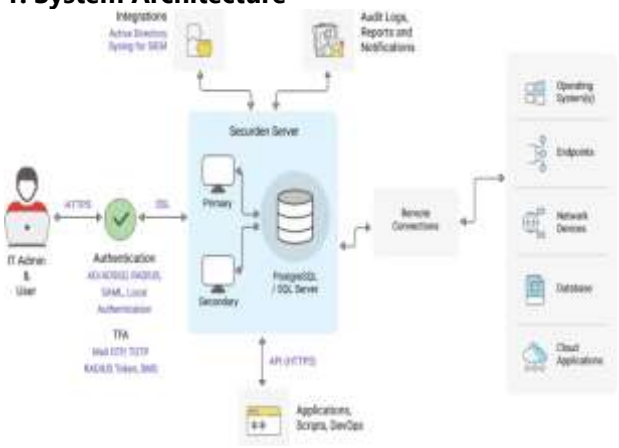

Fig 2: System Architecture

2. UML Daigrams (Unified Modelling Language)
The Unified Modeling Language permits the technologist to specific AN analysis model mistreatment the modeling notation that's ruled by a group of grammar linguistics and pragmatic rules. A UML system is diagrammatical mistreatment 5 completely different views that describe the system from clearly different perspective. Every read is outlined by a group of diagram, that is as follows.

It represents the dynamic of behavioral as elements of the system, portrayal the interactions of assortment between varied structural components delineated within the user model and structural model read.

Use case Diagrams represent the practicality of the system from a user's purpose of read. Use cases are used throughout needs induction and analysis to represent the practicality of the system. Use cases specialize in the behavior of the system from external purpose of read.

Actors are external entities that move with the system. Samples of actors embody users like administrator, bank client …etc., or another system like central info.

Use Case Diagram
In the context of a cross-platform password manager, a use case diagram provides a high-level overview of the interactions between users (actors) and the system, showcasing the various functionalities supported across different platforms. Key actors in the diagram typically include the "User" who interacts with the password manager application across various devices and platforms.

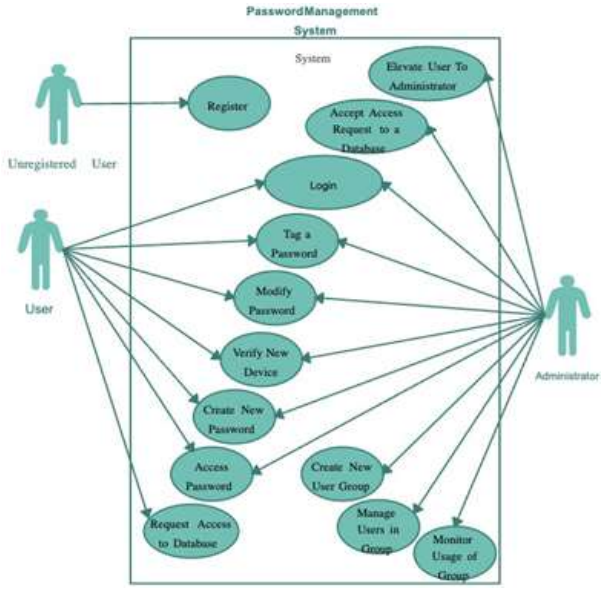

Fig 3: Use Case Diagram

V. IMPLEMENTATION

Auth Crypt is developed using the Flutter framework, allowing for cross-platform compatibility across Android and iOS devices. The application's user interface is designed to be intuitive and user-friendly, with a focus on simplicity and ease of use. The encryption and decryption of user data are performed using the AES encryption algorithm, ensuring robust security. Biometric authentication is implemented using platform-specific APIs, leveraging the built-in biometric authentication features available on modern mobile devices.

Features of Auth Crypt

One Master Password

AuthCrypt employs a single master password, which serves as the key to access the user's stored passwords. This simplifies the authentication process while ensuring security.

Biometrics for Password Viewing

To enhance security, AuthCrypt integrates biometric authentication, allowing users to use their fingerprint or facial recognition to view stored passwords. This adds an extra layer of security, reducing reliance on the master password alone.

Random Password Generation

AuthCrypt offers a built-in password generator that creates strong, random passwords according to user-defined criteria. This feature encourages the use of unique and complex passwords for each account, thereby enhancing overall security.

AES Encrypted Security

All user data stored in AuthCrypt is encrypted using the Advanced Encryption Standard (AES), a widely recognized encryption algorithm known for its security and efficiency. This ensures that passwords and sensitive information remain secure even if the data is compromised.

Dark and Light Theme Modes

AuthCrypt provides users with the option to choose between dark and light theme modes, catering to individual preferences and improving readability in different lighting conditions.

Local Storage

User data in AuthCrypt is stored locally on the device, eliminating the need for reliance on cloud-based storage services. This enhances privacy and gives users full control over their data.

Search Password Feature

AuthCrypt includes a search functionality that allows users to quickly locate specific passwords within their database. This feature improves usability, particularly for users with large numbers of stored passwords.

Password Strength Meter

When creating or updating passwords, AuthCrypt provides a password strength meter that evaluates the strength of the password based on factors such as length, complexity, and uniqueness. This encourages users to create stronger passwords, further bolstering security

VI. RESULTS

Fig 4: On Boarding Screen

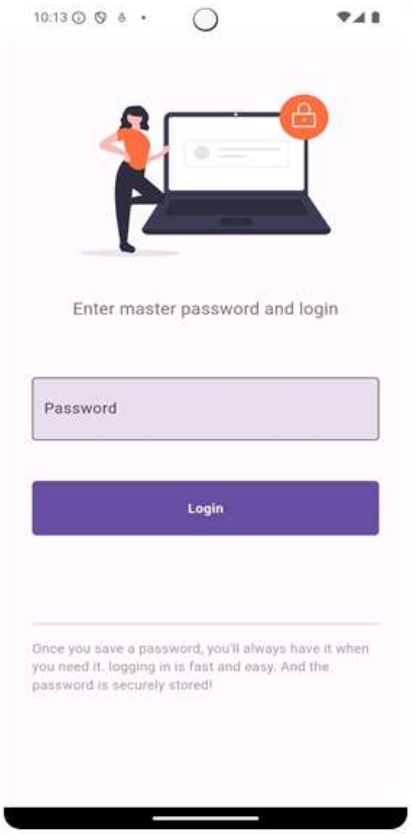

Fig 5: Login Page

Fig 6: Saved Passwords

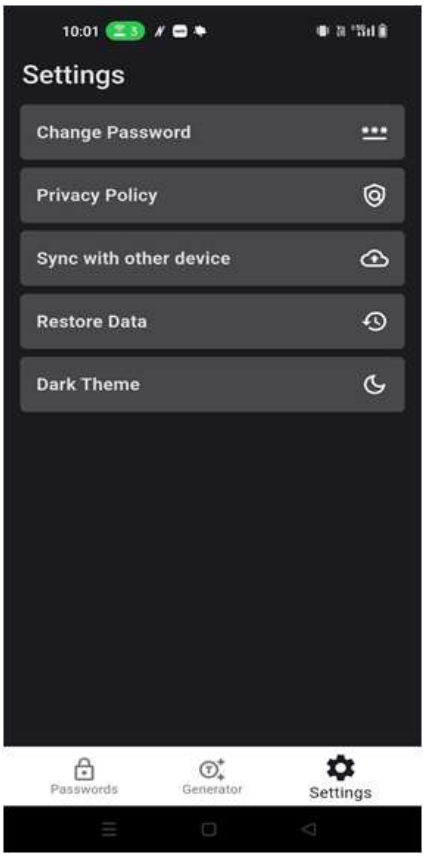

Fig 7: Settings Page

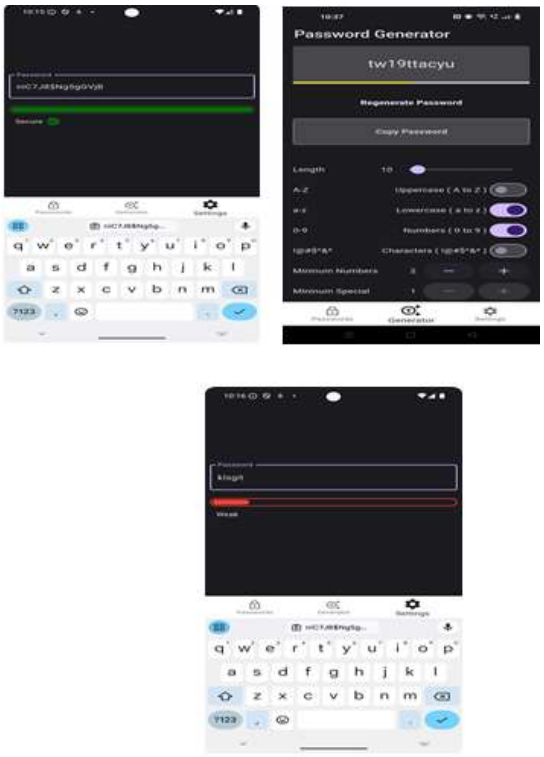

Fig 8: Password Generation and Health (Phone)

Fig 9: Registration Page

Fig 10: Add Password Page

Fig 11: Password Generation (desktop)

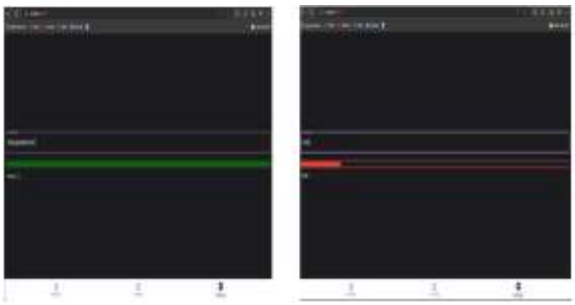

Fig 12: Password health (desktop)

VII. CONCLUSION

Developing a cross-platform password manager involves addressing various challenges such as security, synchronization, and usability across different devices and platforms. Through robust architecture, encryption, synchronization mechanisms, and user-friendly interfaces, a cross-platform password manager can provide users with a secure and convenient solution for managing their passwords.

Future Scope

Enhanced Security Features

Implement additional security features such as biometric authentication, hardware token support, or advanced encryption techniques to further strengthen the security of the password manager.

Improved Synchronization

Continuously refine synchronization mechanisms to ensure seamless and efficient data synchronization across all devices and platforms, even in offline environments.

Integration with Emerging Technologies

Explore integration with emerging technologies such as decentralized identity (e.g., blockchain-based identity solutions) or password less authentication methods to offer innovative and secure authentication options.

Cross-Platform Collaboration

Collaborate with other cross-platform services and applications (e.g., cloud storage providers, productivity tools) to enhance interoperability and offer integrated solutions for users.

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