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Final Project Report

on

“Decentralized Finance (DeFi) Banking Application Using Blockchain Technology”

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CERTIFICATE

This is to certify that the project entitled **“Decentralized Finance (DeFi) Banking Application Using Blockchain Technology”** is a bonafide work carried out by Abhinav Chettri [1DS19CS002], Sai Prithvi Adapa [1DS19CS138], Siddharth Shivam [1DS19CS159], Ubaid Ul Rehman [1DS19CS755] in partial fulfilment of 8th semester, Bachelor of Engineering in Computer Science and Engineering under Visvesvaraya Technological University, Belgaum during the year 2022-23.

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ABSTRACT

The traditional or the current banking systems are not completely automated and have human interceptions at different steps to perform the transactions. This might lead to some tampering with or modification in the transaction history or bank balances. In these banking systems depositing and withdrawing money is also quite a slow and time-taking process. We propose a DeFi banking application using Ethereum Blockchain technology. This DeFi application is fully automated and eliminates any human interception. We will also develop smart contracts that control the procedures of the system. In our proposed model users would be able to deposit and withdraw cryptocurrencies and even earn rewards for that. No one can change financial transactions in this automated banking system. Users can use the proposed system to perform transactions instantly from home or work.

Keywords: Blockchain, decentralization, cryptocurrency, Ethereum, banking system, smart contract.

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Chapter 1

Introduction

1.1 Overview

DeFi, short for Decentralized Finance, is a groundbreaking movement within the blockchain and cryptocurrency space. It aims to revolutionize traditional financial systems by leveraging blockchain technology and smart contracts to create an open, accessible, and transparent ecosystem of financial applications and services. By eliminating intermediaries and enabling peer-to-peer transactions, DeFi empowers individuals to have greater control over their finances, access a wide range of decentralized financial instruments, such as lending, borrowing, trading, and yield farming, and participate in a global financial system without the need for traditional banks. With its potential to enhance financial inclusion, reduce costs, and increase transparency, DeFi has emerged as a disruptive force that has garnered significant attention and investment, driving innovation in the world of finance.

1.1 Motivation

The motivation behind our proposed DeFi banking application stems from the limitations and shortcomings of traditional banking systems. Currently, these systems heavily rely on manual interventions, which can introduce various risks, including the potential for tampering with transaction history or bank balances. Such vulnerabilities compromise the security and trustworthiness of the financial ecosystem, leaving users exposed to potential fraud or unauthorized modifications.

To address these challenges, we propose a DeFi banking application utilizing Ethereum Blockchain technology. By leveraging the decentralized and immutable nature of the blockchain, we aim to automate the banking system and eliminate the need for human interceptions. Through the implementation of smart contracts, we can ensure transparent and secure procedures, reducing the possibility of manipulation and fraudulent activities.

Our proposed model empowers users by allowing them to deposit and withdraw cryptocurrencies seamlessly, providing a faster and more efficient alternative to traditional banking methods. Furthermore, users have the opportunity to earn rewards for their participation in the system, incentivizing their engagement and promoting the adoption of decentralized finance.

The key motivation driving our solution is to establish a fully automated banking system that offers enhanced security, transparency, and speed. By eliminating human interceptions and enabling instant transactions, users can enjoy the convenience of conducting financial operations from the comfort of their homes or workplaces.

1.2 Objective

Our objective is to develop a fully automated DeFi banking application on the Ethereum Blockchain,

eliminating human interceptions. Through smart contracts, users can deposit, withdraw, and earn rewards using cryptocurrencies. The system ensures the immutability of financial transactions, enhancing security and trust. Our goal is to provide a faster, more efficient alternative to traditional banking systems, allowing users to perform instant transactions from the convenience of their homes or workplaces. By leveraging decentralization and blockchain technology, we aim to revolutionize the banking industry and promote the adoption of decentralized finance.

1.4 Scope

Our proposed DeFi banking application aims to automate the banking system, eliminating human interceptions and ensuring the integrity of transactions. Users can deposit, withdraw, and earn rewards using cryptocurrencies. The scope includes instant transactions, enhanced security through the use of Ethereum Blockchain and smart contracts, and the inability to modify financial transactions. The system provides convenience and accessibility, allowing users to perform transactions from home or work. By leveraging decentralization and blockchain technology, our scope is to revolutionize traditional banking systems and promote the adoption of decentralized finance.

Chapter 2

Problem Statement and Proposed solution

2.1 Problem Statement

The problem at hand is to develop a decentralized banking application using blockchain technology that overcomes the limitations of traditional banking systems and provides an inclusive, transparent, and accessible financial ecosystem. The goal is to create a platform that offers open and permissionless financial services to individuals worldwide, regardless of their location or financial background. The application should address the challenges of centralized control, lack of transparency, and restricted access to financial services while reducing costs, streamlining processes, and ensuring the security of user funds. By leveraging blockchain technology, the aim is to create a decentralized finance (DeFi) banking solution that empowers users, eliminates intermediaries, and promotes financial inclusion on a global scale.

2.2 Existing Systems

The existing banking system, known as the traditional or centralized banking system, operates through a network of physical branches, ATMs, and online platforms. Traditional banks act as intermediaries, holding custody of customer funds and facilitating financial transactions. They offer a range of services, including deposit accounts, loans, credit cards, payment processing, and investment products. While banks provide security measures and regulatory compliance, customer privacy can be compromised due to data collection and reporting requirements. Accessibility to banking services may be limited in underdeveloped areas. The traditional banking system lacks transparency, and customers have limited visibility into how their funds are utilized. Moreover, financial inclusion can be challenging, as certain individuals or communities may face barriers to accessing banking services. These limitations have spurred the emergence of decentralized finance (DeFi) as an alternative ecosystem that leverages blockchain technology to provide an inclusive, transparent, and accessible financial system.

2.3 Proposed Solution

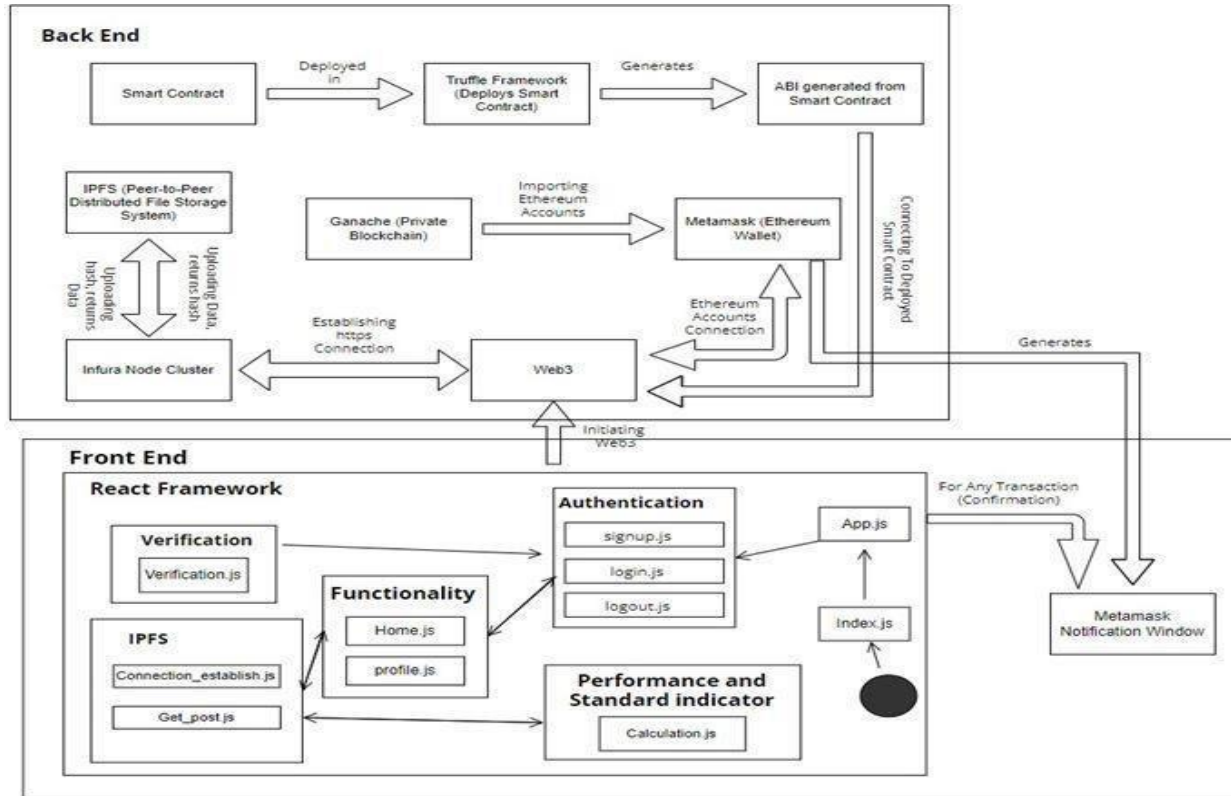


Figure 1.1 High-Level Diagram

As you can see in the figure, a user will run the application through a terminal, which will start a web application on the specified port. This web app will then be accessible from any browser.

The web application is dashboard-based and it will show everything that a security analyst needs. The flow of procedure is as follows:

2.3.1 Register/login into the web application.

2.3.2 Retrieve data from Analyzers

2.3.3 Search through data as per need

2.3.4 View visualizations generated based on the information in the database

2.4 Work Plan:

Work Plan for the DeFi Banking Application Project:

- Project Initiation:

1. Define project objectives, scope, and deliverables.
2. Identify stakeholders and establish communication channels.
3. Form the project team and assign roles and responsibilities.
4. Develop a project timeline and set milestones.

- Research and Requirements Gathering:

1. Conduct market research on the DeFi ecosystem and user needs.
2. Analyze regulatory requirements and compliance considerations.
3. Gather requirements from stakeholders for features and functionalities.

- Architecture and Design:

1. Design the overall application architecture.
2. Define user interface (UI) and user experience (UX) design.
3. Determine the blockchain platform and smart contract architecture.

- Development:

1. Develop the frontend with UI/UX implementation.
2. Implement backend logic, including smart contracts and transaction processing.
3. Integrate external APIs and conduct thorough testing.

- Deployment and Infrastructure Setup:

1. Set up necessary infrastructure and deploy to a test environment.
2. Perform load testing and ensure scalability.
3. Plan deployment strategy for the production environment.

- User Testing and Feedback:

1. Conduct user acceptance testing and gather feedback.
2. Incorporate user feedback and iterate on design and features.
3. Perform security audits and address vulnerabilities.

- Launch and Post-Launch Activities:

1. Prepare documentation and user guides.
2. Execute marketing and promotional strategy.
3. Monitor performance, address issues, and update the application.

- Ongoing Maintenance and Support:

1. Provide ongoing maintenance, bug fixes, and security updates.
2. Offer customer support and address inquiries.
3. Stay updated with regulations and compliance requirements.

Chapter 3

Literature Survey

DeFi banking application using blockchain technology would involve researching and analyzing existing academic papers, articles, and publications related to decentralized finance, blockchain technology, and its applications in the banking sector.

A literature survey for a DeFi banking application using blockchain technology would involve researching and analyzing existing academic papers, articles, and publications related to decentralized finance, blockchain technology, and its applications in the banking sector. Here are some key areas to focus on during the literature survey:

1. Decentralized Finance (DeFi):

- Understand the concepts, principles, and characteristics of DeFi.

- Explore the various financial products and services offered in the DeFi ecosystem.

- Analyze the advantages and challenges of DeFi in comparison to traditional banking systems.

- Investigate the potential impact of DeFi on financial inclusion and global access to financial services.

2. Blockchain Technology:

- Study the fundamentals of blockchain technology, including its architecture and consensus mechanisms.

- Explore the different types of blockchain networks, such as public, private, and consortium blockchains.

- Analyze the security features and immutability of blockchain technology.

- Investigate scalability and interoperability challenges in blockchain systems and potential solutions.

3. Blockchain Applications in Banking:

- Examine existing research and projects that have explored the use of blockchain technology in the banking sector.

- Investigate the potential benefits of blockchain for improving efficiency, transparency, and security in banking operations.

- Analyze case studies of blockchain-based banking solutions and their implementation challenges.

- Explore the regulatory and legal considerations surrounding the integration of blockchain technology in the banking industry.

4. Smart Contracts and Financial Instruments:

- Understand the concept of smart contracts and their role in facilitating automated and self-executing financial transactions.

- Explore the development and deployment of smart contracts in DeFi applications.

- Study the design and implementation of financial instruments such as decentralized lending, borrowing, and decentralized exchanges on blockchain platforms.

5. Security and Privacy in DeFi:

- Investigate the security vulnerabilities and risks associated with DeFi applications.

- Explore the measures and techniques employed to enhance the security and privacy of decentralized financial systems.

- Analyze the potential impact of regulatory compliance, identity management, and data protection in DeFi

applications.

6. Adoption and Challenges:

Examine the factors influencing the adoption of blockchain-based banking solutions and DeFi applications.

Analyze the challenges and limitations faced by decentralized banking systems, including scalability, interoperability, and user experience.

Explore the potential solutions and future research directions in the field of DeFi and blockchain-based banking systems.

By conducting a comprehensive literature survey in these areas, you can gain valuable insights, identify research gaps, and establish a solid foundation for your DeFi banking application project.

3.8 Conclusion

Information technology has become a critical innovation in every industry. Those institutions or teams that can use technology correctly and effectively play a significant role in disrupting the status in a leadership position. Those that do not keep up with technology do not survive. We think the Blockchain technology as a catalyst for emerging use cases in the financial and nonfinancial industries such as industrial manufacturing, supply chain, and banking. Blockchain can play a pivotal role in transforming the digitization of industries and applications by enabling secure trust frameworks, creating agile value chain production, and tighter integration with technologies such as cloud computing, and IoT. In producing a cloud-based application called banking, the researchers have demonstrated the capability to apply professional engineering principles, combined with a DevOps approach to iterative development and management, and integration of cyber security, distributed computing, and Block-chain technologies. We feel banking is one of many examples that demonstrate the transformative capability of Blockchain.

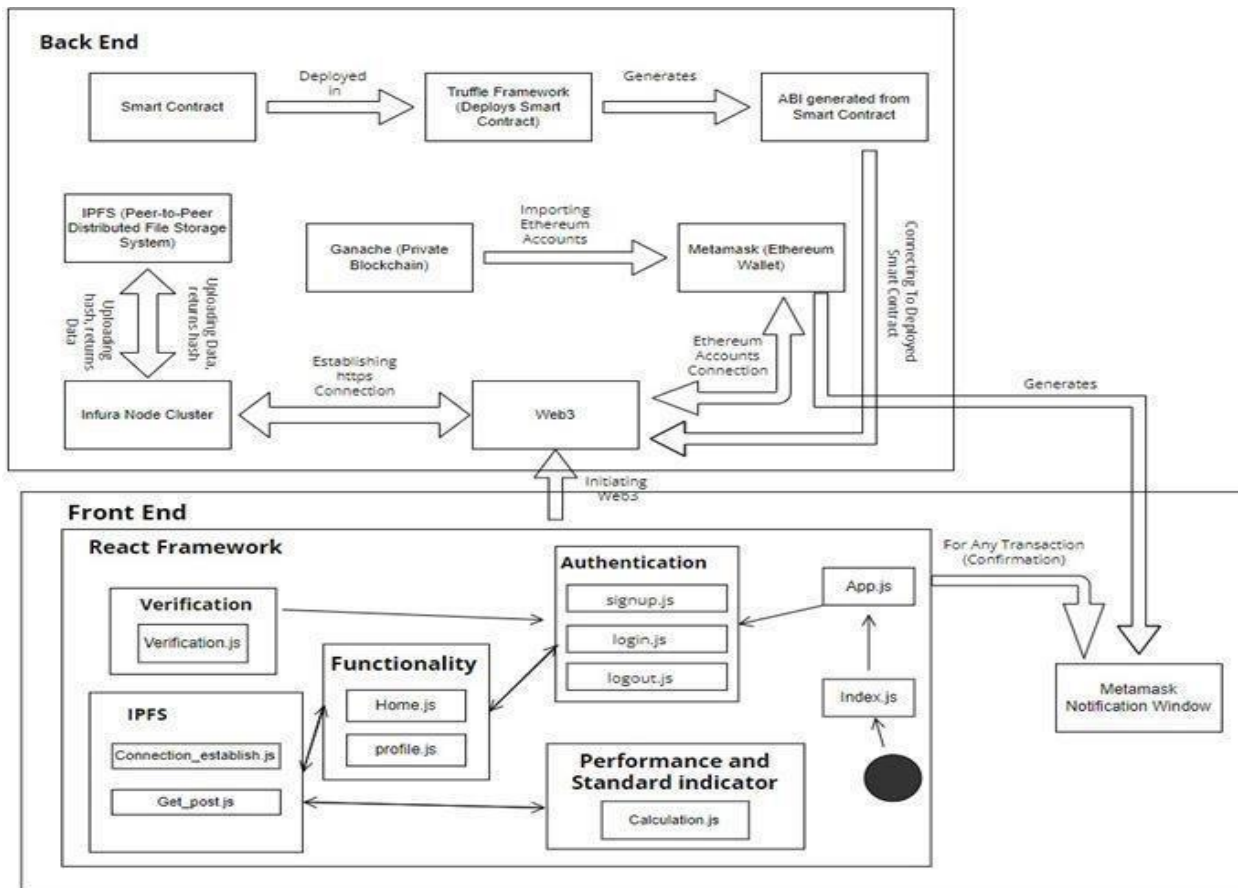
Chapter 4

Architecture and System Design

4.1 System Overview

The design consists of components such as:

- Input component for the collection of data from various sources.
- Processing component which involves categorization of various IOCs and attaching the scores associated with each. These input IOCs are then analyzed to provide some solutions along with visual aid.
- Visualization component comprises the UI with a dashboard that provides easy access to the security engineers for the various threats that are encountered along with the solutions for each.



4.2 System Architecture

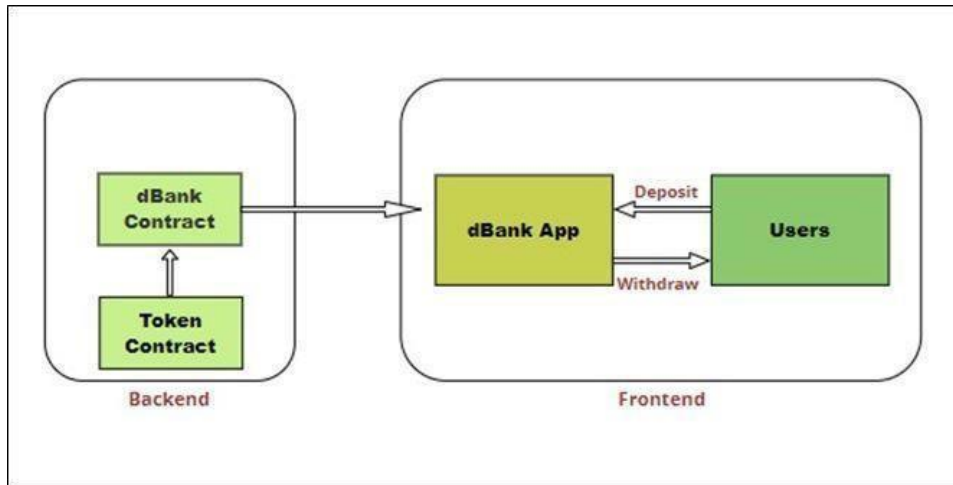


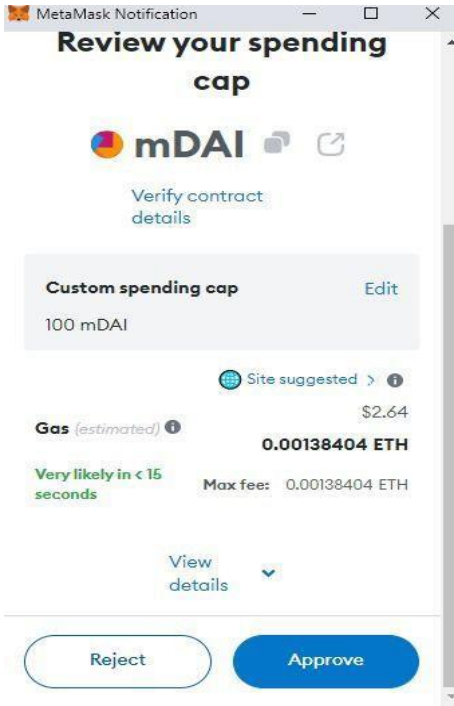
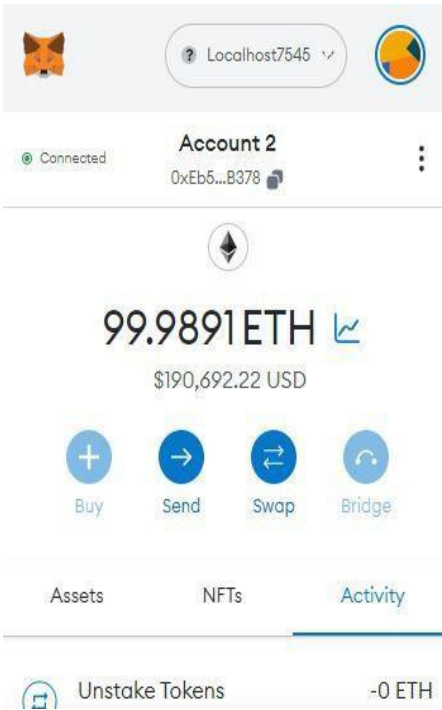
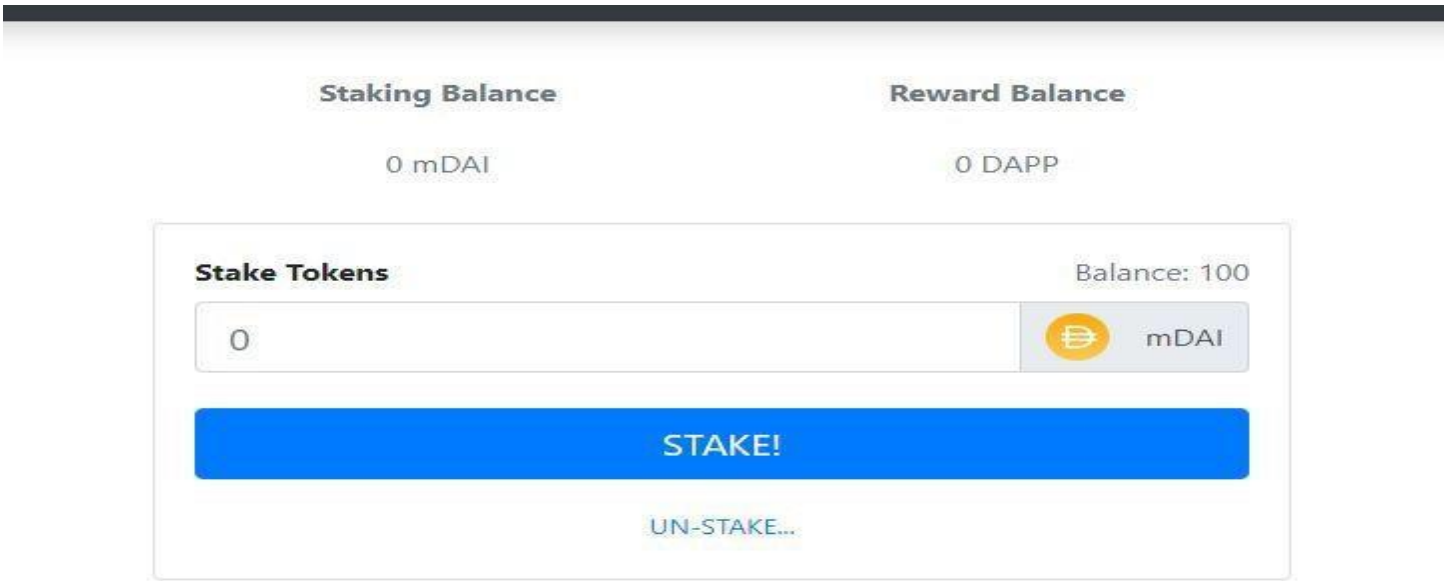
Figure 4.2: System Overview

Input: The data involved with analysis of security breaches come in various formats and standards, this makes the task of collection particularly cumbersome. The data can be formats such as JSON, CSV, STIX etc. There are various open source platforms like AlienVault OTX or google dns also which provide threat data as well. These inputs need to be collected in large numbers so as to get a proper understating and classification of threats that effect a particular industry or company.

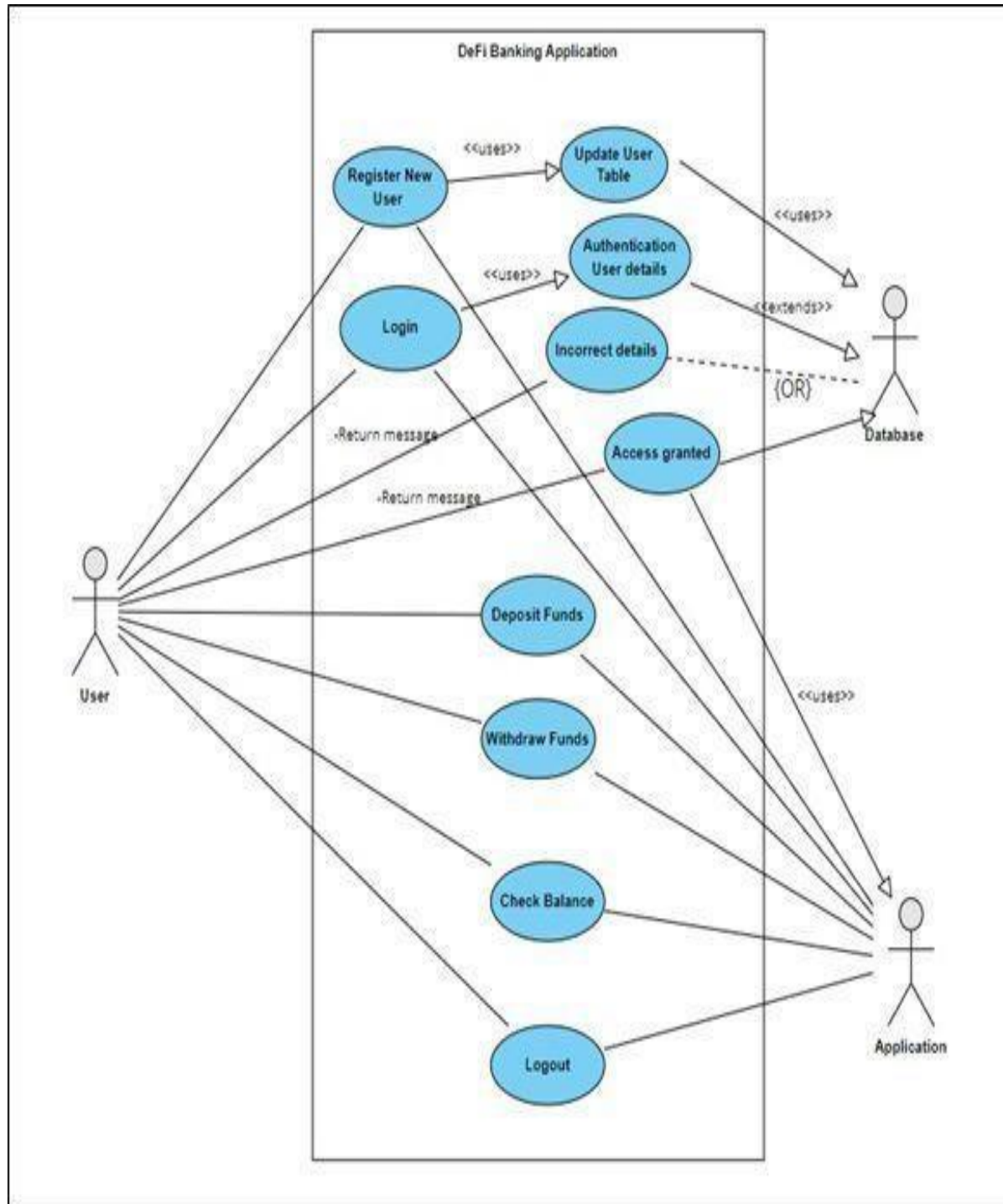
Processing: The inputs that are collected are converted to single standard format which makes it easier to analyze and work with. The aim here is to identify the IOCs to understand the malicious attack from the hackers. Once IOCs have been identified they can be grouped together under similar categories which provides ease of analysis. Each IOC has a threat score associated with them which indicate the level of impact a particular threat might have. These scores are provided by the CVEs. Once these scores are identified for each IOC we can determine the threat which has the maximum impact and alert the user to take action against this particular threat as it has the potential to cause the maximum damage.

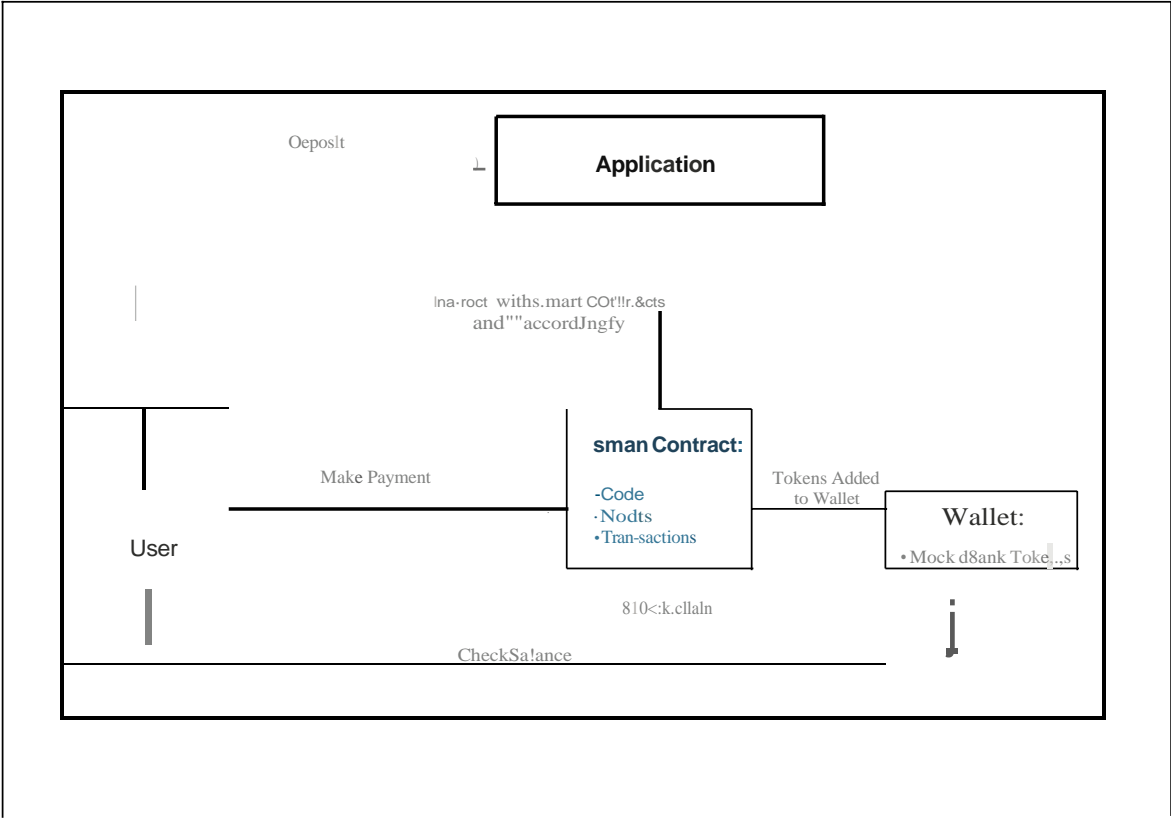
Visualization: This component deals with providing visual aid to the users in the form of a simple UI which comprises a dashboard which acts like a single point of information on all the threats that are currently being identified the various mitigation as well plans for each. This greatly reduces the time a security engineer needs to go through each threat as they can simply identify the most impactful threat and work towards the solution.

4.2.1 Interface Design



4.2.2 Use Case Diagram





Chapter 5

Implementation

5.1 Overview of technology used:

Blockchain is a decentralized ledger used to securely exchange digital currency, perform deals and transactions. Each member of the network has access to the latest copy of encrypted ledger so that they can validate a new transaction. Blockchain ledger is a collection of all Bitcoin transactions executed in the past. Basically, it's a distributed database which maintains a continuously growing tamper proof data structure blocks which holds batches of individual transactions. The completed blocks are added in a linear and chronological order. Each block contains a timestamp and information link which points to a previous block. Bitcoin is peer-to-peer permission-less network which allows every user to connect to the network and send new transactions to verify and create new blocks. Satoshi Nakamoto described the design of Bitcoin digital currency in his research paper posted to cryptography listserv in 2008. Nakamoto's suggestion has solved the long pending problem of cryptographers and laid the foundation stone for digital currency. This Chapter explains the concept, characteristics, and need of Blockchain and how Bitcoin works. It attempts to highlight the role of Blockchain in shaping the future of banking, financial institutions, and adoption of Internet of Things (IoT). The cost of cyber-crime costs quadrupled from 2013 to 2015 however a large portion of cybercrime goes undetected. Gartner report says cost of cyber-crime is expected to reach \$2 trillion by 2019 [1]. IBM's CEO, Ginni Rometty said that cybercrime is the greatest threat to every company in the world at IBM Security Summit [2]. Around two years ago Standard Chartered lost around \$200 million in a fraud at China's Qingdao port [3]. Banking and institutions are using Blockchain based technology to reduce risk and prevent cyber fraud. For example, Nasdaq has announced its plan to launch Blockchain based digital ledger technology which will help to boost their equity management capabilities. Standard Chartered is partnering with DBS Group to develop an electronic invoice ledger using Blockchain. The Blockchain metadata is stored in Google's Level DB by Bitcoin Core client [5]. We can visualize Blockchain as vertical stack having blocks kept on top of each other and the bottommost block acting as foundation of the stack. The individual blocks are linked to each other and refer to previous blocks in the chain. The individual blocks are identified by a hash which is generated using the secure hash algorithm (SHA-256) cryptographic hash algorithm on the header of the block [5]. A block will have one parent but can have multiple children each referring to the same parent block hence contains same hash in the previous block hash field. Every block contains a hash of parent block in its own header and the sequence of hashes linking individual block with their parent block creates a big chain pointing to the first block called Genesis block.

5.2 Implementation details of modules

The project can be divided roughly into three modules:

Frontend: These are the screens that the user can access and use to navigate the web pages. This module is designed in Angular and bootstrap. To implement this module the user needs to first start the frontend server so they can get access to screens. Upon starting the server the user must navigate to the localhost:3000 website and they will be taken to the login page. The user must use valid credentials to login and get access to the content. Once the login is verified the user is taken to the Dashboard where he can have quick access to the various details such as , particular analyzer information, visualizations etc. Various api calls are made depending on user selection to display the necessary details.

Backend: The actual data that is displayed to the users cannot be accessed until the backend Django server is running. The Django server can be started by navigating to the location of where Django is installed and starting the server. Once the server is started the data from the database will be accessed and can be displayed in the frontend. The Django server queries the database based on the selection from the user on the frontend. Each query is executed and the database sends a response and the details are displayed.

Database: The PostgreSQL database contains all the data that is to be displayed and is queried by the Django server to send responses. The database can be edited at all times and is scalable and changes in schema can be incorporated easily.

Chapter 6

Conclusion and Future Enhancements

6.1 Conclusion

Information technology has become a critical innovation in every industry. Those institutions or teams that can use technology correctly and effectively play a significant role in disrupting the status in a leadership position. Those that do not keep up with technology do not survive. We think the Blockchain technology as a catalyst for emerging use cases in the financial and nonfinancial industries such as industrial manufacturing, supply chain, and banking. Blockchain can play a pivotal role in transforming the digitization of industries and applications by enabling secure trust frameworks, creating agile value chain production, and tighter integration with technologies such as cloud computing, and IoT. In producing a cloud-based application called banking, the researchers have demonstrated the capability to apply professional engineering principles, combined with a DevOps approach to iterative development and management, and integration of cyber security, distributed computing, and Block-chain technologies. We feel banking is one of many examples that demonstrate the transformative capability of Blockchain.

6.2 Future Enhancements

Future enhancements for a DeFi banking application could include:

1. Cross-chain interoperability: Enabling seamless interaction and transactions between different blockchain networks, allowing users to access a wider range of DeFi protocols and assets.
2. Improved scalability: Implementing layer 2 solutions or integrating with scalable blockchain platforms to handle increased transaction volumes and improve the overall performance of the application.
3. Enhanced privacy features: Integrating advanced privacy-preserving technologies, such as zero-knowledge proofs or secure multiparty computation, to protect user data and transaction privacy.
4. Integration with traditional banking systems: Facilitating integration with legacy financial systems to enable interoperability between DeFi and traditional banking services, bridging the gap between the two.
5. DeFi lending and insurance: Expanding the application's capabilities to include decentralized lending and insurance services, providing users with more comprehensive financial solutions.
6. Improved user experience: Enhancing the user interface and streamlining user onboarding processes to make. The application is more intuitive, user-friendly, and accessible to a wider audience.

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