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DEPARTMENT OF ELECTRONICS AND COMPUTER ENGINEERING

KALANKI, KATHMANDU

A Major Project Report On

"PAISA: THE DIGITAL WALLET"

[CT 755]

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Project Supervisor:

Er. Bikash Acharya

A Major Project Progress report submitted to the department of Electronics and Computer Engineering in the partial fulfillment of the requirements for degree of Bachelor of Engineering in Computer Engineering

Kathmandu, Nepal

March ,2024

PAISA: THE DIGITAL WALLET

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A MAJOR PROJECT SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE DEGREE OF BACHELOR IN COMPUTER ENGINEERING

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Kalanki, Kathmandu

March ,2024

LETTER OF APPROVAL

The undersigned certify that they have read and recommended to the Institute of Engineering for acceptance, a project report entitled "**PAISA: THE DIGITAL WALLET**" submitted by:

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In the partial fulfillment of the requirements for the degree of Bachelor's Degree in Computer Engineering.

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ABSTRACT

In the modern era, digital wallets have revolutionized the way we conduct financial transactions. With a focus on widespread adoption, digital wallets make transaction easier and more secured and can be done within seconds.

The project illustrates the diversity of applications of digital wallets in banking, e-commerce, and peer-to-peer payments through case studies and examples. Both consumers and businesses can benefit from digital wallets, which simplify payment processes, enhance convenience, and integrate with mobile and contactless technology. Furthermore, the project examines the role of regulations and industry standards in addressing barriers to adoption, such as security concerns and user trust. Finally, the project explores emerging technologies and their potential impact on the future of digital wallets. The project provides valuable insights into the significance, opportunities, and challenges of digital wallets, serving as a comprehensive resource for individuals and organizations interested in embracing this innovative fintech technology.

This project has a feature where KYC verification can be done more swiftly without any humans being involved between the user and the wallet. For KYC verification we will use OCR (Optical Character Recognition) and Face Verification technology for which both technologies use CNN (Convolution Neural Network) algorithm.

Keywords: *e-commerce, peer-to-peer payments, contactless technology, FinTech, CNN, OCR*

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List of Abbreviations

CNN: Convolutional Neural Network

KYC: Know Your Customer

IDE: Integrated Development Environment

OCR: Optical Character Recognition

OTP: One Time Password

ACID: Atomicity, Consistency, Isolation, Durability

CHAPTER 1
INTRODUCTION

1.1 Background

In the rapidly advancing digital age, traditional payment methods are being replaced by more efficient and convenient alternatives. One such innovation is the digital wallet. This is a virtual platform that allows users to store, manage, and transact their financial resources using their smartphones.

A digital wallet, also known as an e-wallet or mobile wallet, is a secure and convenient substitute for carrying physical cash or plastic cards. It eliminates the need to carry bulky wallets or rummage through pockets for loose change. With a digital wallet, users can access their funds and make payments with just a few taps on their screens. Digital wallets offer various features and functionalities, including the ability to link their bank accounts. They also often support loyalty cards, coupons, and other rewards programs, consolidating all these features into a single, easily accessible platform.[1]

Digital wallets have a top priority, and they employ robust encryption and authentication measures to protect users' sensitive information. Additionally, many digital wallet providers offer additional security features, such as two-factor authentication and biometric verification, to ensure transaction safety.[2]

Today, digital wallets have expanded beyond online payments and are widely accepted in every store, making them a versatile and convenient payment solution in both the virtual and physical realms. They have gained significant traction globally, with numerous companies and financial institutions offering digital wallet solutions.[3]

In summary, digital wallets have revolutionized the way we make payments. They provide a secure, convenient, and efficient method of managing and transacting with our financial resources. As technology continues to advance, digital wallets are expected to play an increasingly prominent role in our everyday lives. This will simplify transactions and enhance the overall payment experience.

1.2 Motivation

The creation of digital wallets is driven by a multitude of motivations that are both diverse and multifaceted. One of the primary reasons for their development is the growing demand for secure and convenient payment solutions in today's digital age. With the increasing popularity of e-commerce and digital payments, there is a pressing need for user-friendly platforms that can streamline financial transactions.

Moreover, digital wallets play a crucial role in promoting financial inclusion by providing access to financial services for underserved populations who may not have access to traditional banking systems. By offering improved user experiences characterized by seamless payment processes and centralized financial management, digital wallets have become a popular choice for many consumers. Another key motivation for creating digital wallets is the focus on security and fraud prevention. Robust security measures are implemented to protect users' sensitive information, ensuring that their financial transactions are safe and secure. From a business perspective, digital wallets offer a range of revenue opportunities through transaction fees and partnerships with merchants. They also allow companies to leverage data for targeted marketing and personalized offers, thereby enhancing customer engagement and loyalty.

Finally, digital wallets are a product of technological innovation, pushing the boundaries of what is possible in the realm of financial technology and fostering collaborations within the payment ecosystem. As such, they represent a significant step forward in the evolution of financial services, offering a range of benefits to both consumers and businesses alike. The impetus behind the creation of digital wallets is driven by the constantly evolving landscape of technology and its impact on financial services. The ongoing advancements in mobile devices, biometrics, encryption, and other technological innovations present opportunities for developing more sophisticated and secure digital wallet solutions. Companies that are driven by technological innovation are seeking to leverage these advancements to develop cutting-edge features and functionalities that enhance the overall payment experience. By remaining at the forefront of technological developments, digital wallet providers can meet the changing needs and expectations of users, ensuring their solutions remain relevant and competitive in the market. This drive for innovation fuels continuous improvement and pushes the boundaries of what digital wallets can offer, further contributing to their evolution and widespread adoption.

1.3 Statement of Problem

The rise of digital wallets has brought about a multitude of challenges that must be addressed to fully realize their potential. One of the most pressing issues is security. Despite the implementation of encryption and authentication measures, digital wallets are still vulnerable to data breaches and unauthorized access. To mitigate these risks and build trust in digital wallet usage, it is crucial to enhance security protocols and educate users on best practices.

Another challenge is the lack of standardization and interoperability between different digital wallet platforms. This can lead to users managing multiple wallets for different services or struggling to find merchants that accept their preferred wallet. To simplify the user experience and drive wider adoption of digital wallets, industry-wide standards and increased focus on interoperability are necessary. Additionally, expanding the network of participating businesses and increasing merchant acceptance is crucial for achieving broad adoption.

To overcome these challenges, it is essential to enhance security measures, promote standardization, and educate users on the benefits and functionalities of digital wallets. Collaboration with regulatory bodies to establish clear frameworks and guidelines can also ensure consumer protection and foster widespread acceptance and usage of digital wallets.

In conclusion, while digital wallets offer numerous benefits, addressing the challenges they present is crucial for their continued growth and success. By working together to enhance security, promote standardization, and educate users, we can unlock the full potential of digital wallets and revolutionize the way we conduct transactions.

1.4 Objective

- The main objective of this project is to develop a Digital wallet.

1.5 Significance of Study

Digital wallet has been a new method of payment for many people since it is easier than carrying cash in hand and can perform transactions without visiting banks and filling up vouchers manually. This revolutionary technology has started a new wave of cashless payments. But with this technology there comes many challenges such as security. Trusting your wallet by loading money has huge security risks. Therefore, by using facial recognition and document verification we are able to authenticate and verify the users. The wallet fulfills all the ACID properties required for a secure, convenient, and inclusive platform for managing their financial transactions and digital assets. The facial recognition and document verification is done using CNN algorithm. Our research will contribute in improving the old method of verification of the KYC form filled by the users which would be done manually by a technical team by a new automated system.

CHAPTER 2

LITERATURE REVIEW

“An Android-based Face Recognition System for Class Attendance and Malpractice Control" [6]. The system provides a secure avenue to store data and generally makes it easier for students and lecturers to work together seamlessly removing the challenges faced by the conventional method of paper-pen attendance taking. The proposed model used Viola-Jones algorithm for detecting face in an image, Eigenface for face recognition. The model has some Problems such as students could use a picture of them for the attendance, their friends could do their attendance. As a result, the model made it easier to take attendance of the students who were present in the lecture.

“Design of a Face Recognition System based on Convolutional Neural Network (CNN)” [7]. This paper aims to develop a face recognition application for a biometric system based on Convolutional Neural Networks. It proposes a structure of a Deep Learning model which allows improving the existing state-of-the-art precision and processing time. The proposed CNN achieves a training accuracy of 99.78%, a validation accuracy of 98.7%, and an inference speed of 231 frames per second

“BioWallet: A Biometric Digital Wallet” [8]. In this paper, they propose a model that uses biometric methods to secure digital currencies within wallets. The proposed model improves both usability and security of payment transactions carried out with digital currencies, which are stored in wallets, by using fingerprints of users. The wallet was specifically used for Digital Assets transaction such as bitcoin, doge coin. The system was secured by providing a digital transaction key consisting of alpha numeric password. The system also has a feature of biometrics using fingerprint and retina scan which was not as secured as the digital key

“OCR-MRD: Performance Analysis of Different Optical Character Recognition for Medical Report Digitization” [9]. In this paper the researchers have compared different OCR techniques which consist of Convolution Neural Network (CNN), Long Short-Term Memory (LSTM) networks, Connectionist Temporal Classification (CTC) and Support Vector Machines (SVMs).The result of this paper was not one-sided as while CNNs have shown exceptional performance in various OCR tasks, selecting the "best" model involves experimentation and evaluation based on your specific use case, available resources, and the trade-offs between accuracy, speed, and implementation complexity.

CHAPTER 3

REQUIREMENT ANALYSIS

3.1 Software Requirements

1. Language: Dart, Python
2. OS: Android, IOS
3. IDE: Android studio

3.2 Hardware Requirements

1. OS: Android, IOS
2. Processors: To be tested
3. RAM: To be tested

3.3 Functional Requirements

Functional requirements are the specifications of the product's functions (features). Functional requirements define what precisely a software must do and how the system must respond to inputs. Functional requirements define the software's goals, meaning that the software will not work if these requirements are not met. The functional requirements of this system are:

1. User should be able to transfer funds from one wallet to another.
2. User should be able to enroll photo and information on their digital wallet account.
3. User should be able to top up the balance in their mobile number.
4. User authentication to a digital wallet through OTP Verification.

3.4 Non-functional Requirements

Non-functional requirements are a set of specifications that describe the system's operation capabilities and constraints and attempt to improve its functionality. These are basically the requirements that outline how well it will operate including things like speed, security, reliability, data integrity, etc. The non-functional requirements of this system are:

1. Usability: Usability includes easy to use, efficiency, learnability and user satisfaction experience.
2. Performance: Performance refers to the capacity of the digital wallet to process as per the transaction every second, as it deposits without any failure.
3. Reliability: Reliability depends on failure free transactions and how fast it is able to recover from system failure.
4. Security: Security system feature ensures that the wallet should be protected from unwanted damage and unauthorized access.

3.5 Feasibility Study

The major concern to all application users is the matter of feasibility.

3.5.1 Technical Feasibility

In our project, the resources meet the capacity and the team is capable of converting the ideas into working systems.

3.5.2 Economic Feasibility

Our proposed project proves to be economically feasible. The total expenditure of the project is just computational power. The software is cost-effective and does not require any additional hardware.

3.5.3 Legal Feasibility

From developing this project to the distribution of this project, we will address all the legal requirements. All the data required for this project will be taken only by permission. We will consider protecting our Intellectual Property (IP) rights and minimizing the risk of infringing the IP rights of others. This project will be developed without breaching any law in the country.

3.5.4 Operational Feasibility

Our proposed system is quite simple and easy to use. Users require very less training to operate the system.

3.5.5 Environment Feasibility

Our proposed system does not hamper the environment and its food chain.

CHAPTER 4

SYSTEM DESIGN AND ARCHITECTURE

4.1 Data Flow Diagram

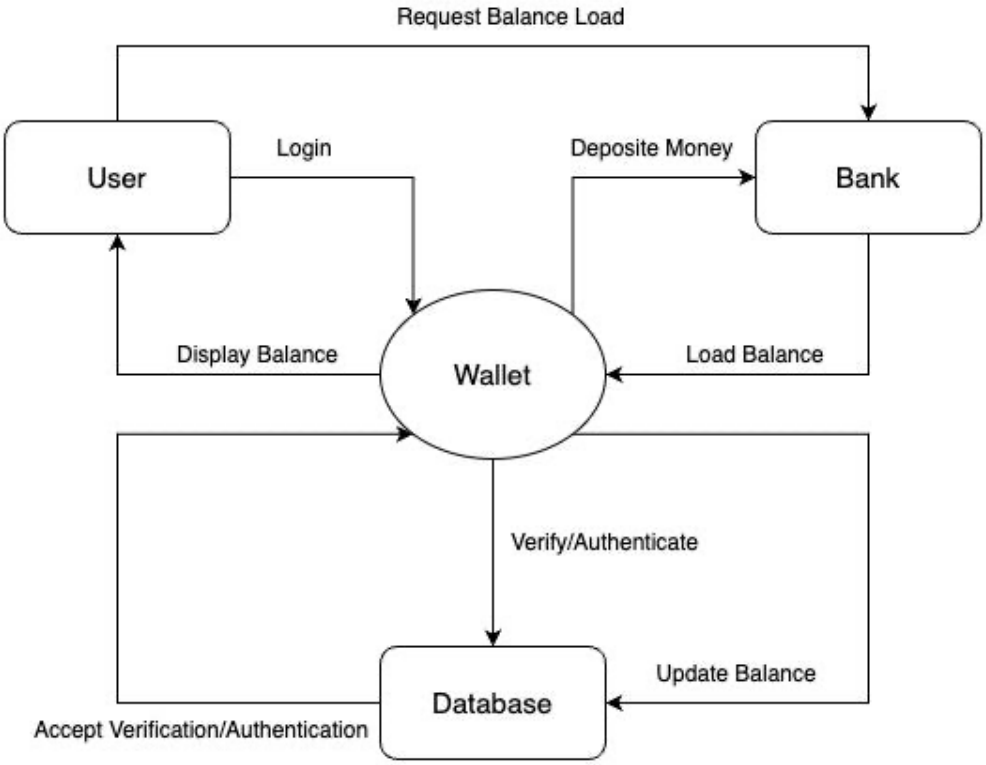

Figure 4.1: Data Flow Diagram Level 0

4.2 Use Case Diagram

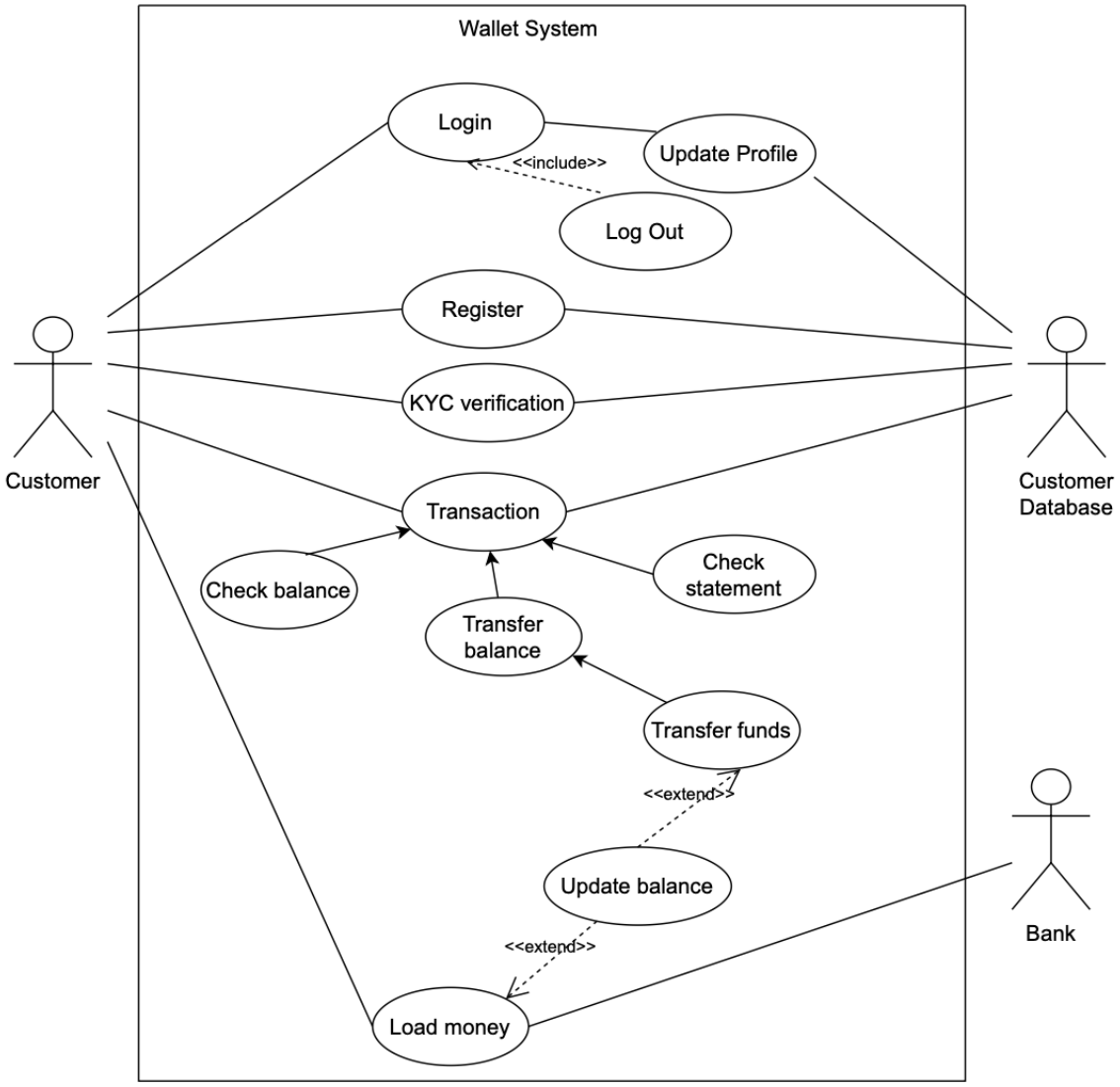

Figure 4.2: Use Case Diagram

4.3 System Block Diagram

For the system we have used Face Recognition and Face Matching algorithm for facial verification and Optical Character Recognition and Text Matching algorithm for document verification of the user. We have used these 4 algorithms of instant KYC verification of the users of the wallet. KYC verification is important to know if the user is genuine or not.

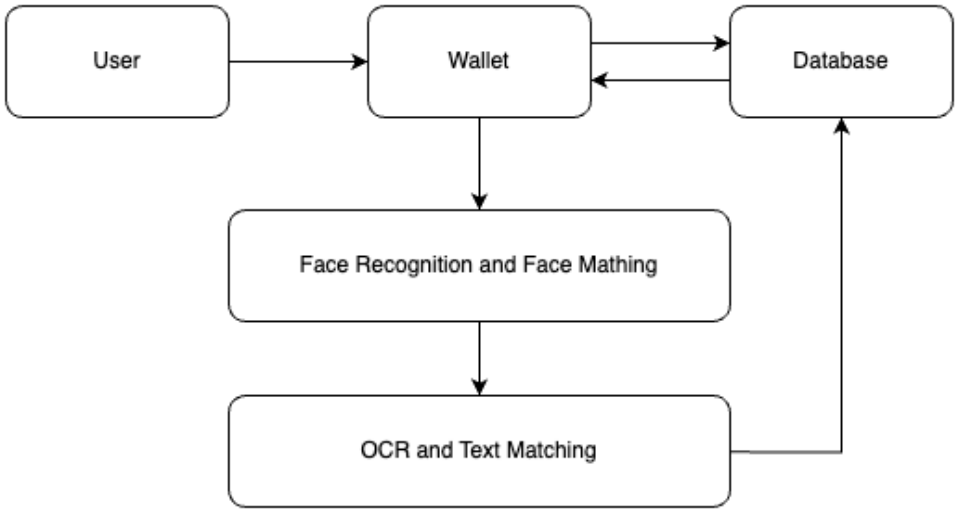

Figure 4.3: System Block Diagram

CHAPTER 5

METHODOLOGY

5.1 Agile Model

Agile development is an iterative and flexible approach to software development that prioritizes collaboration, adaptability, and customer feedback. It involves breaking down projects into smaller tasks called "sprints," with cross-functional teams working closely together to deliver incremental updates. Regular meetings, such as daily stand-ups and sprint reviews, facilitate continuous communication and progress tracking. This methodology promotes rapid responses to changes, fosters a customer-centric mindset, and emphasizes delivering valuable, working software at the end of each iteration.

Figure 5.1: Agile Model

[Source: https://distantjob.com/blog/agile-development](Accessed Date: 02-June-2023)

5.2 Convolutional Neural Network

A Convolutional Neural Network (CNN) is a deep learning algorithm primarily designed for analyzing visual data, such as images or videos. CNNs have revolutionized the field of computer vision and have achieved state-of-the-art performance in tasks like image classification, object detection, and image segmentation. CNNs excel in capturing local patterns, translational invariance, and learning hierarchical representations. They have demonstrated remarkable success in various computer vision tasks and have also been extended to other domains like natural language processing (using 1D convolutions) and audio analysis. CNN architectures like AlexNet, VGGNet, GoogLeNet, and ResNet have set benchmarks in image classification and object detection tasks.

Optimizers are used in Convolutional Neural Networks (CNNs) to iteratively update the parameters (weights and biases) of the network during the training process. There are various optimizers such as nadam, adamW, SGD, etc. We have used SGD optimizer in our models because SGD is computationally efficient and scalable, easy to use and flexible to use.

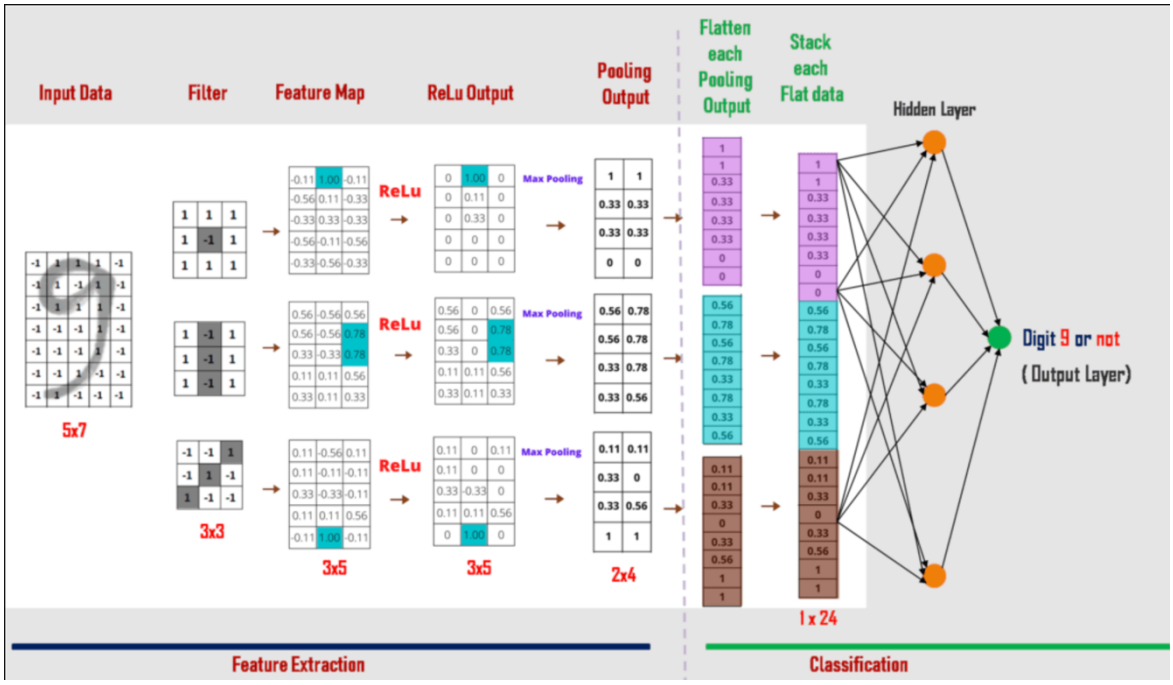

Figure 5.2: Convolutional Neural Network

[Source:https://datagen.tech/guides/computer-vision/cnn-convolutional-neural-network]

(Accessed Date: 03-June-2023)

5.3 Flowchart

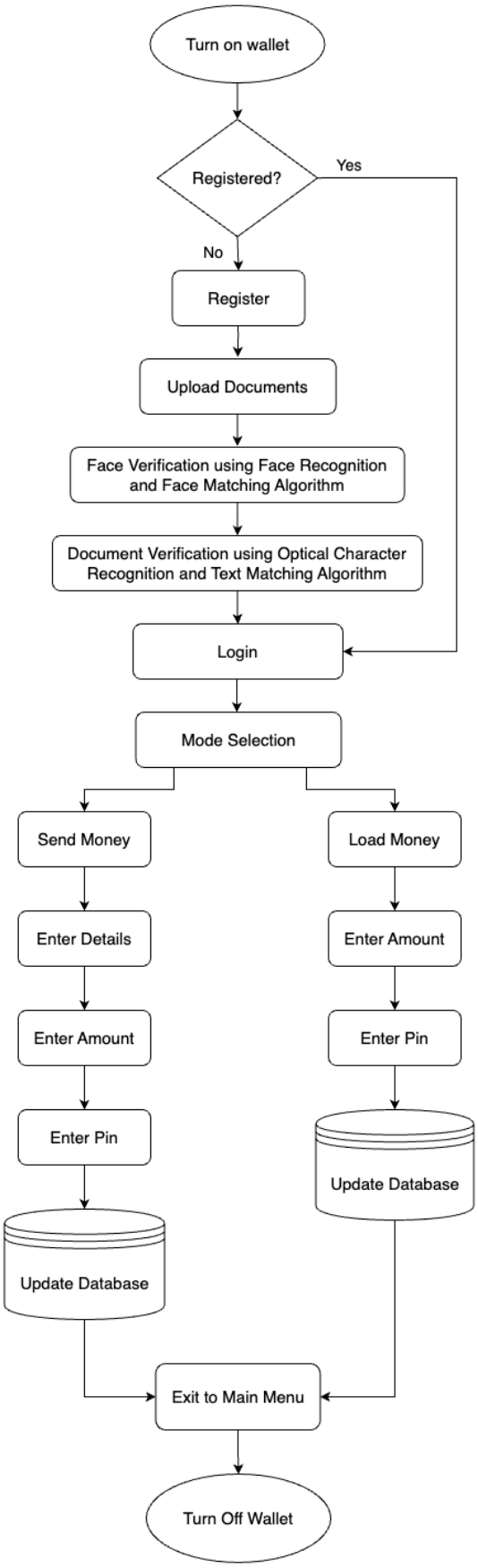

Figure 5.3: Flowchart of the system

5.4 Working Algorithm

1. Start
2. Turn on wallet
3. Registered? If yes go to 5 else go to 3.1
   3.1. Register and go to 5
4. KYC Verification
   4.1. Upload Documents
   4.2. Face verification using Face Recognition and Face Matching Algorithm
   4.3. Document verification using Optical Character Recognition and Text Matching Algorithm
5. Login
6. Mode Selection
   6.1. Send Money
      6.1.1. Enter Details
      6.1.2. Enter Amount
      6.1.3. Enter Pin
      6.1.4. Update Database
   6.2. Load Money
      6.2.1. Enter Amount
      6.2.2. Enter OTP sent by the bank
      6.2.3. Update Database
7. Exit to main menu
8. Turn off wallet

5.5 Flutter and Firebase

Flutter is an open-source UI framework developed by Google. It allows developers to build native mobile applications for Android and iOS using a single codebase. Flutter uses the Dart programming language and provides a rich set of pre-designed widgets and tools to create beautiful and responsive user interfaces.

Firebase, on the other hand, is a comprehensive mobile and web development platform also developed by Google. It offers a wide range of backend services that help developers build

and deploy applications quickly. Firebase provides features such as authentication, real-time database, cloud storage, cloud functions, hosting, and more.

5.6 Machine Learning

Machine learning is a subfield of artificial intelligence (AI) that focuses on developing algorithms and models that allow computers to learn from and make predictions or decisions based on data without being explicitly programmed. In other words, machine learning enables computers to learn from patterns and examples to improve their performance on a specific task or problem. It finds applications in a wide range of fields, including image and speech recognition, natural language processing, recommendation systems, fraud detection, healthcare diagnostics, autonomous vehicles, and more. Popular machine learning frameworks and libraries such as TensorFlow, PyTorch, and scikit-learn provide developers with powerful tools and resources to implement and experiment with machine learning algorithms and models.

There are several key concepts and techniques in machine learning:

- Supervised learning
- Unsupervised learning
- Reinforcement learning
- Deep learning
- Feature Extraction and Selection
- Evaluation and Validation

5.7 Face Recognition and Face Matching Algorithm

Face recognition refers to the technology that identifies and verifies individuals by analyzing their facial features. It involves capturing an image or video of a person's face and comparing it against a database of known faces to determine the identity of the person. Face recognition algorithms typically extract facial landmarks, such as the position of eyes, nose, and mouth, and analyze the unique characteristics and patterns of the face, such as the shape of the face, texture, and distribution of facial features. These features are then used to create a face template or a numerical representation of the face, which is compared with the templates of known faces to find a match.

In face matching, similar techniques are used to extract facial features and create face templates as in face recognition. However, instead of comparing the face template with a database, face matching algorithms compare the face templates of two or more faces directly. The algorithms measure the similarity or distance between the templates and make a decision on whether the faces match or not based on a predefined threshold. Unlike face recognition, which involves matching a face against a database of known faces, face matching focuses on comparing pairs of faces to determine if they are a match or not.The face matching algorithm process involves several steps:

1. Capture Image
2. Preprocess the image
3. Face Detection
4. Feature Extraction
5. Face Comparison
6. Present result

5.8 Optical Character Recognition (OCR) and Text Matching Algorithm.

OCR is a technology that enables the conversion of printed or handwritten text within images or scanned documents into machine-readable text. The OCR process involves several steps:

1. Image Preprocessing
2. Text Localization
3. Character Segmentation
4. Character Recognition
5. Text Post-processing

OCR finds wide applications in digitizing printed documents, extracting data from invoices or forms, automatic transcription, archival and retrieval systems, and more.

Text matching algorithms aim to determine the similarity or degree of matching between two pieces of text. These algorithms are used in various applications, including plagiarism detection, document similarity analysis, information retrieval, and data deduplication. Some commonly used text matching algorithms include:

- Exact string matching

- Cosine Similarity algorithm
- Token based matching
- Sequence alignment algorithm
- Edit distance algorithm

These algorithms can be combined with additional techniques like stemming, stop-word removal, or semantic analysis to improve text matching accuracy and handle more complex text matching scenarios. In our system we have used Cosine Similarity algorithm that measures how similar two vectors are. It calculates the cosine of the angle between two vectors, which provides a measure of similarity irrespective of their size.

CHAPTER 6

RESULT AND ANALYSIS

6.1 Result

The Results generated by our app is shown below.

6.1.1 Face recognition and Verification

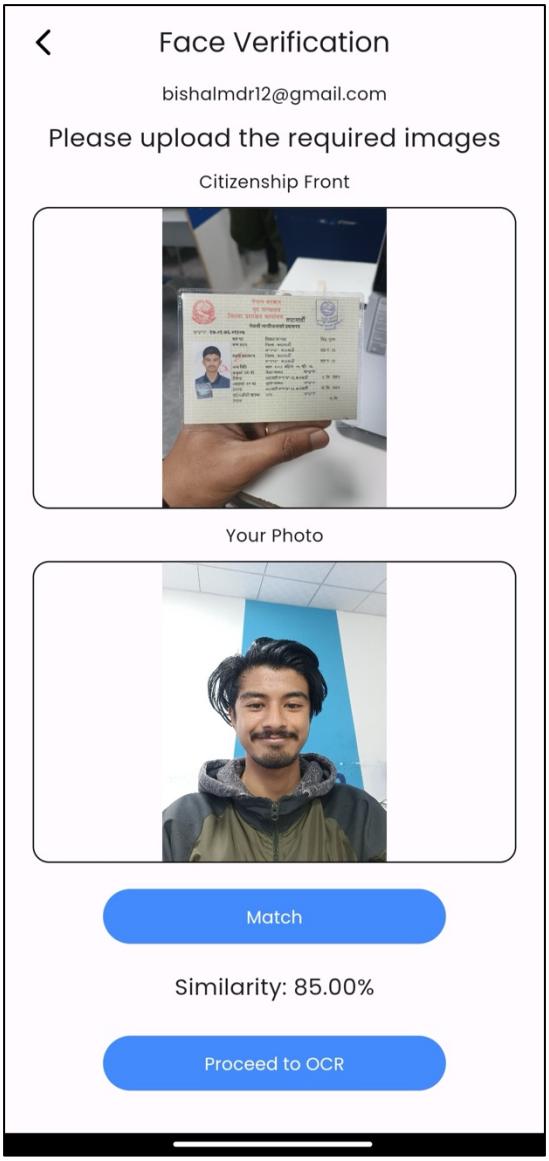

Figure 6.1.1.1 Face Recognition and Verification

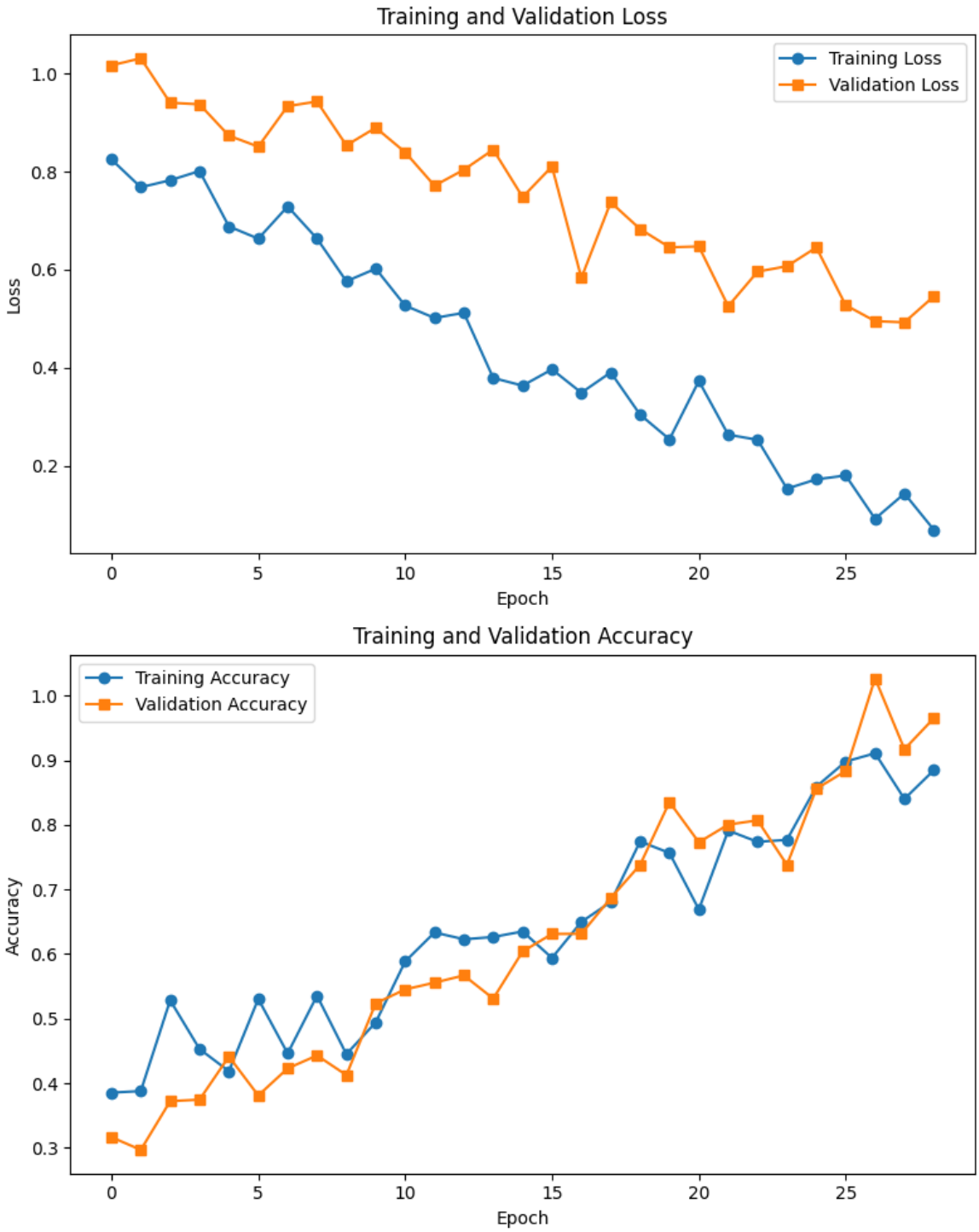

Figure 6.1.1.2 Face Recognition and Verification graph

6.1.2 OCR and Text matching

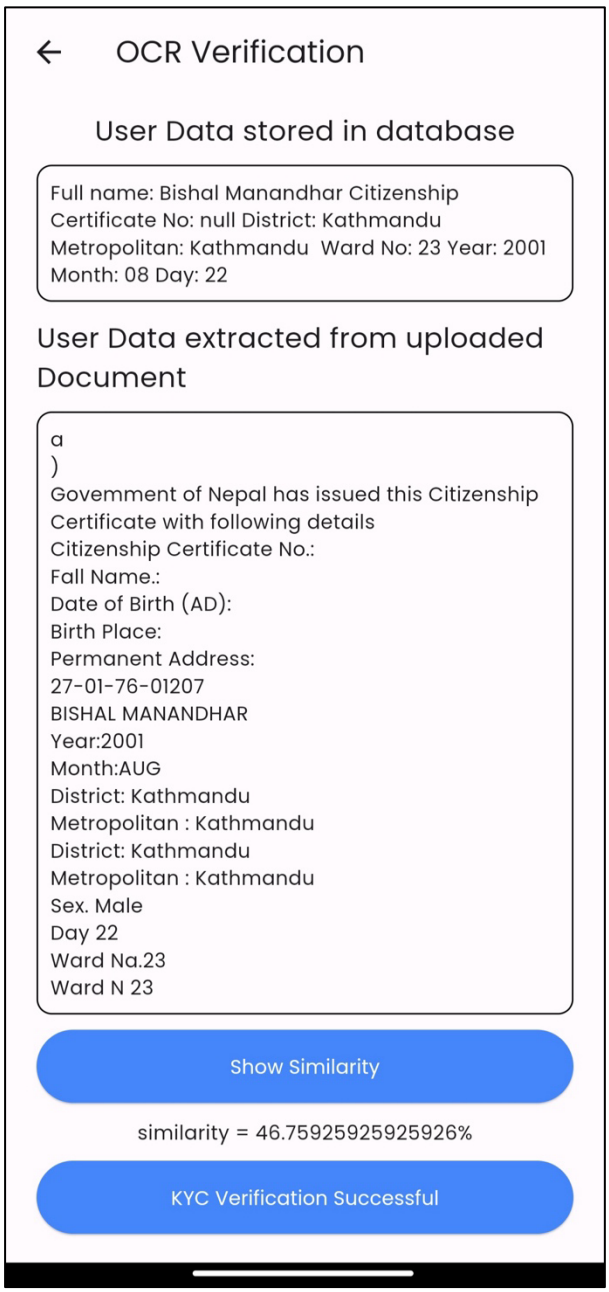

Figure 6.1.2.1 OCR and Text matching

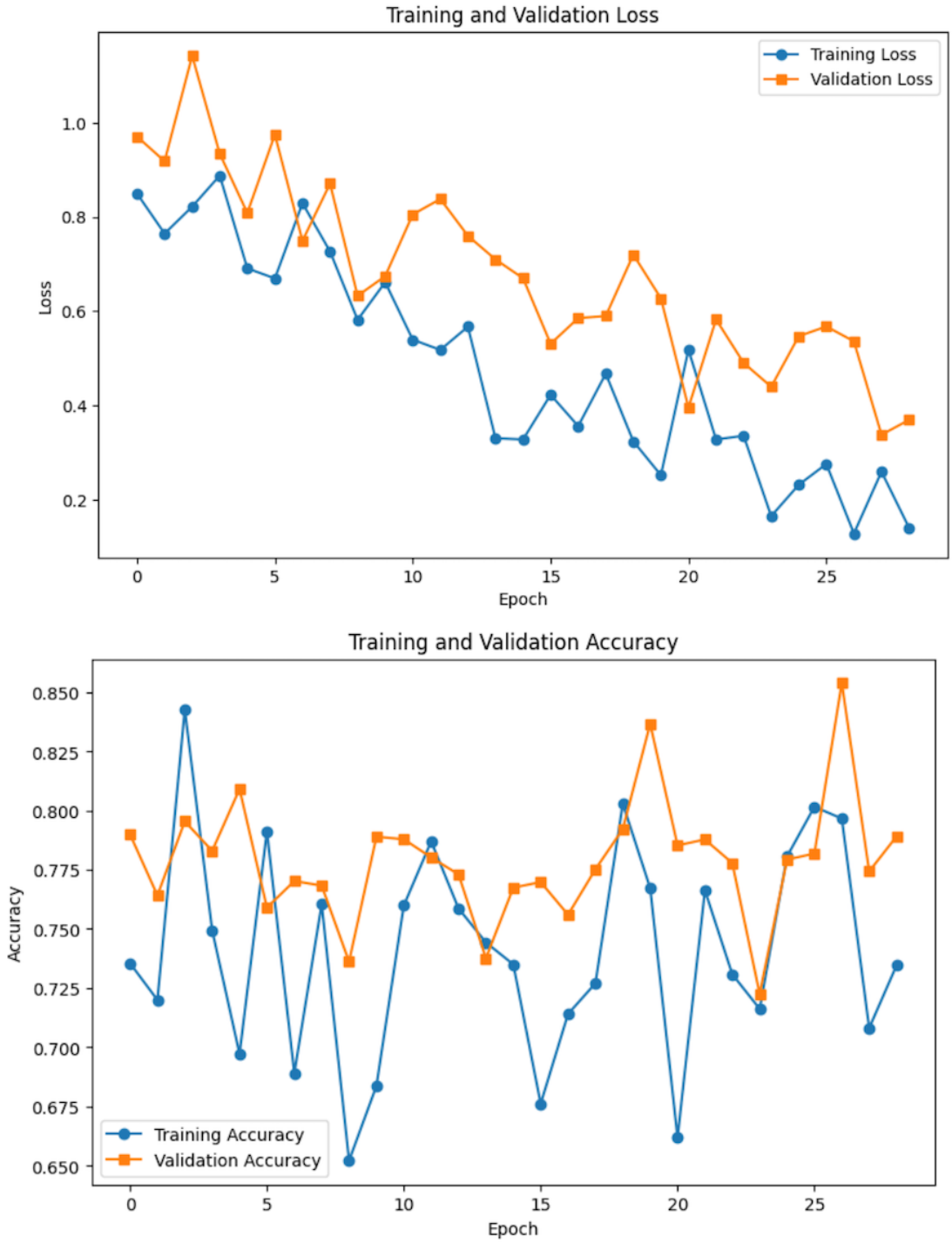

Figure 6.1.2.2 OCR and Text matching graph

6.2 Analysis

Our main motive for this project was to reduce the time of KYC verification which is used to be done manually by introducing AI that uses machine learning techniques for the verification. KYC verification is done manually by existing digital wallet application where a person is manually verifying the details that the user enters to the details in their uploaded document. In our project KYC verification is done step by step within a few minutes which significantly decrease the KYC verification time and manual work load. Our digital wallet can also make transaction between accounts swiftly.

CHAPTER 7

CONCLUSION, LIMITATIONS AND FUTURE ENHANCEMENT

7.1 Conclusion

Paisa: The Digital Wallet offers convenient and secure storage of payment and personal information, streamlining transactions and enhancing financial management. This digital wallet enhances accuracy, efficiency, and scalability in KYC verification processes. It reduces manual error, faster onboarding for customers, improves compliance with regulations, and better detection of fraudulent activities.

7.2 Limitations

The limitations of our project paisa: the digital wallet is:

1. The accuracy of Text Matching after OCR is not a full hundred percent.
2. Recognizing Nepali text is not feasible.

7.3 Enhancement

We could enhance the project further by following manners:

1. Training the model with Nepali dataset for Nepali text recognition.
2. Integrating biometric fingerprint recognition into digital wallet to enhance the security and convenience.
3. Transaction between an actual bank and digital wallet.

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APPENDIX: UI OF THE SYSTEM

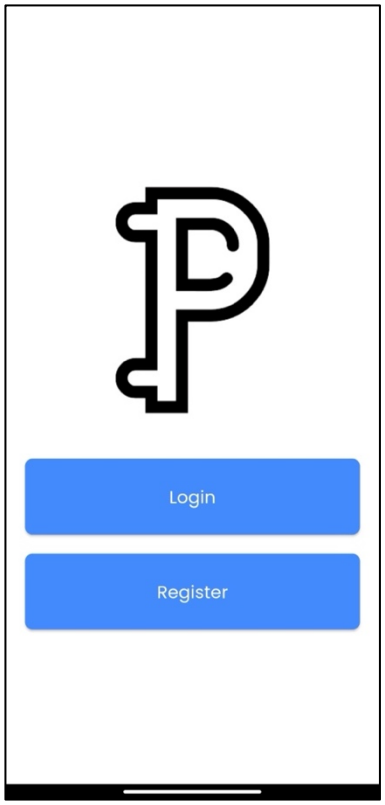

Figure 9.1: Welcome Screen

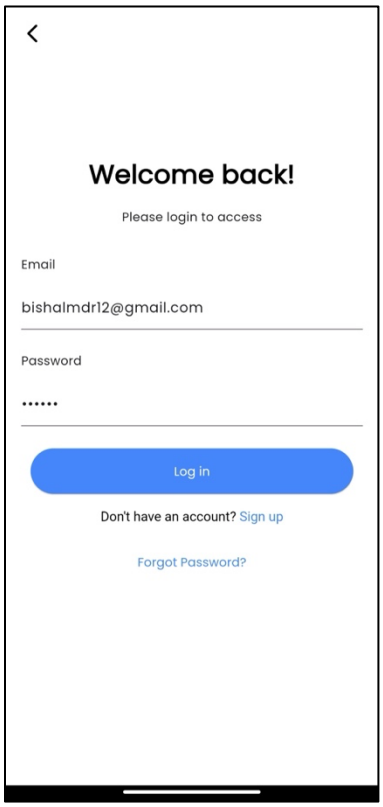

Figure 9.2: Login Screen

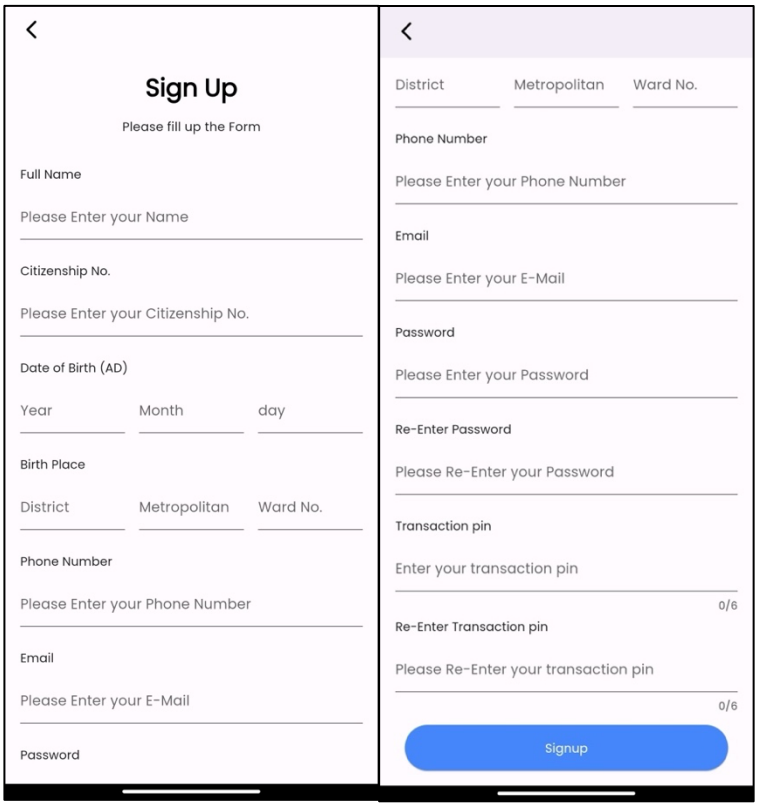

Figure 9.3: Register Screen

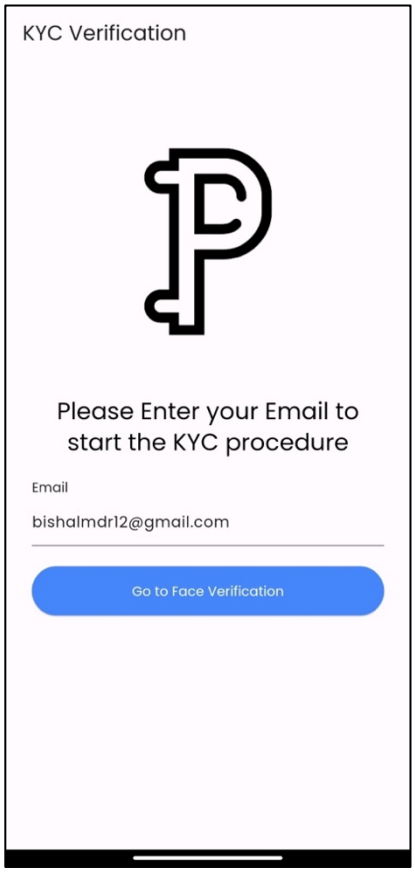

Figure 9.4: KYC Verification Screen

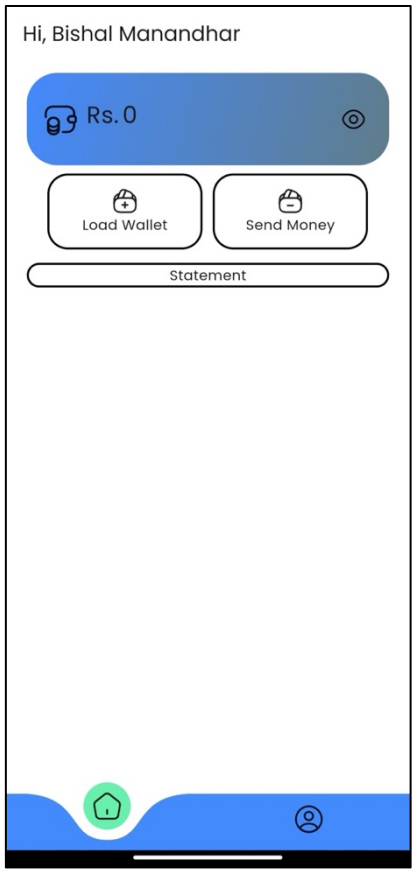

Figure 9.5: Home Screen

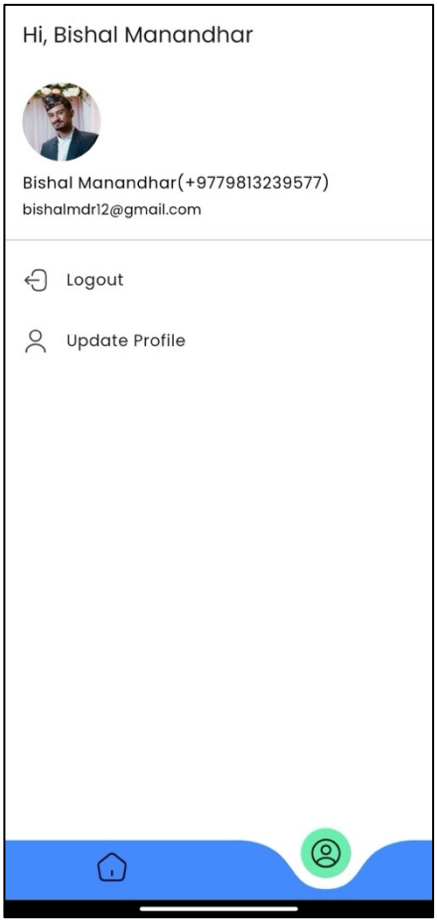

Figure 9.6: User Profile Screen