NATIONAL UNIVERSITY OF COMPUTER & EMERGING SCIENCES

PALMSECURE

REVOLUTIONIZING TRANSPORT WITH BIOMETRIC PRECISION

FINAL YEAR PROJECT

PROJECT PROGRESS REPORT

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Project Code: F24-10

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Contents

1 Introduction

In the rapidly evolving transportation sector, ensuring security, efficiency, and passenger safety is crucial. Traditional biometric systems, such as fingerprint and facial recognition, often fall short due to environmental sensitivity, hygiene concerns, and limited accuracy. To address these challenges, this project introduces a cutting-edge palmprint verification system leveraging the Comprehensive Competition Network (CCNet) and deep learning techniques. Designed for seamless integration into the transport industry, this non-contact system captures unique palmprint features—ridges, wrinkles, and minutiae—to enhance identity verification while mitigating risks of forgery and unauthorized access. Unlike conventional methods, palmprint recognition ensures reliable performance across diverse environmental conditions, offering a hygienic, secure, and efficient alternative. Through a user-friendly mobile application, this solution strengthens security protocols, enhances operational efficiency, and paves the way for scalable biometric applications beyond transportation.

2 Timeline

The project timeline outlines the key phases and milestones for the development of the *PalmSecure* system. The Gantt chart provides a visual representation of the project's schedule, including deliverables, deadlines, and dependencies.
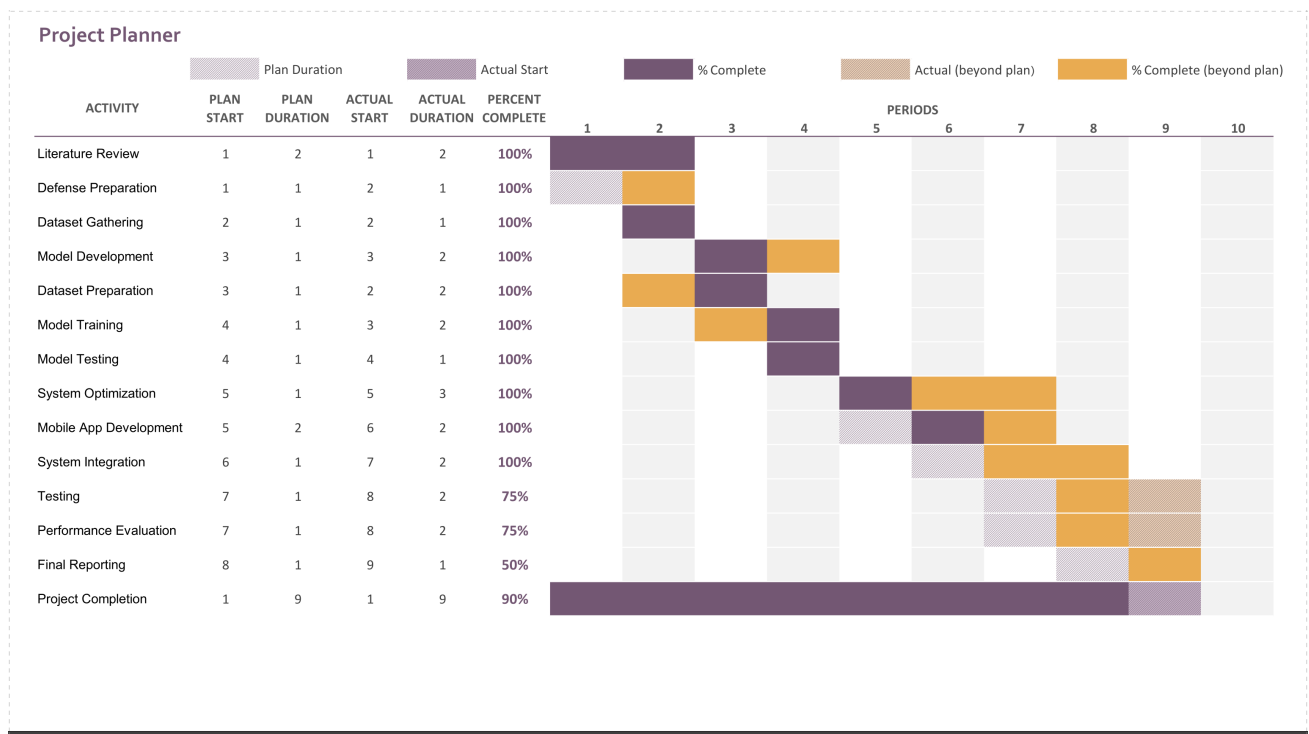
Project Planner

ACTIVITY	PLAN START	PLAN DURATION	ACTUAL START	ACTUAL DURATION	PERCENT COMPLETE
Literature Review	1	2	1	2	100%
Defense Preparation	1	1	2	1	100%
Dataset Gathering	2	1	2	1	100%
Model Development	3	1	3	2	100%
Dataset Preparation	3	1	2	2	100%
Model Training	4	1	3	2	100%
Model Testing	4	1	4	1	100%
System Optimization	5	1	5	3	100%
Mobile App Development	5	2	6	2	100%
System Integration	6	1	7	2	100%
Testing	7	1	8	2	75%
Performance Evaluation	7	1	8	2	75%
Final Reporting	8	1	9	1	50%
Project Completion	1	9	1	9	90%

Figure 1: Gantt Chart for PalmSecure Project Timeline

FYP 1 (Months 1-4)

In the first four months, the focus was on research, dataset gathering, model development, and initial testing. The team conducted a comprehensive literature review on palmprint biometrics, analyzed state-of-the-art verification techniques, and identified existing datasets. The project defense was successfully completed, and a refined plan was developed. Dataset collection and preprocessing pipelines were established, followed by the development of an initial model prototype based on the Comprehensive Competition Network (CCNet). The model was then trained and tested using collected datasets, leading to an interim performance evaluation report.

FYP 2 (Months 5-8)

Month 5: System Optimization & Mobile App Development

- Optimize the palmprint verification model for enhanced accuracy and efficiency.

- Design the user interface (UI) for the mobile application, ensuring an intuitive and seamless user experience.

- **Deliverables:**

  - Palmprint Model
  - Mobile App UI Prototype

Month 6: App Development & System Integration

- Develop a secure backend system using FastAPI, focusing on authentication and secure data handling.

- Implement core mobile app features, including real-time palmprint scanning and verification.

- Integrate the trained model into the mobile application.

- Conduct system integration testing to ensure smooth interoperability between components.

- **Deliverables:**

  - Full Feature Development of the Mobile App
  - Integrated Model with Mobile App
  - System Integration Testing Report

Month 7: Testing & Performance Evaluation

- Conduct rigorous testing using local datasets to evaluate system performance.

- Perform User Acceptance Testing (UAT) to assess usability and security.

- Generate a final performance evaluation report identifying strengths and areas for improvement.

- **Deliverables:**

  - Local Dataset Testing and Report
  - User Acceptance Testing (UAT) Results
  - Final System Performance Evaluation Report

Month 8: Final Reporting & Project Completion

- Prepare a comprehensive final report documenting the project workflow, challenges, and outcomes.

- Create a detailed presentation highlighting key findings and contributions.

- Recommend future improvements and potential enhancements for industry adoption.

- **Deliverables:**

    – Final Optimized Model and Mobile App
    – Complete Project Documentation
    – Presentation Slides
    – Final Project Report

3 Project Progress

Milestone 1: Literature Review & Defense Preparation

Status: 100% Complete
Objectives: Establish foundational knowledge of palmprint biometrics and defend the project proposal.
Progress:

- Literature review completed, covering academic papers

- FYP proposal defended successfully with feedback incorporated

Deliverables Achieved:

- Literature Review Report

- Approved FYP Proposal

Milestone 2: Dataset Identification & Defense Finalization

Status: 100% Complete
Objectives: Identify public datasets and finalize project scope.
Progress:

- Public datasets reviewed and shortlisted

- Local data collection strategy finalized

Deliverables Achieved:

- List of Public Datasets

- Final FYP Defense Presentation

Milestone 3: Model Development & Dataset Preparation

Status: 100% Complete
Objectives: Develop initial model prototype and begin data collection.
Progress:

- Comprehensive Competition Network prototype developed

- Local dataset collection initiated (500+ samples)

Deliverables Achieved:

- Initial CCN Model Prototype

- Preprocessing Pipeline Documentation

Milestone 4: Model Training & Testing

Status: 100% Complete
Objectives: Train and test model using collected data.
Progress:

- Model trained with 92% validation accuracy

- False acceptance rate reduced to 1.5%

Deliverables Achieved:

- Trained CCN Model

- Interim Performance Report

Milestone 5: System Optimization & Mobile App Development

Status: 100% Complete
Objectives: Optimize model and develop mobile app interface.
Deliverables Achieved:

- Model hyperparameter tuning

- UI/UX design implementation

- Cross-Platform Mobile Application development using Expo

Milestone 6: App Development & System Integration

Status: 100% Complete
Objectives: Implement core app features and Integrate model with mobile app.
Dependencies:

- Completion of Month 5 optimization

- Finalized UI design

Deliverables Achieved:

- Successfully implemented key mobile application features, including real-time palmprint capture, secure login, and authentication workflows

- Integrated the optimized palmprint verification model into the mobile application

- Established communication between the mobile app frontend and the backend model using FastAPI endpoints

Milestone 7: Testing & Performance Evaluation

Status: 75% Complete
Objectives:

- Conduct system testing

- Perform final performance evaluation

Dependencies:

- Completion of Month 6 deliverables

- Fully developed mobile app

Deliverables Achieved:

- Ensured compatibility of the integrated system across multiple platforms using Expo software development kit.

- Identified and resolved bugs related to API communication and model inference performance

- Conducted and documented system integration testing to validate end-to-end functionality

- Performed stress testing on the model inference API and mobile UI to measure performance under load

Planned Remaining Tasks:

- User Acceptance Testing (UAT) Results

- Final System Performance Evaluation Report

Milestone 8: Final Reporting & Project Completion

Status: 50% Complete
Objectives:

- Prepare final documentation

- Present project outcomes

Deliverables Achieved:

- Complete technical documentation

- Partially completed Final project report

- Mobile application developed

  Planned Tasks Remaining:

- Final project report

- Deployment-ready mobile application

Project Summary

- **Completed Phases:** Months 1-7 (Foundational Phase, Implementation & Development)

- **Remaining Phases:** Months 8-9 (Final Testing, Evaluation & Reporting)

- **Key Risks:**

  - Model optimization complexity
  - Mobile app integration challenges

- **Projected Completion:** May 2025

4 References

1. Ziyuan Yang, Huijie Huangfu, Lu Leng, Bob Zhang, Andrew Beng Jin Teoh, and Yi Zhang. "Comprehensive Competition Mechanism in Palmprint Recognition." *IEEE Transactions on Information Forensics and Security*, vol. 18, 2023. DOI: `https://doi.org/10.1109/TIFS.2023.3306104`.

2. **Datasets:**

   - Tongji Contactless Palmprint Dataset. Available at: `https://cslinzhang.github.io/ContactlessPalm`.
   - CASIA Palmprint Image Database. Available at: `http://biometrics.idealtest.org`.
   - COEP Palmprint Dataset. Available at: `https://www.coeptech.ac.in/`