TED UNIVERSITY

Final Report

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Senior Project

Project Name:
NextRoute

The URL of the project web page:
https://m-aras.github.io/

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1. Introduction

NextRoute is a mobile platform designed to create personalized travel itineraries for young users by utilizing artificial intelligence. Users specify preferences such as interests (e.g., history, music, food), travel dates, and budget, and the system generates tailored travel plans that include events, accommodations, and dining options. It also supports verified student discounts, making travel more accessible.

The purpose of this report is to summarize the architecture, design, tools, testing outcomes, and broader impacts of the NextRoute platform.

2. Architecture and Design Overview

The application follows a layered architecture:

- **Frontend:** Built using Flutter for a cross-platform mobile experience (iOS and Android).
- **Backend:** Developed in Python using FastAPI with Firebase as the backend database.
- **Chatbot Integration:** LLM-based AI assistant (using ChatGPT or LLama models) for conversational planning.
- **Database & Cache:** Firebase Firestore and local storage (SQLite) for structured and cached data.

The system is modular, scalable, and follows standards such as IEEE 830, IEEE 1016, and ISO/IEC 27001. UML diagrams (e.g., use case, sequence, and class diagrams) model interactions and data flow.

3. Global, Economic, Environmental, and Societal Impact

Global Impact: The platform can be adapted for global travelers and supports multilingual capabilities in future versions.

Economic Impact: Enables budget-conscious youth to explore new locations with exclusive promotions. Businesses benefit from targeting young demographics through campaigns.

Environmental Impact: Promotes localized travel and cultural tourism which minimizes environmental strain from mass tourism.

Societal Impact: Encourages inclusive and personalized travel experiences, ensuring affordability and cultural diversity awareness.

4. Contemporary Issues

Key issues considered:

- **Data Privacy:** Compliance with GDPR ensures user data security.
- **AI Transparency:** Recommendation algorithms avoid black-box behavior by clearly stating reasons for suggestions.
- **Ethical Tourism:** Encourages sustainable tourism practices and local business support.

5. New Tools and Technologies Used

- **Flutter:** For cross-platform mobile UI development.
- **Python + FastAPI:** For backend services and RESTful endpoints.
- **ChatGPT/LLama:** For AI chatbot and recommendation interaction.
- **Firebase:** As backend database and hosting.
- **SQLite:** For offline access and caching.
- **Postman/JMeter:** For API and performance testing.
- **GitHub :** For version control and team collaboration.

Flutter Libraries Used:

- provider, riverpod: State management
- firebase_core, cloud_firestore, firebase_auth: Firebase integration
- dio: Networking (HTTP requests)
- intl: Date and time formatting
- shared_preferences: Local storage
- flutter_local_notifications: For user alerts
- flutter_hooks, hooks_riverpod: Simplified state logic

Python Libraries Used:

- fastapi: For building RESTful backend services
- firebase-admin: For interfacing with Firebase
- httpx: Asynchronous HTTP client for API calls
- pydantic: For data validation and schema management
- pytest: Unit testing framework
- uvicorn: ASGI server for FastAPI deployment

LLM/Chatbot Libraries Used:

- openai: Python SDK for ChatGPT integration (for generating responses and embedding queries)
- transformers: Hugging Face library for working with LLama models
- sentence-transformers: For semantic search and vector similarity
- langchain: High-level abstraction for managing LLM pipelines and memory context

6. Use of Library and Internet Resources

Resources used:

- IEEE and ACM software engineering standards
- Flutter, Python, Firebase, LLama, and OpenAI documentation
- GDPR guidelines and ethical AI frameworks

External references include:

- Bruegge & Dutoit, Object-Oriented Software Engineering
- Pressman, Software Engineering: A Practitioner's Approach
- Flutter, Firebase, and OpenAI documentation

7. Test Results Summary

Testing followed Unit, Integration, and System-level methodologies.

Highlights:

- 20+ core workflows tested
- Full coverage for plan creation, chatbot use, data sync, and student discount logic

Test Case ID	Description	Status
ST-001	Register with .edu email	Failed → Passed
ST-002	Create plan with missing input	Failed →Passed
ST-004	Travel plan creation and recommendations	Failed → Passed
ST-006	Save and retrieve offline plan	Passed
ST-007	Add/remove restaurant to itinerary	Passed
ST-009	Chatbot gives suggestions for given location	Failed →Passed
ST-011	Display hotel discounts for verified students	Passed
ST-012	Try booking without network connection	Passed
ST-015	Handle API timeout from LLM	Passed

Assessment:

- **Initial Failure Rate:** 10% (2 of 20 scenarios failed initially)
- **Post-Fix Rate:** 100% passed after bug resolution
- **Known Bugs:** Scroll issue on specific Android models with small screen height
- **Enhancements Suggested:** Preloading LLM results and event images for better UX

8. Conclusion

NextRoute successfully integrates AI-driven recommendations, seamless plan creation, and student-specific benefits into a mobile platform targeting young travelers. By replacing traditional models with Firebase and advanced LLMs, it emphasizes both modern development practices and ethical, inclusive tourism. The results of extensive testing validate its reliability and usability, with room for future enhancements such as language support and extended partner integration.