AI-Powered Travel Planner: A Smart Solution for Personalized and Efficient Travel Itineraries. 2. Research Area Specific Area Artificial Intelligence (AI) , Software Engineering ,...

Research Proposal · March 2025

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Patalee De Silva
General Sir John Kotelawala Defence University
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Application for Undergraduate final year research Project
Faculty of Computing

APPLICATION FOR UNDERGRADUATE FINAL YEAR RESEARCH PROJECT

1. Project Title *The title of the project should be brief, reflect concisely and accurately the proposed. Students are advised to avoid titles which convey a distant or potential application of the proposed work, or a greater aspiration or goal than is to be expected from the proposed work.*	
AI-Powered Travel Planner: A Smart Solution for Personalized and Efficient Travel Itineraries.	
2. Research Area	**Specific Area**
Artificial Intelligence (AI) , Software Engineering , Tourism Technology	Personalization in Travel Planning , Efficiency in Travel Itinerary Generation , Integration of AI and Tourism , User-Centric Design , Data-Driven Decision Making
3. Supervisor(s)	
Name and Designation: **Mrs. MVT Kawya** Institution (if not from the University): **General Sir John Kotelawala Defense University** Area of expertise related to the proposed project:	Mobile : **076 8361698** E-mail : mvtkawya@kdu.ac.lk
Name and Designation: Institution (if not from the University): Area of expertise related to the proposed project:	Mobile : E-mail :
Name and Designation: Institution (if not from the University): Area of expertise related to the proposed project:	Mobile : E-mail :
4. STUDENT	
Name: **PHPA De Silva** Index No: **D/BIS/22/0005** Stream: **Information Systems**	Mobile : **074 0190268** E-mail : 39-bis-0005@kdu.ac.lk

5. Summary

(a) Explain briefly the research problem, research approach, and expected outputs.
Not exceeding one A4 page, font type Times New Roman, size 11, single space.

This project aims to develop an AI-powered travel planner that provides personalized and efficient travel itineraries based on user preferences, budget, and travel dates. The system leverages AI models like Gemini and Firebase for authentication and data management. The application allows users to create profiles, plan trips, and receive recommendations for flights, hotels, and tourist attractions. The project demonstrates how AI can revolutionize the travel industry by offering tailored solutions for modern travelers.

Research Approach:

This project proposes an AI-Powered Travel Planner that generates personalized itineraries using Gemini AI, Firebase authentication, and real-time data. The system will allow users to create profiles, set preferences (travelers, budget, and dates), and receive AI-generated travel plans with flight and hotel recommendations. AI will also generate images and descriptions of locations to enhance the user experience. The methodology includes user profile management, itinerary generation, and API integration for flight and hotel bookings.

Expected Outputs:

- A web/mobile application that provides personalized travel planning.
- AI-generated travel recommendations, including flights, hotels, and attractions.
- Firebase-based authentication and secure user data management.
- AI-generated images and location details for better visualization.
- A user-friendly interface for seamless trip planning.

(b) Give 3 – 5 keywords for the proposed project:

- AI-powered travel planning
- Personalized itinerary generation
- Gemini AI
- Firebase authentication
- Smart tourism technology

6. Research Problem

6.1 Research problem/s

Planning a trip requires extensive research, including selecting destinations, finding suitable flights, booking hotels, and optimizing itineraries based on preferences, budget, and time constraints. Travelers often struggle to gather and organize information efficiently, leading to suboptimal travel experiences.

- **Time-consuming research:** Manually searching for flights, hotels, and attractions is tedious.
- **Lack of personalization:** Generic travel recommendations do not consider individual preferences, budgets, or travel groups.
- **Difficulty in itinerary optimization:** Travelers find it hard to plan activities efficiently within a limited timeframe.
- **Fragmented booking process:** Users need to visit multiple platforms for flight and hotel bookings.

6.2 Analysis of the problem/s & rationale for the research question

- **Growing demand for smart tourism solutions:** AI-driven recommendations can streamline trip planning.
- **Existing travel apps lack full AI-powered automation:** Most travel apps only provide booking services without AI-driven itinerary planning.
- **Personalized travel planning enhances user experience:** AI can optimize trip plans based on preferences, real-time data, and budget constraints.
- **Efficiency and convenience:** Automating the travel planning process reduces time spent on research and improves decision-making.

7. Comprehensive literature review AND the complete list of references in the relevant area.

(Attach additional sheets if necessary)

The literature review will explore existing research and technologies related to AI-powered travel planning, itinerary optimization, and smart tourism.

AI in Travel and Tourism

- AI is transforming the travel industry by personalizing travel experiences, optimizing itineraries, and automating bookings.
- Studies highlight how machine learning models analyze user preferences to generate tailored recommendations.

- Chatbots and virtual assistants powered by AI improve customer service in travel platforms.

AI-Based Itinerary Optimization

- AI-driven route optimization algorithms help minimize travel time and maximize experience.
- Research on recommendation systems using AI suggests that collaborative filtering and content-based filtering improve travel suggestions.
- Deep learning models have been used to generate travel itineraries based on historical user data and preferences.

Firebase for Authentication and AI Integration

- Firebase is widely used for secure authentication and real-time database management.
- Studies indicate that serverless computing with Firebase enhances the scalability and performance of AI-powered applications.

Gemini AI for Smart Tourism

- Gemini AI (Google AI) enhances travel planning through natural language processing (NLP) and real-time data analysis.
- Studies have shown that AI-generated content (e.g., images, travel descriptions) improves user engagement in travel applications.
-

References

- Authors: [Authors not specified]

Published in: International Research Journal of Engineering and Technology (IRJET), Volume 11, Issue 4, April 2024

https://www.irjet.net/archives/V11/i4/IRJET-V11I4152.pdf

Authors: [Authors not specified]

Published in: Online Scientific Research Journal, 2024

https://www.onlinescientificresearch.com/articles/transforming-travel-planning-the-impact-of-generative-ai-on-itinerary-optimization-cost-efficiency-and-user-experience.html

Authors: Aparna Mote, Nitisha Rajgure, Sanika Koparde, Bhavana Munot, Tanishka Keswad, Tanaya Nalawade

Published in: International Journal of Innovative Research in Information and Development (IJIRID), Volume 3,

Issue 5, October 2024

https://www.ijirid.in/3-5-24Oct/3-5-1-Aparna%20Mote-Nitisha%20Rajgure-Sanika%20Koparde-Bhavana%20Munot-Tanishka%20Keswad-Tanaya%20Nalawade.pdf

- Authors: Jian Xie, Kai Zhang, Jiangjie Chen, Tinghui Zhu, Renze Lou, Yuandong Tian, Yanghua Xiao, Yu Su

Published in: arXiv preprint arXiv:2402.01622, February 2024

https://arxiv.org/abs/2402.01622

- Authors: [Authors not specified]

Published in: IEEE Conference Publication, 2024

https://ieeexplore.ieee.org/abstract/document/10434354

- Authors: [Authors not specified]

Published in: arXiv preprint arXiv:2409.08069, September 2024

personalization.

https://arxiv.org/abs/2409.08069

- Authors: [Authors not specified]

Published in: Electronics, Volume 13, Issue 23, December 2024

https://www.mdpi.com/2079-9292/13/23/4751

- Authors: [Authors not specified]

Published in: International Journal of Creative Research Thoughts (IJCRT), Volume 12, Issue 11, November 2024

https://ijcrt.org/papers/IJCRT2411488.pdf

- Authors: [Authors not specified]

Published in: International Journal of Future Generation Communication and Networking (IJFGCN), Volume 17, Issue 3, March 2024

8. Originality & innovation of the proposed work

This project introduces an AI-powered travel planning system that differentiates itself from existing travel apps through:

1. AI-Generated Personalized Travel Itineraries

Unlike traditional travel apps that rely on static recommendations, this system uses Gemini AI to generate customized trip plans based on:

- User preferences (budget, travel group, dates, destinations).
- Real-time data (weather, ticket availability, flight/hotel pricing).
- Optimized scheduling to maximize travel experience within the available time.

2. AI-Generated Content & Images

- The platform will use AI to generate travel descriptions and images of destinations, enhancing user engagement and visualization.
- This feature eliminates reliance on third-party databases and offers a more immersive and interactive user experience.

3. Integrated Flight & Hotel Booking via AI Recommendations

- Unlike many existing platforms that require users to search manually, this system automatically suggests, and links flights and hotels based on:
    - Availability and price comparison.
    - Proximity to selected attractions.
    - User budget and preferences.

4. Firebase-Powered Authentication & Data Management

- Using Firebase ensures secure and scalable authentication and data storage.
- It allows seamless AI integration, real-time updates, and multi-device accessibility**.**

5. Smart Travel Assistant Powered by Gemini AI

- The system acts as a **virtual travel assistant**, providing:
    - AI-based suggestions for alternative travel plans if there are budget constraints or booking unavailability**.**
    - Real-time updates on flight delays, weather conditions, and event recommendations**.**

9. Overall aim and specific objectives of the proposed work

9.1 Overall aim

To develop an AI-powered travel planner that generates personalized, efficient, and optimized travel itineraries based on user preferences, budget, and real-time data using Gemini AI and Firebase.

9.2 Specific Objective/s

- Develop a user-friendly interface for trip planning
- Implement AI-based personalized itinerary generation
- Integrate AI-powered recommendations for flights, hotels, and attractions
- Enable AI-generated content and images for travel destinations
- Implement Firebase for authentication and real-time data storage
- Develop a trip review and modification feature
- Ensure scalability and performance efficiency

10. Methodology

10.1 Describe Methodology
(*Attach additional sheets if necessary)*

1: System Design & Requirement Analysis

- Identify functional and non-functional requirements.
- Design the system architecture and user flow.

2: Frontend & Backend Development

- **Frontend:** Develop a user-friendly interface using React/Flutter.
- **Backend:** Implement RESTful APIs using Node.js / .NET Core to handle travel data and AI processing.

3: AI Model Integration

- Use Gemini AI for itinerary generation, content creation, and recommendation logic.
- Implement machine learning models for budget optimization and travel scheduling**.**

4: Firebase Authentication & Database Setup

- Implement secure login/signup and profile management with Firebase.
- Store trip history, preferences, and itinerary details securely.

5: AI-Generated Travel Itineraries & Booking Integration

- Generate custom trip plans based on user input.
- Integrate real-time APIs for flight and hotel bookings.

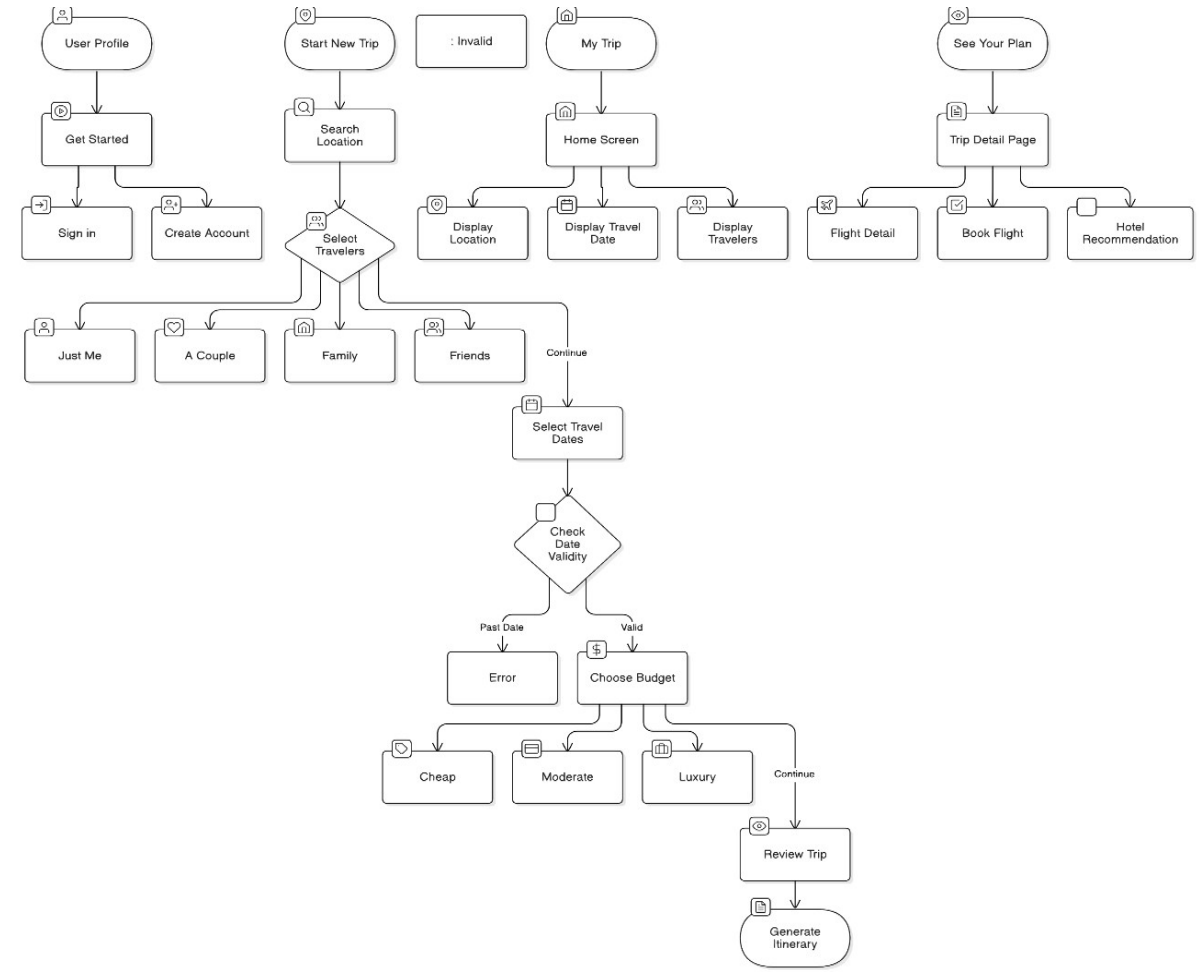
6: Testing & Performance Optimization

- Conduct unit, integration, and user acceptance testing (UAT).
- Optimize API response time and AI model execution speed.

7: Deployment & Final Review

- Deploy on a cloud platform (AWS, Firebase Hosting, or Azure).
- Conduct final system testing and documentation.

10.2 Experimental design where applicable
Please complete relevant sections



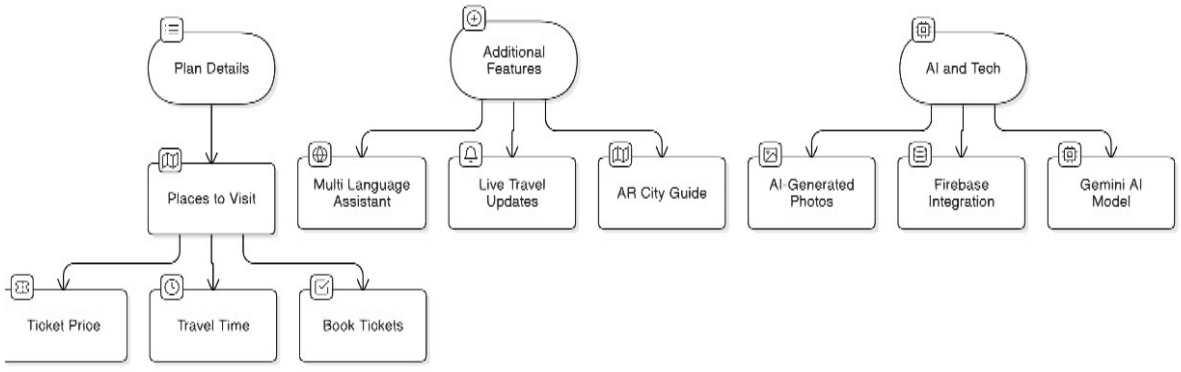


Diagram 10.2.1

Num	Functional Requirement
01	User authentication & profile management.
02	AI-based trip itinerary generation.
03	Real-time flight & hotel booking recommendations.
04	AI-generated travel descriptions & images.
05	Review & modify trip plans.
06	Multi Language Travel Assistant, Live Travel Updates & Alerts and AR city Guide

Functional Requirements

Table 10.2.2 - Functional Requirements

Non-functional requirement

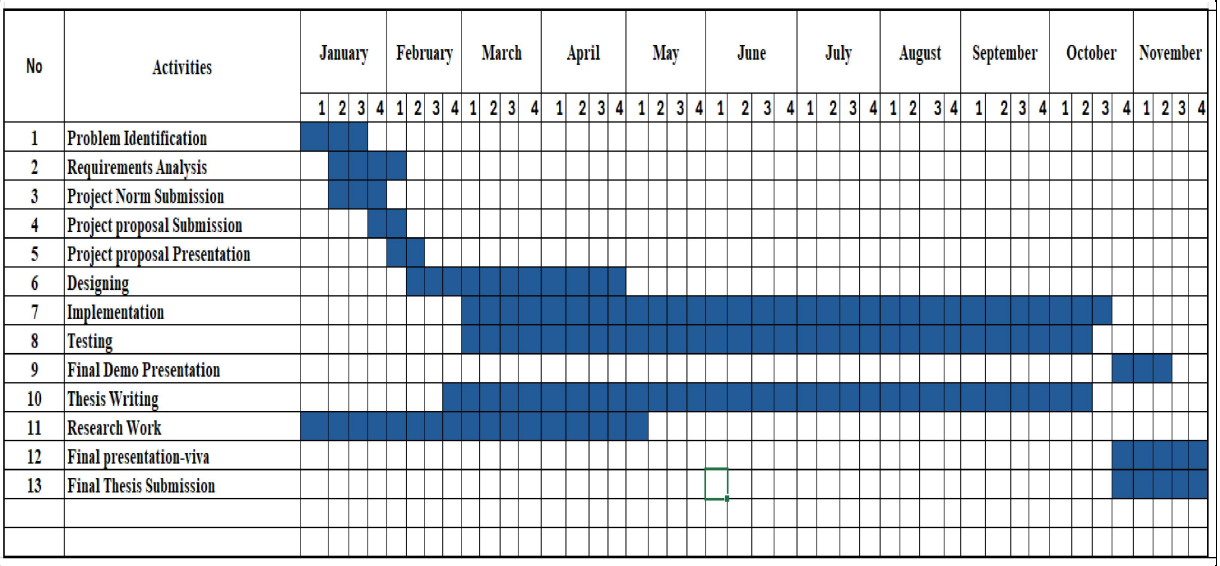
Num	Non-Functional Requirements	Specification
01	The system should support multiple users simultaneously.	Scalability
02	Implement Firebase authentication and data protection.	Security
03	Optimize AI processing time and API response speed.	Performance
04	Ensure seamless navigation and accessibility.	User-Friendly Interface

Table 10.2.3 - Non-Functional Requirements

- **Performance:**
  - Ensure the system can handle 1,000+ concurrent users.
  - AI recommendations should be generated within 2–3 seconds.

10.3 **Work plan**

Please attach the quarterly Gantt Chart to cover the proposed study, as per the format below.



10.4 **Indicators & milestones of progress**

Please list the milestones and indicators that will be used to measure the progress of the proposed Study

1. Completion of requirement analysis and system design.
2. Development of user authentication and profile creation.
3. Integration of Gemini AI for recommendations.
4. Testing and debugging of the application.
5. Final deployment and user feedback collection.

11. Ethical considerations	
Relevance to the project	Relevant ☐ Not relevant ☐

12. Plan to protect the human & environmental safety issues related to the project

- User Data Privacy & Security
- AI Bias & Ethical Use of AI
- Minimizing Environmental Impact
- User Safety Considerations
- Secure authentication & encrypted data storage with Firebase.
- Fair AI recommendations to prevent bias in travel suggestions.
- Integration of travel safety advisories for user awareness.
- Eco-friendly recommendations to promote sustainable tourism.

13. Expected Research Outputs

Deliverables at the end of the project in point form

- AI-Powered Travel Planner Application
- User Profile and Authentication System
- AI-Generated Itineraries & Content
- Integrated Flight and Hotel Booking Services
- Research Paper/Thesis
- Codebase and Documentation

14. Plan to utilize the research output

The research output from this project will have significant practical applications and can be utilized in several ways:

- Commercial Use
- Academic Use
- Consumer Use
- Future Research and Development
- Collaboration with In Stakeholders

15. Research Outcomes

15.1 Significance of research outcomes and the impact on national/socio-economic development of Sri Lanka.
Please write in point form.

This project has the potential to positively impact Sri Lanka's tourism sector and contribute to national socio-economic development in several ways:

- Boosting Sri Lanka's Tourism Industry
- Economic Growth through Partnerships
- Technological Advancement in Sri Lanka
- Sustainability and Eco-Tourism

15.2 Identify relevant stakeholders and potential beneficiaries

- Tourism Industry Stakeholders
- Local Businesses
- End-Users (Travelers)
- Technology Stakeholders
- Government and Regulatory Bodies

16. Plan to protect and exploit Intellectual Property (IP)?
(Indicate if applicable)

- Apply for a patent for the unique AI-powered recommendation system.
- Trademark the application name and logo.
- Explore licensing opportunities for the technology.

17. Signature of Supervisors

The details given above are correct and personally verified.

(a) ……
(Student)

(b) ……
(Principal Supervisor)

(c) ……
(Co- Supervisor -1)

……....
Date

18. Recommendation and Approval

The application is recommended.

……..……
Department Project Coordinator

……..
Date

The application is approved.

……..……
Head of the Department

……..
Date

Guidelines for Applicants

1. The proposed research project should necessarily be an original investigation.
2. The problem to be tackled should be clearly identified.
3. A comprehensive literature review should be done, and all details should be provided together with the list of references.
4. The budget should be calculated correctly and stated in detail.
5. A detailed time-based work plan (Gantt chart) should be included stating the proposed activities and time frames clearly.
6. In the case of selection of a supervisor from an outside institution, it is mandatory to get an internal supervisor appointed.
7. Softcopy can be obtained from the department in word format. Softcopy of the application should be submitted as PDF format.
8. Incomplete applications **will not** be considered.

TWO hard copies of the completed application form should be submitted to:
Project Coordinator
Department of Computer Science, Faculty of Computing

An electronic version (PDF) should also be e-mailed to hoditm@kdu.ac.lk**, on or before the deadline.**