Project Specifications Report

1. Introduction

Project Title: Roadrunner (The Travel Planner)

Brief Description: The "Roadrunner" is an AI-powered travel assistant designed to modernize and simplify the itinerary planning process. Currently, travelers must navigate multiple disjointed platforms to research destinations, book transport, and organize activities. This project addresses these challenges by developing a system that analyzes a user's "story" a conversational input reflecting preferences, constraints, and interests to generate optimized, end-to-end travel routes and daily schedules. The system leverages advanced deep learning (LLMs), Natural Language Processing (NLP), and data mining techniques to provide a personalized, unified planning experience. Here the user story, corresponds to the user's traits, likings and expectations of the given trip he has in mind.

Initial Project Requirements (Summary):

- Personalization: The system must generate itineraries tailored to individual user stories (budget, pace, interests).
- Data Integration: Integration with third-party APIs (Wikipedia, Wikivoyage, Google Places, OpenStreetMap) for real-time data.
- User Interface: A dual-interface approach featuring a conversational chatbot and a visual, interactive map for route customization.
- User Profiling: A dynamic system that learns from user feedback to refine future recommendations.

1.1 Description

The software acts as a smart intermediary and personalization layer within the existing travel ecosystem. It aggregates data from various third-party services (historical data from Wikipedia, POI data from Google Places/Foursquare) and processes it through an LLM to generate cohesive plans. It functions as a standalone web application but is designed with a modular architecture that could allow embedding into larger travel platforms.

Product Functions:

- Personalized Plan Generation: Creates optimized routes and schedules based on natural language user inputs.
- Interactive Planning Interface: Allows users to visualize routes on a map and modify them via drag-and-drop actions.
- Information Retrieval: Fetches up-to-date details (opening hours, prices, ratings) for points of interest.

- Explainable AI (XAI): Provides justifications for specific recommendations to build user trust.

1.2 Constraints

Economic

- The project relies heavily on third-party APIs (Google Places, OpenAI/Gemini, OpenStreetMap). High user traffic could lead to significant operational costs due to API usage fees.
- Running AI models (LLMs) and vector databases requires substantial computational power (GPUs), which imposes a financial constraint on the hosting infrastructure. Mitigation involves optimizing model size (e.g., using quantized models) and efficient caching.

Environmental

- Inference for LLMs are energy-intensive. Electrical cost of hosting and running these models are significant constraints.

Social

- The system must cater to diverse user groups, including families with children, elderly travelers, and individuals with disabilities. Failing to label accessibility features would be a social failure.
- As an online-only tool, it excludes users without reliable internet access or digital literacy skills.

Political

- The project must navigate complex international data regulations. User data stored in one jurisdiction regarding travel to another involves cross-border data flow regulations.
- Political tensions or instability in certain regions may not be accurately reflected in static API data, requiring the system to be sensitive to travel advisories (though this is currently a scope limitation).

Ethical

- Data mined from travel blogs may be biased towards luxury experiences or sponsored content, potentially marginalizing local, budget-friendly, or minority-owned businesses.
- The system must clearly distinguish between organic recommendations and any potential sponsored content to maintain ethical integrity.

Health and Safety

- Incorrect information regarding opening hours or health mandates could leave travelers stranded or in distress.

Manufacturability (Software Development)

- The system uses a microservices-like architecture to ensure that individual components can be built, tested, and updated independently.
- The use of Docker ensures the software is manufacturable across different cloud environments without compatibility issues.

Sustainability

- The system is designed with sustainability in mind and can be extended in the future to support environmentally friendly practices. This aligns with the general principles of sustainable and responsible travel.

1.3 Professional and Ethical Issues

Privacy and Data Protection (ACM 1.6, IEEE 1)

- The system collects highly personal data, including user interests, travel history, budget, and location.
- In accordance with ACM Principle 1.6 (Respect Privacy), the system implements data minimization. We only store data necessary for personalization. Raw location traces are anonymized or deleted after aggregate trends are derived.
- The project follows GDPR and KVKK. Users have the right to be forgotten (data deletion) and must provide explicit consent. Encryption (Argon2 for passwords, TLS for transit) is mandatory to protect user confidentiality.

Fairness and Non-Discrimination (ACM 1.4, IEEE 8)

- AI algorithms can inherently reinforce bias. For example, if the training data mostly features young, wealthy travelers, then the system might fail to provide high-quality recommendations for elderly or budget-conscious users.
- ACM Principle 1.4 (Be fair and take action not to discriminate) mandates that we actively test the system for demographic bias. We must ensure the model's rag data and Google Maps data is diverse and that the algorithm weights inputs from different user types equitably.

Honest and Trustworthy Computing (ACM 1.3, IEEE 3)

- AI Hallucinations. LLMs can confidently invent facts (e.g., listing a museum that doesn't exist).

- IEEE Principle 3 (Be honest and realistic in stating claims) requires us to be transparent about the system's limitations. We implement Explainable AI (XAI) to show why a recommendation was made (i.e. "Recommended because you like Architecture"). We also cross-reference LLM output with structured API data (Google Places) to verify the existence of POIs, reducing the risk of misleading users.

Public Safety and Harm Avoidance (ACM 1.2, IEEE 1, 9)

- Providing a route that leads a user into an unsafe situation is a major issue.
- ACM Principle 1.2 (Avoid Harm) is paramount. While the system helps plan fun activities, it must prioritize safety. The "Constraints" section explicitly notes the exclusion of accessibility features in the initial scope; ethically, this limitation must be clearly communicated to users so they do not rely on the system for critical accessibility needs.

Intellectual Property (ACM 1.5, IEEE 7)

- The project mines data from travel blogs and third-party APIs e.g. Google Maps..
- We must respect ACM Principle 1.5 (Respect the work required to produce... creative works). The web scraping agents (BeautifulSoup/Playwright) must adhere to robots.txt protocols and avoid excessive server load. Attribution must be given to data sources (e.g., "Data provided by Wikivoyage") to avoid plagiarism and respect licensing agreements.

2. Requirements

Functional Requirements (FR)

- FR-001: The system shall parse natural language "user stories" to identify preferences (constraints, interests).
- FR-002: The system shall automatically generate a travel plan with an optimized sequence of POIs and daily schedules.
- FR-003: The system shall create user profiles that store explicit preferences and learn from implicit feedback.
- FR-004: The system shall display plans on an interactive map with clickable POI details.
- FR-005: The system shall allow manual editing (add/remove/reorder) of the itinerary via drag-and-drop.
- FR-006: The system shall fetch real-time data (hours, ratings) from third-party APIs upon request.
- FR-007: The system shall collect explicit feedback (ratings/likes) to update user profile weights.
- FR-008: The system shall provide text-based justification for major recommendations (XAI).

- FR-009: The system shall provide a mechanism for users to delete all their personal data (GDPR/KVKK).

Non-Functional Requirements (NFR)

- Performance: Initial plan generation must complete within 30 seconds. UI interactions must respond within 500ms.
- Reliability: Target uptime of 99.5%. API calls must timeout after 8 seconds to prevent system hangs.
- Security: All data in transit must be encrypted via HTTPS/TLS. Passwords must be hashed using Argon2 or scrypt.
- Scalability: Architecture must support at least 100 concurrent users without degradation (using containerization/load balancing).
- Portability: Web interface must be compatible with Chromium, Firefox, and Safari on desktop and mobile.

3. References

1. ACM Code of Ethics and Professional Conduct. Association for Computing Machinery, 2018. https://www.acm.org/code-of-ethics
2. IEEE Code of Ethics. Institute of Electrical and Electronics Engineers, 2020. https://www.ieee.org/about/corporate/governance/p7-8.html
3. Computer and Information Ethics. Stanford Encyclopedia of Philosophy, 2020. https://plato.stanford.edu/entries/ethics-computer/
4. Google AI for Developers, "Gemini API Documentation," 2025.
5. "GDPR - General Data Protection Regulation," EU Regulation 2016/679.