TOBB ETÜ

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Proposal

QUAD-CORE

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Topic

1. Project Title

GUIDE (**G**uided **U**ser **I**tinerary & **D**estination **E**xplorer): A Personalized Tour Recommendation and Guidance System

2. Problem Definition & Objectives

- **Problem Definition:** Travelers often struggle to design personalized and efficient travel routes that align with their preferences and time constraints. Existing travel recommendation platforms generally provide static lists of popular destinations or fixed tour packages without dynamically adapting to user context, such as travel mode, available time, or specific themes of interests (e.g., cultural, culinary, or scenic tours). Furthermore, during the trip, most applications fail to provide contextual and informative guidance once a traveler reaches a point of interest. As a result; users, frequently switch between multiple sources of information — navigation apps, travel blogs, and guidebooks — leading to fragmented experiences. These fragmented experiences not only lessen the overall quality of the journey but also reduce the traveler's engagement and fulfillment throughout the trip.

  Therefore, there is a need for an intelligent, "context-aware" system that can generate optimized routes based on user preferences and constraints, and deliver integrated and multilingual guidance about visited locations in real time.

- **Objectives:** The main goal of the GUIDE project is to develop a context-aware, personalized travel guidance system that generates customized routes and delivers real-time audio guidance in multiple languages throughout the trip.

  - To provide enhanced traveler experience and engagement.
  - To develop a personalized route planning system that considers user preferences.
  - To identify and recommend points of interests based on user preferences.
  - To provide contextual and multilingual information as an audio for each point of interests through text and text-to-speech (TTS) features.
  - To design an interactive and user-friendly interface in order to ease user-application interaction.
  - To ensure modularity and scalability for future integration of enhanced features such as interactive guidance, weather-based adjustment, price-optimized planning etc.

  Ultimately, the project aims to enhance travelers' experiences by providing a unified platform that replaces multiple fragmented travel tools with one intelligent, adaptive and easy-to-use system.

3. Scope

The GUIDE system has two main components: route planning and guidance services. It is designed to support travelers throughout their journeys by integrating trip organization and on-site assistance within a single platform, combining intelligent route creation with informative guidance during visits.

The functional scope of the GUIDE system includes personalized route planning based on user preferences, point-of-interest recommendations within the selected region, and guidance through textual and multilingual (Turkish, English, German) audio information during visits.

Some advanced features are excluded from the current scope of the GUIDE project. These include real-time weather, crowd data integration or social media connectivity. In addition, real-time route adjustments are not included in this phase but may be considered for future works.

The technical scope of the GUIDE project involves integrating location-based data services, such as OpenStreetMap, with AI-driven route generation and text-to-speech (TTS) technologies. The system will be implemented as a web-based platform supported by backend and frontend components.

4. User Profile

The target users of the GUIDE system are individuals who enjoy exploring new places, with basic technology (smartphone and web apps) usage habits and seek a more personalized and informative travel experience.

5. Anticipated Challenges & Constraints

- **Technical hurdles**
  - The route generation process may face time complexity issues, especially when multiple user preferences and destinations are involved.
  - The system may not be able to detect temporary road closures, maintenance, or other real-time changes in map and data.
  - Achieving high accuracy in providing personalized recommendations for each user may be challenging due to limited personal data.
  - Minor pronunciation errors may occur in text-to-speech (TTS) outputs, especially for Turkish language content.
- **Time/resources limits**
  - The system is not planned to be deployed on advanced hardware, so it may not support a large number of concurrent users or heavy performance loads.
  - With a four-member team, covering different technical areas may require additional learning effort and some stages take longer than expected.
  - Since the project is open to many possible feature additions, new ideas introduced during development may cause scheduling and scope management challenges.

- **Ethical or regulatory considerations**
  - Handling user location and preference data must comply with KVKK/GDPR privacy regulations.
  - Multilingual content should consider cultural differences and avoid inappropriate expressions for the target culture.
  - Data from map and content providers must be used in accordance with their licensing terms.
  - Information about points of interest should remain free from bias or misleading details.

6. Data Sources

- **UNESCO World Heritage Listings, Türkiye Tourism Encyclopedia, and Wikipedia APIs:** These sources are planned to be used to obtain a comprehensive list of historical and cultural sites in Türkiye and to collect short descriptive information about them. They are expected to provide structured and reliable data for generating informative content and supporting tour recommendations[1, 2, 3, 4].
- **OpenStreetMap (OSM) and Open Source Routing Machine (OSRM):** OSM is planned to be used as the main source of Türkiye's road and transportation network, while OSRM will be used to perform shortest-path calculations on this data. Together, they will enable accurate and flexible routing, distance, and travel time estimations for personalized route planning[5].
- **Flickr and Pixabay:** These image platforms are planned to be used to gather high-quality photographs of historical and cultural sites, aiming to enhance the system's user interface and overall user experience through visually rich content[6, 7].
- **ElevenLabs:** The ElevenLabs API is planned to be integrated to generate multilingual audio explanation from the collected descriptive texts using its text-to-speech (TTS) feature. This will increase accessibility and create a more innovative and interactive experience for users[8][1].

[1]Data will be accessed via APIs. If access or licensing issues arise, alternative data sources will be explored.

Topic

1. Project Title

SHELF (**S**tock **H**andling and **E**stimation for **L**ogistics in **F**ood-retail): A Stock Forecasting and Management System for Supermarkets

2. Problem Definition & Objectives

- **Problem Definition:** Efficient stock management is one of the most critical challenges in the retail industry, where short-shelf-life products, variable demand, and limited storage capacity make monitoring essential. Traditional inventory systems often focus only on manual tracking and sales recording without supporting predictive insights. This results in overstocking, product waste, or stock-outs, each directly impacting profit and customer satisfaction.

  Moreover, many small and medium-sized markets still use outdated tools that lack role-based access, visualization and automated decision support. There is a growing need for an integrated system that not only monitors stock levels and sales but also predicts future inventory needs based on historical data and purchasing trends, while providing a user-freindly user interface experience.

  The SHELF system responds to this need by providing a comprehensive, role-specific platform for cashiers, suppliers, and managers, combining traditional inventory control with stock prediction and data visualization features.

- **Objectives:** The main objective of the SHELF system is to develop an intelligent and user-based stock management platform that optimizes retail operations and supports inventory decisions.

  - To develop role-based system design.
  - To monitor sales and stock activities in order to comprehensive control.
  - To integrate barcode-based transaction processing.
  - To manage supplier relations and inventory records.
  - To predict stock levels using historical transactional data.
  - To visualize stock and sales data through analytical dashboards.

  Eventually, the project aims to enhance efficiency and decision-making in product retail environments by combining conventional stock control with predictive-based operations and visual analytics.

3. Scope

The SHELF system is designed to assist small and medium-sized retail markets in managing their daily operations efficiently. It consists of three main "user" interfaces for cashiers, suppliers, and managers, each tailored to specific roles and responsibilities. The system enables users to record sales, monitor stock levels, and manage supplier interactions in an integrated environment. By combining conventional inventory control with intelligent prediction and visualization features, SHELF aims to support the decision-making process and reduce inefficiencies in product retail management.

The functional scope of the SHELF system includes role-based interfaces for cashiers, suppliers, and managers, hardware-integrated barcode scanning connected via USB for real sales processing, and real-time stock monitoring. It also covers supplier and order management, stock prediction using historical sales data, and data visualization for better analysis and decision-making.

Some advanced features are excluded from the current scope of the SHELF project. These include multi-store integration, automatic reordering based on stock levels, and dynamic pricing according to demand or stock conditions. Such functions may be considered in future work as part of the extended development of the system.

The technical scope of the SHELF project involves developing a web-based platform supported by backend and frontend components. The system will utilize a database infrastructure for storing and managing inventory data, and it will integrate machine learning techniques to enable stock prediction and analysis.

4. User Profile

The SHELF system is designed for small and medium-sized retail markets that need a practical and easy-to-use platform to manage daily sales, stock, and supplier operations. The system includes three main user roles with different permissions and tasks:

- **Cashiers:** Handle daily sales using the barcode-integrated interface. They record transactions, update stock levels automatically, and view basic product and price information.
- **Suppliers:** Manage product deliveries and orders. They can update stock information, confirm deliveries, and track which products need restocking.
- **Managers:** Have full control over the system. They can monitor sales and stock data, manage suppliers, view analytical dashboards, and use prediction results to make better inventory decisions.

These roles ensure that each user can perform their tasks efficiently while keeping the overall market operations organized and well-coordinated.

5. Anticipated Challenges & Constraints

- **Technical Challenges**
  - Ensuring that real-time stock changes are accurately reflected in the database without delays or errors.

  - Predicting demand for short-shelf-life products (e.g., milk, yogurt) or items with highly variable sales patterns.
  - Integrating USB-based barcode scanner reliably with the web platform.

- **Time and Resource Limitations**
  - The system is not planned to be deployed on advanced hardware, so it may not support a large number of concurrent users or heavy performance loads.
  - With a four-member team and limited development time, the complexity of predictive models and features may need to be constrained.

- **Ethical and Regulatory Considerations**
  - Ensuring that all customer and supplier data is handled in full compliance with KVKK/GDPR regulations.
  - Stock recommendations and predictive insights must remain under human supervision to guarantee accountability and reliability.
  - Predictions and recommendations should be free from bias toward any particular product or supplier.
  - The use of any external datasets should strictly follow the terms and conditions set by their licenses.

6. Data Sources

- **Real World Data:** The primary aim is to obtain authentic retail data directly from a supermarket or grocery store, capturing actual sales, stock levels, and supplier information. Such data would provide a realistic foundation for demand forecasting, inventory management, and trend analysis, reflecting real operational conditions as closely as possible.

- **Grocery Inventory and Sales Dataset:** This dataset can be used as an alternative or supplementary source. This dataset includes 990 products across multiple categories, with details on stock quantities, reorder levels, sales performance, supplier information, and key dates such as receipt, last order, and expiration. Although smaller in scale, it can be processed and adapted to support model development and analysis[9].

- **FreshRetailNet-50K:** This dataset is planned to be used as an alternative or supplementary source. It consists of approximately 4,500,000 training and 350,000 test records collected hourly over 90 days from 898 stores across 18 cities and 863 products. Containing 19 numerical and sequential columns store-level data suitable for deep learning applications[10].

References

[1] UNESCO. UNESCO National Commission of Türkiye. Accessed: 2025-10-03. URL: https://www.unesco.org.tr/Pages/125/122/UNESCO-D%C3%BCnya-Miras%C4%B1-Listesi.

[2] Türkiye Tourism Encyclopedia. Türkiye Tourism Encyclopedia. Accessed: 2025-10-03. URL: https://turkiyeturizmansiklopedisi.com.

[3] MediaWiki. MediaWiki REST API. Accessed: 2025-10-03. URL: https://www.mediawiki.org/wiki/API:REST_API.

[4] MediaWiki. MediaWiki Geosearch API. Accessed: 2025-10-03. URL: https://www.mediawiki.org/wiki/API:Geosearch.

[5] OpenStreetMap contributors. OpenStreetMap. Accessed: 2025-10-03. URL: https://www.openstreetmap.org.

[6] Flickr. Flickr Photo Sharing Platform. Accessed: 2025-10-03. URL: https://www.flickr.com.

[7] Pixabay. Pixabay Free Images. Accessed: 2025-10-03. URL: https://pixabay.com.

[8] ElevenLabs. ElevenLabs AI Voice Platform. Accessed: 2025-10-03. URL: https://elevenlabs.io.

[9] Salahuddin Ahmed. Grocery Inventory and Sales Dataset. Accessed: 2025-10-04. URL: https://www.kaggle.com/datasets/salahuddinahmedshuvo/grocery-inventory-and-sales-dataset.

[10] Dingdong-Inc. FreshRetailNet-50K. Accessed: 2025-10-04. URL: https://huggingface.co/datasets/Dingdong-Inc/FreshRetailNet-50K.