Museums-Map: An Interactive Web Application for Museum Location and Navigation in Bucharest

Integration of Information Systems

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***Abstract*—This paper presents Museums-Map, an innovative web application designed to enhance the cultural experience in Bucharest by facilitating the discovery and navigation of museums. It leverages cutting-edge GIS services and a user-friendly interface for ease of access to museum information and directions.**

***Index Terms*—Museums, Map, GIS, web application, React, ArcGIS, Spring framework, Oracle database**

I. Introduction

The rich cultural tapestry of Bucharest is often left unexplored due to a lack of easily accessible information on museum locations and navigation. Museums-Map addresses this gap by providing a centralized, interactive platform for both locals and tourists to discover and navigate museums in Bucharest.

Museums-Map integrates GIS services similar to those of Google Maps, providing users with real-time location data, navigation, and the ability to visualize the most popular museums based on visitor statistics.

II. Market Research

The market research for Museums-Map focuses on identifying and analyzing the needs of both locals and tourists in Bucharest regarding museum exploration and navigation. The research aims to understand the market landscape, user preferences, and potential areas for application enhancement.

A. Understanding User Needs

In-depth surveys and interviews were conducted to gather data on how people currently find and navigate to museums in Bucharest. The primary issues identified were a lack of centralized information about museums and difficulties in planning visits efficiently.

B. Competitive Analysis

A comparative study was performed with existing applications like Google Maps. While these applications provide basic navigation and location services, they lack specialized features for a focused cultural experience, such as detailed museum information, personalized recommendations, and real-time updates on museum events or exhibitions.

C. User Demographics and Preferences

Data was collected to understand the demographics of potential users, including age groups, cultural interests, and tech-savviness. Preferences for features such as ease of use, personalized route planning, and interactive content were also identified.

D. Technology Trends and Adoption

The research also included an analysis of current technology trends in GIS and web applications. It revealed a growing trend towards applications that offer more than just navigation, such as augmented reality for enhanced experience and AI-driven personalized recommendations.

E. Feasibility and Market Gap

An assessment of the technical and economic feasibility of Museums-Map was conducted. This involved evaluating the costs of GIS services, database management, and application development. The analysis confirmed a market gap for a specialized museum navigation and information application in Bucharest.

F. Implications for Museums-Map

The research indicates a clear demand for an application like Museums-Map, which not only helps users locate and navigate to museums but also enhances their cultural experience in Bucharest. The insights gained will guide the development of features that align with user preferences and market needs.

Based on these findings, Museums-Map is positioned to offer a unique value proposition by combining advanced GIS capabilities with user-friendly interfaces and specialized content focused on Bucharest's rich museum landscape.

III. General application architecture

The application architecture is designed to support a robust, scalable, and interactive web platform. It consists of a front-end application interfacing with the back-end server, which in turn communicates with the database. The front-end utilizes the React framework for dynamic user interfaces and integrates with ArcGIS JavaScript API for geospatial capabilities. The back-end is built on the Spring framework, handling API

requests and interfacing with the Oracle database for persistent storage.

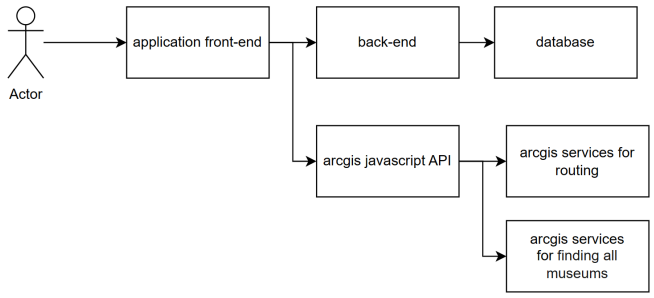


Fig. 1. Block diagram of the application

IV. Use case diagram

The use case diagram illustrates the interactions between the user (actor) and the system. The primary use cases include:

- User registration and login for personalized experiences.
- Viewing a list of all museums or the top 5 most popular museums based on visitor data.
- Obtaining the optimal routing to a selected museum using GIS services.

These use cases encapsulate the core functionalities of the Museums-Map application, focusing on user engagement and ease of navigation.

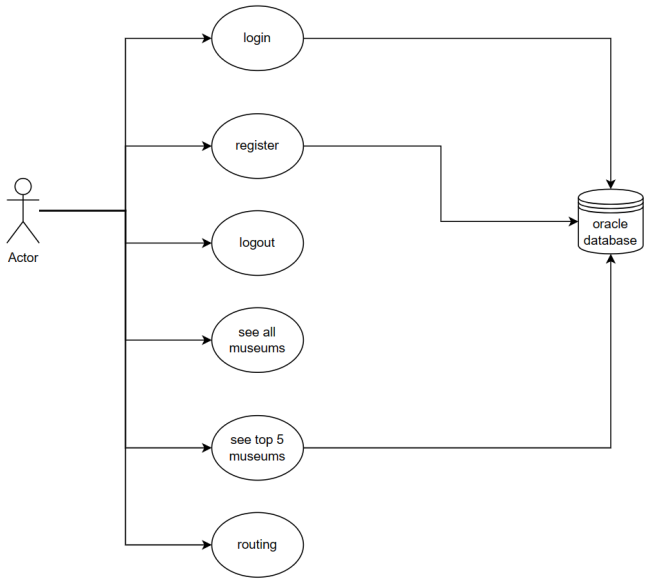
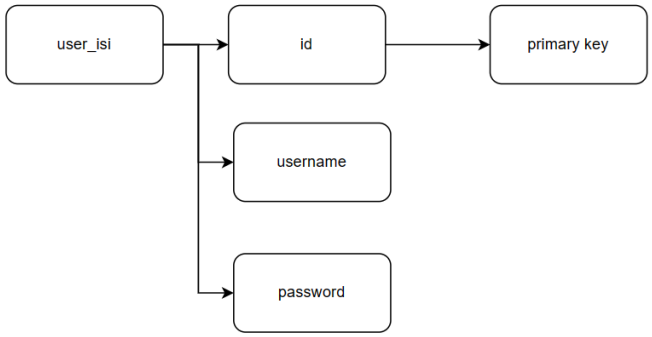


Fig. 2. Use case diagram

V. Data structuring

The data is structured in a non-relational database format, optimizing for flexibility and speed. Each museum's location is stored as a 'Point' with a unique identifier, latitude, and longitude to facilitate precise geospatial queries. User data is managed through 'User_isi' documents, each containing a unique identifier, username, and password hash for security. This schema is designed to be straightforward to extend as the application grows, supporting additional features such as reviews, ratings, and museum details.



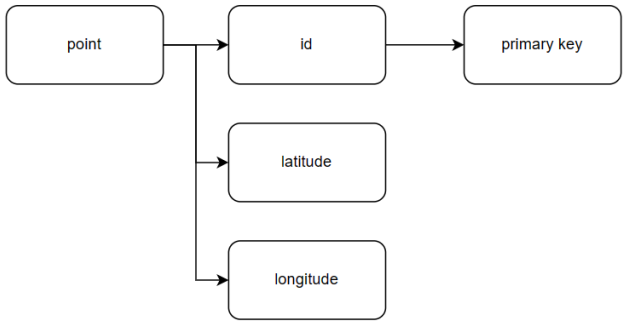


Fig. 3. Database

VI. Technology

The application utilizes the React framework for a responsive front-end, ArcGIS services for advanced location-based functionalities, and a Spring framework for a robust back-end. Oracle databases are used to manage user and museum data efficiently.

- Front end:
  - React framework
  - ArcGIS advanced services for routing and search
  - Integration of a layer (GraphicsLayer) generated based on data from Oracle
  - Integrating an available dataset as a FeatureLayer
- Back end:
  - Spring framework
  - List of APIs:
    - "/api/auth/login" to login
    - "/api/auth/signup" to create a new user
    - "/api/point" to call the top 5 museums
- Database:
  - Oracle to store user and museum data

VII. Organization of activities

The project is structured into six main tasks:
Task 1: architecture design
Task 2: write document
Task 3: design login and register page
Task 4: design API and insert date
Task 5: design map
Task 6: test

Task	Responsabil	L7	L8	L9	L10	L11	L12	L13
Task 1	Tung	check						
Task 2	All		check					
Task 3	Asmaa							
Task 4	Tung							
Task 5	Oana							
Task 6	All							

Fig. 4. Organization of activities

VIII. Identifying risks

Risk	Probability	Impact	Severity	Owner	Mitigation Measures	Contingency Plan
Greater technical complexity than expected	Medium	High	High	Developer	Involvement of the team in solving the problems	Allocate time resources for debugging; seek external help if needed
Insufficient expertise in framework	Low	Medium	Low	Developer	Provide training sessions on the framework	Collaborate with experienced personnel in the domain
Incomplete project or unclear plans	High	High	High	Developer	Regular meetings to clarify current issues; promptly update documentation	Adapt to changes and involve developers in the decision-making process
Lack of communication within the team	Low	Low	Low	Developer	Establish regular team meetings using online communication methods	Establish a backup communication channel
Non-compliant testing that may lead to implementation problems	Medium	High	High	Developer	Implement complete testing strategies; conduct evaluations	Develop plans for thorough testing and backtracking to correct critical errors in development
Lack of version control, leading to code conflicts	Low	Medium	Low	Developer	Implement version control, limit the use of branching strategies	Prompt resolution of code conflicts; enforce regular version updates

Fig. 5. Identifying risks

References

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