



ADVANCED DATABASES

Academic Year 2021-22

Master on Computer Engineering (MEI)

Project 01 Proposal

Barcelos, December 2021

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1. Introduction

This document presents the proposal for the development of project 01. The business domain of the project is the same of the Cloud Computing course: **urban mobility**.

The Cloud Computing course project aims to develop a platform to promote the use of transport vehicles that support an easier, faster, cleaner, and cheaper urban mobility, using electric vehicles: scooters, bicycles, tricycles, etc.

The objective of the project 01 is to document the study, design and analysis of three different database models concerning the requirements for the development of the mobility platform.

2. Urban mobility

The project's purpose is to develop a database for supporting an integrated solution for renting urban vehicles for personal use that allows the registration of entities:

- Users – the people who make a registry to use the electric vehicles.
- vehicles – electric vehicles for personal use: kick scooters, bicycles, tricycles, etc.
- locations – the list of the locations of the urban centre where the system operates

The database must support a set of core operations, such as:

- new trip – start and end location and time, cost, etc.;
- payment – top-ups of the balance associated to the user;
- find vehicle – shows the available vehicles in the neighbourhood of the user's local;
- feedback – users can give feedback at the end of a trip;
- share location – users can share their vehicle location with other users.

Assume the platform can later integrate some more features, such as:

- routes – shows the list of places visited during a trip or in the last month;
- incidents – reporting of problems occurring during a trip;
- relocations – bulk transports of vehicles by the entity from one location to another;
- notifications – users can accept another user's request to be notified whenever they arrive at specific locations.

3. Project outcomes

The project tasks developed in the scope of the project should be documented in the report. Please, organize your report regarding the following items.

3.1. List of platform features

Based on the previous section, (1) present a brief **description of business processes** that will be supported by urban mobility platform and (2) enumerate the **list of features** that will be implemented in your mobility platform.

3.2. Platform workload

Provide a detailed evaluation about the platform workloads, e. g., 10k vehicles, 500k users, 100k rentals/day and **estimated the data size after 3 years** after the implementation.

List the **operations ranked by the importance**, e.g.:

- End/payment of trip,
- Start of a new trip
- Get rides from users
- Get list of trips by start and end location
- Etc.

3.3. Data model design

Identify and map out the **entities and their relationships**. Create a database model for each the three different database models, considering the best practices and characteristics of each model:

- Entity-Relationship Diagram (ERD)
- Collection-Relationship Diagram (CRD)¹
- Graph-based data model

Implement each data model into their specific database management system and **populate the databases** with meaningful data. The database should have enough size to draw conclusions about the performance and suitability of the database model.

3.4. Data model tuning and testing

Test and evaluate some scenarios for each database system, such as, the registry of numerous new users or the starting/ending of high volume of trips. Execute **some high workload queries**, e.g., average trips by start/end location.

¹ <https://docs.mongodb.com/manual/core/data-modeling-introduction/>

Perform the **execution analysis of the operations** described in the previous paragraph, and implement solutions to improve their execution, e. g., the **creation of indexes**.

3.5. Draw conclusions

All the activities, the results and the conclusions should be properly documented. Taking into account the results and conclusions, please provide a grounded recommendation for the database model that should be adopted.

4. Final remarks

The project should be submitted in the Moodle platform according to the schedule. The project should be **later presented and defended** by the students.

The working groups should be composed of **two or three students**.