Software Systems Development

Licenciate in Informatics Engineering
Department of Informatics
University of Minho

2023/2024

Project description

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Conteúdo

1 Introduction

This document outlines the practical work for the Software Systems Development Curricular Unit (UC) for the 2023/2024 academic year. **Read it carefully**, as it describes the system to be developed and the process you must follow to carry out the work. Any doubts should be clarified with the UC lecturers.

2 Objective of the work

E.S.*Ideal* is a chain of Auto Service Stations that provides its customers with car maintenance services. The chain is proving to be a success, with increasing customers. The aim is to design and then implement a system to automate the process of admitting and routing customers within a service station.

3 The service stations

After visiting the service stations of E.S.*Ideal*, it was possible to conclude that each station comprises a fixed set of workstations, each specialised in one type of service. A mechanic operates each workstation. Only the workstations with an assigned mechanic can be used at any given time to carry out services.

The types of service that can be carried out on a given vehicle depend on the type of vehicle in question. Vehicles are classified into four categories:

- Cars with gasoline engines.
- Cars with a **diesel engine**.
- Cars with an **electric** engine.
- Hybrid cars, with a combination of electric motor and combustion engine (gasoline or diesel).

Some services apply to all types of vehicles. These universal services include replacing the tires, calibrating the wheels, aligning the steering, replacing the injectors, replacing the brake pads, changing the brake oil, cleaning the interior and/or exterior and replacing the cabin air filter.

However, there are specific maintenance services that are exclusive to combustion engines. These engines require services such as changing the engine oil, replacing the engine oil, fuel and air filters, replacing the catalytic converter and replacing the starter battery.

Within combustion engines, diesel engines have their own specialised service needs, including glow plug replacement and particulate filter regeneration or replacement. Gasoline engines also have distinct maintenance needs, such as replacing the throttle valve and spark plugs.

Electric engines involve services such as battery performance assessment and battery replacement.

Finally, hybrid vehicles, which integrate combustion engines and electric motors, require a comprehensive approach, requiring maintenance services tailored to both combustion engine and electric motor components.

Note that services can be combined to create new services. For example, changing the tires is typically followed by calibrating the wheels, and you want to be able to define different car servicing packages.

4 Usage scenarios

A set of usage scenarios for the service station are presented to facilitate requirements gathering. The system you develop should be able to support them. However, you can include in your requirements analysis any experience with service stations, either your own or those of third parties with whom you interact.

Scenario 1 – System configuration

Diana goes to the new E.S. service station in Gualtar to install the system. She registers the existing workstations, defining the type of service it can perform for each. It also records the mechanics of the new service station and the station's opening hours.

Scenario 2 – Registering a customer

António learns from an advertisement that the Gualtar service station of E.S.*Ideal* is running a customer acquisition campaign, offering an *voucher* worth €50 in services at that station. António goes to the E.S.*Ideal* website and registers as a customer. He gives his name, VAT number, address, contact details (telephone and e-mail) and a description of his vehicles. You also indicate that you want to be a customer of the Gualtar service station. The E.S. server issues the voucher and sends the information collected to the Gualtar service station application. This registers the new customer in its database.

Scenario 3 – Visit to service station 1

Maria takes her car to the service station and asks for an *check-up* (a free service in which the vehicle is checked and any necessary interventions are identified). The vehicle's file is updated to indicate the need for an *check-up*, and the service is scheduled (depending on the availability of the workstations). As it is expected to be done soon, Maria waits for the service to finish. After the check-up, it was concluded that the brake pads needed to be changed and the steering aligned. The vehicle data sheet is updated to reflect this. The system calculates the work order needed to carry out the work, depending on the availability of the jobs.

Maria is asked (giving an estimate of when the job will be finished) if she wants the services to be carried out, and she agrees. As the work will take some time, Maria leaves the service station and asks to be notified that the work has been completed. After the services are done, Maria receives an SMS and collects the car. She pays for the service and takes the car.

Scenario 4 – Visit to service station 2

Manuel goes to the service station and asks for a wash. The system analyses the planned services and concludes that carrying out the service that day is impossible. Manuel decides to come back another day.

Scenario 5 – Employees

Diogo comes into work using his employee card at the workstation where he will work. The system checks that Diogo has the skills to work at that post and registers the shift's start time. Diogo checks the system for the list of jobs assigned to him and signals the start of the first job on the list. When he has finished, he indicates that the job has been completed and the vehicle's record is updated (he can also indicate that the job cannot be done and the reason why). The process is repeated until it's time to leave. At that point, Diogo uses the card again to register the end of his work shift, and the system records the time.

5 Work realization

The design and development of the application should follow a model-based approach (supported by UML) according to the phased delivery process described in the lectures. The application should be developed using a multi-layered architecture

and object-oriented technologies (preferably Java). A repository will be created on GitHub[1] for each group and where the updated version of the work should be kept.

The work will be carried out in two phases to facilitate the design and development process.

5.1 Intermediate delivery

Requirements analysis - to be completed by October 15.

Objectives:

- A Domain Model with the relevant entities
- A Use Case Model (diagrams plus Use Case specifications) with the system's proposed functionalities

The result of this phase will be **discussed in the Practical-Laboratory classes** on the week of October 15.

5.2 Final deliverable

Conceptual modelling and solution implementation - due by midnight on January 6 (deliveries possible from December 7).

Objectives:

- A conceptual architecture for the system, capable of supporting the requirements identified – in particular, the solution adopted should ensure, as far as possible, that mistakes are not made, such as associating services of the wrong type with vehicles
- The behavioural models needed to describe the system's intended behaviour
- The models you consider necessary to describe the implementation of the system
- The implementation of the system
- Technical document with all the models developed (in PDF).

The technical document is intended to support the analysis of the work, so **it should have the following structure**:

- **Cover with identification** of the Curricular Unit, **of the group (with photos of the elements)** and the URL of the **repository of the work**.

[1] `https://github.com`

- Description of the results obtained (maximum one page).
- Diagrams relating to **requirements analysis** (Domain Modeling, *D*iagramsUse Cases and corresponding descriptions of the use cases).
- Diagrams relating to the proposed **conceptual modeling of the solution** (Class and Sequence Diagrams).
- Diagrams describing the **solution actually implemented** (Class, Sequence, Component and *packages* diagrams).
- Attached is this statement.

The diagrams mentioned above can be complemented with others that you consider relevant.

6 Presentation and discussion of work

You should prepare a presentation lasting up to 15 minutes to present your work. This presentation should describe the solution and the approach taken to achieve it, from the analysis of the scenarios to the implementation and demonstration of the final solution. The presentation should end with a critical analysis of the results obtained.

After this presentation, there will be a period of analysis and discussion of the work lasting up to 30 minutes.

7 Evaluation

The final presentation and discussion of the work will take place during the week of January 8-12, 2024, at times to be agreed upon. Attendance at the discussion is mandatory.

The relative weights of each component of the assignment will be as follows:

- Domain model and requirements analysis: 25%
- Conceptual modelling: 25%
- Final modelling and implementation: 35%
- Presentation and discussion: 15%

The grade for each group member will be individual, considering the assignment's grade and the peer evaluation. The teaching team reserves the right to adjust the marks according to their assessment of each member during the discussion of the work.

8 Working Groups

Working groups must consist of between 3 and 5 members. The definition of the working groups will be made on Blackboard, **ending on September 30th**.