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Task1 Report

# Requirement Engineering Assignment

*A Case Study Based on Maersk Logistics System*

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# 1 Identify stakeholders (RE-1.1)

Maersk is one of the largest international supply chain and logistics companies that provides a variety of services from transportation to finicial services. In this assignment, the case study will focus on creating a Maersk logistics information system which provides service for shipment tracking and management. The stakeholders identification will follow the logistics processes i.e. from suppliers to receivers meanwhile including warehouses and transportations.

1. Customers – buy and use the logistics and transportation services from Maersk
2. Maersk business employees – run business and help customers
3. IT system engineers – maintain the system and ensure the stable operation
4. Carriers/transporters – responsible for shipping and updating shipment status
5. Warehouses – warehouse management
6. Customs – customs clearance

# 2 Elicit and lable requirements (RE-1.2)

## 2.1 Functional requirements (FRs)

| Functional Requirement No. | Functional Requirement Discription |
|---|---|
| **FR 1** | Customers should be able to track their cargo's up-to-date logistics status based on the tracking number. |
| **FR 2** | Customers should be able to register their detailed information – first name, last name, business email, phone number, country/region, password to the system to initiate shipment orders. |
| **FR 3** | Customers should be able to search available routes to find the appropriate schedule for their business demands. |

## 2.2 Non-functional requirements (NFRs)

| Non-Functonal Requirement No. | Non-Functional Requirement Discription |
|---|---|
| **NFR 1** | Tracking number consists of 5 letters and 5 digits without any special characters. (Link to FR 1) |
| **NFR 2** | The registeration process need to apply email verification. (Link to FR 2) |
| **NFR 3** | The available schedules in the system need be updated every 12 hours in order to provide timely and accurate information. (Link to FR 3) |

# 3 Requirements classification faceted approach (RE-1.3)

According to the faceted approach for requirements classification [2], the following table can be generated:

Table 1. Functional Requirements Classification

| **CLASSIFICATION DIMENSIONS** | ***INCLUDED FUNCTIONAL REQUIREMENTS*** | | |
|---|---|---|---|
| ***SYSTEM*** | FR 1 | FR 2 | FR 3 |
| ***USER INTERFACE*** | FR 1 | FR 2 | FR 3 |
| ***DATABASE*** | FR 1 | FR 2 | FR 3 |
| ***COMMUNICATIONS*** | FR 1 | FR 3 | |
| ***SECURITY*** | FR 2 | | |

- **System dimension:** Tracking shipment's logistics information (FR1), customer information registeration (FR2) and scheduler (FR3) all affect the entire system regarding performance and reliability.
- **User interface dimension:** Tracking shipment's logistics information (FR1), customer information registeration (FR2) and scheduler (FR3) are all concerned with user interaction.
- **Database dimension:** Tracking shipment's logistics information (FR1), customer information registeration (FR2) and scheduler (FR3) are all concerned with the data managed by the system.
- **Communication dimension:** Tracking shipment's logistics information (FR1) and scheduler (FR3) are required the external communication facilities typically modern Internet of Things technologies.
- **Security dimension:** Customer information registeration (FR2) involves customer's sensitive information which demands properly handling.

# 4 Requirements analysis (RE-1.4)

By applying checklist for systematic analysis of the requirement [3], the following table can be generated:

Table 2. Functional Requirements Analysis

| QUESTIONS | FR 1 | FR 2 | FR 3 |
|---|---|---|---|
| ***PREMATURE DESIGN*** | No | No | No |
| ***COMBINED REQUIREMENTS*** | No | No | No |
| ***UNNECESSARY REQUIREMENTS*** | No | No | No |
| ***USE OF NON-STANDARD HARDWARE*** | No | No | No |
| ***CONFORMANCE WITH BUSINESS GOALS*** | Yes | Yes | Yes |
| ***REQUIREMENTS AMBIGUITY*** | No | No | No |
| ***REQUIREMENTS REALISM*** | Yes | Yes | Yes |
| ***REQUIREMENTS TESTABILITY*** | Yes | Yes | Yes |

- FR1, FR2 and FR3 do not include any premature design or implementation.
- FR1, FR2 and FR3 are not combined requirements.
- FR1, FR2 and FR3 all three requirements are very important requirements for Maersk's business.
- No non-standard hardware is demanded by FR1, FR2, and FR3.
- All FR1, FR2, and FR3 are consistent with business goals.
- None of FR1, FR2, and FR3 has ambiguity.
- FR1, FR2, and FR3 are all realistic technology in terms of technology.
- FR1, FR2, and FR3 are testable requirements.

# 5 Systematic risk assessment (RE-1.5)

By applying assessment for different types of risks in terms of implementing requirements [4], the following table can be generated:

Table 3. Functional Requirements Risks Accessment

| RISK TYPES | FR 1 | FR 2 | FR 3 |
|---|---|---|---|
| ***PERFORMANCE RISKS*** | Low | Low | Low |
| ***SAFETY AND SECURITY RISKS*** | Low | Medium | Low |
| ***PROCESS RISKS*** | Low | Low | Low |
| ***IMPLEMENTATION TECHNOLOGY RISKS*** | Medium | Low | Medium |
| ***DATABASE RISKS*** | Low | Low | Low |
| ***SCHEDULE RISKS*** | Low | Low | Low |
| ***EXTERNAL RISKS*** | High | Low | High |
| ***STABILITY RISKS*** | Low | Low | Low |

- None of FR1, FR2 and FR3 may adversely affect the overall performance of the system.
- Among the three requirements, only customer information registeration may have medium level risk regarding safety and security due to demand of handling sensitive data from users.
- All the three requirements have no demand for changing the normal development process for unfamiliar implementation technology.
- The state-of-art supply chain management information system has demand for matured AI technology for shipment tracking and schedule planning, therefore both FR1 and FR3 are assessed with medium level of risk.
- None of the three requirements involves non-standarded data.
- None of the thress requirements may be technically difficult or may threaten the planned development schedule for the system.
- Both FR1 and FR3 demand for third parties' (e.g. carriers, warehouses or customs) cooperation to provide the information service, which lead to high risks.
- None of the three requirements may be volatile.

# 6 Systematic validation of requirements (RE-1.6)

By applying systematic validation check method [5], the following checklist table can be generated:

Table 4. Validation Checklist for Requirements

| QUESTIONS | FR 1 | FR 2 | FR 3 |
|---|---|---|---|
| **ARE THE REQUIREMENTS COMPLETE?** | Yes | Yes | Yes |
| **ARE THE REQUIREMENTS CONSISTENT?** | Yes | Yes | Yes |
| **ARE THE REQUIREMENTS COMPREHENSIBLE?** | Yes | Yes | Yes |
| **ARE THE REQUIREMENTS AMBIGUOUS?** | No | No | No |
| **IS THE REQUIREMENTS DOCUMENT STRUCTURED?** | Yes | Yes | Yes |
| **ARE THE REQUIREMENTS TRACEABLE?** | Yes | Yes | Yes |
| **DOES THE REQUIREMENTS DOCUMENT AS A WHOLE, OR DO THE INDIVIDUAL REQUIREMENTS CONFORM TO DEFINED STANDARDS?** | As a whole | As a whole | As a whole |

# 7 Test cases for requirements (RE-1.7)

In this section, the proposal for the test cases of the requirement will be given. The detailed information can be found as following.

Table 5. Proposal for Requirement Test Cases

| REQUIREMENT NO. | PROPOSAL STATEMENT |
|---|---|
| **FR 1** | A database with several different shipments' records should be included. The tracking system should be able to response the shipment with different status – "not delivered" , "on road", "expired shipment". The test should pay attention to how does front-end tracking service cooperate with back-end database information update. |
| **FR 2** | Simulating the mock registration should be applied. The violations of different register information and encryption of sensitive data should be tested. |
| **FR 3** | Simulating the mock searching routes should be applied. Setting up available test routes in the back-end database and applying searching tests to find out. |
| **NFR 1** | Simulating the mock tracking with different types of violations for the format of tracking numbers. The test should pay attention to the robustness of the system. |
| **NFR 2** | Simulating the mock registeration with valid verification code and invalid verification code should be applied, the validity period of the verification code needs to be tested. |
| **NFR 3** | Setting up databases to simulate the information of the logistics ports. Updating the information from the ports and monitoring the information update of the route searching service. |

# 8 UML class diagram modelling for FR 2 (RE-1.8)

In this section, the UML class diagram for FR 2 – customer registering information to Maersk's system will be given. Eclipse EMF modeling tool is applied to create the class diagram.

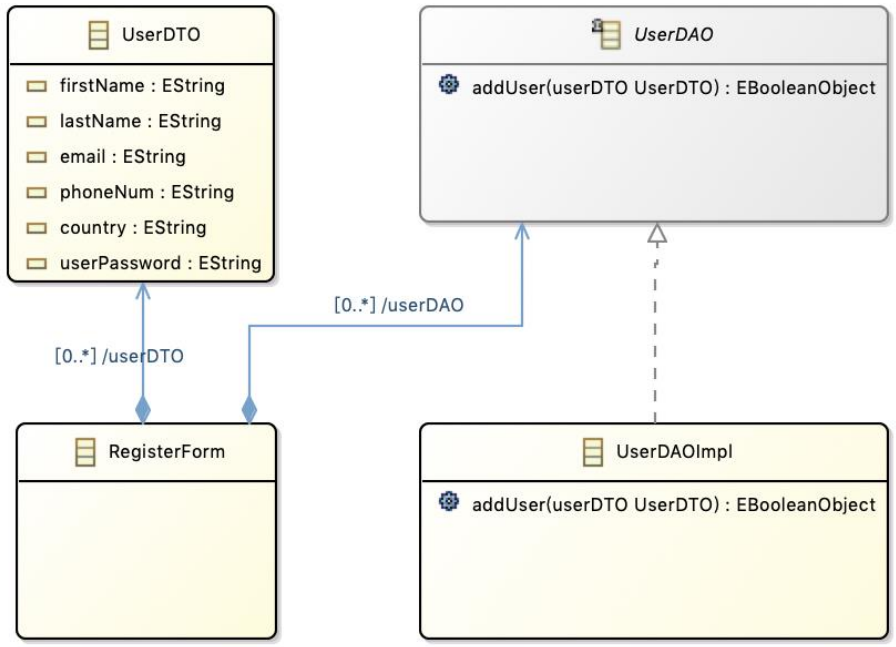


Figure 1. UML Class Diagram for User Register Functional Requirement

In this class diagram, there are four classes, UserDTO (data transaction object) class is responsible for encapsulating the data from the new customer who wants to register in this system. RegisterForm class will use the UserDTO class and transfer it to database to do further operations, and it can instantiate userDTO object. Since there are many different types of databases, RegisterForm should instantiate an interface object for database access object (DAO) which can be implemented in different ways such as MySQL, Oracle, Microsoft SQL Server etc. to adapt changing business demands.

The applied OCL constraints in this class diagram including the following parts: 1) first name and last name should only have the 26 English alphabets (lower and upper case); 2) email should fulfill the general email's pattern with "@"; 3) country name follows same pattern as names; 4) password must be between 7 and 16 digits for the reasons of system security and database efficiency.

# References

[1] Maersk, "*About A.P. Moller - Maersk*", [2022-02-06], url: [https://www.maersk.com/about]

[2] I. Sommerville and P. Sawyer, "RE: a good practice guide," *John Wiley and Sons*, pp. 131–132, 1997.

[3] I. Sommerville and P. Sawyer, "RE: a good practice guide," *John Wiley and Sons*, pp. 118–119, 1997.

[4] I. Sommerville and P. Sawyer, "RE: a good practice guide," *John Wiley and Sons*, pp. 138–139, 1997.

[5] I. Sommerville and P. Sawyer, "RE: a good practice guide," *John Wiley and Sons*, pp. 201–202, 1997.