CMPS310 Software Engineering

- Group Project -

Milestone-2: Design and Implementation (12%)

This is a compulsory project. If you do not submit this, your grade will be 0 in this course.

Submission Due: 07/11/2021 on Blackboard

Fall 2021

Mr Ahmed of the Immigration department has received your *Milestone-1: Requirements analysis and Design*. He has decided that your team should be assigned this project to develop it further. This time he wants that your team identifies the important system properties (constraints and quality requirements), proposes architecture, and implements one use case. This document contains the following items:

(1) Your tasks, grade distribution to tasks, and the submission requirements

(2) The same system description as in Milestone-1, including additional information about constraints and quality requirements is available from **Appendix A**

(3) **Appendix B** includes a use case specification for the implementation.

Your Tasks:

This project concentrates on the technical aspects of the software engineering process, and hence emphasizes on the quality properties and the architectural design issues of the system. The body of your Milestone 2: Design and Implementation will consist of the following deliverables:

1) Identify Constraints and group them into different categories; and recognize quality requirements (NFRs) of the system. You can propose more constraints and NFRs in addition to the requirements of the user (20%).

Note: Desired quality attributes should be precisely specified with exact scenarios. Instead of just saying the system is scalable. You should be more specific by stating the scenario such as, "The system can handle more than 50 thousands orders within next 3 years."

2) (a) Propose a software architecture that addresses some or all of the technical constraints and quality properties identified in Task 1(b). (10%)

(b) Explain how your architecture achieves these properties. If any technical constraints and/or quality properties are not achieved in your architecture, explain why. (10%)

3) Implement one use case (available in Appendix B) using any programming language and provide screen shots demonstrating that your program works along with some sample output of the programs. Use nice user interface to give your program a professional look (20%).

4) Test your program developed in Task 3. You must present test cases and test results. Explain how you have tested the program. (20%)

5) Test at least two quality requirements (NFRs) identified in Task (1). You must show how you have tested those, and explain the test results. **Note**: *You may use any testing technique(s) outlined in Slide 22, Lecture 11; or any other testing approaches to complete this task* (20%).

Provide justifications for any assumptions you made in this milestone. Your submitted components will be evaluated for **accuracy**, **clarity**, **relevancy, justification and completeness** (especially among components and among artifacts) of your document.

Grading scheme for Milestone-2: Requirements Analysis

Deliverables	Grading %
Task (1) Constraints and quality properties	20
Task (2) Software architecture	20
Task (3) Implementation of one use case	20
Task (4) Testing program	20
Task (5) Testing two NFRs	20
Total	100

Submission requirements

Your assignment group/team MUST comply with the following submission requirements; **otherwise grade will be deducted**:

1. Your group should have maximum four members. You will form your own group.

2. **Make sure that each team member must submit the electronic copy individually on Blackboard**.

3. The cover page of your submission MUST contain the following items in four bullets:

   [Each member of the group will be required to submit a peer group evaluation with an estimate of the contribution from each member to the project. Write the percentage contribution made by each team member so that it adds up to 100%. This evaluation *may* be used to adjust the marks awarded to each team member]

   - Effort distribution of the student:

     QUID:_____STUDENT NAME: ___ _____Effort given_____%
     QUID:_____STUDENT NAME: ___ _____Effort given_____%
     QUID:_____STUDENT NAME: ___ _____Effort given_____%
     QUID:_____STUDENT NAME: ___ _____Effort given_____%

   - Class section: **L01/ L02 / L51 / L52 / L53 /** (select one)

   - Course number_____

   - Submission date_____

   - DECLARATION: *We hereby certify that no part of this project or product has been copied from any other student's work or from any other sources except where due acknowledgement is made in the project. No part of this project/product has been written/produced for us by any other persons.*

4. Be aware of
   - *Submitted work must be students' own work*
   - *You cannot copy the project from other groups.*

Appendix-A

Immigration System

(Same description as in Milestone-1)

Currently, the visa application processing is a manual system based on paper work. Many immigration officers work in the office to approve visas. An accountant looks after the payment of visa fees for the applications. Several administrative staff work to prepare paper works such as receiving visa application, making bill, etc. A Law Officer maintains communications with the police office for criminal clearance of all applications. The immigration office has a computer based system that handles the salary of its employees, actual payments of visa fees, and the account of applicants. This is a standard, commercial-off-the-shelf package called AccSys. Mr. Ahmed plans to employ only one staff to handle the new automated software system. The new system will work as outlined below.

The immigration office processes three types of visa applications: Tourist visa, Work visa, and Family visa. For tourist visa, the tourist first requests for online application form. The system displays the form. The tourist fills the form with his/her details and attaches the copy of photo and passport. If any information is missing, it asks for the missing information. The system saves all information and checks if the person applied for visa in the past. It retrieves the status of the previous application. If there is no serious problem with the previous application, the system automatically contacts the Police System for criminal record of the person, otherwise rejects the application. The Police System sends its feedback to the system immediately. If the police feedback is okay, it verifies the rules for visa duration according to the nationality of the applicant. The system maintains a database on the rules for all nationalities. Some nationalities get 30 days, some get 10 days and some get 90 days. The system determines the duration of the visa based on these rules. It then asks for the credit card details of the person. The system forwards the card details to the bank for the payment. The bank sends the payment status to the system that prepares the visa with duration and assigns a unique visa number if the payment is okay. If the payment is not okay, the system rejects the application. The visa needs to be approved by the Immigration Officer. The approval process takes some steps from the Immigration officer. These steps are explained later. Once approved, the system notifies AccSys about the payment with the visa number, otherwise it rejects the application. Finally, the system informs the tourist about the visa status.

For the work visa, the employer of the person requests for online application form. The system displays the form. The employer enters details of the person, and the photo of the person. If any information is missing, it asks for the missing information. The system saves all information. The system automatically contacts the Employer System for the copy of the job offer confirmation of the person and the police report, otherwise rejects the application. The employer must collect the police report about the person form the police station and submits it to the system. The system verifies the job confirmation and the police report. If everything is okay, the system checks with its database on how many total visas have been issued so far to this employer. Every employer has a limitation of total number of work visa they can get. If the total number is less than the limitation, it makes a bill for the employer and sends this bill to AccSys. However, if the limitation is already reached, the system rejects the application. It then asks AccSys for a financial report about the employer. If the report from AccSys is good, the system prepares the work visa, assigns a unique visa number, and associates this with the employer data in the system. If the report is not good, it rejects the application. The visa needs to be approved by the Immigration Officer. The approval process takes some steps from the Immigration officer. It is described later. Once approved, the system increments the total visa number issued to this employer by one, otherwise rejects the application if not approved. Finally, inform the employer about the status of the application.

For family visa, the employee requests for online application form. The system displays the form. The employee enters details of the family members, and their photos. If any information is missing, it asks for the missing information. The system saves all information. It finds the visa status of the employee. If the visa expires in less than 6 months, it asks the employee to extend the visa first and terminates the session. Otherwise it gets the income information of the employee from its database. The system computes if the employee can maintain his/her family with the income. If the income is not satisfactory, it rejects the application, otherwise the system contacts the police system for the criminal record of the family members of the employee. It then computes the visa duration based

on the visa of the employee if the police report is good, otherwise it rejects the application. The system prepares the visa with duration, and assigns a unique visa number. The visa needs to be approved by the Immigration Officer. The approval process takes some steps from the Immigration officer. It is explained later. Finally, the system informs the employee about the status of the application.

Anyone can request for the extension of visa. The applicant first submits the visa number. The system retrieves the visa information. It then computes the remaining duration of the visa. If the duration of the remaining visa is more than one month, the system asks the applicant to apply later and ends the session; otherwise it asks the applicant to pay the extension fee to AccSys directly. Once the fee is paid, AccSys sends the receipt to the system that extends the visa. However, if AccSys does not send the receipt, the system rejects the application. The system prepares the visa with new duration. It updates the applicant's information with new duration of the visa. Finally, it informs the applicant about the extension.

Anyone can also apply for the cancellation of the visa. In order to cancel an existing visa, the applicant submits the visa number. The system retrieves the visa information. It then changes the status of the visa to "Cancelled." However, if it is for a work visa, the cancellation needs to be approved by the Immigration Officer. The system updates the applicant's data in the system. For work visa cancellation, it then decrements the total number of visa allocated to the employee by one. For other visa types, no decrement is needed. The system informs AccSys about the cancellation with the visa number. It sends cancellation to the applicant.

A staff of the Immigration Office can prepare weekly report for overstays. The report includes details of persons whose visas have already expired. The staff requests the system for a overstay report. The system searches for those visas which have already expired but the persons are still staying in the country. It makes a list of such persons with their passport details and visa numbers. It then sends this list to the Police System. It returns a status report to the immigration system that updates the information based on the status report. The system then prepares a final report. It sends it to the Immigration Officer if the number of overstays exceed 50.

For the approval process of visas by the Immigration Officer, the system first checks with AccSys if the payment is made by the tourist, or the bill was issued to the employer for work visa application. The system also checks if the duration of visa issued is correct. If all are okay, it informs the Immigration Officer who approves the visa in the system; otherwise it asks the Immigration Officer not to approve.

Mr. Ahmed wants that the managing of the above activities of the immigration system should be automated as much as possible. There will be also possibility that the administrative staff can generate various summary reports.

Additional Information

Mr. Ahmed now describes you additional information about the immigration system. He said that the system must highly portable, meaning it can run on different operating systems such as Anroid, Linux, iOS, Unix, etc. Time to time, some functions may need upgrading and modifications, but the interfaces to the rest of the system may remain same. The software could be interoperable, that means, it can be integrated with varieties of other software systems. Mr. Ahmed explained that the immigration system does not have budget for more than 8 new technical staff for the project. It has budget for only 4 new servers. The system must run as plug-in for the payment with the Google Pay system. He added that more new functionalities need to be added to the immigration system in the future, some existing ones might be modified or deleted to enhance further capabilities. The payment information of applicants is confidential; these should not be disclosed to unauthorized entities. These need to be protected by separating them from the high level user interface. Mr Ahmed also pointed out that several backup modules will be managed in order to support availability of the systems to the members most of the time. Various components of the software should be less dependent on each other and more focused. Currently the proposed system can handle 1000 concurrent visa applications. However, it is projected that it will increase to 5000 within next 2 years.

APPENDIX- B

This use case needs to be implemented

<table>
<tr><td>Use case Id</td><td colspan="2">Issue Visit Visa</td></tr>
<tr><td>Brief Description</td><td colspan="2">Applicant applies for a tourist visa. The use case approves the visa if all conditions are met.</td></tr>
<tr><td>Primary actors</td><td colspan="2">Applicant</td></tr>
<tr><td>Trigger(s)</td><td colspan="2">The applicant submits an application for visa.</td></tr>
<tr><td colspan="3">Pre condition(s);
1. Applicant must have a valid passport</td></tr>
<tr><td colspan="3">Post condition(s):
1. A visa was issued</td></tr>
<tr><td colspan="3">Normal Scenario</td></tr>
<tr><td>Actor action</td><td colspan="2">System response</td></tr>
<tr><td>1. The tourist provides his/her details such as name, passport number</td><td colspan="2">2. Record details (see 2a) and Check if the details already exist</td></tr>
<tr><td></td><td colspan="2">3. Ask the tourist for credit card details</td></tr>
<tr><td>4. The tourist provides card details</td><td colspan="2">5. Send card details to the bank for payment processing (this can be saved in a file in the program)</td></tr>
<tr><td>6. The bank informs about the payment status (This can be done by entering a Boolean value from the keyboard)</td><td colspan="2">7. Prepare the visa with duration and assign unique visa number (see 7a)</td></tr>
<tr><td></td><td colspan="2">8. Save the visa number and duration in the file and display this information on the screen.</td></tr>
</table>

Alternative flows:

2a. If details already exist reject the application.

7a. If the payment status is not okay, reject the application, otherwise inform the tourist with the visa number and a duration.

Hints:

- Enter tourist information such as name, passport number from the keyboard
- Same the information in a simple file
- Display a text on the screen requesting to enter credit card number. This can be integer. Instead of sending the credit card number to a bank, save this number in the same file or in a separate file.
- Instead of a real bank informs about the status of the payment, this can be either from a separate file or manually enter a Boolean value from the keyboard.