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CSC 490 - Software Engineering

Phase I

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I- Introduction

Students at the LAU are facing many issues with their studies. Therefore, students requested a new tool, namely a new system entitled Virtual Learning Assistant that will assist them and tackle their problems. To begin with, students are facing difficulties in deciding whether they are studying enough for each course. Thus, the VLA will track study hours spent by students, compare them to the required work hours and class average and notify them when they are behind. After that, a report is generated at the end of each week that shows the students their productivity statistics (such as study hours per day, tasks completed per day, progress made, etc.). Study hours could be measured in two ways, using the stopwatch of the LMS or the time that a student spends on the tab in the LMS. Another issue that the students face is organizing their tasks and not missing some of them. Thus, the system allows students to set up a to-do list to record their tasks. According to their to-do list, the system will notify the students to complete the tasks added at the respective time that they chose (give them the setting to decide how frequently and when the notification is delivered). Hence, the system will determine the students' tasks status (percentage completed, finished not finished, not started). Moreover, the VLA allows the students to search for a specific topic or title within the Contents and Materials section to save time. For this purpose, a search bar will be included that allows students to search by typing in a keyword. Then, they will be redirected to the location of this keyword in the Content and Materials section. In other words, the output of the requested search can result in a document where the searched word is present in its title. The search feature is more advanced in which it can output the most compatible document with the text typed in the search bar. Another issue the students face is the difficulty in choosing the course they will register for and the instructor. The VLA will facilitate this issue by adding a reviews section, this way students can know what courses to take and with which instructor. The student can evaluate the instructor in several skills or topics related to the content of the course. So, students can write reviews on courses & instructors and can rate them (scale from 1 star to 5 stars). Note that each student can submit only one review for each course with a specific instructor. However, the user can edit their review. Finally, the last issue that the VLA will solve is the ability to upload the students' notes to organize them or, in other cases, to share them with other students. Hence, the system allows students to upload notes to LMS & online resources to organize their work. Add an option to have this content private or public for other students to view). In the case of public notes, any documents uploaded by the students should take the approval of the instructor to ensure the reliability and consistency of these notes. In the end, the VLA will ensure to provide all the desired requirements efficiently.

II- Background

The numbers do not lie, and they all speak the same truth—almost every corporate organization today relies on an LMS for its training operations. Nowadays, we live in the digital age, and with the spread of the COVID-19 virus, most schools and universities all over the world switched to the online learning mode. Switching to an online mode of learning demands an online learning management system that connects instructors to the students. As a result, many LMS(s) have been developed in the last few years such as Moodle, Google Classroom, and Blackboard. Such LMS(s) provide the users (Students and instructors) with the ability to do

online meetings and post online resources. However, they limited and missed some features that might be important for both the student and the instructor. Hence, there should exist a virtual learning Assistant tool that adds more functionalities to the existing LMSs. This tool will track the study hours of the students and enable instructors to help students of different education levels. Moreover, VLA will assist the students as well as the instructors in the exams by providing sample exams to the students and autocorrect the exam instead of the instructors.

III- Glossary:

- **LMS:** An LMS enables you to create, manage, and deliver e-learning courses the same way word processors (like Microsoft Word) help you write documents and email servers (like Gmail) help you manage your email.
- **VLA:** The Virtual Learning Assistant provides the students with an innovative approach to learning through an online platform.
- **MCQ:** A multiple-choice question is a question type where the respondent is asked to choose one or more items from a limited list of choices.
- **Moodle:** Moodle is a free and open-source learning management system (LMS) written in PHP With customizable management features, Moodle used to create private websites with online courses for educators and trainers to achieve learning goals.
- **Re-Captcha:** reCAPTCHA is a free service from Google that helps protect websites from spam and abuse. A "CAPTCHA" is a Turing test to tell humans and bots apart.
- **RDBMS:** Relational Database Management System is a program that allows you to create, update, and administer a relational database. Most relational database management systems use the SQL language to access the database.
- **HTML, Bootstrap CSS, JS, PHP, and Microsoft SQL:** Set of technologies and programming languages used to develop the system.

IV- User requirements:

Notation followed for User Requirements:

UF → User Functional

UFD → User Functional Domain

UNF → User Non-Functional

UNFD → User Non-Functional Domain

Functional:

UF01- When the student is late on the suggested study plan, the system will notify both the instructor and the student of the issue, and the instructor will be able to act accordingly.

UF02- At the end of each week, the instructor gets a detailed report that describes each student's performance in the past week.

UF03- The system shall track the study hours of each student by keeping track of the time he was active on the LMS.

UF04- The system shall allow the students to make a to-do list that tracks the progress of their studies.

UF05- The system should send students a reminder of the tasks on their to-do list.

UF06- The system should provide the users (students and instructors) with a search bar present on every page.

UF07- The system shall allow the instructor to publish sample exams to help the students prepare for their upcoming assessments.

UF08- The system shall allow the course instructor to post resources of various types to check out before exams.

UF09- The instructor can give different study plans to each student according to their capabilities.

UFD01- The system shall enable the students to add their reviews and evaluation for each course registered by these students.

UF10- The system shall allow the students to post and organize their notes appropriately.

UF11- For consistency and validity purposes, if the student chooses to make the uploaded document public, the system will make the document positive if it gets the approval of the instructor.

Non-Functional:

UNF01- The VLA should be relatively easy to use and require minimal training of the users to manipulate it without any help.

UNF02- When needed, the system should integrate web services from another LMS tool.

UNF03- The system shall require the user to log in again when the VLA is left open without any activity detection to ensure security.

UNF03- The system should censor the reviews by detecting the reviews that violate the LAU code of conduct and rules.
LAU code of conduct is a set of regulations and limitations that the students should respect and follow.

UNF04- The system shall keep all reviews posted by students on specific instructors and courses anonymously.

UNF05- The system should run smoothly and rapidly.

UDNF01- The system shall allow only the instructors and the students registered in the course to access its content.

UNF06- The technologies used to build the software are HTML, CSS, JS, PHP, and RDBMS.

UNF07- The system shall be able to run on well-known browsers.

UNF08- The system shall be continuously available 24/7 throughout the whole week.

UNF09- The system should allow the administrator to have the privilege to view all the courses, students, and instructors in the institution.

UNF10- The system should allow the administrator to view the authors of the reviews.

Source of the User Requirements:

The functional user requirements are mainly extracted from the interviews conducted with the students of different majors and different levels. On the other hand, the non-functional user requirements are deduced from the discussion between the team members and online resources.

V- System Requirements

Notation followed for System Requirements:

SFS→ System Functional Student Interaction with VLA
SNFC→System Non-Functional Compliance with the LMS
SFI→ System Functional Instructor Interaction with VLA
SFSI→ System Functional Student & Instructor interaction with VLA
SNFU→ System Non-Functional Usability
SFU→ System Functional Usability
SFSEC→ System Functional Security
SNFE→ System Non-Functional Ethical
SFA→ System Functional Administrator Interaction with VLA
SNFPR→ System Non-Functional Privacy
SNFP→ System Non-Functional Performance
SNFD→ System Non-Functional Development
SNFAV→ System Non-Functional Availability
SNFA→ System Non-Functional Administrator

- **System Functional Student Interaction with VLA**

SFS01- The system should notify the students when they are behind schedule by more than 10 hours.
SFS02- For each student, the system shall generate statistics for their report. The data will be the number of hours spent studying a course, the number of external sources visited, and the collected grades. This information and statistics may be collected and sent to the instructor when needed.
SFS03- The system shall track the study hours of each student by measuring how long each tab of the LMS/VLA is open or by a stopwatch integrated into the LMS/VLA.
SFS04- The system shall enable the students to make a new to-do list for every course they are studying. The students can divide the list into many sections, where the students can add as many categories as they want and give titles to each section.

SFS05- The system shall enable the students to add a task to the to-do list and specify a deadline and a set interval of time to work on it using a calendar-like interface.
SFS06- The system shall remind the students of the deadline of their remaining tasks in the to-do list by sending a notification to the student using the integrated notification feature of the LMS.
SFS07- The system should notify the students if they have some unfinished work. The student will be able to decide the frequency of these reminders.
SFS08- The system shall evaluate the students' capabilities based on the students' grades so far in exams. If there are no grades, there can only be one study plan.
SFS09- The system should allow the students to evaluate their instructor's performance and skills in the review section.
SFS10- The system will provide the student with a comment to write their personalized opinions concerning their instructors. The system will also give the students a rating section to rate their instructor's performance using different criteria and a scale between 1 and 5 stars.
SFS11- Each student has one form to upload; therefore, the student can only edit his comment & ratings instead of adding another form.
SFS12- The system shall allow the students to organize their notes by uploading them to the VLA. The student can categorize the documents according to their respective courses and chapters.
SFS13- The student can choose whether to make his notes private or public. The private option makes the notes only accessible to the user that uploaded them. The public option makes the note documents available to all the students enrolled in the same course.

➢ System Functional Instructor Interaction with VLA

SFI01- When students are behind schedule in their studies for a specific course, the system should notify the course instructor. The instructor may then communicate with the students and discuss their problems and difficulties.
SFI02- Every Saturday night, the system shall generate a detailed report that analyses and displays the amount of time & effort each student spends studying a course. The system will then send this report to the instructor.
SFI03- Before each exam, the system shall enable the instructor to add automated sample tests (MCQs). The system should create a directory called sample exams for each course, where the instructor can add sample tests and their solutions.
SFI04- The system should be able to autocorrect the sample exams. The students will receive their scores immediately after finishing their exams since the instructor has previously specified which of the options the correct answer is.
SFI05- The system shall allow the instructors to post different types of resources before each exam. The resources can be YouTube videos, PDFs, or links to external websites.
SFI06- The system shall allow the instructor to add a description for each posted resource. The note should explain how a resource would help the student understand a specific concept or help them become more comfortable with solving different types of problems. (Instructor interaction with VLA).

SFI07- The instructor will make an intensive and briefer study plan, and the VLA would give each student a study plan depending on his capabilities.
SFI08- For validity purposes, if a student decides to make his notes public, the system should notify the instructor to check them before allowing the student to share them.

a) If the instructor approves to make the notes public, all the other students will have access to these notes.
b) If the instructor finds the notes inconsistent with the explained material, the student will have his notes uploaded in private, and he can make them public again after he fixes them.

➢ System Non-Functional Compliance with the LMS

SNFC01- The system should use the notification feature of the Moodle LMS.
SNFC02- The system should utilize the services provided by the Moodle LMS whenever required by calling the corresponding Web Service from within the VLA client. (Compliance with LMS)

➢ System Functional Student & Instructor interaction with VLA

SFSI01- The system shall provide the users with a search bar. The users can type in keywords to the search bar, and the system should then direct the user to where there is the course content that may be related to this keyword.
SFSI02- If the user presses the search bar; the system will first search the titles of the documents in the course content section.

a) If there are similarities between the title of a file and the searched keyword, the system will direct the user to the corresponding file.
b) Otherwise, the system will perform a broader search: scanning the whole text of the documents and then will point the user to a specific line in a file.

➢ System Non-Functional Usability

SNFU01- 95% of the users should have the ability to use the LMS without any difficulty after one training session.
SNFU02- The system shall be able to run at least on Google Chrome, Firefox, Safari, and Microsoft Edge.

➢ System Functional Usability

SFU01- The system shall contain tooltips and hints in the UI to help the user navigate the VLA's website.

➢ System Functional Security

SFSEC01- When the VLA is left open without any activity for 15 minutes; the user will have to log in again for security purposes.
SFSEC02- The system should ask the user to solve a re-captcha for security reasons and protection against automated bot attacks.
SFSEC03-The system will encrypt all sensitive and private data using a PHP library.

➢ System Non-Functional Ethical

SNFE01- The system will filter out inappropriate expressions from the review section by replacing the profanity with star symbols.

➢ System Functional Administrator Interaction with VLA

SFA01-The system allows the administrator to ban a student from writing reviews if they submit a review that contains inappropriate language. The system also allows the administrator just to delete the review without taking any further action.

➢ System Non-functional Administrator Interaction with VLA

SNFA01-The system should allow the administrator to have the privilege to view all data related to the courses, students, and instructors in the institution.

SNFA02-The system will not allow the administrator to view the authors of the reviews for confidentiality purposes.

➢ System Non-functional Performance

SNFP01- The system should have good performance and a maximum delay time of 2 seconds when performing any operation.

➢ System Non-Functional Privacy

SNFPR01- The system shall make all submitted reviews in the review section of the VLA anonymous. In other words, the submitter's name will not be present next to their comment in the review section.
SNFPR02-The system shall allow the course to be visible only for the instructors teaching it and the students taking it.

➢ System Non-functional Development

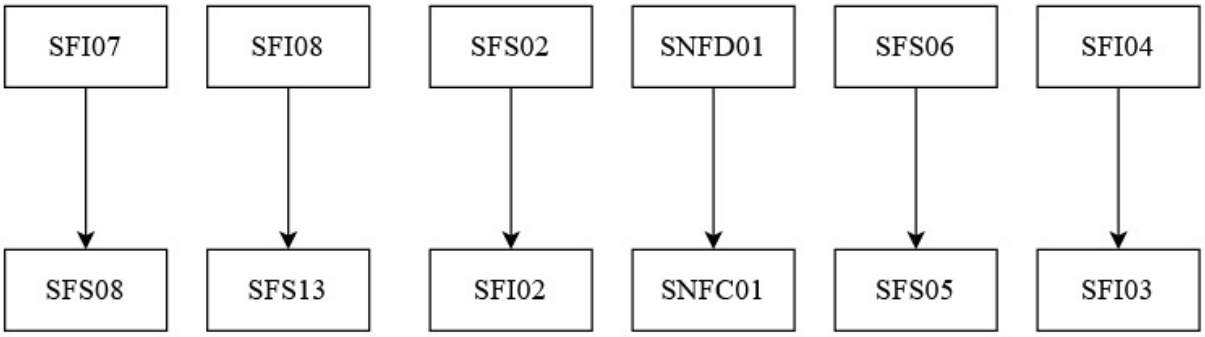
SNFD01- The system will be a website developed with HTML, Bootstrap CSS, and JS for front-end; PHP, and Microsoft SQL for back-end.

➢ System Non-functional Availability

SNFAV01-The system shall be continuously available 24/7 throughout the whole week.

VI- Requirement Revolution

Dependency Graph



- SFI07 is dependent on SFS08 since if we want to change SFI07 into making one study plan for all students, then we do not need to evaluate the students' capabilities.
- SFI08 is dependent on SFS13 since if we want to remove the option to make notes public and private and make it only private, then the intervention of the instructor is not necessary.
- SFS02 is dependent SFI02 on since if the data recorded changes in the report, then the report sent to instructor would have different content and format.
- SNFD01 is dependent on SNFC01 since if we want to interact with Moodle API we are in need to the PHP language.
- SFS06 is dependent on SFS05 since if we want to change in the scheduling settings then the reminder of the task would change accordingly.
- SFI04 is dependent on SFI03 since if we want to change in the format of the sample test (different from MCQs), then the exams would not be automatically corrected and the students would not get their grades automatically.

VII- Conclusion

This requirements document summarizes the main phases of the requirement engineering process. It provides an overview of the system and user requirements of the virtual learning Assistant. Developing this system or software will help the students in their courses and exams. Moreover, the VLA will facilitate the work of the instructors and managers in the schools and universities.