C868 – Software Capstone Project Summary

Task 2 – Section A



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| **Capstone Proposal Project Name:** | Semester Scheduling Mobile Application |
| **Student Name:** | Derrick A. Koehn |

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# **Business Problem**

## The Customer

Study Free is a small nonprofit that works to provide free resources to high school and university students to lessen the financial difficulty often associated with obtaining an education. Over the past several years, they have shifted their efforts to the software space, where they seek to empower students by creating mobile applications that are a better alternative to what is offered by for-profit companies, and by making those applications free to use.

Study Free is a fully remote organization and is staffed completely by volunteers. These fifty-three volunteers primarily communicate via a Slack Nonprofits workspace. The nonprofit is divided into three departments, each of which is headed by a senior volunteer, called a director. The three departments are Solutions, Marketing, and Fundraising. Officially, Solutions handles the designing, development, and maintenance of software solutions, Marketing works to make people aware of the software solutions, and Fundraising works to raise money to fund expenses associated with the organization’s activities. Many volunteers are active in more than one department’s work. Overseeing the entire organization is an Executive Director, who answers to the nonprofit’s board.

Study Free’s total annual budget is less than $15,000, most of which is allocated to marketing, so volunteers in Solutions must be comfortable working with free software development tools and open-source code libraries. Volunteers have embraced this reality and are proud to say that they have not spent any funds on software vendors or hosting platforms in the past five years.

As a non-profit, Study Free measures its success by how many people use what they build, and by how many students it can help. Their motto is “It mattered to that one.”, a reference to their belief that no matter how small or large its impact, their work truly matters to the students it touches.

## Business Case

Study Free’s Solutions Director has identified that there is an unmet need in the student software space that the organization is well-placed to address. Students around the world use a variety of mobile applications to keep track of assignments and courses. However, existing applications were built with a profit incentive in mind, and as a result, they all come with features that do not prioritize what is best for students. The proposed semester scheduling mobile application will allow Study Free to disrupt the student scheduling software segment by providing a free-to-use mobile application that does not include said problematic features.

While app stores are saturated with mobile applications that allow students to store information about their course load, each option has at least one of several problems. The first problem is that many are not free to use. Students must pay the application’s developers to use the app. The second common problem is that many application developers use “free” software to collect data which is then sold to companies that use it to serve students with advertisements for predatory student loans. Finally, many existing applications include features that display distracting and/or unhelpful advertisements within the application itself. As a result of these problematic features and business practices, students everywhere face small but unnecessary obstacles. Study free does not currently offer a semester scheduling application as an alternative.

The proposed semester scheduling mobile application will fill this gap in Study Free’s software portfolio. This will be accomplished by designing, developing, documenting, and deploying a standalone mobile application for Android devices. The completed application will be completely free to use, will store all data on the user’s device to prevent predatory data collection, and will not display advertisements to users.

Different from for-profit companies, Study Free measures its success by how many students it can help, rather than by how much money its software earns. The proposed semester scheduling mobile application will contribute to Study Free’s success by allowing the organization and its volunteers to positively impact more students.

## Fulfillment

The proposed semester scheduling mobile application will be a standalone mobile application for Android users. It will allow Study Free to provide students with an easy and completely free system for tracking school assignments and deadlines for all of their courses using a secure mobile application.

When a student launches the application, they will be greeted by a login screen. The first time the application is run, this screen will prompt the user to create a username and a password. After the initial setup, and for all subsequent launches of the application this screen will require the user to enter their username and password before it allows authenticated users to access other application features or stored data.

The first screen that will appear after user authentication is a “Term Manager” screen on which saved terms will be displayed in a vertical list once terms have been added by the student. Near the top of the screen, there will be a button that, when tapped, will display an “Add Term” screen which will allow the application’s user to input and save information for a new school term. Once information, including a term title and the term’s start and end date, has been entered into the displayed form, the user will, by tapping the “Save” button, save a new term in the application’s internal database. Such saved terms will then be displayed in the list on the “Term Manager” screen.

Tapping a term displayed on the “Term Manager” screen will open a “Term Details” screen which will include a form enabling the user to update the term’s title, start date, and end date, as well as a button to delete the term entirely. This screen will also include a list of courses for the term, once courses have been added by the student. Near the top of the screen, there will be a button that, when tapped, will display an “Add Course” screen which will allow the application’s user to input and save information for a new course associated with the term. Once information, including a course’s name, the course’s start date and end date, and whether the user wishes to receive push notifications when the course begins or ends, has been entered into the displayed form, the user will, by tapping the “Save” button, save a new course in the application’s internal database. Such saved terms will then be displayed in the list on the respective term’s “Term Details” screen. The “Term Details” screen will also allow users to quickly find specific courses in the list by entering search terms into a displayed search tool.

Tapping a course displayed on the “Term Details” screen will open a “Course Details” screen which will include a form enabling the user to update the course’s name, start date, end date, and notification settings as well as a button to delete the course entirely. This screen will also include a list of assignments for the course, once assignments have been added by the student. Near the top of the screen, there will be a button that, when tapped, will display an “Add Assignment” screen which will allow the application’s user to input and save information for a new assignment associated with the term. Once information, including the assignment’s name, start date, and due date, and whether the user wishes to receive push notifications when the assignment begins or ends, has been entered into the displayed form, the user will, by tapping the “Save” button, save a new assignment in the application’s internal database. Such saved assignments will then be displayed in the list on the respective course’s “Course Details” screen.

Tapping an assignment displayed on the “Course Details” screen will open an “Assignment Details” screen which will include a form enabling the user to update the assignment’s name, start date, due date, and notification settings as well as a button to delete the course entirely.

If the user chooses to enable notifications for start dates or end dates on any courses or assignments, the app will notify them via push notifications on days when courses or assignments begin or end.

To sum that all up, the semester scheduling application will be a standalone Android mobile application that will allow Study Free to provide students with a completely free system for tracking school assignments and deadlines for all of their courses using a secure mobile application.

# **Existing Gaps**

While app stores are saturated with mobile applications that allow students to store information about their course load, each option has at least one of several problems. The first problem is that many are not free to use. Students must pay the application’s developers to use the app. The second common problem is that many application developers use “free” software to collect data which is then sold to companies that use it to serve students with advertisements for predatory student loans. Finally, many existing applications include features that display distracting and/or unhelpful advertisements within the application itself. As a result of these problematic features and business practices, students everywhere face small but unnecessary obstacles. Study Free does not currently offer a semester scheduling application as an alternative.

# **SDLC Methodology**

For this proposed application, there is already a clear sense of what the requirements are, and a clear sense of what the application needs to do, making this project a good match for the Big Design Up Front methodology known simply as Waterfall. The Waterfall methodology is characterized by a detailed design process at the beginning of the project, and subsequent project phases which take place one at a time in an intuitive order. For the proposed scheduling application project, I will be using the Waterfall methodology.

The first phase of the Waterfall methodology is called the **requirements** phase. During this phase, developers work to identify and document exactly what the requirements for the project are. To do this, I will meet with Study Free’s Solutions Director to discuss in detail what the mobile application needs to do, what features it needs to include, and what, if any, features it must not include. I will then script what I have learned into a requirements document. The requirements document will be reviewed by the Solutions Director to ensure that my understanding of the requirements is accurate.

The second phase of the Waterfall methodology is called the **design** phase. During the design phase, developers create a detailed design of the product and a plan for how to turn that design into a finished software product. For the design phase, I will use what I learned in the requirements phase to create a design document that will include wireframe images depicting the application’s user interface design and a class diagram showing the custom object classes which will be used to implement the design. The design document will also detail how the application will handle and store information in a relational database. In addition to the design document, during the design phase, I will also create a detailed testing plan.

The next step is called the **implementation** phase. During this phase, the application will be built. Using the requirements and design documents from the previous steps, I will construct a working Android mobile application that includes all the necessary functionality. This is also the phase where I will create documentation for the application, including a maintenance guide and a user guide.

The step after that is called the **testing** phase. This phase is exactly what it sounds like: a time for testing the application to verify that it works as intended and meets or exceeds all project requirements. During the testing phase, I will carry out the tests in the testing plan created during the design phase, modifying the application where necessary to ensure that it functions as designed. Then, the Solutions Director will review the application in a final acceptance test before the deployment phase.

Once testing is completed satisfactorily and any bugs have been fixed, the next phase is called the **deployment** phase. During this phase, the completed product is released to users. To deploy the proposed semester scheduling mobile application, the Solutions Director at Study Free will publish the finished application to the Android application store, Google Play, via Study Free’s existing Google Developers account.

The last phase is called the **maintenance** phase. After the application has been deployed, any bugs or compatibility issues must be rectified as they become known. For the semester scheduling application, ongoing maintenance tasks will be assigned to volunteer developers from Study Free’s Solutions department as issues become evident.

# **Deliverables**

Each stage of the Waterfall methodology has its own deliverables. These are often organized into two groups: project deliverables and product deliverables. Project deliverables are items related to the development project, for example, a schedule. Product deliverables are what is actually created by the project, for example, the mobile application itself.

## Project Deliverables

* Requirements Document
  + Will include a detailed description of what the mobile application must do, and what its intended purpose is.
  + Will include a detailed description of features the mobile application must include.
  + Will include a detailed description of problematic features which must not be included in the application.
  + Will include specific documentation describing with which devices and operating systems the scheduling application must be compatible.
* Project Timeline Document
  + Will include a breakdown of the project into the tasks associated with each phase, showing a projected start date and end date for each task.
  + Will include a brief description of who will carry out the tasks in the timeline.
* Wireframes
  + Will include images of a low-fidelity mockup of each screen in the mobile application’s user interface.
  + Images will be formatted as JPEG image files embedded within a Microsoft Word document.
* Class Design Diagram
  + Will include each custom class that will be used in the application.
  + Will depict all custom fields, their data types, and associated privacy attributes for each custom class.
  + Will also depict any custom functions, their parameters, their return types, and associated privacy attributes for each custom class.
  + For non-static custom classes stored in a database, any database relationships will be depicted.
  + Class design diagram graphics will be provided as JPEG image file(s) embedded within a Microsoft Word document.
* Testing Plan Document
  + Will detail at least one unit test.
  + Will describe what items are required to complete the test.
  + Will describe what feature or function is to be tested.
  + Will detail the tasks required to test the feature or function.
  + Will describe what deliverables the test will produce.
  + Will explain what system and/or environment needs to be in place before the test can be performed.
  + Will clarify what criteria will cause the test to be considered passed or failed.
  + If testing code is used, this code will be included in the testing plan.

## Product Deliverables

* Finished Android Mobile Application
  + Mobile application will include all required functionalities and features described in the requirements document.
  + Mobile application will be consistent documentation created during the design phase, including the class diagram(s) and the wireframes.
  + All associated source code files will be provided to Study Free.
* Maintenance Guide
  + A maintenance guide will be provided.
  + Maintenance guide will include detailed instructions describing how to set up an integrated development environment capable of modifying the project’s source code and running the application in a simulated environment.
* User Guide
  + A user guide will be provided.
  + User guide will include detailed instructions for how to create user credentials and log in to the mobile application the first time.
  + User guide will include detailed instructions for how to carry out typical tasks using the mobile application.

# **Implementation**

Implementation of the proposed semester scheduling mobile application will not interfere with other ongoing projects or processes at Study Free. My primary point of contact throughout the stages of the development process will be Study Free’s Solutions Director. During the requirements phase, I will work with Study Free’s Solutions Director to discuss in detail what the mobile application needs to do, what features it needs to include, and what, if any, features it must not include. After the requirements document is completed, it will be the Solutions Director who reviews it to verify whether it accurately reflects Study Free’s needs for the application. I will work independently during the design and implementation, phases, and will not require additional Study Free resources or involvement until the testing phase, near the end of which the Solutions Director will review the application to ascertain whether it meets the organization’s needs, in a final acceptance test before the deployment phase. In the deployment phase, I will pass the finished application to the Solutions Director, who will publish it to the Google Play store via Study Free’s Google Developers account.

Because the application is not replacing an existing program, no special considerations need to be made concerning how the deployment will impact pre-existing users. There will be no users until after the initial deployment process is completed and the application is available to the public for download. The application will then accumulate users slowly over time.

Study Free is a small organization, and their use of a Slack Nonprofits workspace for communication will make communication simple. Volunteers, including the Solutions Director, have invited me to reach out at any point during the project with any questions.

# **Validation and Verification**

In the first phase of the project, the requirements phase, I will work with Study Free’s Solutions Director to create and validate a detailed list of features and functionalities that the application must include. This document will serve as a guide throughout the design and development process and will guide the creation of a detailed testing plan.

After the application has been designed and built, I will complete comprehensive unit testing. During this testing phase, I will verify that the application complies with each of the requirements and prohibitions set out within the requirements document. After testing has concluded, the Solutions Director will have a final opportunity to review the finished application before publishing it to the Google Play store. If they determine that the application does not meet their requirements, we will work together collaboratively to understand what modifications need to be made for the application to meet and exceed Study Free’s requirements.

When navigating validation and verification discussions, I will seek to engage in a collaborative dialogue with the Solutions Director, focusing on how we can build the best application possible rather than trying to prove that the application matches an imperfect set of requirements set out at the beginning of the project.

# **Environments and Costs**

## Environment

To build the application, I will use an integrated development environment called Visual Studio 2019. Within Visual Studio, I will use an open-source user interface framework called Xamarin.Forms. The project’s source code will be written in XAML and C#, which the Xamarin.Forms framework will convert into an executable android mobile application. To create the application’s internal database, I will use an open-source code library called SQLite-Net-PCL. Study Free allows volunteers to use their own devices, so I will complete coding tasks using a Hewlett Packard Elitebook Pro laptop running Windows 10 Pro.

Once the application is completed, it will be made available to the public via the Google Play store. Individual users will install the application on their respective Android mobile devices.

## Environment Costs

The integrated development environment, the user interface, and the code libraries selected for this project are all open-source and completely free to use. In addition, the computer on which development costs will be carried out has already been purchased, so that does not involve any expenditure either. This means that there are no environment costs associated with the development of this application.

The application will function independently on each end user’s device, so there will be no recurring hosting or cloud computing costs associated with the program.

## Human Resource Requirements

Because Study Free is staffed entirely by volunteers, there is no direct cost of labor for the project. However, opportunity cost, the theoretical value of expending volunteer labor on other projects instead of developing this proposed application, could be considered.

The impact on other projects will be minimal, as only the Solutions Director and myself will contribute labor to the project. The following project timeline outlines how much labor the project will require during each phase.

# **Project Timeline**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Project  Phase | Milestone or  Task | Deliverable | Description | Start & End Dates | Labor Required |
| Requirements | Clarify and document requirements | Requirements document | Meet with the Solutions Director to explore what Study Free’s requirements are for the project. | 3/12/2023 - 3/12/2023 | Solutions Director  (4 hours)  Developer  (4 hours) |
| Design | Design application user interface | Wireframes | Create wireframe images depicting an appropriate application user interface | 3/12/2023 - 3/12/2023 | Developer  (2 hours) |
| Design | Design Custom Classes and Database | Class Diagram | Create a class diagram depicting custom object classes required for application. | 3/12/2023 - 3/12/2023 | Developer  (2 hours) |
| Design | Testing Plan | Testing Plan Document | Create a plan describing unit testing for the application. | 3/13/2023 - 3/13/2023 | Developer  (4 hours) |
| Implementation | Build Application | Mobile Application | Build the mobile application. | 3/13/2023 - 3/15/2023 | Developer  (24 hours) |
| Implementation | Create User Guides | Maintenance Guide & User Guide | Write a maintenance guide and a user guide to accompany the application. | 3/16/2023 - 3/16/2023 | Developer  (4 hours) |
| Testing | Unit Testing | Unit tests are completed successfully. | Complete all necessary unit testing. | 3/17/2023 - 3/17/2023 | Developer  (4 hours) |
| Testing | Acceptance Test | Solutions Director Accepts final application. | Meet with the Solutions Director for a final review of the application. | 3/17/2023 - 3/17/2023 | Solutions Director  (2 hours)  Developer  (2 hours) |
| Deployment | Publish Application | Application is available on the Google Play store. | The Solutions Director will publish the application. | 3/17/2023 - 3/17/2023 | Solutions Director  (2 hours) |
| Maintenance | Provide Maintenance Guide to the Solutions Director | Maintenance Guide | Deliver maintenance guide created during the implementation phase to the Solutions Director. | 3/17/2023 - 3/17/2023 | Solutions Director  (15 minutes)  Developer  (15 minutes) |