

# **C868 – Software Capstone Project Summary**

## **Task 2 – Section A**



**Capstone Proposal Project Name:** Time Cutter – Workforce Management

**Student Name:** Jesse Anderson



3 AM Productions

# *Software Solution*

*Time Cutter: A Workforce Management System*

## Table of Contents

A. Project Recommendation .....	5
A.1 Customer .....	5
A.2 Business Problem.....	5
A.3 Existing System Analysis .....	5
A.4 Existing Gaps.....	6
A.5 Business Case.....	6
A.5.1 Introduction .....	6
A.5.2 Methods and Assumptions.....	7
A.5.3 Business Impacts.....	7
A.5.4 Risks and Contingencies.....	7
A.5.5 Recommendations.....	7
A.6 Related Works.....	7
A.7 Prerequisites .....	8
Table A.7.1 Prerequisites .....	8
A.8 Scope.....	8
A.9 Environment Overview .....	9
A.10 Fulfillment.....	10
A.11 Developer Expertise.....	10
A.12 Proposal Highlights .....	10
B. Requirements.....	12
B.1 Business Requirements.....	12
B.2 User Requirements .....	12
B.3 Functional Requirements.....	12
B.4 Nonfunctional Requirements.....	13
C. Methodology.....	14
C.1 Advantages.....	14
C.2 Disadvantages .....	14
C.3 Stages.....	14
C.3.1 Planning / Design .....	14
C.3.2 Implementation .....	15
C.3.3 Verification.....	15
C.3.4 Maintenance .....	15

- D Deliverables ..... 16
  - D.1 Project Deliverables..... 16
  - D.2 Product Deliverables ..... 16
- E. Design..... 18
  - E.1 Planning Documents ..... 18
    - E.1.1 Initial ERD ..... 18
      - Table E.1.1 ERD ..... 18
      - Figure 1 ERD created during the planning phase..... 18
    - E.1.2 Initial GUI: High fidelity wireframing ..... 19
      - Table E.1.2 GUI Pages ..... 19
      - Figure 2 Series of Wireframes during planning phase ..... 19
  - E.2 Implementation ..... 22
  - E.3 Integration..... 22
- F. Validation and Verification..... 23
  - F.1 UXD Platform Testing ..... 23
    - F.1.1 Windows Platform..... 23
    - F.1.2 Android Platform..... 23
  - F.2 Report Creation ..... 23
    - F.2.1 On Device Report View ..... 23
    - F.2.2 PDF Export..... 23
  - F.3 Use Case Scenarios..... 24
    - F.3.1 Use Case 1: Correct times incorrectly entered ..... 24
      - Figure 3 User Persona 1 ..... 24
    - F.3.2 Use Case 2: New Customer and Job Registration ..... 25
      - Figure 4 User Persona 2 ..... 25
    - F.3.3 Use Case 3: Complete a job..... 25
      - Figure 5 User Persona 3 ..... 25
- G. Resources and Costs ..... 26
  - G.1 Environment Breakdown..... 26
    - G.1.1 SQLite..... 26
    - G.1.2 Azure..... 26
  - G.3 Programming Costs ..... 26
  - G.4 HR Costs..... 27

G.5 Budget .....	27
Table G.5 Budget.....	27
H. Schedule .....	28
Table H Schedule.....	28
I. Sources and References .....	29

## A. Project Recommendation

### A.1 Customer

The client, Eve Habitats is a small landscaping business that is experiencing a stage of growth. The company provides professional landscaping services to customers across Central Virginia, with work ranging from independent work to large crew projects. Customers of Eve Habitats vary from large government contracts to individual small home projects. The client has been operating in Central Virginia providing specialized professional property planning for over two decades. Eve Habitats has multiple cooperate contracts and residential properties they manage. The company prides itself in its professional work and integrity. The owner will offer the labor as free or discounted if he can't accurately show the hours and tasks completed on a property. As the company has grown, the owner has had less ability to personally oversee properties and keep records, which makes it difficult to measure the costs associated with the work. As a business providing services, the owner's inability to oversee the timekeeping involved with the employees, tools, multiple properties, and projects have affected his pricing and scheduling.

### A.2 Business Problem

As Eve Habitats has expanded, the owner's reliance has increased on the employees and supervisors to keep accurate reporting of hours worked, tools used and the hours a project requires. Inaccurate times and employees forgetting to record times have left the business reporting in disarray. This has also affected scheduling as inaccurate timekeeping leads to inaccurate estimates for hours till a job is complete. The method that is currently used to keep records is a work-log in a white binder. The employees need to remember to turn in the worksheets and this often requires the owner to chase down the logs to know the employee and work hours. As jobs may dynamically change throughout the day, the employer needs to contact the crew to change the work schedule. Access to the work log and diligence in filling it out would require a system more readily available to all parties.

### A.3 Existing System Analysis

The current system of records being kept in a binder is a bottleneck for productivity. It works well for a single crew headed by the owner, so he can check off daily objectives and look at records. The owner is required to keep track of when the jobs have been done and when they are due and make sure the new worksheet is put into the binder. He retains his records in his binder that he references when filling out the crew binder. Every day he creates the list with the work for the day and must recall from his other notes the requests the customers have made. This system doesn't work well for multiple crews or times when he is not present. If he doesn't have records from a certain day, he may not know what the customer requested or what jobs were still necessary to complete.

If employees forget to immediately record their times and resort to a recording when they get back to the vehicle or at the end of the day, they will start rounding or guessing, which will result in overcharging or undercharging and inaccurate estimations for job durations. This causes the owner to second guess the times provided and discounts or offers for free some services provided.

Any dynamic changes due to customer requests or scheduling issues require the owner to access the binder for the crew headed to the property through a call to an employee or directly locating the work crew and modifying the binder contents. This can be a problem if the owner isn't sure where in the workday the employees are, and where their vehicle might be. Since the work environment is loud, often employees can't hear the phones and will miss the call to notify them of changes.

The crew returning the worksheet to the owner isn't just a bottleneck, it directly costs him income. If the work crew doesn't communicate on the worksheets at the end of the day what still needs to be accomplished, the owner can't schedule the following day correctly. If the crew loses the worksheet, the owner doesn't know how much to charge an hourly customer, and usually will then offer the work for free.

As the company has expanded and work has become varied the workbook becomes a hindrance to productivity and income. A more accessible and dynamic system of reporting is necessary for the employer to be able to keep records.

#### A.4 Existing Gaps

In addition to a better management system for recording labor and scheduling, the current system and current applications on the application markets don't track the dynamic movements of the supervisors and crew between jobs to show correct hours. One example is when the owner will have crew members float between jobs. They will be pulled from larger jobs to go complete a small one quickly, before returning to assist in the larger job's completion. This would require specialized recording and is often undocumented in the current system. Different tasks are charged differently due to the cost of the tool fuel and maintenance, which is also not recordable in current systems on the android market.

#### A.5 Business Case

##### A.5.1 Introduction

Eve Habitats has issues with its current transition that would cause ongoing frustrations and income loss. With a software solution created for their phones, workers would have more access to recordkeeping and work expectations, allowing the owner to focus more on other aspects of his business. This software would include a simple work view for each level of authority, a calendar for scheduling, a messaging platform, the ability to add or change different aspects of the workforce or projects, and the ability to view business level reports. The development of a cross-platform application would be first accessible to users with Android and Windows devices but would allow the extension to Apple devices in the future. The objectives include increased income from better billing, better scheduling leading to more time for appointments, and simpler communication between management and crews. These things will allow for the continued growth of Eve Habitats.

### A.5.2 Methods and Assumptions

The development of the application will be staged through an Agile iterative process towards creation within 4 months. The development will use general Software Engineering best practice guidelines. The project growth objectives assume the continued service of current properties, the employees successfully trained to use the new product, and the development of new properties concurrent with better scheduling.

### A.5.3 Business Impacts

#### A.5.3.1 Financial Impacts

Eve Habitats will see an increase in properties they service through a better schedule which will have a direct impact on the income they produce. There will be more accurate billing which will allow the owner to continue to operate in integrity and not worry about overbilling a customer. The monthly base cost of the Azure database hosting will be \$5 a month which will be easily recuperated by the increased workflow.

#### A.5.3.2 Non-Financial Impacts

Eve Habitats will better communication of workflow and task completions. Customer satisfaction will increase as their properties are better tracked and followed upon. Employer and supervisor frustrations will decrease as the workflow is communicated globally. The owner will have more freedom to focus on other aspects of the business. With better charting of how long a job takes, the owner will be able to tell when workers aren't at peak production and why certain jobs may take longer.

### A.5.4 Risks and Contingencies

The risk of this solution is that the employees will not embrace and adhere to the system provided in the software. While it provides easier access to the 'workbook' the solution cannot force employees to record their times on work. A system would have to be in place between switching tools or leaving jobs to make sure times are accurately recorded. This system would be under the purview of the owner and outside of the scope of the software solution project.

### A.5.5 Recommendations

3 AM Productions recommends the development of the scheduling software to create a more productive environment at Eve Habitats. This business looks to increase communication, produce more income, and maximize workflow which are all positive impacts of the software solution. This software will help facilitate Eve Habitats' current stage of growth by negating the obstructions or frustrations they currently.

## A.6 Related Works

Applications found on the Android Application Store focus either on scheduling appointments for business contact, or they focus on timekeeping. Scheduling applications on that platform have over 1 million downloads but have in-application costs ranging from 0.99 cents to \$199.99. The current hosting cost of the proposed software solution is \$5 a month on Microsoft's Azure SQL Database. Most of the other scheduling applications don't allow online hosting but host the database locally.

The scheduling and business tracking applications aren't adequate for what Eve Habitats require but do show the success of applications that leverage that software. They tout the increase in

productivity and tracking of revenue streams. Separately, the timekeeping applications show benefits in recording accurate times for employee workdays. Comments on both recommend the products as ways to increase productivity. The software solution looks to build out that functionality to include employee timekeeping on tasks and jobs.

### A.7 Prerequisites

Below is a list of things required before the new software solution can be developed then implemented. Development is scheduled in the Timeline Section. This is a rough timeline and is subject to change dependent upon when Eve Habits decides to act upon this software solution suggestion. This timeline also will be subject to change dependent on the changes in the scope of the software solution. This timeline is separate from any additional timeline(s) produced in this document and should be taken as a rough estimate wherein the client can finalize their software needs.

Table A.7.1 Prerequisites

Number	Prerequisite	Description	Completion Date Range
1	None	Contact Microsoft Azure for pricing options of the different SQL platforms. Have an Azure representative present pricing options.	06/01/2020 – 06/04/2020
2	None	Meetings with the stakeholder (owner and supervisors) for preliminary approval of the software solution. Present drafts of the software solution showing the current UI wireframe and Use Case Diagrams. Check for any additions or scope changes to the solution. Redraw scope according to changes.	06/05/2020 – 06/09/2020
3	1, 2	Get budget approval for a payment plan for developer and maintenance costs. Represent the software scope with examples of class diagrams, updated Use Case Diagrams, and updated UI wireframes.	06/10/2020 – 06/13/2020
4	3	Meet with supervisors to finalize the software use and capabilities. Check for any concerns, requests, or scope changes to the solution.	06/14/2020 – 06/16/2020
5	4	Determine the name of the software solution and present it to stakeholders.	06/17/2020 – 06/20/2020
6	5	Begin Development. See Development Schedule.	06/21/2020

### A.8 Scope

The scope of the Software Solution will include all stages of the Software Development Life Cycle (SDLC) up to two years after the development of the software. It will not include change requests



after development unless put through the change request process with the developer. After the two years of the maintenance stage of the SDLC, the software will no longer be considered within the terms of change requests and will be considered a new software development. Regular maintenance includes a monthly or yearly fee after the completion of development and specifically includes security and compatibility updates. The first year of maintenance is automatically covered in the fees.

The application is currently only considered for development on the Windows and Android application market and inclusion of the product on the Apple store can be put through as a regular change request but will affect pricing and the included timeline.

The current application includes the development of three different access points for the owner, supervisors, and workers. Each will only include pages relevant to their needs and will include: an overview page for quick reference of the day, a calendar for scheduling employees and employee requests, the ability to search employees and jobs, the ability to review business level reports, the ability to add or modify crews, workers, jobs, tasks, or tools, and messaging. The application will store contact information and can call a contact or navigate to an address at the push of a button.

Testing and integration plans are included in the scope of this solution. Testing will occur on the most recent versions of Android and Windows devices and functionality will be only required on the most recent updates. Any devices that are incompatible with the most recent version and device security will be considered incompatible with this software. This software will not be developed or supported on any devices not supporting the most recent version of Android and Windows, and any issues that arise from the software's use on those devices will not be considered the responsibility of 3 AM Productions.

The high-level reporting ability will include the ability to export to PDF. There will also be included a user manual that will explain the different functionality and use of the software. The software will address these business workflows: Activity Management, Contact Management, and Reporting. The scope may be increased to include the ability for the Reporting to include: Forecasting, Sales Opportunity Management, or Contracting. Currently, the scope does not include these functions. The reporting is intended as a tool used to create additional scheduling and income opportunities when paired with outside business development tools. The report itself does not produce additional income.

The client agrees to differ some of the costs of development and hosting by producing the application to allow for use by other potential clients on the application stores. The monthly costs for use of other interested parties will be decided by the developers with the contingency that there will be no ability for client or customer information being compromised or any drops in service.

## A.9 Environment Overview

This software solution will be developed using Xamarin Forms, which will include development for these operating systems:

- Windows PC
- Windows Phone or Tablet
- Android Device

Since this solution will leverage Xamarin Forms, it could be extended to include IOS devices but would require additional pricing and scheduling for development and testing. The application currently does not support a browser platform but leverages Microsoft's Azure to utilize:

- Microsoft's Azure SQL Database Server
- Microsoft's Azure App Service

Use of Microsoft's SQL Database Server will be routed through an API hosted on Microsoft's Azure App service to provide additional security and allow for the possibility of future web development of the application without having to change the entire backend.

#### A.10 Fulfillment

The software solution proposed by 3 AM Designs will fulfill the needs of Eve Habitats by ensuring employee, task, and job timesheets are recorded accurately and available to the owner upon their need. Having the record system transition to an application will provide a cloud-based system with easy access and communication.

The user will be able to login to their business portal and view the jobs and tasks required for them to have fulfilled. A registration page will allow owners to register new users to their business and for new businesses to start using the software. The application will check for internet access upon logging in and if the user is remote and access is limited, it will display the last known schedule. Once the user is reconnected, they will be able to modify the data.

After the initial login page, pages will be provided for each of the objectives of the aspects of the services, including tools, labor costs, tasks, and crews. Each page will allow the user to view, add, modify, and delete those aspects dependent upon their access level. The user will also have access to a calendar with the ability to request days off, and days where requests will be denied. The owner will be able to see requests and approve or deny them. The supervisor and workers will be able to clock themselves and tasks in and out. The owner will be able to track those times dynamically. Additionally, a chat feature will allow users to send updates to the owner or supervisor if workflow issues are encountered.

#### A.11 Developer Expertise

3 AM Productions is a Software Development company founded by Jesse Anderson, an imminent graduate from Western Governors University (WGU). The C# school requires the production of professional applications in Xamarin Forms and C# as coursework, and Mr. Anderson has completed each required course in his program at an accelerated pace. Multiple projects are available on request. The most recent project developed at 3 AM Productions was a Xamarin Forms course tracking application for tracking classes and assessments for students.

#### A.12 Proposal Highlights

- Eve Habitats has experienced a period of growth that is being hampered by their ability to successfully track employee times and workflow. Their current system is a binder that is frequently forgotten about or unused. This leads to the owner's additional frustration, income loss, and hours spent tracking down the correct information. To continue to expand, a different system must be introduced that allows for more accessible information exchange.

- Our proposed software solution will provide the users at Eve Habitats the ability to dynamically track its workforce and workflow. This will be accomplished with an application on the Android and Windows markets that hosts real-time cloud access to their scheduling and workflow. The burden of recordkeeping and upkeep will then be shifted from the owner to the workers, allowing the owner to focus more on keeping the workflow productive and bringing in more customers.
- Though the method of recordkeeping will change, the requirements for workers to make sure they use the system will not change. A system of responsibility will have to be introduced to leverage the company's new dynamic access to those records. Workers will be able to update them from their phone while on the move, without returning to wherever the workbook is located. With increased accuracy, the owner will have better scheduling and a better revenue stream.
- 3 AM Productions Owner has worked on several projects across different software platforms and has recently developed with this software a program that mirrors the needs of this specific project. The development of this application falls within the ability of the developer to produce this program.
- Eve Habitats can commit itself to further growth by moving from an archaic method of recordkeeping to a method that allows itself the freedom to continue to product revenue streams. Less time spent chasing after worksheets and checking their accuracy means more time developing current and new customers. It allows the owner to view the workflow at a glance and make real-time adjustments. Without this transition, the owner risks spending an exponential amount of time chasing records for every employee, crew, or customer he adds.

## B. Requirements

Eve Habitats requires its owner to leverage his time to produce more customers and accurately bill those customers for Eve Habitats to continue to expand beyond its current stage of growth. This system must be able to dynamically host workflow data and make it accessible to relevant workers, allowing them to update times of tasks and attendance in the workday. This software solution will be a combination of scheduler and timeclock application that replaces their current handwritten system. It will provide:

- Activity Management – A time clock and scheduling application will allow the owner and users to track the workflow
- Contact Management – Contact information will be recorded and accessed from the application
- Reporting – Reports will be viewed from the application and printable to pdf.
- Data Types – Private information will be protected behind the Azure Database and application suite.

### B.1 Business Requirements

The new application will provide a cloud-based database and accessibility to customer information from the user's device. It will provide snapshots of the workflow and the ability to update the schedule and accurately measure costs and income. The system will be designed to produce reports that will show areas of growth and availability in scheduling. This means multiple report types and the ability to export reports to pdf.

### B.2 User Requirements

Users must be able to search and view jobs and notes easily. Starting and stopping tasks should take moments and not require many multiple steps. The owner should be able to view the workday as it progresses and knows which job the workers are currently at with a glance. Reports will be simple to view and can send to pdf.

### B.3 Functional Requirements

The software will be based on the needs and framework of a landscaping company but be extensible into other service industry jobs. This will include the ability to add and charge for use of tools, labor, and task type. The owner will be able to add, remove, or change each of these fields.

The information will be house in Microsoft Azure SQL Database and use Entity Relationship Management (ERM) normalization to produce a stable database. Access to the database will be through a secure API set up on Microsoft Azure Application Service. The application will be able to be viewed with historical data when not connected to the internet for work when in remote areas and will be able to update upon request.

The main view of the application will give the user the ability to see the list of the job for that day. The database will have a calendar and request system for employee vacation scheduling. There will be a messaging application that allows communication between management and employees. Employees will be able to record start times and end times for tasks. There will also be a reports page for the owner to review which will show the different times recorded by employees.

#### B.4 Nonfunctional Requirements

The software solution will be user friendly and intuitive. For any gaps in understanding the software will come with a user manual. The solution will include security for the username and password that will protect from common hacking exercises. The system will use the C# programming language with Xamarin Forms to provide easy portability to other device platforms.

## C. Methodology

The Software Development Lifecycle (SDLC) methodology used at 3 AM is the Agile method. It is a very common methodology used in the market. The schedule and scope of the project will be subject to the method. It is an iterative process that allows the developer the ability to create bookmarks or checkpoints to review and readjust.

### C.1 Advantages

This method will allow the software to be adaptable while in development. It will allow more opportunities for stakeholder input in the process. Changes can be made during the development process. This creates a dynamic environment where change requests can be acted upon during development. This method requires thorough and ready communication throughout the development process. Shorter stages allow for early recognition of issues and adjustment to prevent larger issues with the software down the road.

### C.2 Disadvantages

The strength of this method easily communicates into its weakness. The dynamic structure of the method and short stages can cause projects to creep in scope and drag on forever. This can be expensive for companies who are looking to finalize a project but have many stakeholders and change requests. These weaknesses lead the methodology to be a poor choice for large projects and companies. This project is neither.

### C.3 Stages

The following stages are an overview and rough application of the methodology and are not meant to be directly taken as a schedule. Further in the document, a schedule is produced. The Agile Methodology has a different kind of framework and has a quick iterative method that doesn't align perfectly with the SDLC's model of Planning/Design, Implementation, Verification, Maintenance. Below we display it in those familiar stages to demonstrate how it fulfills each stage. Agile is primarily a development method focusing on the implementation stage, but its disadvantages are depreciated during the Planning and Verification stages.

#### C.3.1 Planning / Design

As the Agile method is an iterative process, it requires a careful examination of each stage. Before the first sprint, objectives are laid out for what objectives that sprint will focus on. Because of the quick navigation of change requests available to Agile development, this project will need a solid plan and scope in place before beginning. A well thought out scope in the planning stages will prevent many change requests and scope creep later as needs are discovered.

For this project, this will include the [Prerequisites](#) schedule that determines the scope in stages with the stakeholder to prevent heavy scope creep or large changes during development. Each sprint of the Agile method allows for a stage of planning the next set of objectives to complete, so between each sprint, we will review what is the next set of objectives to complete. Thorough communication and adequate planning in the initial planning stage will remove the weakness inherent in this development model.

### C.3.2 Implementation

The development process of the Agile method is broken up into a series of sprints and 'rests' where planning and review are done. These sprints of meeting objectives and rests where objectives are verified and new objectives are planned appear to fit into the Planning/Design and Verification parts of the SDLC but are smaller iterative parts of the implementation and development of the software. The value of the Agile method is the frequent rests to verify and plan, but the real meat of it is the sprint itself where objectives are completed in short iterative spans.

For this project, we will break down each section into units of development, and through them in each sprint. As we continue into rests we will reevaluate and verify the work done so far for completion. During a development sprint, objectives that are completed are tested for completion and adherence to the objective that was set. After the sprint, each objective will be checked to see if it was fulfilled correctly in a detailed manner that was laid out before the sprint began. So, between each sprint is a process of verification of the previous objectives, and careful examination and development of the next objectives. As the sprints continue and pass each phase of testing, the product continues forming and is delivered to the stakeholders for approval. If the scope set before the beginning of development is fulfilled in the stakeholder's eyes, the project is complete.

Between each sprint of the agile method is an opportunity to review and institute change management if an objective doesn't give the required results or the stakeholders discover an additional item for the scope. This change management process only happens between each sprint and is why communication is valued in this method.

### C.3.3 Verification

Since a measure of verification occurs throughout the development process, verification here means verification with the stakeholders that the completed project aligns with the scope. If the project has correctly planned, implemented, and verified throughout its iterative processes, this verification should be the stage of development that ends with publishing the application for use.

### C.3.4 Maintenance

This is the stage of development where the software has been successfully implemented at the company and the responsibility of the developer transitions to maintenance. It is a period to time established to cover regular updates and security enhancements. The change management process is closed at this point, and any additional features will need to be renegotiated.

3 AM Production's responsibility at this point will be to maintain the program and its background support for two years. The initial first year will be covered in the development costs, and additional maintenance costs will be billed at the end of the first year. Bugs discovered at this point will be resolved as part of the regular maintenance. After the two years, a regular maintenance contract may be reached.

Currently, the database is designed for limited use of a small landscaping company. If additional companies begin using the application, a fee will be applied for those companies to cover the costs of expanding the database. 3 AM Production absolves Eve Habitats of any responsibility to increase the capacity of the database. The current rage of Azure's services is \$5 a month which will be furnished yearly by Eve Habitats before December 1<sup>st</sup> for the continued use the following year.

## D Deliverables

The project deliverables will be created during project completion. They will be delivered to Eve Habitats during the duration of development and are not listed in chronological order.

### D.1 Project Deliverables

- **Project Scope**

The Project Scope included in this document will be delivered to Eve Habitats and covers the items to be developed in the project. The scope document defines what the project will cover and what the project will not cover. It gives a clear definition of what will be included for all parties.
- **Sprint Logs**

The records from each sprint including the objectives planned, how they were met, what was tested and verified, and what changes were requested.
- **Project Schedule**

The proposed schedule for the project and the actual timeline that occurred. The timeline will not include the prerequisites timeline shown earlier. The timeline will begin when the project formally begins.
- **Project Requirements Document**

The document lists all the requirements the project must meet to be considered complete. It includes requirements that are business requirements, user requirements, functional requirements, and non-functional requirements.
- **Testing Plan**

These are the verifications that will occur before the project is considered complete to show it has met all project scope and requirements.
- **Final Software**

The finished product will be downloadable by the members of the company with no payment for download or subscription. The Android Package (APK) or windows executable will be provided for sideloading onto the devices. The finished uncompiled software will remain the sole property of the developer 3 AM Designs for continued development for additional clients as per the development compensation agreement with Eve Habitats.

### D.2 Product Deliverables

- **UI Wireframe**

The user interface (UI) wireframes produced and reviewed by the stakeholders as early mockups. This document is loosely reflecting what the finished product may look like.
- **Class Diagrams**

Diagrams of what the class layout looks like before development to guide development. These are well thought out plans for development that allow development to flow quickly once it has begun.
- **ERD Diagram**

The ERD Diagram is for the database construction as an early development guide and reference that shows how the different tables will exist and relate to each other.
- **User Manuals**



User manuals on how to use the product will be furnished. They will be available in-app and printed for the owner to review.

## E. Design

The section describes the plan for the design of the software dependent on the initial planning documents provided below. More planning documents will be produced as development proceeds.

### E.1 Planning Documents

Planning documents included in this section include the initial Entity Relationship Diagram (ERD) and UI diagrams created for sampling to the prospect Eve Habitats and does not reflect the final database diagram or user interface created during development. Changes are necessary during development dependent on User Experience Design principles, available functionality, and changes necessary to fulfill the scope outlined in the scope document.

#### E.1.1 Initial ERD

The initial diagram displays functional dependencies between different tables that will be made accessible dependent on the owner’s email. The ERD displays industry-standard normalization and will adhere to industry security standards enforced by the Microsoft Azure platform.

Table E.1.1 ERD

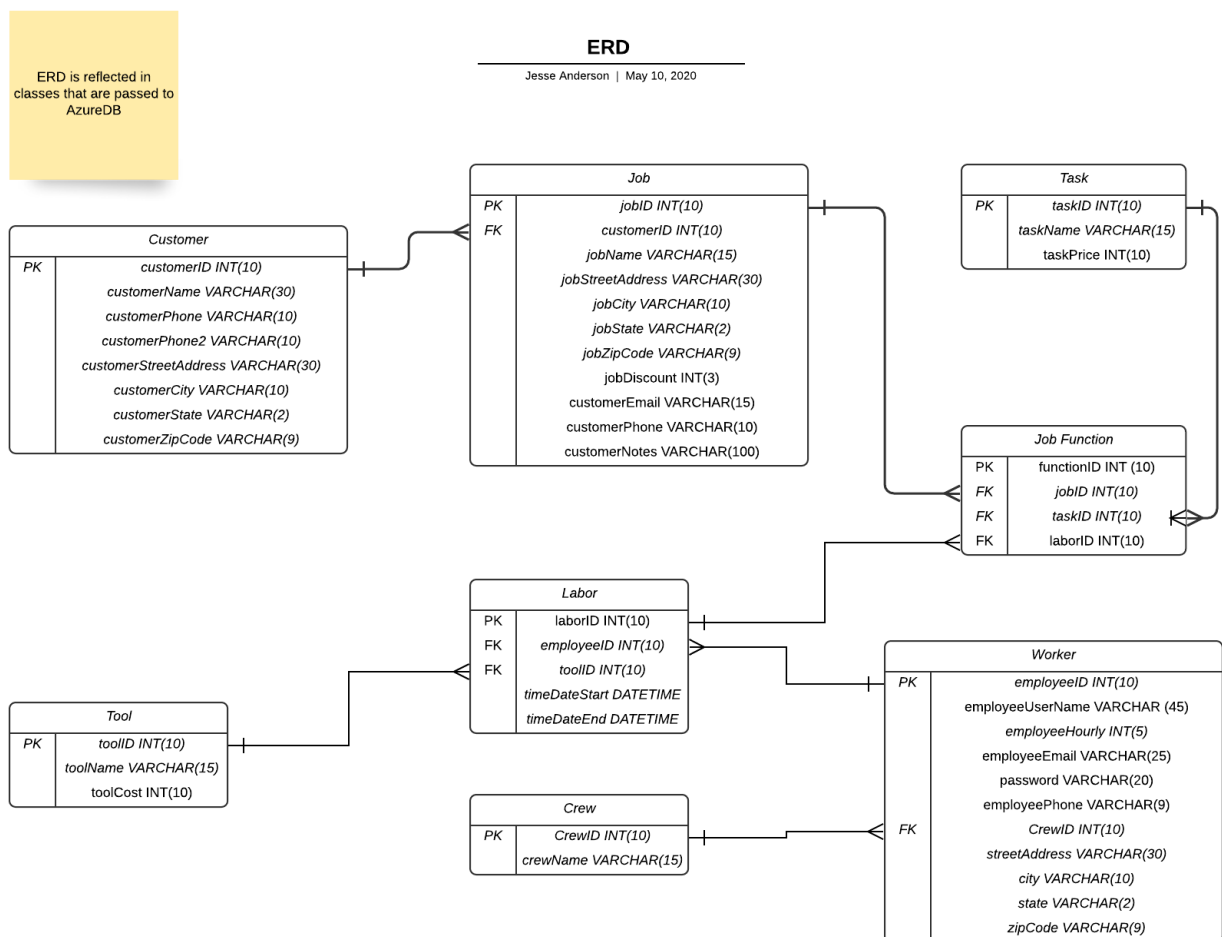


Figure 1 ERD created during the planning phase

### E.1.2 Initial GUI: High fidelity wireframing

The initial outline of the graphical user interface includes login and registration pages, splash pages for each level of business responsibility, and pages allowing business and task interaction. ‘Owner’ pages will assume the largest areas of responsibility and business functionality. ‘Supervisors’ will have some functionality allotted from the owner pages to allow them to oversee ‘worker’ user functions. ‘Worker’ pages will be allotted the lowest level of responsibility, but the most important function of the application, time tracking of tasks, and the employee.

Table E.1.2 GUI Pages

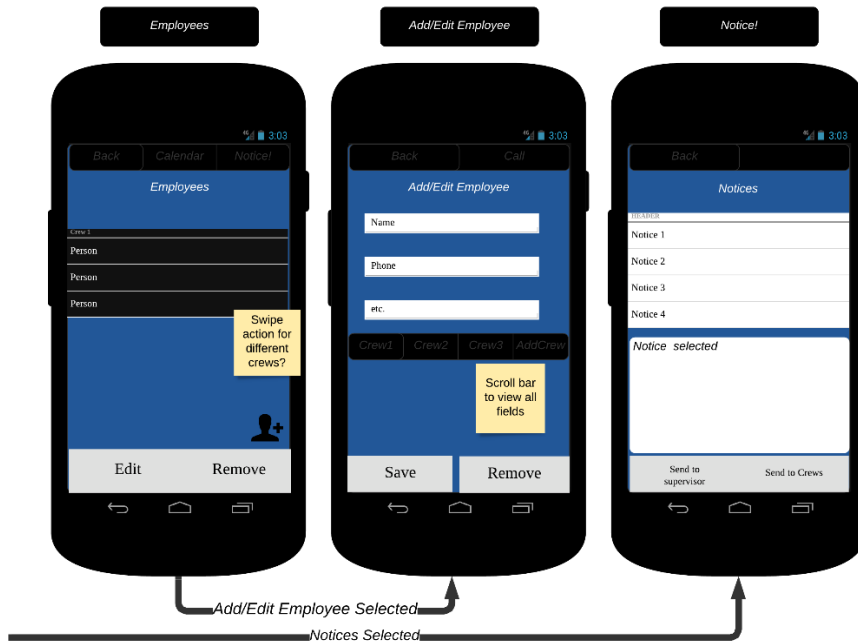


Figure 2 Series of Wireframes during the planning phase



**Owner Employee/Notice**

Jesse Anderson | May 10, 2020



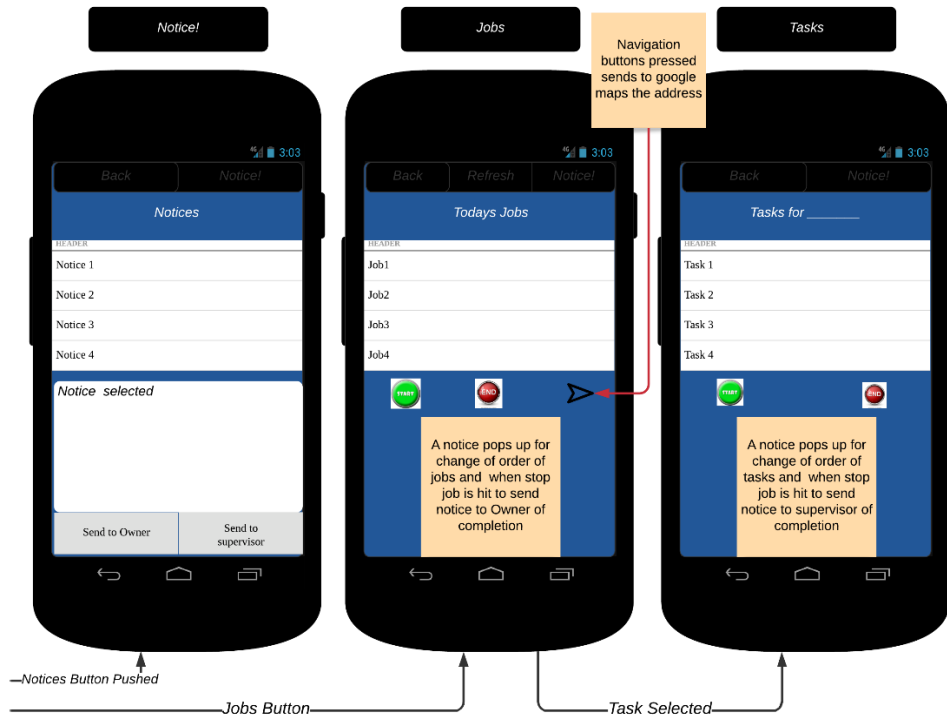
**Super Splash/Job/Task**

Jesse Anderson | May 10, 2020



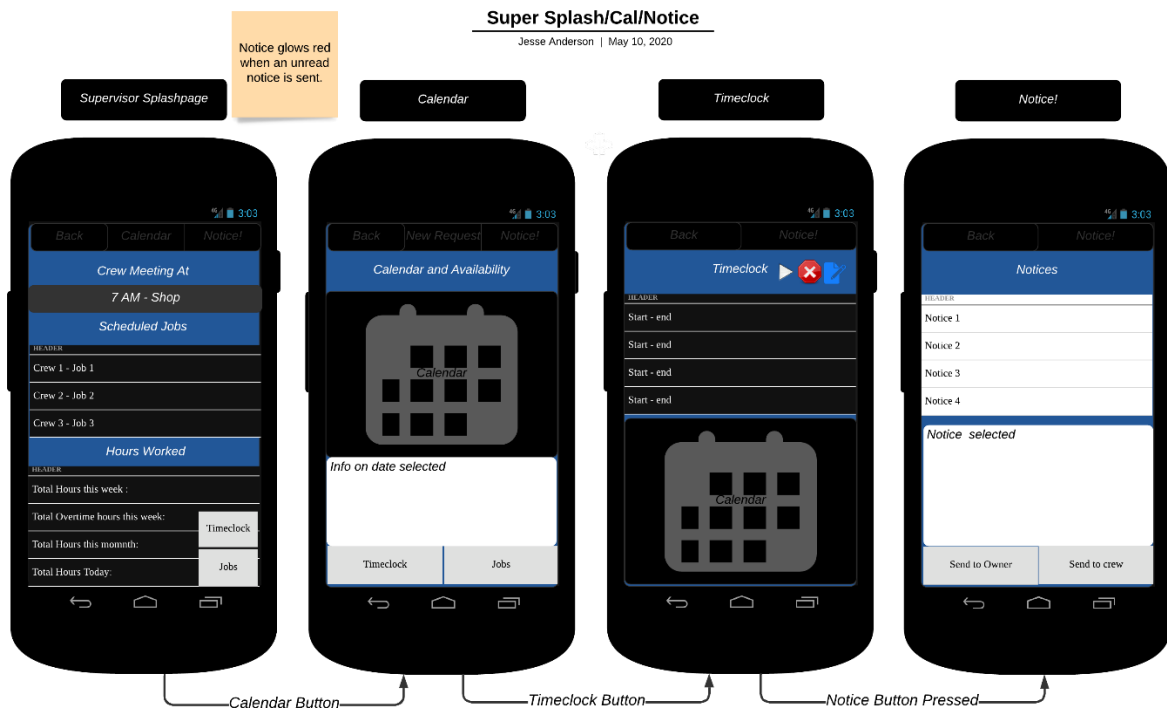
### Worker Pages Jobs

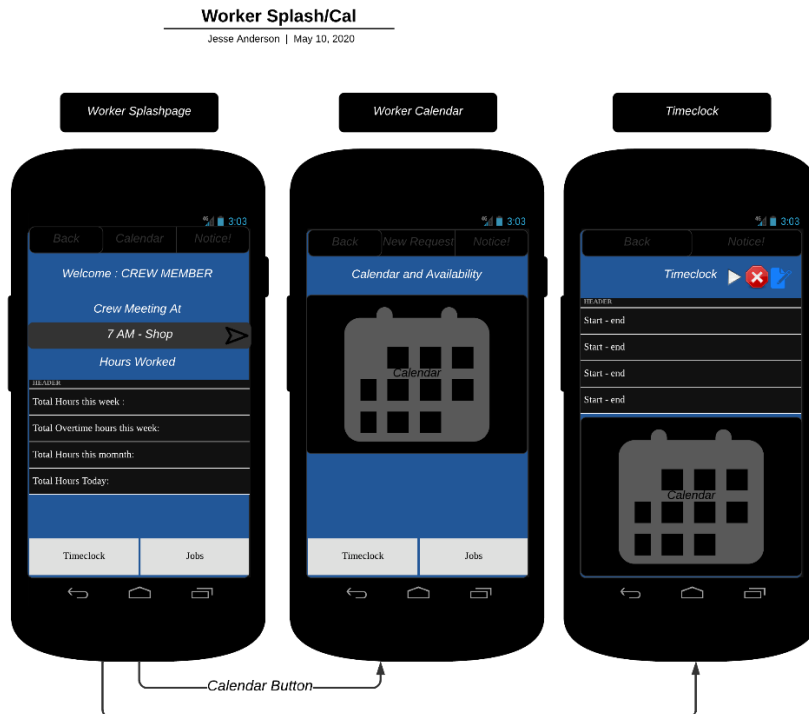
Jesse Anderson | May 10, 2020



### Super Splash/Cal/Notice

Jesse Anderson | May 10, 2020





## E.2 Implementation

The implementation of the software is when the actual physical development of the software will occur. This stage is outlined with applications in [Implementation](#) under Methodology. As there is one programmer for this project this will mean using the Agile methodology to plan iterative stages of development with frequent validation to check the design for necessary changes or bugs and making the changes then. Change requests will still be able to be submitted as the developer communicates and displays the fulfillment of the requirements. Once development is closing on its final drafts, submissions of the prototype will be made during regular updates that fall during rests between sprints.

The design will be broken down into objectives for completing individual page functionality and programmatic functionality. Page functionality as an objective will include loose alignment to the wireframe GUI. Programmatic functionality includes operations like using the Azure database. As sprints of development are complete, validated objective groups will be shared with the shareholders, and prototypes demonstrating functionality will be furnished when available.

## E.3 Integration

This phase of the software is after the production is complete and the software is delivered to Eve Habitats. Implementation of the software by 3 AM Designs will include successful installation on user devices. The user devices of Eve Habitats will be tested for functionality. The developer will be responsible for troubleshooting and bugs that arise on specific devices of Eve Habitat users.

The developer will be responsible for the training on the information in the user manual. It will be the owner and supervisor's responsibility to ensure the use of the software by the employees. After the initial scheduled training for the owner, supervisors, and workers it will be their responsibility to train further employees on how to use the application.

## F. Validation and Verification

Validation of the software will occur throughout development with unit testing of each objective completed. Additional validation will occur before integration to assure the final product meets all the [scope](#) and [requirements](#) outlined above. Fulfillment is outlined in section [Fulfillment](#). Verification will be concluded after completion of the following tests. Afterward, the product will be turned over to Eve Habitats for final approval.

### F.1 UXD Platform Testing

This unit of testing will test on the following platforms the software for UX Design issues due to incorrect rendering or bugs that prevent functionality. These will be tested by navigating through each of the pages on both platforms and checking to see if rendered pages display correctly. Adding, modifying, and removing a single worker and crew from the database will sufficiently test the database connections to the Azure Database and SQLite database.

#### F.1.1 Windows Platform

Agile objective testing will be in debugging mode available on visual studio, but this test will be performed on a windows computer from an executable and not the windows tablet or phone. Functionality should be mirrored correctly on both tablets and phones based on what is rendered on the desktop. Tests will check what is described above and this platform will be considered functional when they are complete with no errors.

#### F.1.2 Android Platform

Agile objective testing will be on an Android emulator, but this will be performed on two android devices. This will mean the creation of an Android Package (APK) and sideloading on both devices before the release of the application to the android store or Eve Habitats. Validation on this device will be considered complete when the above testing is completed with no errors.

## F.2 Report Creation

The developer will test the ability to display business reporting by both viewing tables on the application and exporting a PDF of the data. The report must be clear and display a snapshot of information for the owner. This function is necessary for the development of future scheduling and business opportunities and is not intended to be a tool used in tandem with other business practices and not promised to chart and create a business opportunity. So, the information should be clear and concise for outside use.

### F.2.1 On Device Report View

This will include viewing data added from other parts of the application into a concise view showing hours worked on specific jobs and tasks. Validation will be complete for reporting when the reports tab is selected, and the reports are navigated through with no errors.

### F.2.2 PDF Export

Exporting the report will produce a PDF for viewing and sharing with other devices and software. The PDF is not formatted for any specific software, business development, or business auditing. This test will be considered complete when information is exported with no errors and the PDF is viewed on the device.

### F.3 Use Case Scenarios

Below are 3 scenarios of use that a user may require the application that aligns with the requirements outlined above. Each use case is created to describe a scenario with a user persona that illustrates the fulfillment of requirements in a storyboard format intended to reflect real-life requirements that Eve Habitats will require.

#### F.3.1 Use Case 1: Correct times incorrectly entered



Daan is a student at a local college who is working part-time as a supervisor for a hardscaping and pool installation business in Miami. Daan noticed that the clock on the truck was off and the other employees on his crew had used it to enter the times for the day. Daan must correct the times entered by those employees.

#### Key Attributes

- Name: Daan Van Dijk
- Age: 21
- Married: Yes
- Kids: 0
- Sex: Male



#### Background

- Occupation: Student and part-time employee
- Salary: 20,000/Year
- Education: Highschool
- Origin: Netherlands, Utrecht
- Home: USA, Miami, FL

#### Positive Points

- Speaks 5 languages
- Pursuing nursing degree
- Very Confident & takes initiative
- Plays classical piano



#### Pain Points

- Stubborn
- Doesn't like technology
- Travels often and seldom stays at one job
- Prefers a flip-phone

Figure 3 User Persona 1



F.3.2 Use Case 2: New Customer and Job Registration



Sarah is the owner of a gardening and soft scaping company in Oklahoma City who needs to enter new customer information. Sarah met a neighbor down the street from a customer and needs to enter their information for a job for two weeks from now.

🔑 Key Attributes

- Name: Sarah Bell
- Age: 38
- Married: No
- Kids: 1
- Sex: Female

👤 Background

- Occupation: Business Owner
- Salary: 150,000/Year
- Education: Bachelors Degree
- Origin: USA, Portland OR
- Home: USA, Oklahoma City, OK

✓ Positive Points

- Loves to stop and enjoy nature
- Knows every country song
- She's a hugger
- Very detail oriented
- First business owner in her family

✗ Pain Points

- She's a hugger
- She often micromanages
- She cant leave until its perfect
- Works extremely long days

Figure 4 User Persona 2



F.3.3 Use Case 3: Complete a job

George is a long-time retiree from a teaching position in Albuquerque and has been traveling every year. This year he wanted to take an additional trip to Dubai and started working as a delivery driver and soft-scaper with pine mulch for a soft-scaping company. He needs to show that he delivered and spread the pine needle bushels a residential property.

🔑 Key Attributes

- Name: George Diamond
- Age: 66
- Married: No
- Kids: 1
- Sex: Male

👤 Background

- Occupation: Retired Teacher
- Salary: 50,000/Year
- Education: Bachelors Degree
- Origin: USA, Raleigh, NC
- Home: USA, Albuquerque, NM

✓ Positive Points

- Goes on a yearly destination vacation
- Loves photography
- Been to every continent
- Taught in public schools for 40 years

✗ Pain Points

- Gets back pain when doing any lifting
- Really quiet and doesn't communicate well
- Likes to be alone

Figure 5 User Persona 3

## G. Resources and Costs

This section outlines the resources and costs involved in creating and maintaining the software solution proposed. Each resource and cost is broken down into its smallest part.

### G.1 Environment Breakdown

The development environment will be using C# with Xamarin Forms for cross-platform development. The software will be developed for Android and Windows platforms and will make use of the relevant emulators for system testing. The software will make use of SyncFusion's developer packages for Xamarin. For small business development, SyncFusions plug-ins are free. If during the development process Eve Habitats decides to expand the development of the software solution to include IOS devices the environment costs will change to include purchasing a new Apple device for the developer to test the solution.

The software will use 2 database solutions to retain continuity offline and online. They are described below:

#### G.1.1 SQLite

This database will be used to display the last information passed from the Azure database when the internet is unavailable. It will also be used for creating crews on individual owner devices. The database will require additional space on the device but has no cost included.

#### G.1.2 Azure

The Azure platform is a secure hosting platform provided by Microsoft for cloud software solutions. This software utilizes Azure's SQL database and Azure's Application Service.

- Azure SQL Database Description:

A PaaS SQL server solution that displays the resources in a single view, IaaS virtual machines with direct database engine access. Costs for the database start at \$6 a month for limited usage. The database is designed for continuity and availability. If additional use is required Eve Habitats agrees to pay for the upgraded service. The development of the software solution is expanded to allow for additional companies to leverage at a cost to differ the costs of upgrading the service.

- Azure Application Service Description

Azure hosts an API platform service that can connect to Github for continued development. A secure interface for Azure's SQL Database, the applications service adds no additional costs to hosting.

### G.3 Programming Costs

The software developer will be considered a contractor for the duration of the project. Additional costs may be incurred for additional meetings and change requests outside of the [Prerequisites](#), [Scope](#), and [Integration](#) plans. If a change request falls outside of the scope that requires the developer to hire additional help, this will be billed separately to Eve Habitats as an additional contractor and Eve Habitats agrees to be responsible for the immediate fulfillment upon project completion. A table has been designed under the '[Budget](#)' of billing estimates to display unit costs for

each part of the Software Development Life Cycle (SDLC). Some items in the SDLC have been broken down while others are billed as a unit.

#### G.4 HR Costs

The Eve Habitats software project will have some foreseen additional expenses. One such expense will be the training of the employees to use this solution. The developer is not required to compensate the employees during training. The employer will cover all costs associated with training. Additional costs may occur if the developer requires travel arrangements to be made to meet during the prerequisites and integration stages and those will also be covered by the customer. Costs for compensation of the developer's travel will be incurred at \$15 / hour or \$15 / mile driven, whichever is higher.

#### G.5 Budget

Below is a budget estimate of the costs associated with the development of the project. A discount has been applied due to the freedom of use the developer retains to continue development outside of the scope for additional companies. Marketing, maintenance, and customer service from the use of the application stores will be the responsibility of the developer. Estimated totals may vary due to the increased needs of the client.

Table G.5 Budget

<i>Resource or Unit of Development</i>	<i>Hourly Rate</i>	<i>Estimated Hours</i>	<i>Total</i>
<i>Prerequisites meetings</i>	25	60	\$1,000
<i>Planning/Design</i>	30	200	\$6,000
<i>Implementation</i>	40	900	\$36,000
<i>Verification</i>	25	100	\$2,500
<i>First Year Maintenance / Month</i>	25	8	(Included)
<i>Estimated Second Year Maintenance</i>	25	8	(\$200)
<i>Change Management Meetings</i>	25	-	-
<i>Integration</i>	25	8	\$200
<b><i>Subtotal</i></b>			<b>\$45,700</b>
<i>Discount (outside dev application)</i>	25% discount		-11,425
<b><i>Total</i></b>			<b>\$34,275</b>

Billing will be divided into 3 installments of 30%, 30%, and 40% throughout the project. The first 30% will be due upon completion of the prerequisites. The second will be due two months into the project and the final payment will be made upon completion of integration. Payments will be made promptly, and development and services will be suspended if payments are delayed.

## H. Schedule

3 AM Designs will schedule an aggressive development schedule to complete this software solution for Eve Habitats. The development methodology is the Agile method, so stages of the schedule and timeline may be broken down into multiple sprints and rests as development, planning, and verification iterate through the process. Because of the flexibility of this methodology the schedule is an estimate and does not reflect actual hours and days, but instead segments of time. Estimates will be based on the expected duration of each sprint. This schedule will follow the [Prerequisites](#) and will require the completion of that schedule first. The schedule is intended to show a flow of development and is not meant to be taken as a direct reflection of a schedule.

Table H Schedule

Objective/Phase	Dependencies	Estimated Duration in workdays	Projected Start Date	Projected End Date
<b>Phase 1:</b> <a href="#">E.3.1 Planning/Design</a> <a href="#">G.1 Planning Documents</a> Change Management	Must complete prerequisites to determine complete scope before beginning Planning/Design	25 Days	06/21/2020	07/22/2020
<b>Phase 2:</b> <a href="#">G.2 Implementation</a> Sprint Planning <a href="#">Development Sprint</a> Development Validation <b>Estimated sprints: 17</b>	Must complete Phase 1: Planning/Design before starting to prevent endless change requests and iterations	<b>Per Sprint:</b> 2 Days / Sprint 5 Days / Sprint 1 Day / Sprint 113 days	07/22/2020	12/24/2020
<b>Phase 3:</b> <a href="#">H. Verification</a> Platform Testing Report Creation testing Use case scenarios	Final verification follows Phase 2: Implementation, which must be completed testing	12 Days	01/01/2021	01/16/2021
<a href="#">G.2 Integration</a>	Once verified by the customer in Phase 3: Verification, the product is delivered to the customer and they are trained	3 Days	01/17/2021	01/20/2021
<a href="#">E.3.4 Maintenance</a>	The product is reviewed for bugs and updated regularly. User issues are resolved.	1 Year	01/21/2021	01/21/2022

## I. Sources and References

Wingen, Malte (Photographer). (2018, November 18). Retrieved from <https://unsplash.com/photos/85XLV4Po2mk>

Borba, Jonathan (Photographer) (2020, April 28) Retrieved from <https://unsplash.com/photos/vLnmmRq6bMY>

Maria, Orlova (Photographer) (2019, February 5) Retrieved from <https://unsplash.com/photos/LuRFzqHGiA4>

Birkett, Adam (Photographer) (2017, August 15) Retrieved from <https://unsplash.com/photos/TLomZTHslqg>