Risk Management Plan for Irrigation Recommendation System

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Version 1.5

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1. Introduction

1.1 Purpose

The purpose of this Risk Management Plan is to list and organize potential issues that may arise during the course of this project. By being forward thinking about these potential issues, strategies can be developed to mitigate or avoid these risks, if they do arise.

1.2 Evolution of the Risk Management Plan

This document will continue to change throughout the course of this project. It will be updated periodically to reflect changes to any referenced documents and any changes in the risk management plan.

Version	Date	Author	Changes
1.0	7/8/2017	Raulie Raulerson	Initial version
1.1	7/12/2017	Raulie Raulerson	Added section 2
1.2	7/14/2017	Raulie Raulerson	Added section 3
1.3	7/16/2017	Raulie Raulerson	Added section 4
1.4	11/1/17	Raulie Raulerson	Revised section 4
1.5	12/4/17	Raulie Raulerson	Revised section 1.3

1.3 References

1.3.1 Project Definition Report

Version	1.2
Date	10/5/2017
Author	Raulie Raulerson

1.3.2 Software Requirements Specification (SRS)

Version	1.7
Date	12/4/2017
Author	Raulie Raulerson

1.3.3 Software Design Description (SDD)

Version	1.3
Date	12/5/2017
Author	Raulie Raulerson

1.3.4 Software Project Management Plan (SPMP)

Version	1.5
Date	12/4/2017
Author	Raulie Raulerson

CGE Risk Management Solutions. (2017). Risk Matrices. Retrieved June 25, 2017, from https://www.cgerisk.com/knowledge-base/risk-assessment/risk-matrices

CMMi Risk Management (RSKM). (n.d.). Retrieved July 01, 2017, from http://www.software-quality-assurance.org/cmmi-risk-management.html

OpenCampus. (n.d.). Risk Identification tools and techniques. Retrieved July 08, 2017, from https://www.greycampus.com/opencampus/certified-associate-in-project-management/risk-identification-tools-and-techniques-in-capm

Pressman, R. S., & Maxim, B. R. (2015). *Software engineering: A practitioner's approach* (8th ed.). New York: Mcgraw-Hill.

Please note that the CMMi Risk Management template (referenced above) was used to complete this Risk Management Plan.

1.4 Definitions, Acronyms, Abbreviations

API – Application Programming Interface

EC – Electrical Conductivity

EV – Earned Value

FDACS – Florida Department of Agriculture and Consumer Services

PV – Planned Value

RMMM – Risk Mitigation, Monitoring, and Management

RNN – Recurrent Neural Network

SBDTS - Software Budget and Detailed Timeline Spreadsheet

SDD – Software Design Description

SDLC – Software Development Life Cycle

SPI – Schedule Performance Index

SPMP – Software Project Management Plan

SMS – Soil Moisture Sensor

SRS – Software Requirements Specification

STD – Software Testing Document

UI – User Interface

2. Risk Management Preparation

2.1 Risk Sources and Categories

2.1.1 External Risk Source List

- Ambiguous requirements.
- Changing requirements.
- End users unwilling to embrace technology.
- Miscommunications with client and/or mentor/management.
- Negative and insurmountable feedback from client and/or mentor/management.

2.1.2 Internal Risk Source List

- Project budget.
- Design issues.
- Resource issues.
- Scheduling/tracking issues.
- Testing issues.

2.1.3 Risk Categories

The following categories and sub-categories will be established for the risks identified:

- Communication
  - Project Initiation
  - Requirements Gathering
- Planning
  - Estimating
  - Scheduling
  - Tracking
- Modeling
  - Analysis
  - Design
- Construction
  - Coding
  - Testing
- Deployment
  - Delivery
  - Support
  - Feedback

These categories and sub-categories will make it easier to identify what phase in the software development life cycle that the risk is most likely to occur in. The categories and sub-categories identified above are the stages seen in the software development life cycle (SDLC) according to Pressman and Maxim (2015, p.42).

2.2 Risk Parameters

The risk likelihoods and consequences listed by CGE Risk Management Solutions in their Risk Matrices article were used in developing the risk matrix seen below, risk likelihoods, and risk consequences for this project (2017).

2.2.1 Risk Likelihood

The following likelihoods, that correspond to the range of percentages noted, will be used when ranking the probability that a particular risk might occur:

- Highly unlikely (HU) – 0-20%
- Unlikely (U) – 21-40%
- Possible (P) – 41-60%
- Likely (L) – 61-80%
- Highly Likely (HL) – 81-100%

2.2.2 Risk Consequences

The following consequences for the project will be assumed when ranking the impacts that will result if a particular risk were to occur:

- No impact (NI)
- Small (SM)
- Medium (M)
- High (H)
- Severe (S)

2.2.3 Thresholds to Trigger Management Activities

One threshold that will be utilized to inform management if the project is falling behind is the Schedule Performance Index (SPI). The SPI is calculated by dividing the earned value (EV) of the project to date by the planned value (PV) to date (SPI = EV/PV). This will be done by calculating the earned/actual amount of money earned so far versus the amount of money that was planned to be earned at that point in time. If this value is below 90% than management will be informed, so a decision can be made about getting the project back on track. This threshold will be used specifically in the Planning category.

No other thresholds are proposed to be used as status updates/progress reports will be submitted to management for their feedback on the progress of the project. These updates will occur weekly throughout the course of the project.

2.3 Risk Management Strategy

The strategy that will be utilized to manage risk throughout this project will be a robust and comprehensive method. A number of methods are outlined below that will be part of the overall strategy for dealing effectively with risk throughout the course of the project. Documentation reviews will be the main technique for identifying risks that may occur in the project. In addition, brainstorming with the client and mentor/management may lead to the identification of other risks (OpenCampus).

There are a number of techniques that could be used to analyze risks (i.e., sensitivity analysis, etc.) associated with the project. However, given the limited scope of the project, the analysis will simply consist of placing each risk in the appropriate category, and sub-category, determining its likelihood to occur, and the severity of any impacts to the project, if the risk were to occur.

Risks will be monitored during the course of the project by examining the risks identified in this document for each category, and sub-category. The categories and sub-categories of risks will help the project manager watch for the possibility of particular risks as he progresses through that particular phase of the SDLC. The project manager will also use the documentation review technique to search for any possible risks arise during a particular phase of the SDLC.

When a team of software engineers work on a project together, they typically develop a Risk Mitigation, Monitoring, and Management (RMMM) plan. This plan involves peer review of any documents produced, as well information sharing amongst the team. The idea is to ensure that there are collogues that can provide back up to the other software engineers in case of turnover, etc (Pressman & Maxim, 2015). Because of the limited resources and staff involved in this project, this approach isn't feasible. Instead, documentation review will be the main method for monitoring risks during the project. The mentor/management will also review these documents and will provide feedback, as appropriate.

An evolutionary, prototyping process model will be used to help mitigate any potential risks associated with the design and construction of this project. By providing the client with frequent prototypes during the coding phase, feedback will be solicited often and, hopefully, any risks regarding client satisfaction will be avoided. During the communication and modeling phases of the SDLC, the mitigation plan will be to ask enough questions to elicit the requirements necessary for the project. Frequent, communication (preferably written) will occur to mitigate any issues in the requirements gathering or design phases. The best plan for mitigating any risks in the testing phase will be to have enough time to run a diversity of tests on the project's code.

Finally, it is important to note that this document is dynamic and that risks will be monitored constantly throughout the project. If any risks that are not included in this document have the probability to occur, they will be added to this document. In addition, the risks currently listed in this document will be reassessed throughout the project to determine their likelihood and possible consequences to the success of the project.

3. Risk Identification and Analysis

3.1 Risk Identification, Evaluation, Categorization, and Prioritization

ID	Risk	Category	Sub-category	Likelihood (HU/U/P/L/HL)	Impact (NI/SM/M/H/S)	Priority*
1	Underestimated project budget	Planning	Estimating	P	M	6 *(12)*
2	Design is difficult to implement	Modeling	Design	P	H	4 *(21)*
3	Ambiguous requirements provided by client.	Communication	Requirements Gathering	P	M	7 *(6)*
4	Project will fall behind schedule	Planning	Tracking	P	H	5 *(14)*
5	Product will not integrate well with other existing data sources	Deployment	Delivery	P	SM	2 *(25)*
6	Frequent changes in requirements.	Communication	Requirements Gathering	P	M	7 *(6)*

7	End user will not be willing to utilize the product.	Deployment	Feedback	L	SM	1 *(30)*
8	Issues with project code encountered while testing.	Construction	Testing	P	M	3 *(24)*
9	Negative and insurmountable feedback from client and/or mentor/management.	Deployment	Feedback	U	H	1 *(30)*

*** Total points are shown in parentheses and italics.**

To determine the priorities of the risks identified above, a weighting system was developed to be used in calculating priorities.

The following points were assigned to the Likelihood column:

- Highly unlikely (HU) – 1 point
- Unlikely (U) – 2 pts
- Possible (P) – 3 points
- Likely (L) – 4 points
- Highly Likely (HL) – 5 points

The following points were assigned to the Impacts column:

- No impact (NI) – 1 point
- Small (SM) – 2 points
- Medium (M) – 3 points
- High (H) – 4 points
- Severe (S) – 5 points

The following weighting factors were applied to each SDLC phase defined:

- Communication – 1.0
- Planning – 2.0
- Modeling – 3.0
- Construction – 4.0
- Deployment – 5.0
-

Please note that higher weights were assigned to the phases that occur later in the SDLC. This is because it is much harder to mitigate or address risks that occur later in the SDLC.

The total points for a risk was calculated by summing up the number of points for the risk's likelihood and potential impacts and multiplying that sum by the weighting factor assigned to the SDLC phase it falls into. This is shown in the equation below:

Risk's Priority = (Likelihood (pts) + Impact (pts)) x Risk's Category

Below is an example of the priority for the risk with ID #1 being calculated:

Risk ID #1's Priority = (3 points + 3 points) x 2.0 = 12

Thus, the risk with ID #1 has a priority total of 12 points because it is **possible** that it will occur, it will have a **medium** impact, and it falls in the **Planning** phase of the SDLC. Rankings will be determined using total points with priority #1 assigned to the risk with the highest total. The same priority level will be given to risks with the same point totals.

4. Risk Mitigation

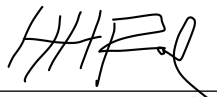
4.1 Risk Mitigation Plan and Plan Implementation

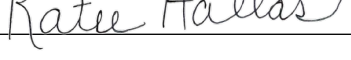
The appropriate handling of risks requires developing a plan to mitigate the risks identified in section 3 of this document. The plan for mitigating the risks identified in section 3 will primarily be risk avoidance, monitoring, and acceptance. Avoiding risks will be the preferred course of action in this this plan.

Risk monitoring will occur during each phase of the SDLC and monitoring activities will be focused on avoiding the risks, identified in section 3 of this document, that occur within that specific phase of the SDLC. Each risk will actively be monitored as mentioned above and its status will continually be updated if the risk's likelihood or possible impacts change. Utilizing the risk table in section 3 will help assess which risks are most likely and begin to implement a mitigation strategy for them. For instance, the risk with ID 9 has the highest priority and could greatly impact the outcome of the project. However, because this risk has been assessed and evaluated early on in the project, the project manager will ensure that frequent communication occurs with the client and the mentor/management. This strategy will help avoid the potential ramifications of this particular risk. Risks that have a small to no impact will also be monitored, but no strategies will be developed to mitigate these risks as their impacts will be negligible.

This risk mitigation plan will be implemented by having a risk management section of the project's Progress Reports that will be updated to identify and document the risks that may occur during the SDLC. The Progress Reports will be submitted to the mentor/management twice per semester. The section of the progress report will identify the SDLC phase that the project is currently in, the risks identified for that phase, a list of the risks that have previously been identified and evaluating for their potential to occur during that phase, likelihood for each risk, potential impacts associated with each risk, and the individual countermeasures that will be employed to avoid or mitigate those risks. This form will be updated twice with notes detailing what monitoring or handling of risks has occurred throughout the week. The two progress reports were submitted on 10/15/2017 and 11/5/2017 to provide the mentor/management with a risk monitoring and assessment update during the SDLC.

5. Risk Management Plan Approval

Project Manager Signature 

Client Signature 

Mentor/Management Signature _____