Graphical user interface, text, application

Description automatically generated

**SOEN 6481 Systems Requirements Specification**

Delivery #2

***Requirements Analysis and Risk Evaluation***

Submitted To: **Prof. Dr. Rodrigo Morales**

**Requirements Analysis and Risk Evaluation**

**Task 0 - Logging**

|  |  |  |
| --- | --- | --- |
| **S.No .** | **Task** | **Time Spent (Hours)** |
| 0 | Task 0 - Logging | 5 mins |
| 1 | Task 1 – Identifying and finding inconsistencies in the vision document | 3 |
| 2 | Task 2 – Documenting conflicts | 2 |
| 3 | Task 3 – Conflict resolution | 1 |
| 4 | Task 4 – Conflict evaluation | 2 |
| 5 | Task 5 – Risk management | 4 |

**Task 1 – Identifying and finding inconsistencies in the vision document**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Defect #** | **Location** | **Defect**  **type** | **Classification** | **Description** | **Status** | **Date Corrected** |
| 1 | 3.1. Stakeholder Summary | Omission | Major | Missing key Stakeholders to illustrate the requirements. No information regarding Competitors who are one of the primary stake holders |  |  |
| 2 | 3.2. User Summary | Omission | Major | Consumers age requirement is nowhere mentioned in the vision document. |  |  |
| 3 | 3.3. User Environment | Inadequacy | Minor | Not sufficiently describing the future enhancements of the product. |  |  |
| 4 | 3.4. Key Stakeholder or User Needs | Omission | Major | Tool reservation constraints were not explained in the User needs section. |  |  |
| 5 | 3.4. Key Stakeholder or User Needs | Omission | Major | Information regarding rental period is not mentioned as a part of user needs. |  |  |
| 6 | 4.1. Product Perspective | Inadequacy | Minor | Architecture Diagram can be more detailed. Only Abstract information are given. System's stack is not explained in the architecture diagram Only System's data flow is covered. |  |  |
| 7 | 4.2. Assumptions and Dependencies | Ambiguity | Major | Exceptional cases like rental tool lost, rental tool damage policies are not emphasized in the Assumptions and Dependencies section. |  |  |
| 8 | 5. Product Features | Inadequacy | Major | Products primary features like password recovery, Web Push Notification and Live chat were not included as a part of product features |  |  |
| 9 | 6. Other Product Requirements | Contradiction | Minor | Market is flooded with lot of browsers, there is no information about the best supported browsers to access the application. |  |  |

**Task 1.1 - Inconsistencies Inspection Form**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **S.no** | **Location** | **Inconsistency type** | **Classification** | **Description** | **Status** | **Date corrected** |
| 1 | ***3.4. Key Stakeholder or User Needs*** S1 : Customers must be at least 18 years old.  S2 : Customers must have a government-issued photo ID that is valid at the time of rental. | Designation | Weak | Customers who are 18 years old, might not have a valid government ID, as they would have just turned out 18, they might have applied for a government ID, there should be an option to accept college ID to verify the age. |  |  |
| 2 | ***3.2. User Summary*** S3 : Store branches are being added, modified, and deleted by system administrator.  S4 : Customers can request a reservation for as early as the next day and up to 30 days in advance. | Structure | Strong | Customers might rent tools or reserve tools in advance, but due to organization policies if Administrator tries to delete a branch, System shouldn’t permit the administrator to do so as they were some existing rental reservations existing in advance for the respective store/Location. |  |  |
| 3 | ***3.4. Key Stakeholder or User Needs*** S5 : The branch employees are responsible for adding/removing tools for rental in their respective locations.  S6 : The branch employees are also responsible to hand out the tools to the customers in store, and to receive them. | Designation | Major | Once the customer returns the equipment, the branch manager should place the tools in the store and failing to update in the system will never update the availability of tools and there will be an inconsistency between the tools available in the store and the available rental tools in the ETR system. |  |  |

**Task 2 – Documenting Conflicts**

A standard documentation technique consists of building an interaction matrix (Kotonya & Sommerville, 1997).

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Statements** | **S1** | **S2** | **S3** | **S4** | **S5** | **S6** | **S7** | **S8** | **Total** |
| **S1** | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| **S2** | 1 | 0 | 0 | 1000 | 0 | 0 | 1000 | 0 | 2001 |
| **S3** | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| **S4** | 0 | 1000 | 1 | 0 | 0 | 0 | 1000 | 0 | 2001 |
| **S5** | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| **S6** | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| **S7** | 0 | 1000 | 0 | 1000 | 0 | 0 | 0 | 0 | 2000 |
| **S8** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Total** | 1 | 2001 | 1 | 2001 | 1 | 1 | 2000 | 0 | **6006** |

Total number of non-conflicting overlaps and conflicts : 6006 / 1000 = 6.006

Conflicts = 0.006

***So, according to interaction matrix,***

Total number of conflicting statements = 6

Total number of overlapping statements = 6

**Task 3 – Conflict Resolution**

***3.1. Conflict between S1 and S2 :***

**Operator Applied: Specializing Conflict source or target**

This conflict can be resolved by specializing the conflict source or target by enabling the auto verification of the customers age by integrating the system with Federal system, whereas the customer can enter their last 4 digits of SIN id and the system can identify the customer’s age by request authorization approved from the Government.

**Operator Applied: Weaking Conﬂicting Statements**

The conflicting statements can be weakened by, accepting any non-governmental ID’s too which has the date of birth details in it.

***3.2. Conflict between S3 and S4 :***

**Operator Applied: Avoid Boundary Condition**

The specific boundary condition for this conflict is Admin’s privilege to delete a branch and User’s privilege to rent or return the tools, these two statements are contradicting and puts the system in a deadlock situation if the admins deletes a store which has some reservations and ongoing rental records, it will end up in data loss and financial loss, this can be eradicated by introducing a new requirement that, Admin will never be allowed to delete a store, until the store has no reservation or rental records.

**Operator Applied: Restore Conflicting Statements**

The statements S3 and S4 can be retained by, having a law imposed by board of directors of ETR organization, to not to delete a store until the organization decides to close the business in a particular location due to some non-functional and business-oriented issues.

***3.3. Conflict between S5 and S6 :***

**Operator Applied: Avoid Boundary Condition**

If the branch employee doesn’t update the system after receiving the equipment from the rental customer the boundary condition would occur where the customer won’t have the details of the updated inventory in the system, this can be avoided by having an automated system to perform an inventory count in the respective store before closing the business for the day and updating them in the system.

**Operator Applied: Weaking Conﬂicting Statements**

The Statement S6 can be made weaken by having a dedicated branch employee team who can focus only on receiving the tools and updating them in the system, this way the inventory details will be consistent with the available inventory.

**Task 4 – Conflict Evaluation**

Using Weighted matrices for evaluating alternative options for the above documented conflicts*.*

𝑡𝑜𝑡𝑎𝑙𝑆𝑐𝑜𝑟𝑒(𝑜𝑝𝑡)= ∑(𝑆𝑐𝑜𝑟𝑒𝑠(𝑜𝑝𝑡,𝑐𝑟𝑖𝑡)×𝑊𝑒𝑖𝑔h𝑡(𝑐𝑟𝑖𝑡)) 𝑐𝑟𝑖𝑡

***4.1. Evaluation for S1 and S2 :***

***Option 1:*** Integrating ETR with government system to obtain User’s age.

***Option 2:*** Accepting Non-governmental Id’s which has age details.

|  |  |  |  |
| --- | --- | --- | --- |
| ***Evaluation Criteria*** | ***Significance Weighting*** | ***Option 1*** | ***Option 2*** |
| Time efficient | 0.4 | 0.3 | 0.9 |
| Minimal Inconvenience | 0.2 | 0.4 | 0.7 |
| Reliable Response | 0.4 | 0.4 | 0.8 |
| Total | 1.0 | 0.36 | 0.82 |

From the above computation, **Option 2** can be used to resolve the conflict.

***4.2. Evaluation for S3 and S4 :***

***Option 1:*** A new requirement that, Admin will never be allowed to delete a store, until the store has no reservation or rental records.

***Option 2: A*** law imposed by board of directors of ETR organization, to not to delete a store.

|  |  |  |  |
| --- | --- | --- | --- |
| ***Evaluation Criteria*** | ***Significance Weighting*** | ***Option 1*** | ***Option 2*** |
| Time efficient | 0.3 | 0.2 | 0.8 |
| Accessing the System | 0.2 | 0.8 | 0.3 |
| Reliable Response | 0.5 | 0.9 | 0.2 |
| Total | 0.1 | 0.67 | 0.4 |

From the above computation, **Option 1** can be used in place of S4 to resolve the conflict.

***4.3. Evaluation for S5 and S6 :***

***Option 1:*** An automated system to perform an inventory count.

***Option 2:*** A dedicated branch employee team who can focus only on receiving the tools and updating them in the system.

|  |  |  |  |
| --- | --- | --- | --- |
| ***Evaluation Criteria*** | ***Significance Weighting*** | ***Option 1*** | ***Option 2*** |
| Interactive | 0.4 | 0.7 | 0.7 |
| Quality | 0.2 | 0.6 | 0.8 |
| Time efficient | 0.4 | 0.6 | 0.9 |
| Total | 1.0 | 0.66 | 0.77 |

From the above computation, **Option 2** can be used in place of S6 to resolve the conflict.

**Task 5 – Risk management**

A risk is an uncertain factor whose occurrence may result in a loss of satisfaction of a corresponding objective. It has a likelihood of occurrence and one or several undesirable consequences associated with it. Each consequence has a severity in terms of degree of loss of satisfaction of the corresponding objective Risks can be identified by several methods like risk checklists, risk trees and component inspection. And the identified risks are below as follows:

***a) By component Inspection***

1. Server/Database failure

2. Communication Network component failure

3. Hardware and Software component failure

***a) By Risk Checklists: Considering the Non-Functional Requirements***

4. Data Breach / Data leakage (Safety and Security)

5. Accidentally downloading malware (Installation)

6. Project not delivered at scheduled time (Time)

7. Developing the wrong software functions (User Interaction)

8. Lack of Budget (Cost)

***a) Risk Tree***

Diagram

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Figure 1: The risk tree shows the major point of failure where the stakeholders are unable to access the system

***b) Risk Assessment: QUANTITATIVE***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Risk Number | Likelihood | Probability | Impact (Thousands in Capital) | Exposure (Probability X Impact) |
| 1 | High | 0.5 | 0.5 | 0.025 |
| 2 | High | 0.06 | 0.2 | 0.012 |
| 3 | Moderate | 0.01 | 0.3 | 0.003 |
| 4 | Low | 0.01 | 0.2 | 0.002 |
| 5 | Low | 0.01 | 0.2 | 0.002 |
| 6 | Moderate | 0.05 | 0.5 | 0.025 |
| 7 | Moderate | 0.05 | 0.5 | 0..025 |
| 8 | High | 0.04 | 0.8 | 0.032 |

***b) Risk Assessment: QUANTITATIVE***

1. ***Server Failure***

|  |  |  |  |
| --- | --- | --- | --- |
| Consequences | Likely | Possible | Unlikely |
| Error 404: This website is not available | Moderate | Severe – Scale 7 | Moderate |
| Data loss | High | Severe – Scale 8 | Low |

1. ***Communication Network Failure***

|  |  |  |  |
| --- | --- | --- | --- |
| Consequences | Likely | Possible | Unlikely |
| users unable to login | Moderate | Severe – Scale 7 | Moderate |
| Slow response | High | Severe – Scale 8 | Low |

1. ***Hardware and Software component failure***

|  |  |  |  |
| --- | --- | --- | --- |
| Consequences | Likely | Possible | Unlikely |
| Location of Store, GPS locating Functionality is misbehaving | Moderate | Severe – Scale 5 | Moderate |

1. ***Data breach or Data Leakage***

|  |  |  |  |
| --- | --- | --- | --- |
| Consequences | Likely | Possible | Unlikely |
| Hackers misusing the system’s data (user details compromise) | Low | Severe – Scale 9 | High |

1. ***Accidentally downloading malware***

|  |  |  |  |
| --- | --- | --- | --- |
| Consequences | Likely | Possible | Unlikely |
| Data corruption | Low | Severe – Scale 8 | High |

1. ***Project Not Delivered at scheduled time***

|  |  |  |  |
| --- | --- | --- | --- |
| Consequences | Likely | Possible | Unlikely |
| Losing Market value | Moderate | Severe – Scale 9 | Moderate |

1. ***Developing the wrong software functions***

|  |  |  |  |
| --- | --- | --- | --- |
| Consequences | Likely | Possible | Unlikely |
| User dissatisfaction | Low | Severe – Scale 5 | High |

1. ***Lack of Budget***

|  |  |  |  |
| --- | --- | --- | --- |
| Consequences | Likely | Possible | Unlikely |
| Incomplete Product | Low | Severe – Scale 9 | High |

**c) Risk Control**

1.

Option 1 – Frequent Backup

Option 2 – Replication of server for Server failure:

Both methods will help in preventing loss and corruption of data when risk happens.

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***Risk Reduction Leverage (RRL):*** Consider a server which maintains a repository of data. The probability of losing the data is 15%. The cost of losing the data is measured in terms of the cost of its reproduction and re-entry into the database which is estimated at $30,000. To reduce the risk of losing the data, there are two options. The first option is estimated to reduce the risk to 10%. It is estimated to cost to $2000. The second option is estimated to reduce the risk to 5%. It is estimated to cost $2500.

So here, we need to calculate the RRL for both options and choose the option that has value above 1.

Risk Reduction Leverage = (Risk Exposure Before) – (Risk Exposure After) / Cost of Risk Reduction

Risk Exposure Before = 30000 X 15 / 100 = 4500

Option 1 – Risk Exposure After = 30000 X 10 / 100 = 3000

Option 2 – Risk Exposure After = 30000 X 5 / 100 = 1500

RRL Option 1 = 4500 – 3000 / 2000 = 0.75

RRL Option 2 = 4500 – 1500 / 2500 = 1.2 **So, option 2 is better.**

2.

Option 1 – Fiber Optic Cable

Option 2 – Wireless Optical Networks for Communication Network failure:

Both methods will help in preventing loss and corruption of data when risk happens.

***Risk Reduction Leverage (RRL):*** Consider a network company providing network services. The probability of losing the connection is 15%. The cost of losing the network is measured in terms of the cost of its coverage and re-establishment into the database which is estimated at $30,000. To reduce the risk of losing the data, there are two options. The first option is estimated to reduce the risk to 5%. It is estimated to cost to $2500. The second option is estimated to reduce the risk to 10%. It is estimated to cost $2000.

So here, we need to calculate the RRL for both options and choose the option that has value above 1.

Risk Reduction Leverage = (Risk Exposure Before) – (Risk Exposure After) / Cost of Risk Reduction

Risk Exposure Before = 30000 X 15 / 100 = 4500 Option 1 – Risk Exposure After = 30000 X 5 / 100 = 1500 Option 2 –Risk Exposure After = 30000 X 10 / 100 = 3000

RRL Option 1 = 4500 – 1500 / 2500 = 1.2

RRL Option 2 = 4500 – 3000 / 2000 = 0.75 **So, option 1 is better.**

3. *Reduce Risk Likelihood for Hardware and Software Component failure:* The risk can be prevented by replacing the GPS device or restoring the compass positioning of the system.

4. *Reduce Risk Likelihood for Data breach/ Data Leakage:* By opting methods like securing database, encryption, authentication, authorization we can create and maintain a safe web portal.

5. *Avoid the Risk for accidentally downloading malware:* This can be obtained by having an anti-virus installed in the system, avoiding advertisements, avoiding e-mail attachments.

6. *Mock-ups and Prototypes for Project Not delivered at scheduled time and for Developing the wrong software functions:* To avoid both risks we can practice the mentioned elicitation technique as it will be highly helpful to analyse and act accordingly. Scheduling a delivery and achieving it will give confidence to the team and if no will give them an idea on where to work, where they are lacking. Similarly, having evolutionary prototypes will help in achieving the features and can work on iterations to complete the product.

7. *Mitigate risk for Lack of Budget:* This risk can be handled by adding a separate team for handling the financial flow ensuring the team doesn’t run out of money.