

# Software Requirements Specification for Software Engineering: Document Management System

Team 15, SyncMaster

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## Revision History

Date	Version	Notes
Date 1	1.0	Notes
Date 2	1.1	Notes

# **1 Purpose of the Project**

## **1.1 User Business**

*Insert your content here.*

## **1.2 Goals of the Project**

*Insert your content here.*

# **2 Stakeholders**

## **2.1 Client**

- Matt Yakymyshyn (P.Eng)
  - Role: Senior Project Manager of Technical Services
  - Interest: Team leader for the facilities team within Technical Services who are the primary group responsible for maintaining facility infrastructure at pumping stations. Primary contact at the City for the capstone team.

## **2.2 Customer**

- Technical Services team
  - Role: Primary user within Hamilton Water
  - Interest: As the primary stakeholder, the requirements of this project are aimed at their specific needs. Their main concern is that station documentation is managed as a single source of truth, and is easily distributed/retrieved with relevant parties.

## **2.3 Other Stakeholders**

- Supervisory Control and Data Acquisition (SCADA) team
  - Role: Responsible for the control system controlling the treatment process.

- Interest: The SCADA team also manages contractors and is interested in accessing and updating documentation maintained in this system.
- They will have valuable input regarding existing City platforms and technologies, as well as how technology can be integrated into pumping stations.
- Corporate Security
  - Role: Pumping Station Security
  - Interest: Provide feedback on any system involving station access.

## 2.4 Hands-On Users of the Project

- Facilities project managers
  - The facilities project managers will be using the application daily to perform a variety of tasks. This includes verifying work was performed by contractors, accessing station documentation to share with contractors and internal staff, receiving signed forms and storing in a manner which is associated to the signee, and other tasks. They will have to be able to achieve all their needed requirements through the applications user interface, and will be a critical stakeholder to receive feedback from through user testing.
- Facilities co-op students
  - Facilities co-op students will be using the application to physically authenticate on site when performing inspections, scoping work, and verifying completion of work.
- Facilities contractors
  - Many contractors access pumping stations daily. They will interact with the application each time they perform facilities related work at the station. Interactions would include uploading and receiving documentation, and authenticating their presence on site to verify completion of work. Contractors come from a wide range of backgrounds depending on their trade, but are typically skilled



workers in a particular field and are of working age (18 - 65 years old).

- Facilities sub-contractors
  - Many contractors employ sub-contractors as part of their work. While these subcontractors work for the contractor who hired them, they will still require access to the application to authenticate on site and access site information. Their roles and interactions will be similar to contractors, except they will be much less familiar with the application and may only use it for a short duration as they are not regular workers.

## 2.5 Personas

- Greg: A facilities manager
  - Greg has a few tasks to complete this morning at work. He sees that another department has requested compliance documentation on crane inspections for the ministry, so he signs onto SyncMaster to retrieve the current version of these documents for each of these sites. While on the application, he receives a notification that a contractor he manages authenticated at site to complete a work order, but the application identified they had not completed their health and safety training. Greg prompts the system to issue this training to them, and runs a report on this contractor to see if any other employees of theirs require their training soon.
- Nancy: A newly onboarded contractor
  - Nancy is a plumber who is servicing her first work order after being hired by “Worldly Plumbing”. Her company has notified her of the application she must use to authenticate for the work. When she authenticates, she is notified that the device she is servicing is located within a confined space and that she must sign and return a hazard assessment form and proof of confined space training.

## 2.6 Priorities Assigned to Users

- Key users

- Facilities managers. They are the primary stakeholder of the application and it is intended to be a tool to greatly improve the efficiency of their work.
- Secondary users
  - Contractors. They will frequently use the system, but their needs are secondary to the key users.

## 2.7 User Participation

- Facilities managers will be frequently consulted throughout the duration of this project to demonstrate prototypes, receive feedback, and conduct user testing.
- Co-op students can also be consulted for user testing. They tend to have more availability for longer durations and will be able to provide insight into how a less experienced user interacts with the system.

## 2.8 Maintenance Users and Service Technicians

The facilities managers will be responsible for ensuring that day-to-day data is added to the application appropriately. The team does not have a dedicated software position, so maintainability of the technical aspects of the application would need to be brought to the IT division of the City when the project reaches that stage.

# 3 Mandated Constraints

## 3.1 Solution Constraints

C-SOL1. System must be cloud-based to fit in with current existing systems at the City of Hamilton.

## 3.2 Implementation Environment of the Current System

To understand the current practices at the City of Hamilton see the *Problem* section of the Problem Statement and Goals [here](#).

### **3.3 Partner or Collaborative Applications**

N/A

### **3.4 Off-the-Shelf Software**

C-OTS1. The system must integrate with Sharepoint to synchronize documents in Sharepoint with documents in the system.

C-OTS2. The system must integrate with Infor EAM, to show the status of work orders associated with a document.

C-OTS3. The system must integrate with MySDS to show relevant SDS documents to users on a given site.

### **3.5 Anticipated Workplace Environment**

### **3.6 Schedule Constraints**

C-SCH1. A requirement is to integrate with the Infor EAM system the city intends on using however, this system will not be available until February 2025, so no testing can be done on this system until then.

C-SCH2. The project deadline is April 2, 2025.

### **3.7 Budget Constraints**

C-BDG1. Total expenses up until April 2, 2025 must not exceed \$750.

### **3.8 Enterprise Constraints**

N/A

## **4 Naming Conventions and Terminology**

### **4.1 Glossary of All Terms, Including Acronyms, Used by Stakeholders involved in the Project**

- BAS: Building Automation System.

- BCOS: Beyond Compliance Operating System.
- CMMS: Computerized Maintenance Management System.
- Confined Space: A partially or fully enclosed space, not designed for continuous human occupancy, which has the potential for atmospheric hazards.
- Controlled Space: A City defined space which has the potential to become a confined space.
- CSE: Confined Space Entry
- Dry Well: A room which houses industrial equipment such as pumps and valves.
- Hazard Assessment Form: A form outlining potential hazards at a location.
- Hot Works: Work which produces ignition sources. Requires an accompanying hot works permit.
- HVAC: Heating, Ventilation, and Air Conditioning.
- Infor EAM: An Enterprise Asset Management system.
- PMATS: Plant Maintenance and Technical Services.
- PO: Purchase Order.
- PPE: Personal Protective Equipment.
- SCADA: Supervisory Control and Data Acquisition.
- SDS: Safety Data Sheets.
- Wet Well: A portion of a wastewater pumping station which receives and temporarily stores wastewater.

## **5 Relevant Facts And Assumptions**

### **5.1 Relevant Facts**

- There are over 100 pumping stations throughout the City.
- There are dozens of service contracts, and many contractors and staff accessing stations each day.
- Some stations are in remote locations and may have poor cell signal.
- Some properties have multiple stations at the same site.
- Certain stations have special entry procedures.

### **5.2 Business Rules**

- External contractors do not have access to the internal network.
- Only authorized users can approve new procedures.
- There is work at stations performed through a work order and routine work which doesn't have a work order.
- Employee collective agreements have restrictions on the release of GPS logs and video recording, which would require their approval.

### **5.3 Assumptions**

- Our project will focus on the application itself and our team will implement an authentication system adequate for our development. When the City integrates our application into their systems they would replace our authentication system with one that meets their detailed cybersecurity specifications.
- The existing entry and exit procedure for stations is not modified and our application will coexist with it.

## **6 The Scope of the Work**

### **6.1 The Current Situation**

*Insert your content here.*

### **6.2 The Context of the Work**

*Insert your content here.*

### **6.3 Work Partitioning**

*Insert your content here.*

### **6.4 Specifying a Business Use Case (BUC)**

*Insert your content here.*

## **7 Business Data Model and Data Dictionary**

### **7.1 Business Data Model**

*Insert your content here.*

### **7.2 Data Dictionary**

*Insert your content here.*

## **8 The Scope of the Product**

### **8.1 Product Boundary**

*Insert your content here.*

### **8.2 Product Use Case Table**

*Insert your content here.*

### 8.3 Individual Product Use Cases (PUC's)

*Insert your content here.*

## 9 Functional Requirements

### 9.1 Formal Definitions

- Let  $U = \{u_1, u_2, \dots, u_i\}$  be the set of users in the system.
- Let  $R = \{r_1, r_2, \dots, r_r\}$  be the set of roles (e.g. manager, contractor, subcontractor).
- Let  $A = \{a_1, a_2, \dots, a_s\}$  be the set of actions (e.g. upload, authenticate, sign, view).
- Let  $C = \{c_1, c_2, \dots, c_t\}$  be the set of compliance requirements (e.g. safety training, hazard assessments).
- Let  $I = \{l_1, l_2, \dots, l_q\}$  be the set of allowed locations.
- Let  $loc(u_i)$  represent the current location of user  $u_i$ .
- Let  $D = \{d_1, d_2, \dots, d_n\}$  be the set of documents.
- Let  $hasRole(u_i, r_k)$  represent that user  $u_i \in U$  has a role  $r_k \in R$ .
- Let  $notify(u_m, u_i)$  represent a notification from user  $u_m \in U$  to user  $u_i \in U$ .
- Let  $manages(u_m, u_i)$  represent that user  $u_m \in U$  manages user  $u_i \in U$ .
- Let  $permitted(r_k, a_s, d_j)$  represent that a user with role  $r_k \in R$  is permitted to perform action  $a_s \in A$  on document  $d_j \in D$ .
- Let  $requires(a_s, c_t)$  represent that action  $a_s \in A$  requires compliance requirement  $c_t \in C$ .
- Let  $T(u_i) \subset C$  represent the set of completed training for a user  $u_i \in U$ .
- Let  $assoc(d_j, u_i)$  denote that document  $d_j$  is associated with user  $u_i$ .

- Let  $upload(u_i, d_j)$  represent the action of user  $u_i \in U$  uploading document  $d_j \in D$ .
- Let  $performAction(u_i, a_s, d_j)$  represent that user  $u_i \in U$  performs action  $a_s \in A$  on document  $d_j \in D$ .

## 9.2 Formal Expressions

1.  $\forall u_i \in U, \forall d_j \in D, \forall r_k \in R, \forall a_s \in A :$

$$hasRole(u_i, r_k) \wedge permitted(r_k, a_s, d_j) \implies performAction(u_i, a_s, d_j)$$

2.  $\forall u_i \in U, \forall c_t \in C :$

$$(requires(a_s, c_t) \wedge a_s = sign \implies (c_t \in T(u_i)) \implies performAction(u_i, a_s, d_j))$$

3.  $\forall u_i \in U, \forall d_j \in D :$

$$(loc(u_i) \in L) \implies upload(u_i, d_j)$$

4.  $\forall u_i \in U, \forall d_j \in D :$

$$(loc(u_i) \notin L) \implies \neg upload(u_i, d_j)$$

5.  $\forall u_i \in U, \forall d_j \in D :$

$$sign(u_i, d_j) \implies assoc(d_j, u_i)$$

6.  $\forall u_i \in U, \forall c_t \in C, \forall u_m \in U :$

$$(manages(u_m, u_i) \wedge c_t \notin T(u_i)) \implies notify(u_m, u_i)$$

## 9.3 Functional Requirements

- FR1. System should support at a minimum the docx, xlsx, and pdf file formats for upload and viewing.
- FR2. Documents in this system must be synchronized with Sharepoint, this means any changes in this system must be reflected in the corresponding Sharepoint document, and any changes to the document in Sharepoint must be reflected in this system.



- FR3. The system should have different access levels depending on the type of user. Only Admin users should be able to change access permissions of other users and have read and write accesses to all documents in the system. Contractors/general users should only have read access to documents and be able to sign documents.
- FR4. The current site, work order number, job details, and entry/exit time of contractors should be visible to admin users in the system.

## 10 Look and Feel Requirements

### 10.1 Appearance Requirements

*Insert your content here.*

### 10.2 Style Requirements

*Insert your content here.*

## 11 Usability and Humanity Requirements

### 11.1 Ease of Use Requirements

- UH-EU1. Users between the ages of MIN\_AGE and MAX\_AGE, regardless of technical expertise, must be able to discover at least 70% of the web application functionality within 10 minutes of being introduced to the system without any explanation or training.

**Rationale:** Usability is of high importance to the users of the system. They will be mainly non-technical and must be able to learn and use the system quickly if it is to be of any value to them.

- UH-EU2. The system should provide undo options or warnings for irreversible actions and 95% of users should successfully use these features when prompted.

**Rationale:** It is important to provide users of the systems with confirmations or warnings to prevent errors and if they do happen, make it easy to recover from them.

## 11.2 Personalization and Internationalization Requirements

N/A

## 11.3 Learning Requirements

UH-LR1. Users between the ages of MIN\_AGE and MAX\_AGE should not take more than 10 minutes to learn a feature of the web application after it is discovered.

**Rationale:** A well designed system should give the user the most amount of functionality while being easy to understand. Users will be able to be productive with the system in a short amount of time, reducing frustration.

UH-LR2. Users between the ages of MIN\_AGE and MAX\_AGE should be able to complete the system onboarding tutorial or walkthrough within 5 minutes, and 80% of users should report feeling confident in using the system afterward.

**Rationale:** It is important that users are able to understand system documentation quickly to reduce mental overhead and increase productivity.

## 11.4 Understandability and Politeness Requirements

UH-UP1. The application must not contain symbols or allusions that may be offensive or politically charged.

**Rationale:** As the system is to be used by people of diverse backgrounds and in a professional setting, it is important to keep a professional and neutral tone.

UH-UP2. System error messages should clearly explain the issue and suggest a resolution within 2 sentences. 90% of users between the ages of MIN\_AGE and MAX\_AGE should report understanding the error and being able to resolve the issue without external support.

**Rationale:** Useful system feedback is crucial since users need to know what the system is doing and how it interprets their input in order to determine next steps.

## **11.5 Accessibility Requirements**

TBD may be in constraints.

## **12 Performance Requirements**

### **12.1 Speed and Latency Requirements**

*Insert your content here.*

### **12.2 Safety-Critical Requirements**

*Insert your content here.*

### **12.3 Precision or Accuracy Requirements**

*Insert your content here.*

### **12.4 Robustness or Fault-Tolerance Requirements**

*Insert your content here.*

### **12.5 Capacity Requirements**

*Insert your content here.*

### **12.6 Scalability or Extensibility Requirements**

*Insert your content here.*

### **12.7 Longevity Requirements**

*Insert your content here.*

## **13 Operational and Environmental Requirements**

### **13.1 Expected Physical Environment**

*Insert your content here.*

### **13.2 Wider Environment Requirements**

*Insert your content here.*

### **13.3 Requirements for Interfacing with Adjacent Systems**

*Insert your content here.*

### **13.4 Productization Requirements**

*Insert your content here.*

### **13.5 Release Requirements**

*Insert your content here.*

## **14 Maintainability and Support Requirements**

### **14.1 Maintenance Requirements**

MS-MTN1. A deployment of the system should take no more than 30 minutes (not including testing, and building time).

MS-MTN2. The build time of the system should be no longer than 10 minutes (not including testing time).

MS-MTN3. All automated tests should be able to run in under 10 minutes

MS-MTN4. The system should have rigorous unit testing, line coverage should be  $\geq 95\%$ , branch coverage should be  $\geq 90\%$ .

- MS-MTN5. All core functionalities of the system (i.e. Functional Requirements), should have both automated end-to-end and unit testing corresponding to them
- MS-MTN6. The project must be able to be maintained by its users, as original developers will not be maintaining it after April 2, 2025.

## 14.2 Supportability Requirements

- MS-SUP1. The application should have user-facing documentation on how to use the core functionalities of the system (i.e. functionalities described in functional requirements).
- MS-SUP2. The application should have documentation for all API's for future maintainers.
- MS-SUP3. The application should have documentation of internal functions and abstractions for future maintainers.
- MS-SUP4. The application should have documentation on deployment, so users can deploy this application for themselves.

## 14.3 Adaptability Requirements

- MS-ADP1. The application must be able to run on at least Google Chrome and Microsoft Edge browsers.
- MS-ADP2. The application must be able to run on tablets, smartphones, and laptops.
- MS-ADP3. The application must be able to run on Android, IOS, and Windows 10

# 15 Security Requirements

## 15.1 Access Requirements

*Insert your content here.*

## **15.2 Integrity Requirements**

*Insert your content here.*

## **15.3 Privacy Requirements**

*Insert your content here.*

## **15.4 Audit Requirements**

*Insert your content here.*

## **15.5 Immunity Requirements**

*Insert your content here.*

# **16 Cultural Requirements**

## **16.1 Cultural Requirements**

*Insert your content here.*

# **17 Compliance Requirements**

## **17.1 Legal Requirements**

*Insert your content here.*

## **17.2 Standards Compliance Requirements**

*Insert your content here.*

# **18 Open Issues**

*Insert your content here.*

## **19 Off-the-Shelf Solutions**

### **19.1 Ready-Made Products**

Currently there exist many document management systems (i.e. Google Docs, Sharepoint). However, They miss some of the clients major requirements. The city wants to be able to integrate with their work order management system to show the status of a work order that is associated with any given document, but existing solutions do not provide this capability. They also want to be able to verify that people were at a given site, when completing work, which again there isn't a ready made product to do.

### **19.2 Reusable Components**

We can use Sharepoint as file storage, since the city wants Sharepoint and this system to be in sync, and storing the files in two seperate locations and then syncing them will introduce a lot of overhead. Instead, all files can just be stored on Sharepoint.

### **19.3 Products That Can Be Copied**

N/A

## **20 New Problems**

### **20.1 Effects on the Current Environment**

*Insert your content here.*

### **20.2 Effects on the Installed Systems**

*Insert your content here.*

### **20.3 Potential User Problems**

*Insert your content here.*

## **20.4 Limitations in the Anticipated Implementation Environment That May Inhibit the New Product**

*Insert your content here.*

## **20.5 Follow-Up Problems**

*Insert your content here.*

# **21 Tasks**

## **21.1 Project Planning**

*Insert your content here.*

## **21.2 Planning of the Development Phases**

*Insert your content here.*

# **22 Migration to the New Product**

## **22.1 Requirements for Migration to the New Product**

MI-NP1. The system must be compatible with existing user roles in Active Directory.

**Rationale:** Compatibility with existing business rules is needed to ensure migration can be completed in a short period of time without having to defined new roles.

## **22.2 Data That Has to be Modified or Translated for the New System**

MI-TR1. Information stored on paper must be digitized for consumption for the system.

**Rationale:** Some content that the system is to consume has not



yet been digitized. It will have to be digitized before the system is able to use it.

## **23 Costs**

*Insert your content here.*

## **24 User Documentation and Training**

### **24.1 User Documentation Requirements**

*Insert your content here.*

### **24.2 Training Requirements**

*Insert your content here.*

## **25 Waiting Room**

*Insert your content here.*

## **26 Ideas for Solution**

*Insert your content here.*

## Appendix — Reflection

### 26.1 Symbolic Parameters

$MIN\_AGE = 18$

$MAX\_AGE = 70$

The information in this section will be used to evaluate the team members on the graduate attribute of Lifelong Learning. Please answer the following questions:

1. What knowledge and skills will the team collectively need to acquire to successfully complete this capstone project? Examples of possible knowledge to acquire include domain specific knowledge from the domain of your application, or software engineering knowledge, mechatronics knowledge or computer science knowledge. Skills may be related to technology, or writing, or presentation, or team management, etc. You should look to identify at least one item for each team member.
2. For each of the knowledge areas and skills identified in the previous question, what are at least two approaches to acquiring the knowledge or mastering the skill? Of the identified approaches, which will each team member pursue, and why did they make this choice?