Critical Systems Lab - MESCC Water Pumping Automated System

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ISEP, January 2024

Contents

1	Introduction			3
2	Requirement Specification			3
	2.1	Problem Domain		
		2.1.1	Stakeholder Needs	3
		2.1.2	System Context	3
		2.1.3	Use Cases and Requirements	3
		2.1.4	Measure of Effectiveness	4
		2.1.5	Functional Analysis	4
		2.1.6	Conceptual Subsystems	4
		2.1.7	Traceability to Stakeholder	4
	2.2 Solution Domain			4
		2.2.1	System Structure	4
		2.2.2	System Behavior	4
	2.3	Analys	sis of safety and reliability	4
3	Selected Technologies			5
4	1 List of physical sensors/actuators			5

1 Introduction

2 Requirement Specification

2.1 Problem Domain

2.1.1 Stakeholder Needs

- **SN-1**.1: The water in the wet well must be pumped to a higher level.
 - .2: Every WPS is an independent system; they don't have influence on each other.
- **SN-2** .1: The status of each element of the wet well needs to be displayed in a Remote Status Station (RSS).
 - .2: The RSS must display the water level, the pump status, an alarme and a button to disable the alarm.
- SN-3 The status information must be accessible through a web page.

2.1.2 System Context

2.1.3 Use Cases and Requirements

- **SR-1**.1: While the water level is above the minimum level, WPS shall have a pump working.
 - .2: When the water level is below minimum level, WPS shall have all pumps stopped.
 - .3: If the water level is above the maximum level, then the WPS shall trigger an alarm at the Remote Status Station (RSS).
 - .4: A second pump shall be turned on only when the water level is above 2/3 the maximum water level.
 - .5: When only one pump is available, the maximum water level shall be reduced to 2/3.
 - .6: If the alarm is ON, the button in the RSS shall only disable it.
- SR-2 The status of all WPS shall be displayed on all RSS.
- **SR-3** The status of all WPS shall be visible on one web page.

- 2.1.4 Measure of Effectiveness
- 2.1.5 Functional Analysis
- 2.1.6 Conceptual Subsystems
- 2.1.7 Traceability to Stakeholder
- 2.2 Solution Domain
- 2.2.1 System Structure
- 2.2.2 System Behavior
- 2.3 Analysis of safety and reliability
 - H-1: Description: One of the pumps stops working.
 - Cause: Mechanical problem.
 - Effect: Lost of redundancy and reduction of system performance.
 - Mitigation: Reduce the maximum water level to 2/3 and trigger alarm.
 - **H-2: Description:** The two level sensors give contradictory readings, i.e. one above max and one below min.
 - Cause: Sensor malfunction, connection issues.
 - Effect: Inapropriete system behavior.
 - Mitigation: Choose a worst case or compare with the last reading to find the fault. Trigger alarm.
 - H-3: Description: Power shortage.
 - Cause: Multiple causes
 - Effect: Complete failure of the system.
 - Mitigation: RSS with independente power supply and trigger alarm.
 - H-4: Description: Both pumps stopped working.
 - Cause: Mechanical problem.
 - Effect: Complete failure of the system.
 - Mitigation: Trigger alarm.
 - **H-5: Description:** RSS are not getting information from WPS.
 - Cause: Connection issues.
 - Effect: Wrong status readings.
 - Mitigation: Trigger alarm.
 - **H-6: Description:** A pump doesn't turn OFF when the water level in bellow minimum.
 - Cause: Mechanical problem.
 - Effect: Pump overheating and complete failure.
 - Mitigation: Trigger alarm.

- 3 Selected Technologies
- ${\bf 4}\quad {\bf List~of~physical~sensors/actuators}$