

Bachelor's Thesis

Requirement Specification IEEE

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**Reduction of Physical
Supervision / Herning Vand**

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1. Introduction

1.1. Purpose

The purpose of this document is to establish the requirements and other specifications of the Herning Vand Reduction of Supervision Project. Furthermore, to clarify how we understood the requirements set by the company and ensure that everyone understands the project and what it encompasses. This paper is meant for the VIA supervisors as well as the employees at Herning Vand who are participating in this project.

1.2. Scope

The Reduction of Supervision system will follow an IOT architecture with the exception of the hardware tier, which is already set in place. The system will collect its own data and a database will be utilized. Data will be retrieved from an interface, prepared for processing and stored in a database. The results of the processes will be displayed to the company through a single page web application built upon the ASP.NET Framework.

1.3. Definitions, acronyms, and abbreviations

IOT - Internet of Things. A system of computing devices that can transfer data over a network.

Database - A data persistence system that often contains, queries, and allows analysis on large amounts of recorded data.

ASP.NET - A development platform that is made up of many types of components for building applications. .NET is the base platform and ASP is an extension of .NET which provides more libraries and components for building different types of web applications.

Single Page Web Application - A website design concept where page content is generated through the use of JavaScript by manipulating the DOM(Document Object Model) elements of the current webpage.

SCADA - Supervisory Control And Data Acquisition. A SCADA system is an industry based system of various hardware and software elements and is used to help organizations to remain efficient, manage data and reduce downtime. A SCADA system enables this by allowing the company to control various systems at their locations to help monitor data, interact with devices and record events.

User - The users of the system will be the educated employees who work at Herning Vand.

Customer - The customer is the company, Herning Vand.

System - The system is the product to be delivered to Herning Vand as described in this specification. Reduction of Supervision System.

1.4. References

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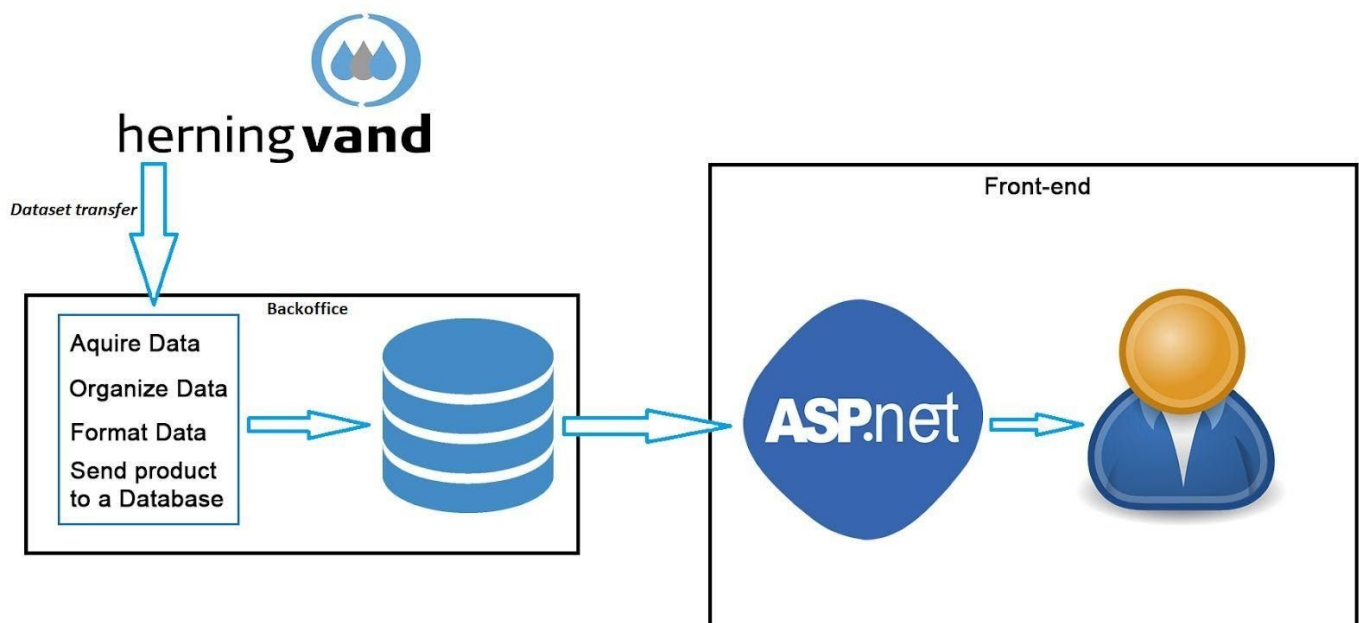
1.5. Overview

Having the purpose and the scope defined will help the team to determine the characteristics of the solution. A good perspective of the approach will lay grounding to the functionality of the product and the classification of its users. Having insightfully characterized features is a precursor to a thorough description of the constraints. As of the nature of communication, there are some speculations, which will be mentioned as assumptions and dependencies.

2. Overall Description

2.1. Product Perspective

The software relies strictly upon the validity and consistency of the data that Herning Vand collects. It is not bound to the systems in place and the solution will be a stand alone proof of concept. A single connection will be established through a system API interface which will be responsible for the data acquisition. This interface will be open for requests from the reporting system at Herning Vand.



2.1.1. System Interfaces

For the system to accurately label data attributes and receive sensor signals, two respective interfaces would be required. A socket connection will serve the purpose of security and stability for the sensor interface, while an API would satisfy the requirements of labeling.

2.1.2. User Interfaces

A single page user interface will be forged, holding two tables for the two sets of data, collected by the respective functions. The user interface will have the main goal of displaying information and exposing input fields for labeling pump information.

a. Logical Characteristics

The only required screen format is that the system be able to display output as HTML on a web page. There is no demand for a particular layout or specification of the design. It is only required that the user interface display information from the pumping stations and be able to warn of any anomalies in the reading that would indicate that physical interference is necessary.

b. Aspects of Optimizing the Interface with Users

The users should be able to see recorded data from the pumping stations and report anomalies in the readings. It should only take less than a minute to access the system and require little extra training to use.

2.1.3. Operations

The user will be able to initiate an operation to check the recorded data for any anomalies that would indicate that a physical visit to a particular pumping station is necessary.

The system will otherwise be unattended and make connections to the reporting stations to collect various data and record anomalies.

2.2. Product Functions

The system's functions are the following:

- Analyze Herning Vand's pump station data sets
- Find patterns which imply a malfunction in the pumping stations
- Display on a HTML page information about the pumps that need supervision

2.3. User Characteristics

The system is built for Herning Vand's employees. The anticipated audience is a small number of experienced Danish workers and engineers who supervise the data. The users are expected to have knowledge about the meaning of the data collected about the pumping station's state and be able to react accordingly to its readings.

2.4. Constraints

The system will function as a stand-alone tool of which usage comes with some limits. How sufficient the datasets are will define the accuracy of the algorithm output. A risk of incomplete data still exists, but Herning Vand is open for any hardware suggestions. The company made it clear that the system should not connect to any network including its own intranet, which concludes that certain additional APIs and deployment will not be utilized. The only exception to this is the Lorient connection, which would serve as an interface between the sensors and the system.

2.5. Assumptions and Dependencies

Until the datasets that Herning Vand utilizes are examined it is assumed that their data is complete. The team will be dependent on any "trial subscriptions" to deployment platforms and developer tools.

2.6. Apportioning of Requirements

For the duration of the project the system will be standalone from the rest of Herning Vand's system. However, it is intended that if the system exceeds company

expectations then future changes to the system implementation in relation to Herning Vand's own SCADA system will occur at their discretion..

3. Specific Requirements

3.1. External Interfaces

The system will be an independent program, which will not interact with any other systems. The input received will be from a user and the sensors. The sensor data will be received at least once per hour. The output created by the system will be an HTML web page.

3.2. Functions

- The system must not connect to the internet.
- The system must refresh frequently.
- The system must display data to the users at their request.
- The system must be able to expose anomalies within the analyzed data sets.
- The system must be modular.

3.3. Performance Requirements

All computers within Herning Vand should have access to the system.

While the system should be able to support between 1-3 users at minimum. Due to the system's expectation to be accessible from all computers, usage from 100% of employees should also be supported.

The data will be received in the form of a data set from a reporting system at Herning Vand. The amount of data will correspond to the number of connections made to the reporting system and the data is expected to be retrieved at least once every hour.

3.4. Logical Database Requirements

As of now the data set is expected to be in the form of a csv file, however, the type of output has been left as a variable to be defined later.

The frequency of database usage will correspond to the number of times that the system connects to Herning Vand's reporting system. This connection is expected to be at least once every hour.

The database will be accessed for persistence purposes after it has been analyzed and cleaned, and when employees of the company seek to review the data in search for anomalies that indicate a persistent problem with the hardware.

Any further constraints on the data will be defined based on what is considered normal operating range for the various sensors that will be present in the received data set.

Data will be retained for as long as necessary.

3.5. Design Constraints

- The system is not allowed to access the internet.
- The system is not allowed to access Herning Vand's own systems.
- The output will be an HTML web page.