Software Requirements Specification MECHTRON 4TB6: Formulate

Team 25, Formulate
Ahmed Nazir, nazira1
Stephen Oh, ohs9
Muhanad Sada, sadam
Tioluwalayomi Babayeju, babayejt

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Revision History

Date	Version	Notes
Date 1	1.0	Notes
Date 2	1.1	Notes

1 Introduction

1.1 Document Purpose

This document provides the set of Software Requirements Specifications (SRS) used to describe the system developed to assist testing efforts in technical teams. Both hardware and software system requirements were included to fully specify all system requirements.

The user can expect to understand the system behavior under expected use cases, the functional and non-functional requirements the system must adhere to, and a phase in development plan.

1.2 Project Description

Effective test data collection and storage is a common challenge extra-curricular teams face in the technical domain. In teams who do not invest in streamlining data collection and storage, teams cannot fully utilize test data to validate designs. As a result, teams encounter difficulty proving design validity during competition, experience reduced competitiveness when presenting an under-validated system, and fail to generate trends on aggregated test data to efficiently find areas of improvement in design.

Project ”Formulate” enables engineering teams to streamline data collection and storage, resulting in testing overhead reduction and increased control of raw test data gathered by automating aspects of the testing procedure.

1.3 Project Scope

Project Formulate aims to provide the McMaster Formula Electric team with a well-documented and complete system. To accomplish the project goals within an 8 month timeline, the following scope of requirements were developed to set clear boundaries on deliverables.

1. Documentation for tool integration into testing workflows for common tests.
2. Hardware capable of collecting data from test equipment.
3. User interface to interact with raw data and submit the data to a database.
4. Record of organized, historical data.
5. Visualization of test data stored in a database with auto-generated KPI metrics.
6. Short setup time to integrate device into testing workflow, regardless of technical background.

Out of Scope Items:

1. Custom website to visualize test data results stored in a database.

2. Security through data encryption.
3. Predictive intelligence to estimate if rate of test data collected is on track to produce a fully validated product.

1.4 Table of Symbols

Symbol	**Unit**	**Description**
A_C	m^2	coil surface area

1.5 Abbreviations and Acronyms

Symbol	**Description**
A	Assumption
DD	Data Definition
GD	General Definition
GS	Goal Statement
IM	Instance Model
LC	Likely Change
PS	Physical System Description
R	Requirement
SRS	Software Requirements Specification
DBTL	Design Build Test Learning
KPI	Key Performance Indicators

2 User Characteristics

2.1 Stakeholders

2.2 Use Cases

2.3 User Consideration

2.4 Impact

3 Requirements

[The requirements refine the goal statement. They will make heavy use of references to the instance models. —TPLT]

This section provides the functional requirements, the business tasks that the software is expected to complete, and the nonfunctional requirements, the qualities that the software is expected to exhibit.

3.1 Functional Requirements

3.1.1 Hardware

RH1: The device should contain a rechargeable battery

RH2: The device should have a screen to display the current status to the user

RH3: The device should easily mount to the base of a Formula SAE car

RH4: The device should connect to a PC wirelessly to transmit data

RH5:

3.1.2 Desktop Application

3.1.3 Data Analytics Platform

3.2 Nonfunctional Requirements

3.2.1 Usability

NFR1: **Ease of Learning**
The user will be able to learn the tool's operation quickly to integrate into their testing workflow efficiently

NFR2: **Ease of Use**
The system will be fast at processing data such that additional overhead through the use of the tool is less than if all components of the testing workflow were completed individually.

3.2.2 Performance

NFR3: **Speed**
The system bandwidth will be high enough to support testing equipment with high data collection frequencies.

NFR4: **Reliability and Availability**
The system will be fail-safe to withstand single point of failures in components with high probability of operational failure.

3.2.3 Operational

NFR5: **Expected Technological Environment**
The tool will be able to facilitate a variety of tests using a range of equipment, as long as the equipment is compatible with the data measuring hardware.

NFR6: **Expected Physical Environment** The system will be operational under a wide range of temperatures and operational vibrations.

3.2.4 Maintainability and Portability

NFR7: **Maintainability**
The system will be modular and have low cohesion such that users can adapt elements

of the tool's hardware and software infrastructure to current needs without breaking other elements.

NFR8: **Portability**
The user's ability to conduct tests will not be affected by the physical constraints from the tool.

3.2.5 Security

NFR9: **Software Integrity**
The system will be secure against malicious spam aimed at reducing validity of aggregate test data stored in the database.

3.2.6 Cultural and Political

N/A

3.2.7 Legal

N/A
zzz

4 Likely Changes

LC1: [Give the likely changes, with a reference to the related assumption (aref), as appropriate. —TPLT]

5 Unlikely Changes

LC2: [Give the unlikely changes. The design can assume that the changes listed will not occur. —TPLT]

6 Development Plan

The development plan is categorized into multiple sections, where each section represented a significant phase in the progress of project execution. A section is given a number in the hundreds (X00) to denote a significant phase in the project. Each section is subdivided further into segments given by numbers specified in the tens (XX0) to denote smaller steps within each phase. The expected order of segment completion follows the order of increasing number count; the lowest number segment should be completed first and the highest number segment should be completed last.

Each segment has an overall goal that can include the coordination of multiple teammates. Upon completion of each segment, the team members relevant to the segment review and buyoff the readyness of the segment. Upon completion of buying off each segment within a section, the overall phase is considered to be bought off and completed with confidence. The relevant stakeholders must aim to buyoff each segment in a phase before the phase deadline.

Phase 1: Preperation (100 series)
Phase 1 Deadline: October 28, 2022

100 Buyoffs	**Explanation**	**Stakeholder(s)**
110	Purchase sensor equipment, data measurement hardware, 3D print material.	Stephen
120	Obtain licenses for 3D CAD software use and database access	Stephen
130	Document material costs and licensing constraints	Stephen
140	Distribute materials and licensing to relevant project area Stakeholder	Stephen
150	Completion of tool chassis mechanical design and modelling	Stephen
160	Completion of electrical connection hardware circuit design and schematic	Stephen
190	Tool chassis manufactured	Stephen

Phase 2: Proof of Concept (200 series)
Phase 2 Deadline: November 11, 2022

200 Buyoffs	**Explanation**	**Stakeholder(s)**
210	Desktop application program developed with basic user interface	Stephen
220	Desktop application program can recieve data from data measurement device using a wired connection	Stephen
230	Desktop application program can interface with database to send data	Stephen
240	Desktop application program can edit data from data measurement device before sending it to the database	Stephen
250	Visualization application can pull data and generate KPI metrics from the database	Stephen
260	Integration between data measurement device and desktop application	Stephen
270	Integration between desktop application and visualization application	Stephen
290	Integration between data measurement device, desktop application, and data measurement device	Stephen

Phase 3: Revision 0 Presentation (300 series)
Phase 3 Deadline: February 3, 2023

300 Buyoffs	**Explanation**	**Stakeholder(s)**
310	Mechanical design and modelling completion of physical user interface components on tool chassis and connection modules	Stephen
320	Completion of wireless communication between data measurement device and desktop application	Stephen
330	Completion of database security against tests that break utility of database	Stephen
390	Completion of extended KPI features for visualization application	Stephen

Phase 4: Final Demonstrations (400 series)

Phase 4 Deadline: March 17, 2023

References

[The following is not part of the template, just some things to consider when filing in the template. —TPLT]
[Grammar, flow and LaTeXadvice:

- For Mac users `*.DS_Store` should be in `.gitignore`
- LaTeX and formatting rules
  - Variables are italic, everything else not, includes subscripts (link to document)
    - Conventions
    - Watch out for implied multiplication
  - Use BibTeX
  - Use cross-referencing
- Grammar and writing rules
  - Acronyms expanded on first usage (not just in table of acronyms)
  - "In order to" should be "to"

—TPLT]
[Advice on using the template:

- Difference between physical and software constraints
- Properties of a correct solution means *additional* properties, not a restating of the requirements (may be "not applicable" for your problem). If you have a table of output constraints, then these are properties of a correct solution.
- Assumptions have to be invoked somewhere
- "Referenced by" implies that there is an explicit reference
- Think of traceability matrix, list of assumption invocations and list of reference by fields as automatically generatable
- If you say the format of the output (plot, table etc), then your requirement could be more abstract

—TPLT]