System requirements specification

Some System

Mr Ima Student

12345678

Document Identification

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Origination and Approval

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Acceptance

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Distribution List

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Security Levels and Restrictions

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| Level | Description | Applicable Level |
| 1 | Strictly Confidential – not to be distributed |  |
| 2 | Company Confidential – distributed inside company |  |
| 3 | Client Confidential – distributed to limited clients and contractors | X |
| 4 | Public Domain – distributed freely |  |

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DOCUMENT REVISION HISTORY

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**Table of Contents**

[Document Identification 1](#_Toc508705490)

[Origination and Approval 1](#_Toc508705491)

[Acceptance 1](#_Toc508705492)

[Distribution List 1](#_Toc508705493)

[Security Levels and Restrictions 1](#_Toc508705494)

[Contact Information 1](#_Toc508705495)

[DOCUMENT REVISION HISTORY 2](#_Toc508705496)

[1 Introduction and scope 4](#_Toc508705497)

[1.1 Identification 4](#_Toc508705498)

[1.2 Intended use 4](#_Toc508705499)

[1.3 Background 4](#_Toc508705500)

[1.4 System Overview 4](#_Toc508705501)

[1.5 Document Overview and Use 4](#_Toc508705502)

[2 Applicable and other referenced documents 5](#_Toc508705503)

[2.1 Applicable documents 5](#_Toc508705504)

[2.2 Other referenced documents 5](#_Toc508705505)

[3 Meanings, Acronyms, and Abbreviations 5](#_Toc508705506)

[3.1 Meanings 5](#_Toc508705507)

[3.2 Acronyms 6](#_Toc508705508)

[3.3 Abbreviations 6](#_Toc508705509)

[4 Requirements 7](#_Toc508705510)

[4.1 Identification of External Interfaces 7](#_Toc508705511)

[4.1.1 Operator control interface 7](#_Toc508705512)

[4.2 Identification of States and Modes 7](#_Toc508705513)

[4.3 System Function and Performance Requirements 7](#_Toc508705514)

[4.3.1 Control Process water temperature 7](#_Toc508705515)

[4.3.2 Inform operator 7](#_Toc508705516)

[4.4 Relationships between States and Modes 7](#_Toc508705517)

[4.5 System External Interface Requirements 7](#_Toc508705518)

[4.5.1 Patient-Control I/F 7](#_Toc508705519)

[4.6 System Environmental Requirements 8](#_Toc508705520)

[4.6.1 Classes of environment 8](#_Toc508705521)

[4.6.2 Operational Environment 8](#_Toc508705522)

[4.7 External Resource Utilization Requirements 8](#_Toc508705523)

[4.8 System Physical Requirements 8](#_Toc508705524)

[4.9 Other System Qualities 8](#_Toc508705525)

[4.10 Design and Construction Requirements 9](#_Toc508705526)

[4.10.1 General Design and Construction Requirements 9](#_Toc508705527)

[4.10.2 Characteristics of sub-ordinate elements 9](#_Toc508705528)

[4.11 Precedence of requirements 9](#_Toc508705529)

[5 Verification requirements 9](#_Toc508705530)

[6 Value Model 11](#_Toc508705531)

# Introduction and scope

## Identification

This system specification pertains to the Some System being developed by the North West University (NWU).

## Intended use

Insert here a short section (paragraph or two) detailing how the intended system is to be used. Include information that is important to the use case but DO NOT supply a solution here.

## Background

(Optional) If there is specific background on this project / system available that would be pertinent to this specification include it here (if possible) or provide a reference. Typically projects that affect an upgrade will make use of this section to describe the previous version.

## System Overview

(Optional) If the envisaged system will be made up of several aspects (some of which might not be under development) this paragraph is used to provide a description of the interactions between the development item and the other system elements. A figure might be of value depending on the complexity of the system.

## Document Overview and Use

This SyRS is intended to be used by the client and their appointed contractors to develop the Some System. Unless explicitly stated herein all contents of this SyRS is to be treated as client confidential by any contractors. At the discression of the client this SyRS may be distributed to any party deemed to have a stake in the development of this system or the management of the system development.

# Applicable and other referenced documents

## Applicable documents

(Optional) Any other applicable documents to be listed here. Include specific versions / locations as required.

## Other referenced documents

Unless explicitly states any requirement in this specification that is found to be in conflict with the referenced standards shall be considered to be subservient to said standard.

|  |  |
| --- | --- |
| Document identifier | document description |
| SANS 60601-1-11:2012 Edition 1 | Medical electrical equipment Part 1-10: General requirements for basic safety and essential performance. |

# Meanings, Acronyms, and Abbreviations

## Meanings

Unless otherwise explicitly states here all words and terms shall be interpreted as per the latest edition of the United Kingdom variant of the Oxford English dictionary.

|  |  |
| --- | --- |
| TERM | DEFINITION |
| shall | Expresses a characteristic which must be present in the item of specification, thus a binding requirement |
| should | Expresses a goal or target to be pursued but not necessarily achieved |
| may | Expresses permissive guidance |
| will | Expresses a declaration of intent on the part of a party |
| STATE | The state of a system refers to a state of being of the system. |
| MODE | The mode of a system refers to the state of doing of a system. Typically modes are encapsulated within states. |
| ARMED STATE | In the armed state the system shall be receptive to command that cause a state transition |
| DETONATING MODE | In the detonating mode the system shall perform all actions required to initiate the process of detonating the explosive payload. |
| Insert additional rows as needed |  |
|  |  |

## Acronyms

|  |  |
| --- | --- |
| Acronym | DEFINITION |
| NWU | North West University |
| Syrs | System Requirements Specification |
| tbd | To Be Defined |

## Abbreviations

|  |  |
| --- | --- |
| ABBREVIATION | Explantation |
| e.g. | For example |
| REQID | Requirement Identifier |

# Requirements

## Identification of External Interfaces

Simply list the identified external interfaces of the system here. A brief description of the interface may be provided

### Operator control interface

The interface through which the operator provides control command to the system.

## Identification of States and Modes

The system shall have the following states and modes as defined in Section 3.1

* Prove a list of all the states and modes of the system.
* State – Armed
* Mode - Detonating

## System Function and Performance Requirements

For each of the identified functions of the system identify the specific requirements.

### Control Process water temperature

The system shall control the process water temperature within a temperature band not exceeding ±5 ⁰C from the set point. REQID 00123

The system shall provide control actions at a rate of no less than 1 Hz. REQID 00124

### Inform operator

The system shall provide a graphical representation of the process state to the operator. REQID 00125

## Relationships between States and Modes

Provide the relationships between the various states and modes of the system. In simple systems the number of states might be small and can be excluded in lieu of using mode transitions. For each transition between states and/or modes both a transition requirement (what must happen) and a response requirement (how will the system respond) must be provided.

## System External Interface Requirements

For each of the identified external interfaces the requirements can be developed. Note that there might be multiple requirements for a single interface. Once again the aim is on specifying functionality and not necessarily technology.

### Patient-Control I/F

The patient-control interface shall provide the patient with the means to select a pre-configured exercise routine. **REQID** **0018**

The patient-control interface shall provide the patient with the means to commence the selected exercise routine. **REQID** **0019**

The patient-control interface shall provide the patient with a means terminating the currently active exercise routine. **REQID** **0020**

## System Environmental Requirements

Specify the environment that the system will be operated in here. Typically transportation and storage environments would also be defined if necessary. For instance transporting sensitive equipment via helicopter will subject the system to vibration loads that might not be part of the operating environment (on the ground in a fancy temperature controlled research laboratory).

### Classes of environment

For the purposes of this SyRS only the operational environment is defined, with transportation and storage environments being contained within the parameter envelopes of the operational environment.

### Operational Environment

The NHRS shall be operated indoors under either natural or artificial light with an intensity of at least 500 lux at the level of operation. **REQID** **0036**

The NHRS shall not be exposed to ambient air temperatures in excess of 50 ⁰C with a relative humidity not exceeding 95% **REQID** **0037**

The NHRS shall be operable in a dusty environment with nominally spherical particulate matter ranging in size from no less than 10μm to 2mm in diameter **REQID** **0038**

The NHRS system shall bear all markings with regards to the environmental operating environment as per SANS 60601-1-11 **REQID** **0039**

## External Resource Utilization Requirements

Specify the rate at which external resources may be consumed by the system under development. Typically this implies that at least one external interface exists across which this resource can enter the system. Note: for this example it is assumed that I already specified that the power source to be a single phase electrical plug point (as per some SANS standard). Since such a plug point could theoretically provide 3.5 kW (220 V at 16 A) these requirements limit what the system can draw from the plug point.

The system shall consume a maximum of 1500 W of electrical power. REQID 0012483

The system shall consume no more than 10 A of current. REQID 0012484

## System Physical Requirements

Requirements such as length, height, mass, colour, etc. are specified here. If there is not a good reason to include aspects here simply state that there are no specific requirements. For instance, requiring that the PCB must be purple for aesthetic reasons seems sound – but this has now immediately placed a requirement on the PCB fabrication process. For interest sake purple PCBs are usually a special order and thus expensive!

“The system must be able to fit through a door “. Which door? Dimensions of said door?

## Other System Qualities

Qualities that are difficult to measure quantitatively are included here. Don’t go overboard.

The NHRS shall be safe and ergonomic to use for patients, therapists, and care-takers where applicable. **REQID** **0040**

The NHRS shall exhibit high quality workmanship insofar as cabling and wiring is concerned as per the NASA workmanship standards. **REQID** **0041**

Where software configuration items are to be delivered the developer shall make use of the git version control system. **REQID** **0042**

For all software configuration items (Application, Server, or Embedded) the developer shall make use of a developer selected coding standard. **REQID** **0043**

## Design and Construction Requirements

In this sections specific aspects of the system design are mandated. Unless absolutely unavoidable limit these inclusions to the minimum. Typically each design requirement takes away design freedom from the system developer. Remember this is a specification of what the system must do, how well it must be done, and in which context it must be done.

### General Design and Construction Requirements

The NHRS design shall be optimised for manufacture by means of additive manufacturing technologies. **REQID** **0044** Here I specifically want the thing to be 3D printed. Not always a good idea. Would you 3D print a submarine?

### Characteristics of sub-ordinate elements

The NHRS rehabilitation device enclosure shall not make use of materials not certified for food-grade use. **REQID** **0045**

The NHRS rehabilitation device shall be inherently safe to all patients, caretakers, and technicians as set out in SANS 60601-1-11:2012. **REQID** **0046**

## Precedence of requirements

All requirements stated herein are subservient to requirements of safety. Should the satisfaction of a requirement lead to the safety requirement being violated the contractor is required to notify the stakeholder.

# Verification requirements

Technically for each requirement there must be a matching verification requirement (simply put if the system must perform X how will I know that it performs X to a sufficient degree?) For the purposes of EERI474 2018 this is overkill. However, you must be able to quantitatively answer “How well does the solution function?”. In consultation with the supervisor, determine which of the requirements are critical to your project (typically only 3/4 would suffice), and determine which performance level results in which grade.

For the purposes of example, let’s assume that you need to build a bread toaster with the following key requirements:

The toaster system shall toast bread, contained within the toaster enclosure, according to the user selected level in no more than 5 minutes. **REQID 001**

The toaster system shall provide a degree of toasting mechanism to the user of the toaster ranging from heated to charcoal **REQID 002**

The toaster system shall provide consistent and repeatable toasting performance between repeated toasting cycles regardless of the environmental conditions. **REQID 003**

Now, it would be reasonable to assume that at a minimum the system must be able to at least toast something.

* Thus, if your system cannot accomplish toasting at all a mark of <40% (fail) is awarded.
* If your system is capable of toasting bread but it takes longer than expected and only to some fixed degree of “toastedness” maybe 50% is in order.
* If your system is capable of only toasting to some pre-set degree but at least within the required time limit, maybe 60% would again be in order.
* If your toasted is capable of toasting bread, to user set levels, and in the required time, but the results are not repeatable 70-75% is fair.
* If your toaster can accomplish the above and complies with all other requirements we leave the assigned mark up to the examiner and assign 75%+.

Depending on the complexity of the above “matrix” a graphical representation might be in order. **However, the important aspect to keep in mind is that the performance requirements for your system has now been agreed upon. So if, for whichever reason, some compromises needs to be made the impact thereof has been determined beforehand.**

# Value Model

(Optional) If a value model of the system as a whole has been developed in conjunction with the stakeholders it can be included here. Availability of a value model significantly aids in the development of trade-off criteria later on in design. At the very least one would assume system cost to be of importance.

*Note: The utility function of a cost item can be expressed mathematically as a sigmoid function mapping cost extremes to utility scores from [0,1] with the slope as indicated.*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Measure of effectiveness** | **Minimum acceptable** | **Maximum acceptable** | **Relative Importance** | **Utility function** |
| Cost of rehabilitation mechanism | R 3 000 | R 7 000 | 100 |  |
| Reliability of rehabilitation system | 95 % | 99.99% | 80 |  |
| Operational support and deployment cost (per device p.a.) | R 100 | R 750 | 50 |  |
| Operational support and deployment cost (per NHRS supporting 50 devices) | R 150 | R 1500 | 30 |  |