ADAPTIVE QUALITY UPSCALING WITH ADVANCED MANUFACTURING

(AQUA MANUFACTURING)

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**Prepared for:**

AQUA Management Project

University of Cape Town

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# Summary

## Introduction

This section explains the aim of the project as a whole and identifies the problem statement of this subproject focused on in this document in relation to the overall project. Thereafter the scope and limitations of this document is discussed.

# Introduction

## Problem Description

The Adaptive Quality Upscaling with Advanced Manufacturing (AQUA Manufacturing) is a Masters-level initiative led by Timothy Reddy at the University of Cape Town. This multidisciplinary project aims to enhance the capabilities of a modified Creality 3 V2 3D printer – referred to as the AQUA system – by integrating key technological components including firmware development, electrical system design, peripheral control software, basic slicer functionality, and real-time print monitoring (insert citation).

The broader project is divided into several subprojects. This report focuses specifically on the design and implementation of the AQUA system's electrical subsystem and the development of the accompanying Python-based peripheral control module.

## Scope and Limitations

This report is limited to the design, implementation, and testing of the electrical subsystem of the AQUA Manufacturing project. It specifically addresses the development of smaller supporting subsystems related to the overall electrical infrastructure, as well as the creation of the Python module responsible for controlling external peripherals connected to the system.

The following elements fall outside the scope of this report:

* The planning and development of the mechanical hardware of the AQUA Manufacturing system
* The design of the broader electrical architecture beyond the assigned subsystems
* All software development tasks unrelated to the Python-based peripheral control module

The limitations of this subproject include:

* A strict development time frame of six weeks
* Budget constraints
* Limited component availability, restricted to parts already procured by the Research Supervisor, Timothy Reddy, or components available from the White Lab at the University of Cape Town

# Sub System Analysis

## Overview

The electrical system of the Aqua system is contained in the Creality V4.2.2 board and in this AQUA Manufacturing project is extended to include a Rasberry Pi 5 as well as Stepper Motor HAT all working in conjunction with one another. Below depicts a visual representation of the initial electrical system design prior to any changes made to optimize the project.

[Insert image]

[insert caption]

This section of the report will focus on the smaller subsystems of the AQUA manufacturing project focusing on the

## Requirement Analysis

This requirement analysis describes the requirements of the electrical subsystems mentioned in the [Introduction](#_Introduction) section of this report.

Table Table of requirements

|  |  |  |
| --- | --- | --- |
| ID | Requirement | Description |
| RQ01 | Toggle LED | Turn on/off the LED ring |
| RQ02 | LED control | Control the brightness of the LED ring |
| RQ03 | Toggle lasers | Turn on/off the lasers of the 3D printer |
| RQ04 | Laser control | Control the brightness and intensity of the lasers of the 3D printer |

# DESIGN

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# PYTHON CODE

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# Bibliography

**There are no sources in the current document.**