Fan Control Component Design Description

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Revision Data

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01	11/19/2020	Initial Release of the FanControl Component	Juan Nunez

Revision History

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1.0 Introduction

1.1 Purpose

This document covers the design of the Fan Control software component. The intended audience of this document are software engineers at Intuitive Surgical for the purpose of evaluating the authors candidacy for employment.

1.2 Terms and Definitions

Table 1 provides definitions for names, acronyms and abbreviations used in this specification.

Name, Acronym or Abbreviation	Definition
gRPC	gRPC is an open source remote procedure call system initially developed at Google in 2015.
GTest, Gtest, gTest	Google Test unit test library.
Qt	Pronounced “cute” or “Q.T.”, is a Graphical User Interface Application framework.

Table 1: Definitions

2.0 Component Overview

The Fan Control Component is responsible for monitoring the temperatures of the SubSystems. Based on the highest temperature across all SubSystems, Fan Control will adjust the speed of every fan.

2.1 FanControl

The Fan Control Component is broken up into two sub-components, the FanControl and the TempMonitor

The TempMonitor polls all the subsystems for their temperature, using gRPC, at a rate of 200ms. It will keep track of the temperatures and identify the highest temperature across all SubSystems. The TempMonitor will notify FanControl every time a new high temperature is identified.

Upon notification, FanControl will first calculate the base duty cycle. Then, based on a table of fan proportionalities, FanControl will calculate the PWM counts for each fan and write the value into the fans register.

2.1.1 FanControl Calculations

- If the temperature is 25°C or below, the duty cycle will be at 20%.
- If the temperature is 75°C or above, the duty cycle will be at 100%.
- If the maximum highest temperature is in between 25°C and 75°C, the duty cycle will be linearly interpolated between 20% and 100% duty cycle.
- The PWM counts is proportional to duty cycle, with every fan potentially having a different proportionality.

- Note that the duty cycle is zero-rounded when calculating the PWM counts.

2.2 SubSystem

The SubSystem component is a Mock SubSystem, written to generate temperatures every time it is requested. The SubSystem keeps track of its temperature. With every request, the SubSystem will randomly choose to increase, decrease or not change the temperature. If there is a change in temperature, the adjustment will be in 0.1°c increments.

2.3 Threads

There are two threads being used in the overall FanControl. One thread exists within the TempMonitor, allowing it to poll subsystems. The second thread is within FanControl, allowing it to program the Fan speeds upon being notified of a new high temperature.

2.4 Unit Testing

Basic unit testing was accomplished using google test.

2.5 QT User Interface

The UI for the UI based demo was created using QT. Callbacks were used instead of built in QT data models to keep things simple for the coding challenge, as the main focus is on FanControl and not the UI.

2.6 Class Diagram