Laser Projector - Real-Time Control Design Report

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Abstract

(includes a summary of what each of the following sections will discuss)

Nomenclature

- STM32 - STM32F103C8T6 Micro-controller
- CPR - Counts per Revolution
- FPS - Frames per Second
- PPS - Points per Second
- SS - Steady State

1 Defining Constraints

The constraints of the design process of the real-time control system, must first be identified before the project is started. The STM32 runs at a frequency of 72MHz and is used to calculate the PID-controlled output in real time. To achieve the minimum frame rate of 30 frames per second of the displayed laser image shown in Figure 1, the motor must reach each of the shape's 15 points within 2.22 milliseconds or a frequency of 450 points per second.

$$\theta_{range} = 2.86^{\circ} = 0.099832\ rad \tag{1}$$

Specification	Units	Requirement	Constraint	Goals
Encoder Count Range	-	± 389	-	-
PID Overshoot	%	-	≤ 10	min
PID Settling Time	ms	-	≤ 2.22	min
PID Noise Error	%	-	≤ 2	min
ISR Utilization	%	-	≤ 75	min

Table 1: Real-Time Control RCG's

2 PID Design

2.1 Overview

2.2 PID Tuning

2.3

3 ISR Design

3.1 Overview

3.2 Clock Configuration

3.3 ISR Utilization

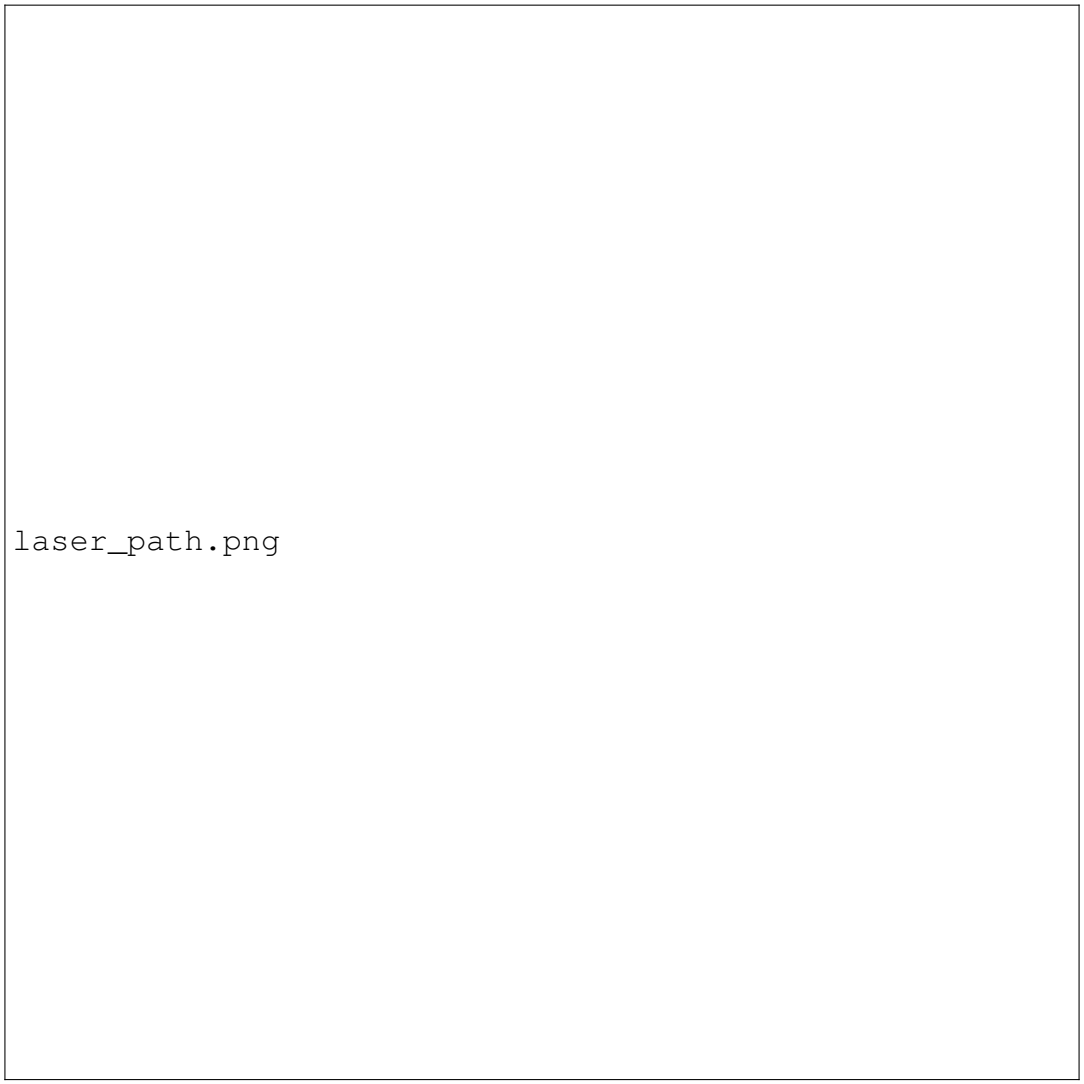

Figure 1: Laser Path and Point Order