# Optimization of the use of Motion Profiling in the First Robotics Competition with a New Velocity Profile Generator

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## Motivation

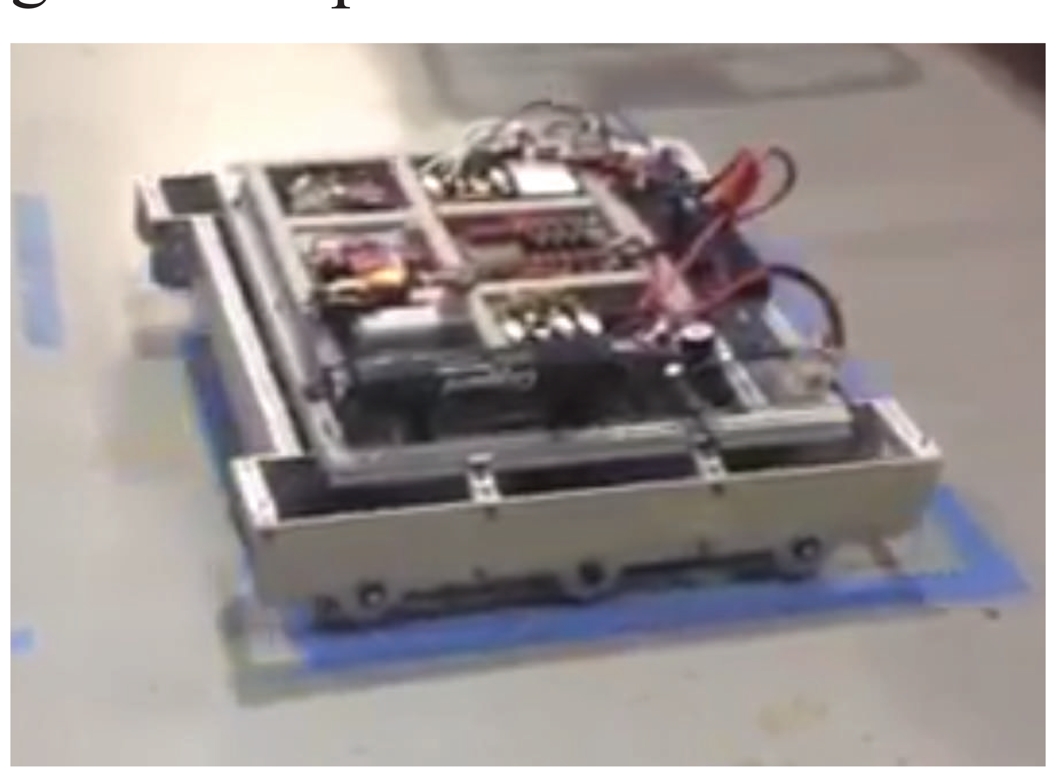
• Enabling realiable real-time motion profile generation in the First Robotics Competition (FRC)

## Introduction

• Most attempts to use motion profile in FRC are either off-board or inflexible (e.g. straight-line trapezoidal profiles).
• CV-guided motion profile generation can add extreme capabilities to FRC robots.

## Approach

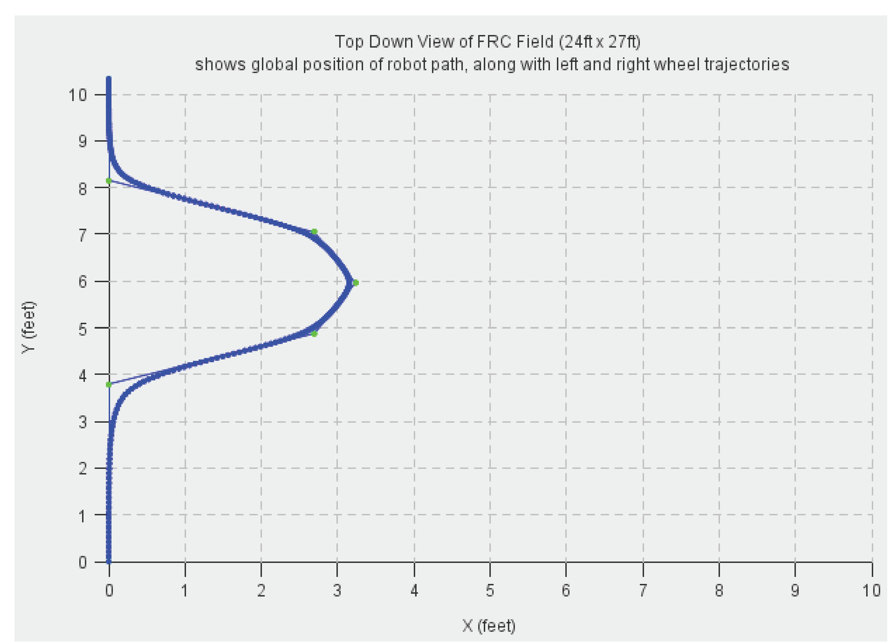
• First testing straight-line paths, then a curved path
• Field-testing the effects of several variables on the quality of the generated paths



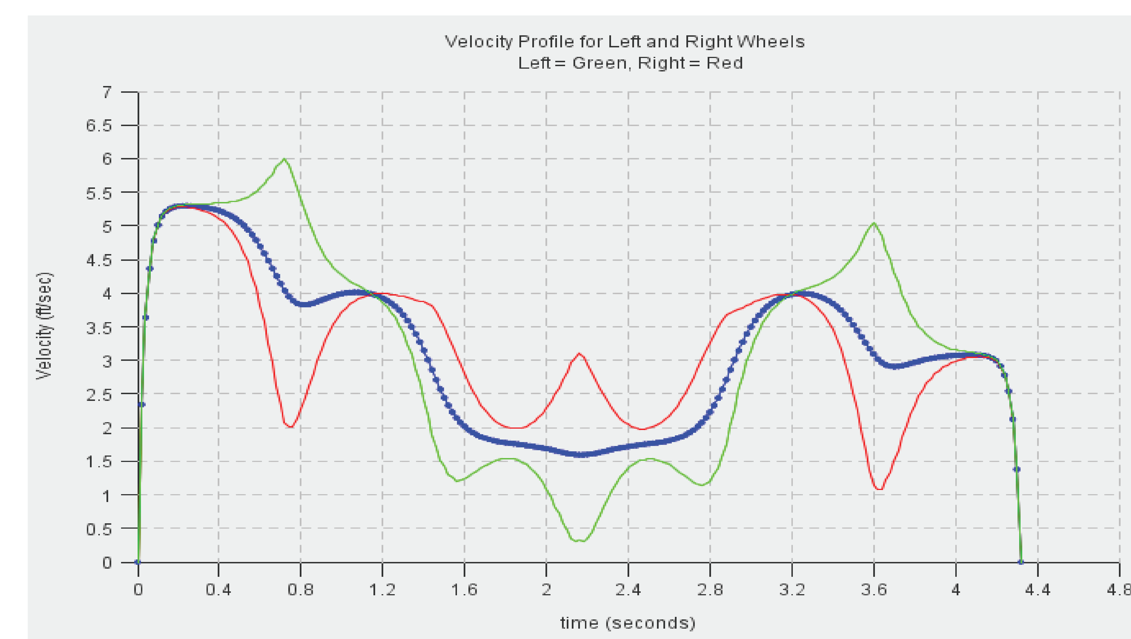
## Methods

• Using the newly-developed “SmoothPathPlanner”[1] tool to generate velocity profiles for left and right wheels

**Path:**



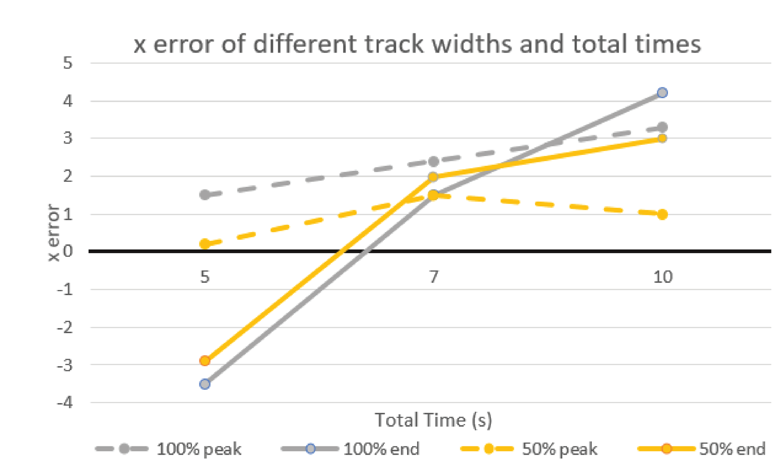

**Velocity Profile:**

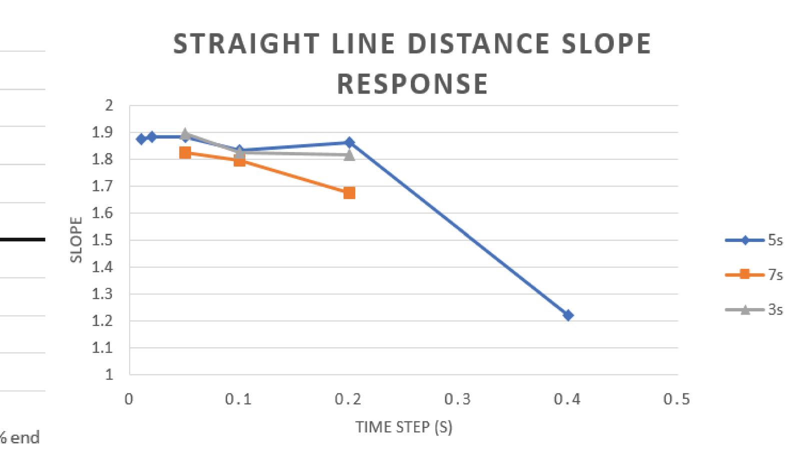



• Writing programs to load the generated 2d arrays onto the motor controllers, with the newly built “Motion Profile” funtionality on the Talon SRX motor controller.
• Studying the effects of several vatiables such as time step, total time, and track width on the quality of both straight-line paths and curved paths.
• Using a specifically-designed curved path to measure the x- and y- error of two critical waypoints (peak-point & endpoint)
• Writing programs to generate generate motion profiles based on visual feedback using an OpenCV-powered software GRIP.
• Setting up by tuning PID values and calibrating for straight-driving
• Calibrating between real-world distance values and input distance values during straight-path testing

## Results

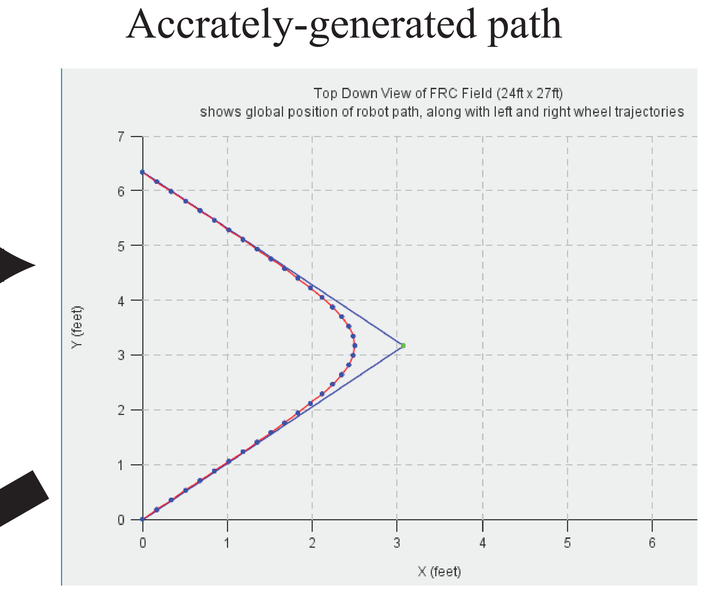
• Able to generate smooth and accurate straight-line paths
• Able to generate high fidelity curved paths with proper parameters set up



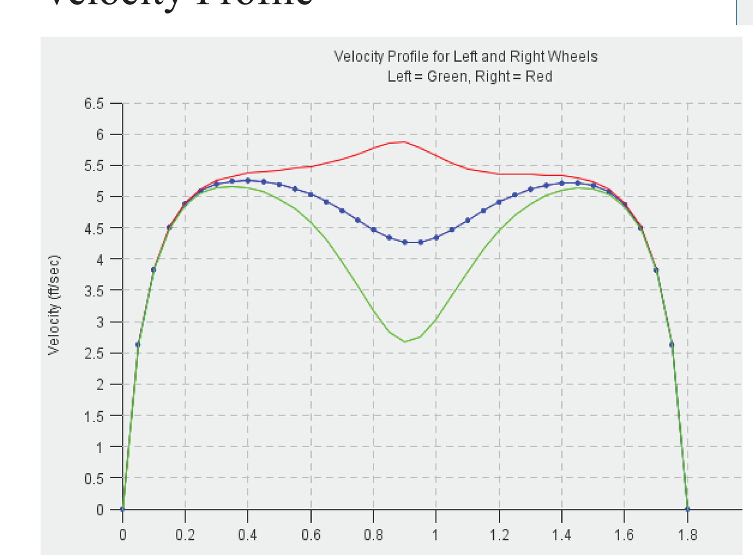




Target (at an angle)

Accrately-generated path



Velocity Profile



• total path time is negatively correlated to fidelity of path shape
• track width is positively correlated to the path’s curvature
• PID values, battery power have effect on consistency of path
• shorter paths have less reliability

## Future Work

• Resolve static-state y- errors with different calibration functions
• Develop high-resolution velocity monitor tools to tune PID values more accurately
• Test accuracy of CV-guided motion profile paths

### Reference

[1] KHEngineering," SmoothPathPlanner," (2014), GitHub repository, https://github.com/KHEngineering/SmoothPathPlanner.

### Acknowledgements

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