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

Chun Ming Jeffrey Zhang, Carnegie Mellon University | Mentor: Dr. George Kantor

**Motivation**

- Enabling reliable 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:**

<table>
<thead>
<tr>
<th>Time (s)</th>
<th>Velocity (m/s)</th>
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<tbody>
<tr>
<td>0</td>
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<td>1</td>
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**Velocity Profile:**

- Writing programs to load the generated 2d arrays onto the motor controllers, with the newly built “Motion Profile” function on the Talon SRX motor controller.
- Studying the effects of several variables 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 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

**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

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**Reference**