Applying a Simplified Motion Profiling Algorithm to a Target Following Arm With Two Degrees of Freedom: A Three Year Study

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When moving autonomously, robots struggle to move to an exact target position, usually overshooting the goal. This is because it is impossible to infinitely decelerate (or stop immediately). A motion profiling algorithm uses the robots kinematics (like velocity and acceleration) to calculate the best path to take to reach the target position smoothly and without much overshoot. This year, motion profiling will be applied to a robot with two degrees of freedom (two axes of rotation) that uses a camera to follow a target (in this case it was an April tag). The arm was tested using code without motion profiling, code with motion profiling, and PID, another way of correcting error in robot movement that uses tuned constants. Each motor of the arm was rotated individually to a target without change in target, with target correction, and towards a target using the camera. Then both motors were tested together to see the effects on the accuracy. The target following proved to be successful, and the motion profiling increased the accuracy across all tests. PID was at a lower accuracy than motion profiling and had less precision and longer runtime due to the difficulty of tuning the PID constants. While the different loads and physics can affect the robot movement, the motion profiling code allows for editing to account for these factors. Overall, the motion profiling proved to increase the accuracy of the arm movement and be an applicable, easy to use code for robot movement.

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