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| PID TRANSPORT  **Year 13 project**  **LUKE WALTON** | |

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# Requirements Analysis

## Introduction of project/scope

PID is a closed feedback loop using Proportional, Integral, and Derivative calculation, designed to meet a numerical goal without overshooting. This is often used in automatic systems, for high speed and accuracy.

Some important terms to understand for this are:

Set Point – The desired value

Process Value – The current value

Error – The difference between the SP and PV

Output – The calculated PID output

kP, kI, kD – The constants used in calculation

I intend to build a teaching tool able of demonstrating mathematical principles, like Integral and Derivatives, in a fun and interesting way for the students. I think to be able to see calculations being ran and used in real time will really help them develop an interest in what’s happening behind the screen, and hopefully help them remember what they are learning.

Alternately, the PID module could be separated and used for any of the aforementioned applications, and more. The PID algorithm itself is usable in any context, provided it is tuned correctly via the passed in parameters, like P, I and D constants, or clamping and scaling values.

## Identification of problem

Imagine a thermostat. When you set it to a particular temperature, you want it to reach that point quickly and accurately. Behind the screen there will be a PID module controlling the heating, turning it up and down perfectly so that it reaches the set temperature, without overshooting.

Behind the screen, there will be a PID model reading the Process Value from the temperature sensor and giving its output to control the heating. Now imagine those exact same principles but controlling a servo or piston to reach a distance or angle, and you have a robotic arm, picking up and moving items off of a conveyor belt.

## Identification of the prospective user(s)

Usable in maths for demonstrating the uses of Proportional, Integral and Derivative relationships, Maths teachers and students alike could use and benefit from this tool, watching how the calculations work, what they do for the system, and being able to influence it themselves.

However, it is also applicable to Mechanics in Maths and Physics as the models demonstrate a physical autonomous system moving and compensating for momentum and drag. The models representing systems keeping a rocket upright, or automatically driving a car, would be very helpful to study how the system compensates for these outside factors that the students will study.

When put into a program, it becomes open to Computer Science students and teachers, demonstrating autonomous systems and feedback loops. The PID module itself being useful in robotics, but also the programming principles demonstrated by using the one module in multiple front-end models.

## Interview with Sponsor

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## Research into current or alternate methods

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## Interview end users

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## User Needs

e

## Requirements and Limitations

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## Objectives (SMART)

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# Technical Analysis

## Technology comparisons

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## Chosen Technology

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## Architecture overview

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## Mathematical model

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## Gap Analysis

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## Prototype

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# Functional Design

# Technical Design

# Technical Solution

# Systems Testing

# Evaluation