Name(s) Michael L. Yuan	Project Number **S1022**

Project Title

PID Controlled Ball Balancing System

Abstract

Objectives/Goals

The purpose of this project is to create a precise control system for applications in microscopy, microsurgery, and robotics. Currently in this area (field), cost and precision are things that could be improved. This system is used as a general approach to demonstrate accuracy while maintaining a lower cost (making it more accessible). The goal is to design and implement an automated system that can balance a ball (at a desired location) on a platform. The product (result) will be evaluated based on accuracy (how well it can balance the ball), speed (how fast can it return the ball to the desired position), and cost.

Methods/Materials

I started to tackle this project by coming up with a (structural) design through online research and finding a structure (model) that would fit the design requirements (able to perform the necessary functions). This model allowed me to start gathering the components needed for the system to operate. The Arduino Mega 2560, a programmable microcontroller that is used to control the other components, is the core of this system. Other notable components include Micro Servo motors (allows movement) and a resistive touch screen (provides data). After testing and getting familiar with these components, I put everything together to form one cohesive system. This lead to the development of the (my own) software (including the PID control algorithm) that would be driving the rest of the system. Following the integration of software and hardware, I began tuning the PID control algorithm through manual calibration.

Results

The current, fully functional, system can balance a ball under eight seconds and with an accuracy of ± 1.5 cm. The total cost of this system is around \$90.

Conclusions/Discussion

This project successfully achieved the original goal of creating an automated control system. It demonstrated that a precise system could be created while still considering the cost factor. Throughout the process, I learned a lot about the engineering process, the diversity of the Arduino platform, the PID control algorithm (how to implement and tune it), and about the different components. The results are general, and the backend system is very versatile, having a sundry of applications.

Summary Statement

A system that can automatically balance a ball (to a desired location) on a platform using a PID control algorithm.

Help Received

Most of the project (software and hardware) was done by myself. I discussed and worked together with my parents and teachers when I had questions.