# Development of An Inverse Pendulum Control System

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## Introduction

The inverted pendulum project was leftover from a previous project that couldn’t successfully balance the pendulum upside down. For the mechanical components, our motivation was to integrate and improve the mechanical system that the previous group had put designed and assembled. The motivation for the software was to develop it in such a way that it can successfully balance the pendulum efficiently by communicating with the encoders from the previous group. Need more.

## Specifications

## Design Development

## Hardware Design

Much of the hardware design was dictated by what was leftover from the previous group. The previous group had an aluminum frame, motor mounting with idler pulleys, a motor with an encoder equipped, a rail, two pulleys at each end of the rail with one in housing and the other on their motor, a belt, a linear cart with bearings, the pendulum housing, a pendulum, and an independent encoder on the pendulum.

With the bulk of the mechanical components already acquired, we focused on improving the design to meet certain functions. This involved getting rid of the idler pulleys on the motor mount as they interfered with the torque delivery of the motor significantly. The leftover motor was swapped for a new motor that was powerful and responsive enough for our demands while still being able to be powered conveniently. Limit switches were purchased, and mounts were made specifically to them to allow positioning at the ends of the rail in a location where the slider could hit it. Foam dampers were positioned at the end of the rail to protect the limit switches in case our system moved the slider faster than the limit switches could tell the motor to stop. To prevent the belt from rubbing on the pendulum housing, we replaced our leftover pulleys with bigger pulleys which matched the pitch of the belt left on the machine. The bigger pulleys also allowed the motor to move the slider faster due to the higher gear ratio than with the previous pulleys which we concluded would help make our system more responsive.

## Software Design

## Results

## Appendices