BALL AND PLATE

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Introduction

Automation, a continuously evolving field, has led to decreased human labor, increased production speed, and reduced error rates. This project uses a ball and plate system to illustrate these concepts, focusing on the PID control algorithm for system automation.

Electrical Design Requirements

COMPONENT	TASK
	MG996R servo motor is used for adjusting the plate position.
	The LED power supply is responsible for regulating the voltage coming from the mains.
	Arduino Mega is used for data processing.
	The LM2596 buck converter system is responsible for regulating 6V output voltage.
	The 4 wire touchscreen is used to achieve the ball position

Table 1: Electrical components required for the system

Solution Methodology

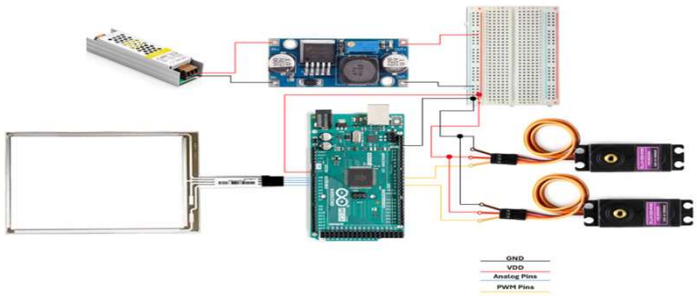

Figure 1: The overall electrical architecture of the system

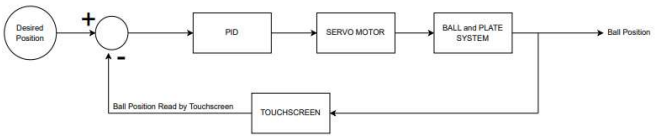

Figure 2: The block diagram of the system

The system has been theoretically modeled, resulting in the transfer functions for the X and Y axes as given below.

$$G_x = \frac{K_x}{s^2} \qquad G_y = \frac{K_y}{s^2}$$

Using these transfer functions, theoretical PID parameters were obtained, but they were not suitable for the actual system. Therefore, practical parameters were determined through trial and error.

Application Areas

- **Precision System Design:** The Ball and Plate project is a great project for learning how to reduce human errors in mass-produced products.
- **Robotic:** The insights gained from the ball and plate project can be used in the design and production of robotic systems.
- **Automation:** The ball and plate project is an excellent way to understand the fundamental building blocks of automation

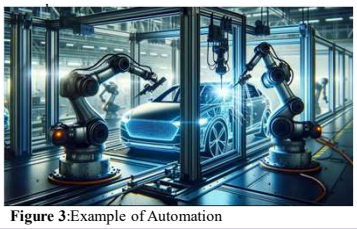

Figure 3:Example of Automation

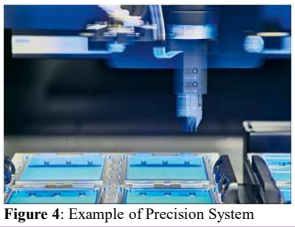

Figure 4: Example of Precision System

Results and Discussion

The required PID parameters were obtained using transfear functions and the trial and error method. The studies were guided by our advisor's feedback and exmined in a simulation environment.

The necessary PID parameters for the project were obtained using transfer functions and the trial and error method. The studies were conducted according to our advisor's feedback and examined in a simulation environment. As a result of these studies, the integrator value was set to zero as it affected the system's stability. For the X-axis, $K_p = 3$ and $K_d = 1$ were determined, while for the Y-axis, $K_p = 2$ and $K_d = 1$ were calculated.

Understanding the fundamentals and principles behind the ball and plate project facilitates the comprehension of automation and robotics industries. As a result of studies in these fields, designing more precise and professional systems that require less human labor in the future will be easily achievable.

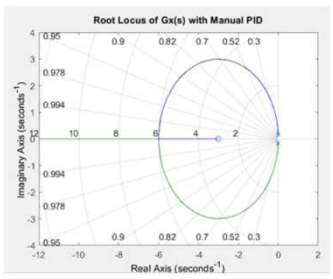

Figure 5: Root locus of the X-axis

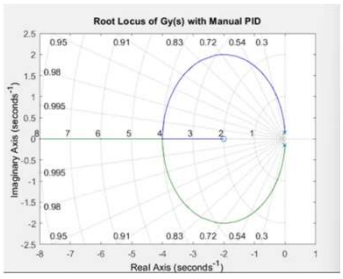

Figure 6: Root locus of the Y-axis

Figure 7: Demo of the Ball and Plate System

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References

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