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Final Project Proposal

PID-controlled Ball Balance

PROJECT GOALS:

Design and implement a PID-controlled ball balance system using the AVR BLE Atmega3208 board, a digital servo motor, and an ultrasonic sensor. The project will involve programming the PID algorithm to maintain the ball's position on a balancing platform.

This project leverages several key skills learned in the course:

- **Digital I/O:** Interfacing the digital servo motor and ultrasonic sensor.
- **Interrupts and Timers:** Implementing precise control and timing within the PID algorithm.
- **Analog I/O:** Ensuring accurate sensor readings.
- **Wired communication:** Integrating components via SPI.
- **Embedded software design practices:** Developing robust, real-time software for the system.
- **Control systems:** Applying PID control theory to balance the ball.
- **Real Time:** Managing real-time constraints in the system.

Challenges include fine-tuning the PID parameters for optimal performance in order to ensure accurate and consistent readings from the ultrasonic sensor, and managing the real-time constraints of the system. Additionally, integrating the hardware components with the AVR-BLE board and ensuring stable communication can be challenging.

I expect to deepen my understanding of control systems, particularly PID controllers. This project will enhance my skills in sensor data acquisition, real-time system programming, and hardware-software integration.

HARDWARE NEEDS/BOM:

Parts:	Part #:	Manufacturer:	Man. Product #:	Vendor	Link:	Quantity:	Price:
Ultrasonic Distance Sensor - 5V DC SEN-15569	HC-SR04	-	-	SparkFun	LINK	1	\$4.50
Digital Servo20KG Servo Motor High Torque RC Servo Metal Gear Waterproof for 1/6, 1/8, 1/10, 1/12 R/C Model	DS3218	Miuzei Store	DS3218	Amazon	LINK	1	\$13.59
DC Barrel Jack Adapter - Breadboard Compatible	PRT-10811	4UCON TECHNOLOGY	-	SparkFun	LINK	1	\$1.05
AC/DC WALL MOUNT ADAPTER 5V 10W	237-1385-ND	Triad Magnetics	WSU050-2000	DigiKey	LINK	1	\$7.04
Ping pong Balls	-	Meizhour	-	Amazon	LINK	1	\$6.59
11x14 Picture Frame	-	Fun Memories Store	-	Amazon	LINK	1	\$27.99
05018 Beveled Wooden Ruler With single metal edge	-	Westcott Store	-	Amazon	LINK	Pack of 2	\$4.50