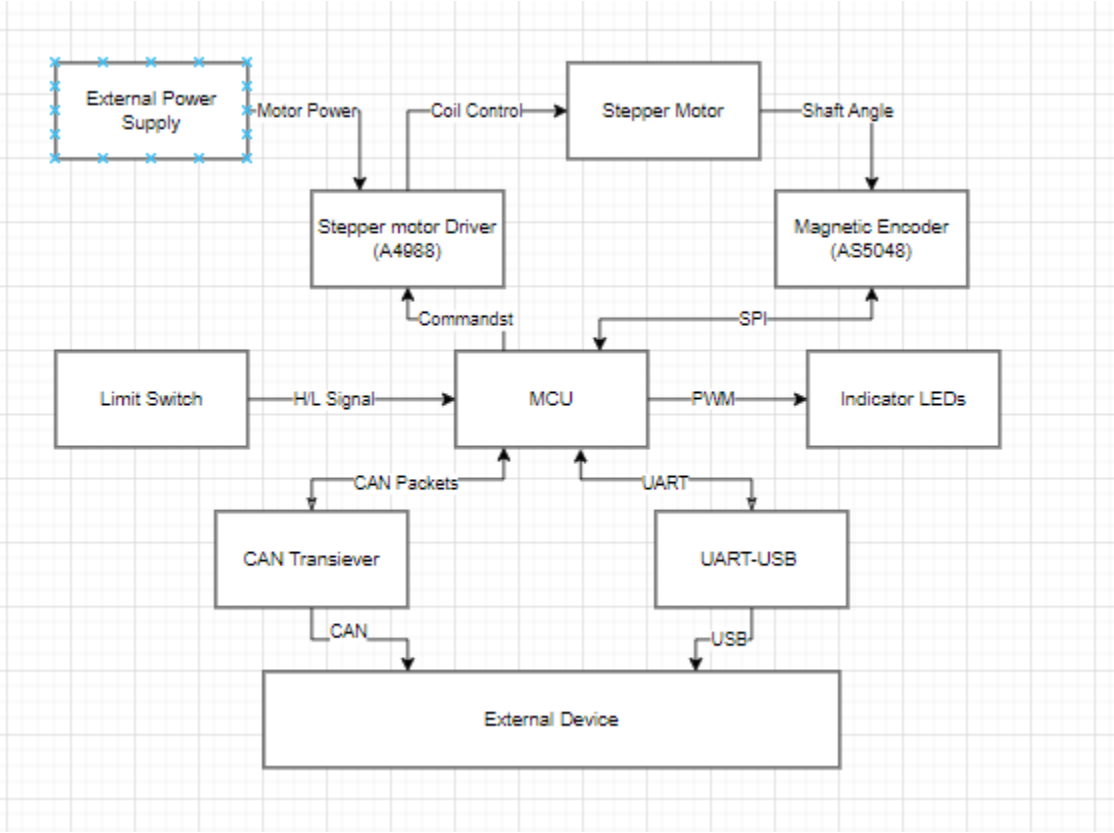
Easy Drive: Servo Controller with CAN and UART Interface

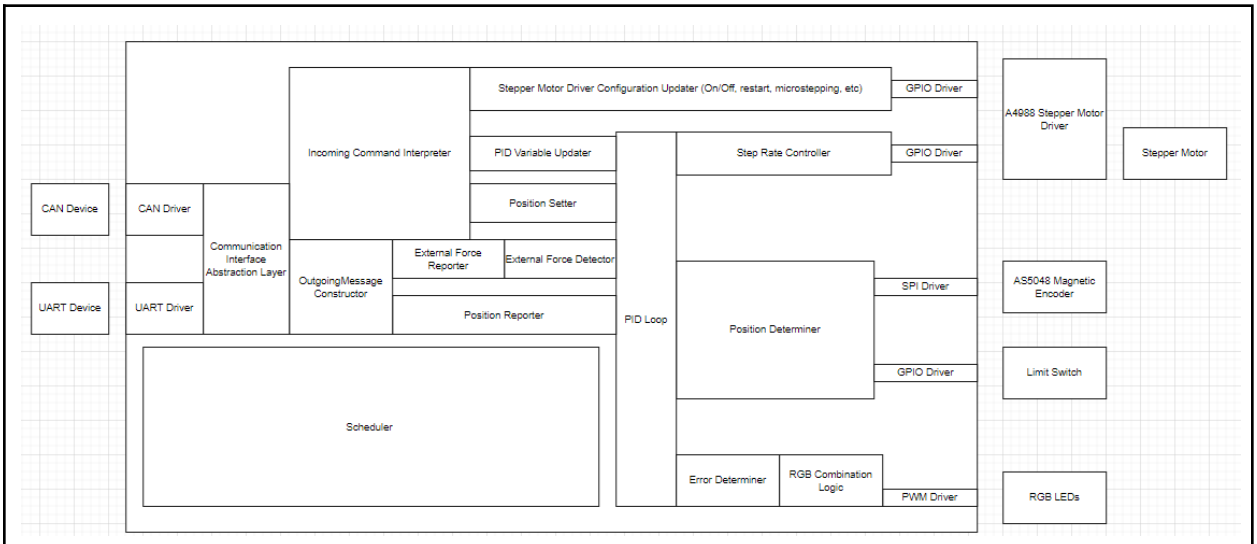
Description:

Easy Drive is a closed loop stepper motor controller, it features both CAN bus and UART control interfaces. Easy Drive is able to accept a number of commands such as “go to angular position”, “report current position”, and can notify host devices if external forces cause changes to the system state (angular position). Easy Drive also incorporates LEDs to give qualitative information about the instantaneous error of the angular control system.



Hardware Block Diagram

Development Setup



Software Architecture Diagram

Bits of code which need to run at set intervals		
Code Block	Description	Frequency
Step rate Controller	As the stepper motor driver takes a single high/low transition to signal a “step”, the output of the PID loop must be converted into a step frequency and said step frequency continuously implemented	High
PID Loop	The PID loop must run at consistent intervals in order for the Integral action to be effective and give good results	Medium
Position Determiner	Reads Encoder and reports angular position. The position determiner must run at least as often as the PID loop to ensure accurate feedback is always present in the control loop. It must also be high enough to ensure External forces can be detected. Frequency is limited by max sampling frequency of SPI bus	Medium or greater
External Force Detector	Reads the Position Determiner value and compares it to the last value as well as looks at the input commands and determines if any movement seen is caused by external forces or is the result of a movement command.	Medium

	Frequency is limited by the frequency of the position determiner	

Bits of code which are triggered by events		
Code Block	Description	Trigger
RGB output	The color of the LED should change based on the error of the output to the commanded value (Green = low error, Red = high Error)	Change in Error value
Position Setter	Updates the setpoint in the PID loop based input commands.	Setpoint Command Received
Position Reporter	Constructs and sends output message containing the current angular position of the output	Report Position Command Received
External Force Reporter	Constructs and sends output message indicating that an external force has been detected (also includes clockwise/anti-clockwise direction of force)	External Force Detector determines that an external force has changed output position
PID Variable Updater	Updates the proportional, integral and derivative constant values within the PID for tuning purposes.	PID Variable Update Command Received
Stepper Motor Driver Configuration Updater	Updates the configuration settings of the A4988 driver such as microstepping rate, reset, on/off	Stepper Driver Configuration update command Received