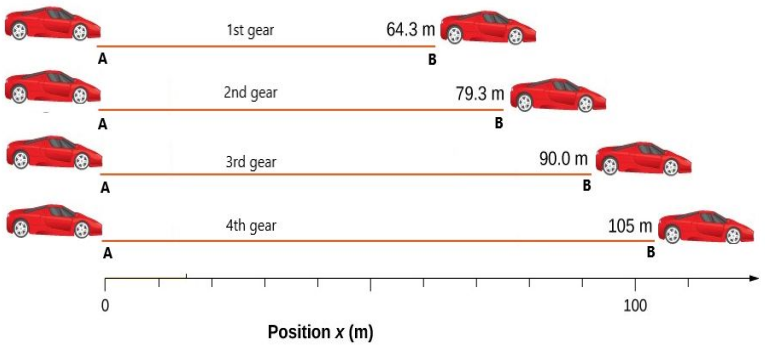
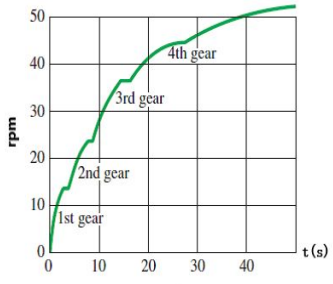
Empathize

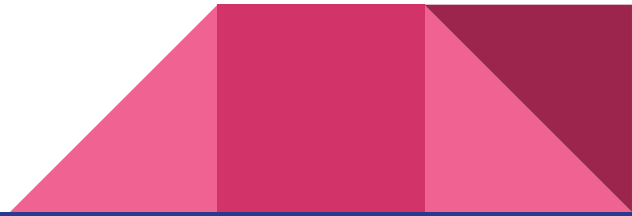
BMW designed a dual-clutch transmission, which allows incredibly fast gear shifting. However, it is not commercially viable, due to lackluster acceleration. The company wants to redesign the transmission to meet the industry acceleration benchmarks.





Define

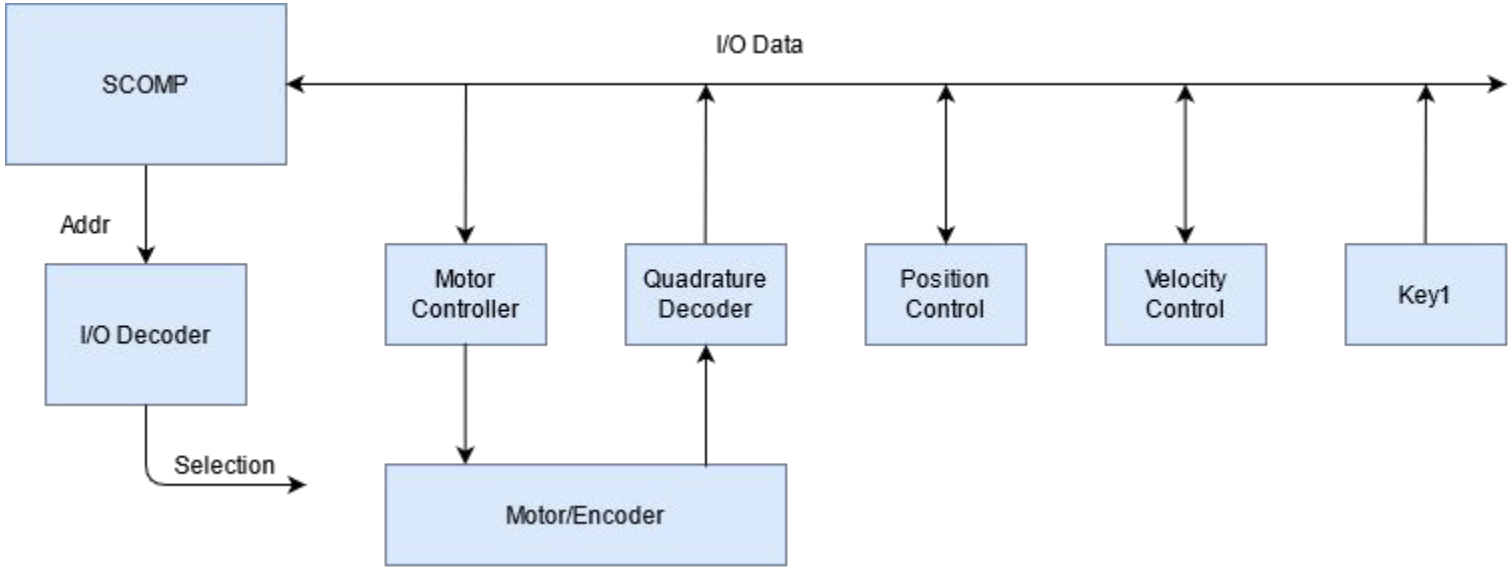
- Basic Requirements
  - Read motor position at maximum resolution
  - Control motor position
  - Control motor speed in both directions
- Additional Requirements
  - User Interface (how the user interacts with the basic features)



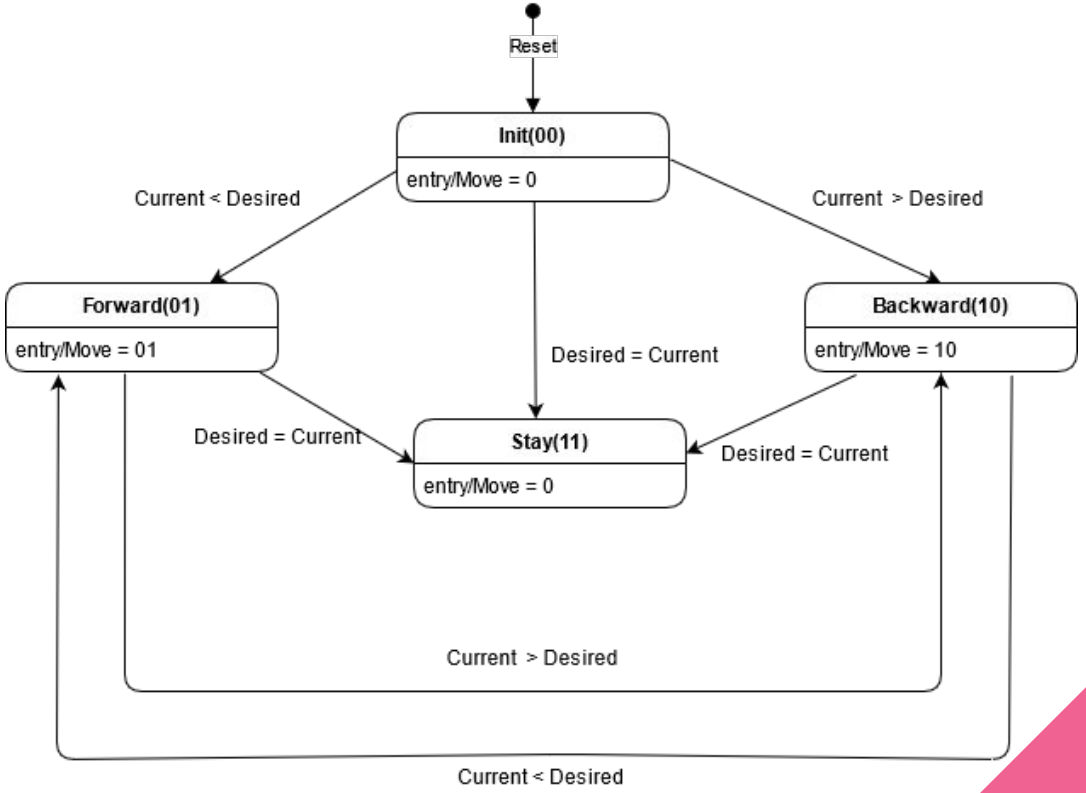
Ideate

- The user gives two positions and a time value through FPGA switches
- The motor moves to the first position (position control)
- The motor moves to the second position over the given time (velocity control)

Prototype

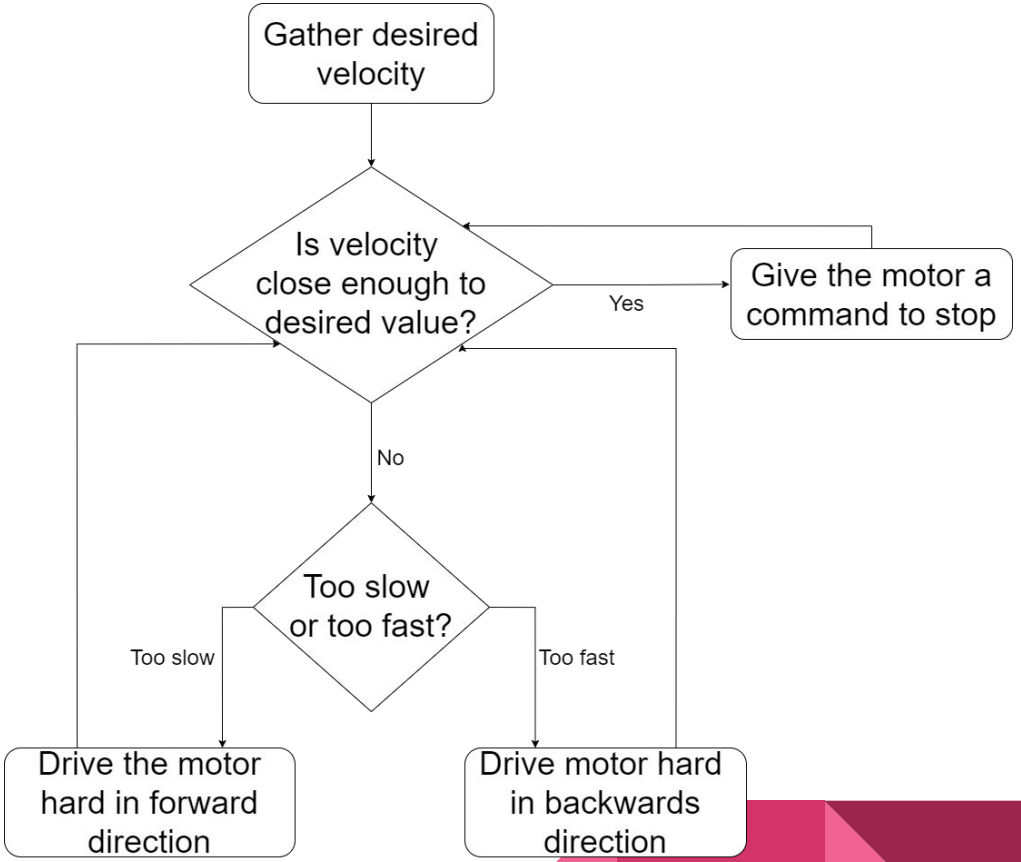

SCOMP
I/O Data
Addr
I/O Decoder
Selection
Motor Controller
Quadrature Decoder
Position Control
Velocity Control
Key1
Motor/Encoder

Position Control



Velocity Control

- Need to find and control velocity
- Tools that we have available:
  - Quadrature encoder signals
  - Pulse Width Modulation (PWM) signals
  - Bang-zero-bang motor control

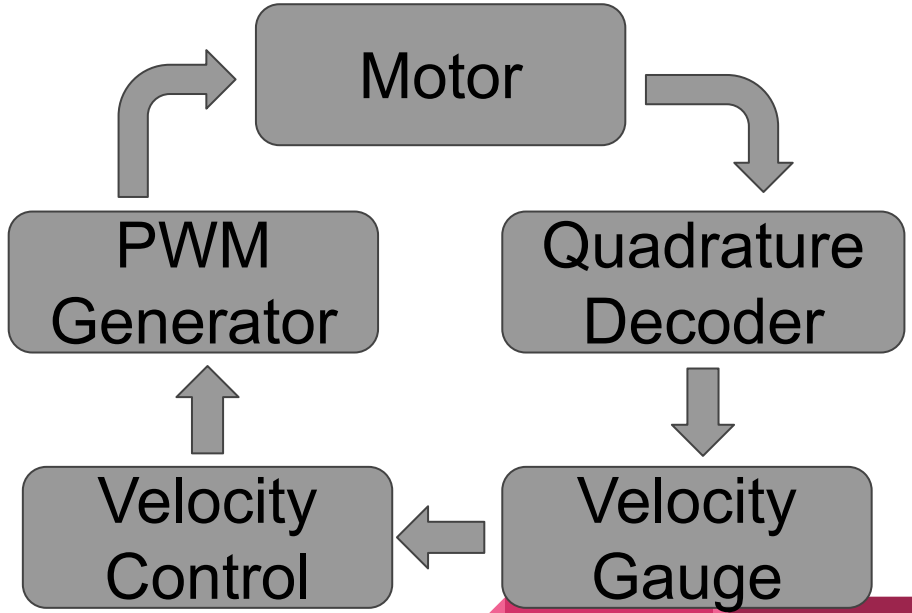


How can we use these tools to find velocity?

- Create a peripheral to find the velocity
  - Takes in the count value from the quadrature decoder peripheral every .1 seconds
  - Finds change in the count value after each interval
  - Counts per interval can be converted to revolutions per minute

How can we use these tools to control velocity?

- Peripheral to control the velocity
  - Compares the desired velocity value to the current velocity
  - Apply bang-zero-bang control to determine what the motor should do

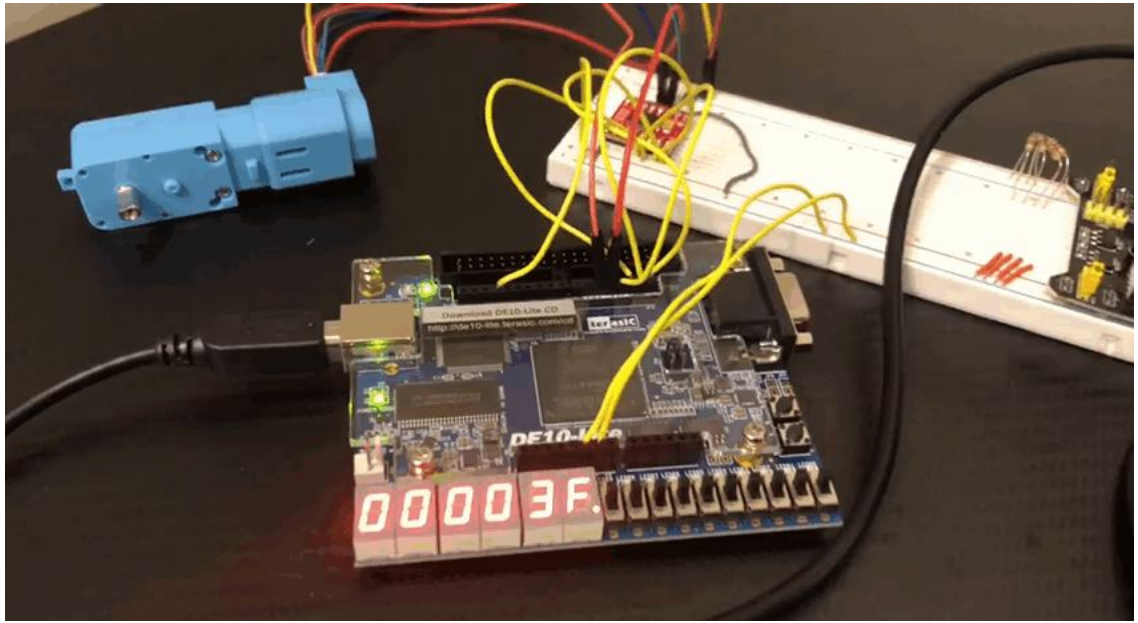


Justification For Approach

- Approach is similar to bang zero bang
- Approach uses time and length inputs for our problems
  - Transmission Testing
- Fits with position and velocity control parts
- Use of peripherals simplifies software

Results

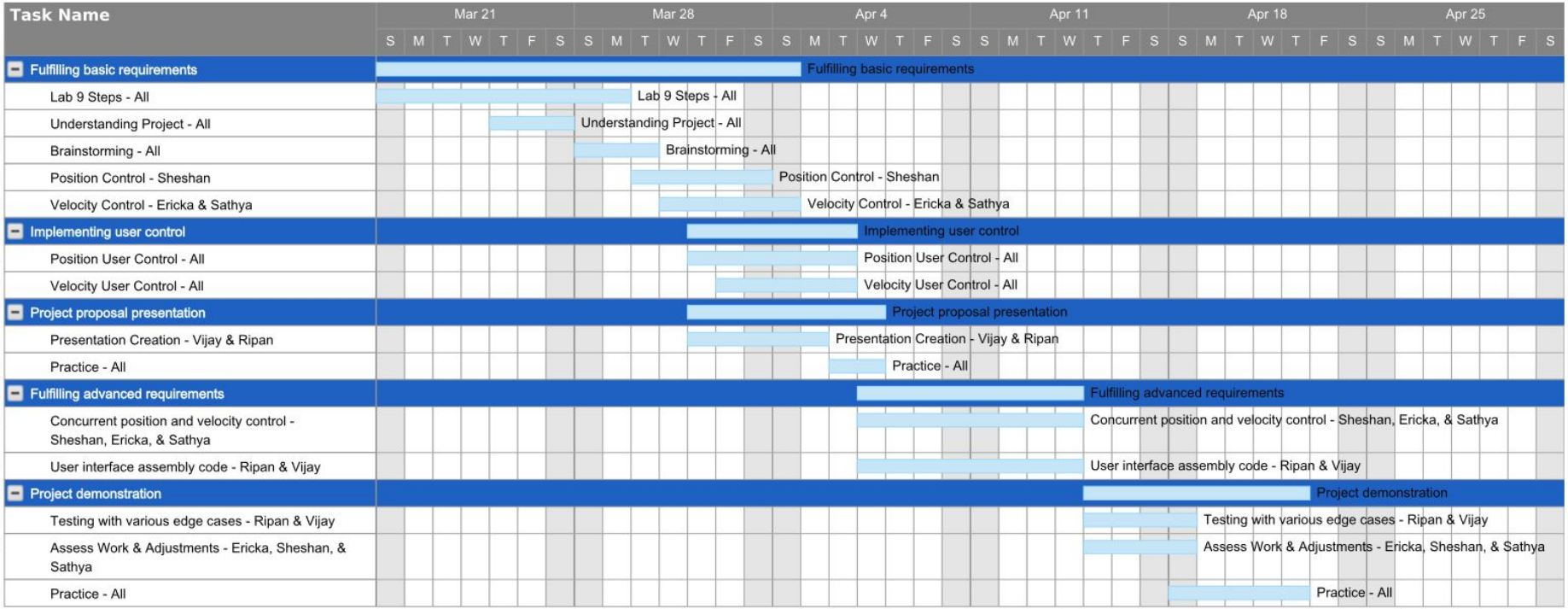
- So far, we have
  - Controlled motor position
  - Controlled motor velocity



Project Parts and Deadlines

- Fulfilling basic requirements
- Implementing user interface
- Project proposal presentation
- Fulfilling advanced requirements
- Project demonstration

ECE 2031 Final Project Timeline



Contingency Plan

- We can fall back to a basic version of the project if needed
  - Simpler Version of Bang-Zero-Bang and Velocity Control
- We have a time buffer if more time is needed
  - Allows us to meet more standards requested by the user

Completing Our Goal

- Our goal:
  - To create a system applicable to our problem space
- We have completed:
  - Position control
  - Velocity control
- Moving forward:
  - We have a plan and timeline in place
    - Make velocity and position control work concurrently
    - Create assembly code for user interface