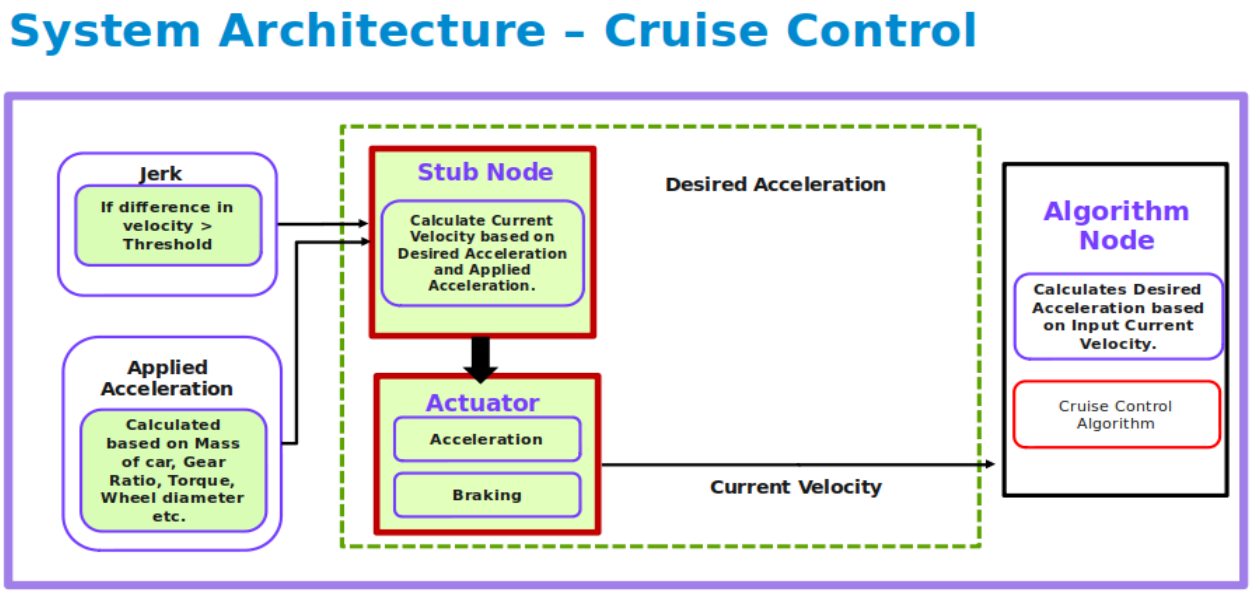
Rudimentary Cruise Control

Stub Node: The Stub Node sends(publishes) the current velocity to the Algorithm Node and subscribes(receives) the desired acceleration from Algorithm Node.

Algorithm Node: The Algorithm Node receives the current velocity calculates the desired acceleration based on the cruise control algorithm and publishes(sends) the desired acceleration to the Stub Node.

Applied Acceleration: The Applied acceleration is calculated using the desired acceleration from Algorithm Node and the Vehicle dynamics.



Vehicle dynamics:
1. Mass of the car
2. Gear Ratio
3. Torque
4. Tire radius

Torque at Wheels = Torque * Gear Ratio
distance = Tire radius / InchtoFeet(12)
Force at Wheels = Torque at Wheels / distance;
Applied Acceleration = Force at Wheels / Mass of car
Applied Acceleration with gravity = Applied Acceleration * GravityPerFeetSquare(32.2)
Applied Acceleration in MPH = Applied Acceleration with gravity * ConstantMPHConvert(0.6818)

Current Velocity: The current velocity is calculated with,

Current Velocity = Previous Velocity + Acceleration wrt time (time =1).
where,
Applied Acceleration: It is the acceleration applied to the current velocity wrt time.

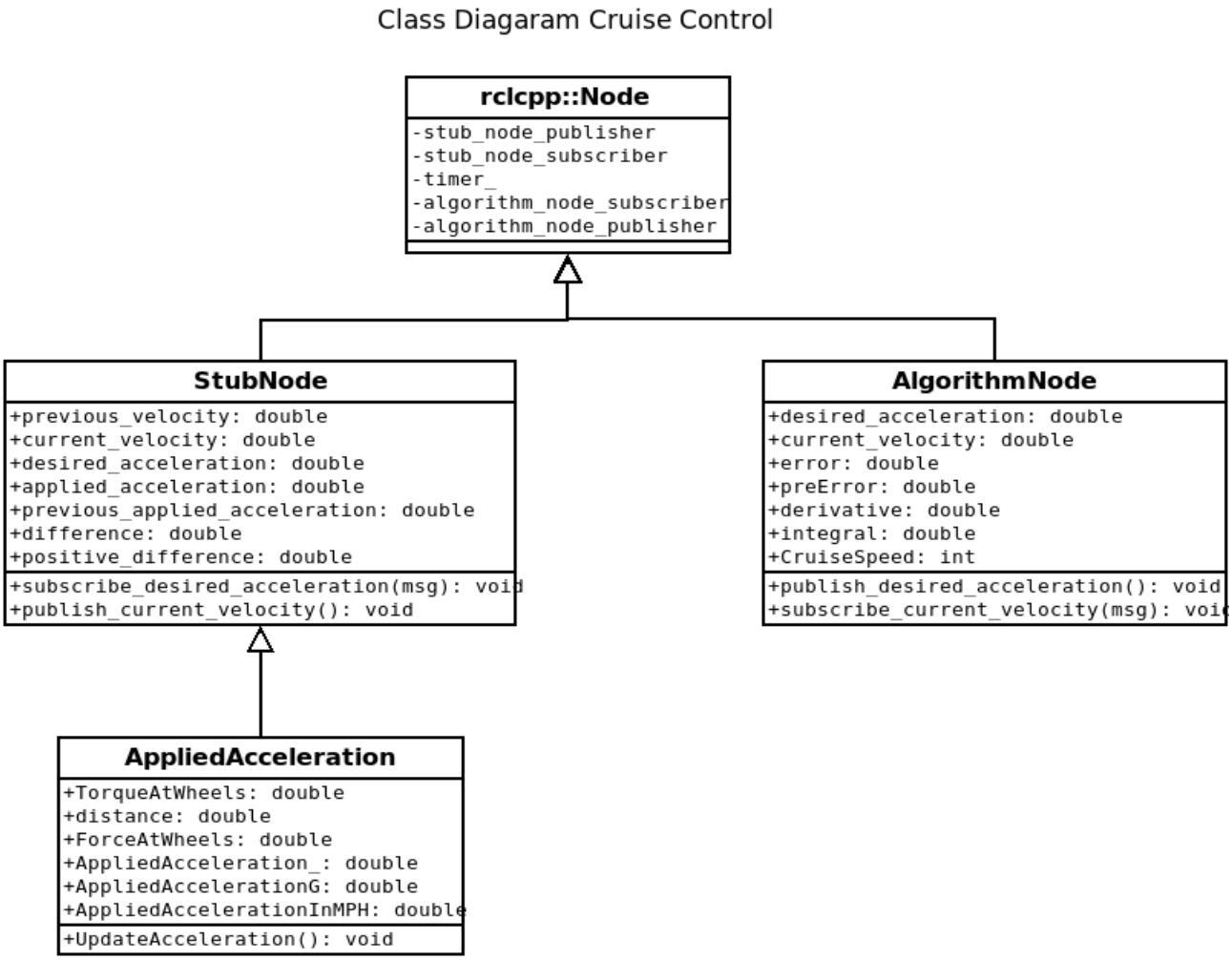
Jerk: It is the rate of change of acceleration; that is, the derivative of acceleration with respect to time, and as such the second derivative of velocity, or the third derivative of position.

Here Jerk is calculated if difference in Previous Velocity and Current Velocity is greater than the threshold value.

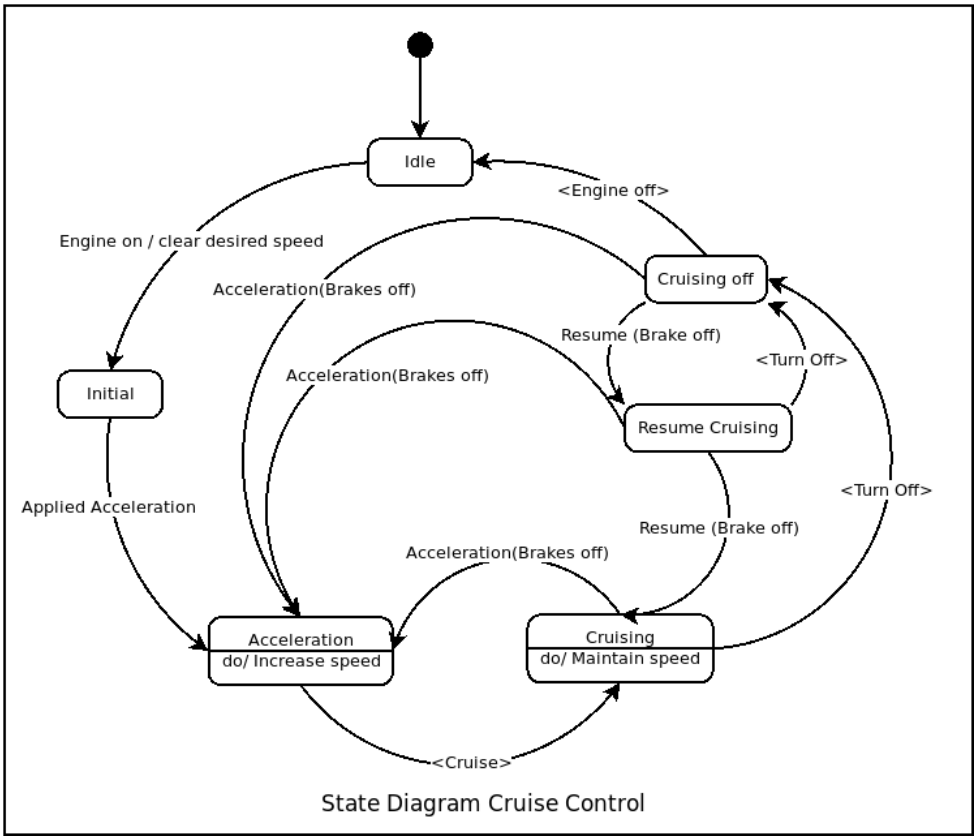
Parameters: The Cruise Speed is given to the system on the command-line using parameters.

Command: *ros2 param set /AlgorithmNode CruiseSpeed value*

Class Diagram:



State Diagram:



State Diagram Cruise Control

Node_Graph: