TASK-1 Implementation of a Controller into prototype Vehicle

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What is Controller?

What are our Major Goals?

**What Necessary assumptions were made by our team?**

What are key questions-

Q. What is the vehicle's desired state?

Q. What kind of control algorithm will be applied to reduce the discrepancy between the desired and actual state?

Q. What limitations on the control outputs are there to maintain the vehicle's stability safety?

Q. Are there any constraints on the control algorithms (e.g., computational complexity hardware limitations)?
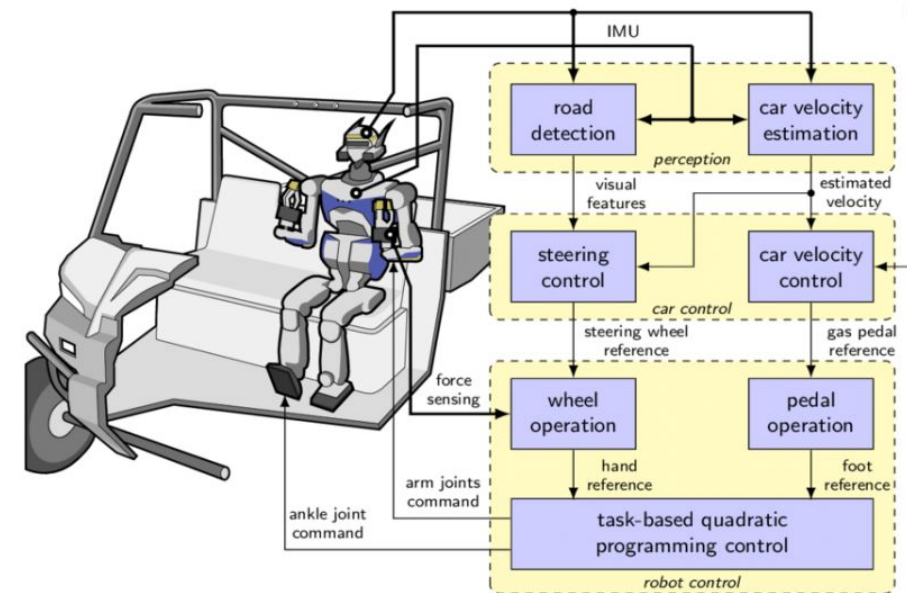
TASK-2 Ride Dynamics analysis using Accelerometer on Phone.

Testing Set-up:

Using the Vibration meter app data related to the accelerometer X,Y & Z axis in m/s^2 is taken on a moving vehicle on for various events such as steady state, acceleration, braking, and bump.

Main Goals-

1. Perform statistical analysis on accelerometer data.

- Being acceleration, the data is noisier than expected even for steady-state driving.
- As per ISO 2631 Z acceleration of less than 0.8m/s^2 can be described as comfortable.
- Fig2 is a bump scenario with peak acceleration @ 3m/s^2, Fig3 is a braking scenario, circled in red is steady state.
- As we can see only during the bump scenario the Z acceleration goes over 0.8m/s^2 which means all noise of the Z signal during other events can not be considered as discomfort.

2. Understanding still what level physical actuator can nullify Z acceleration and noise perception of the driver:

- More than amplitude the capability of the actuator is limited by the frequency of excitation, most actuators are even thought capable of nullifying small displacement but aren't controlled to since tires and some subsystems like bushing are able to nullify those small inputs. Hence most active and semi-active suspensions are tuned for relatively higher excitation. Noise perception mostly isn't affected much by an actuator as noise perception works much above the 400 to 3000Hz range.

Fig1

Fig2

Fig3

Vehicle body's natural mode
Wheel assembly natural model
Engine natural model
Natural modes of windows cabin interior
Vehicle Response
Frequency (Hz)