Arshnoor Singh Sachdeva

Portfolio

Arshnoor Singh| About Me

I am Arshnoor Singh Sachdeva, a recent graduate from Arizona State University with a Masters in Robotics & Autonomous Systems (Mechanical Concentration). I have always been interested in understanding the working behind different things and gaining hand-on experience by working on interdisciplinary projects from initial concepts to final product.

Education

B.E Mechanical Engineering


M.S. Robotics (Mechanical Concentration)

Experience

Analysis Engineering (CAE) Intern

Arshnoor Singh| Tesla

During my summer internship at Tesla, I was part of the Analysis Engineering team.
- I was given the opportunity to work in the durability sub-team and was responsible for the static stress analysis, fatigue life analysis and modal analysis of various components and sub-assemblies.
- I worked on Front Instrument Panel, Brake Pedal, Doors, Center Screen, Frunk and Motor mounts.
- Used Ansa, Abaqus, Meta and nCode Design Life throughout the internship.
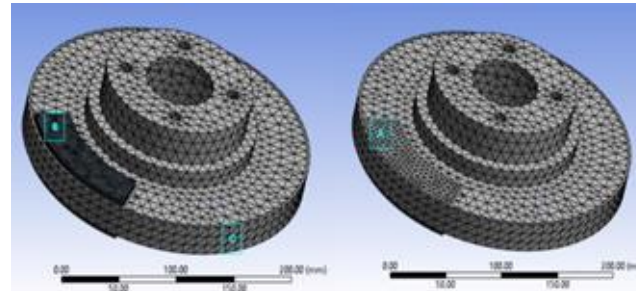

Brake Pedal FEA Model

(a) Displacement

(b) Von-mises Stress

(c) Plastic Strain
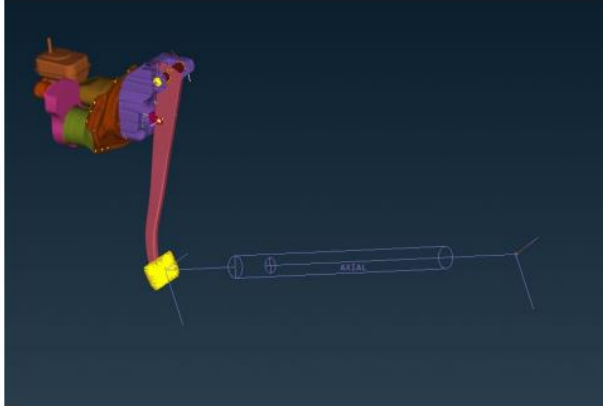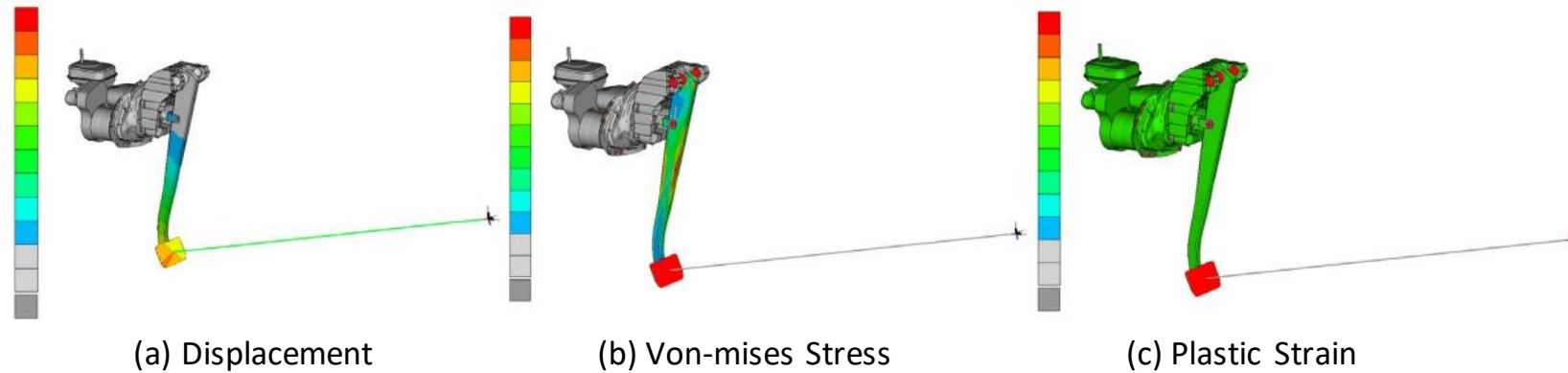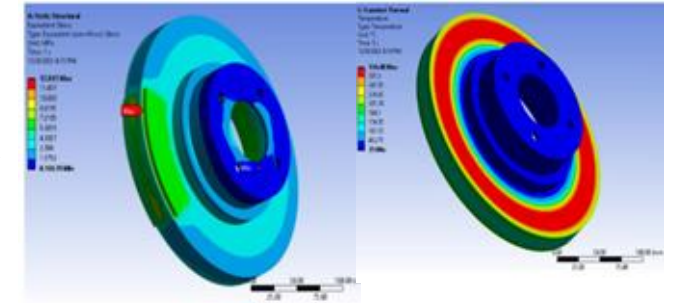
Values are hidden due to NDA

Arshnoor Singh | Brake Disc Optimization

Objective: Reduce the volume of the brake disc geometry while maintaining the static, thermal and modal performance within the limits.

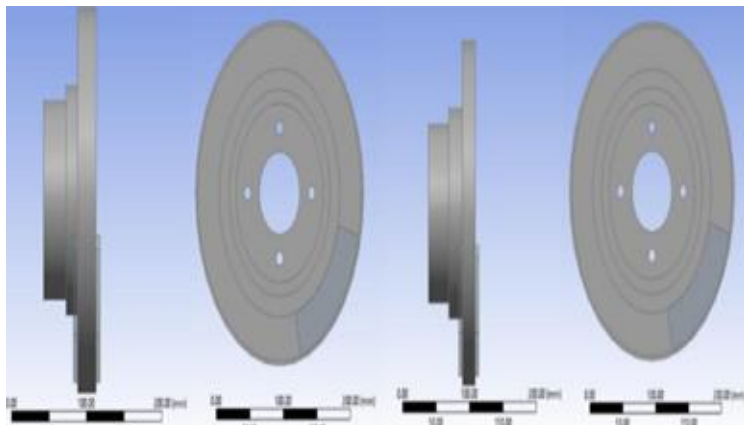Tools Used: Ansys Mechanical, Design of Experiments library, Response Surface

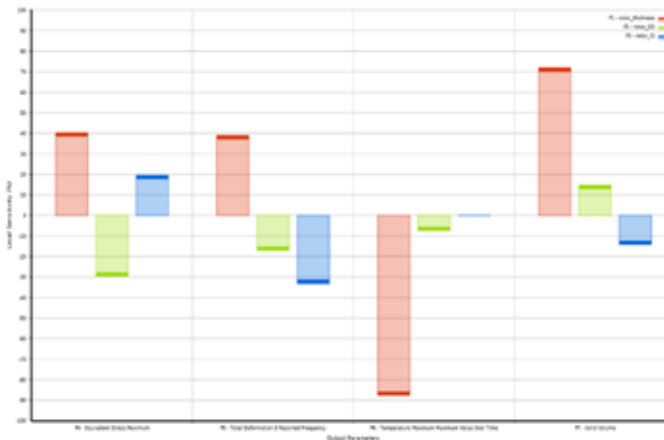Meshed the geometry into small 3D elements

Analyzed structural and thermal loading.

Utilized DOE (Design of Experiment) to construct the 2nd order polynomial response surface model.
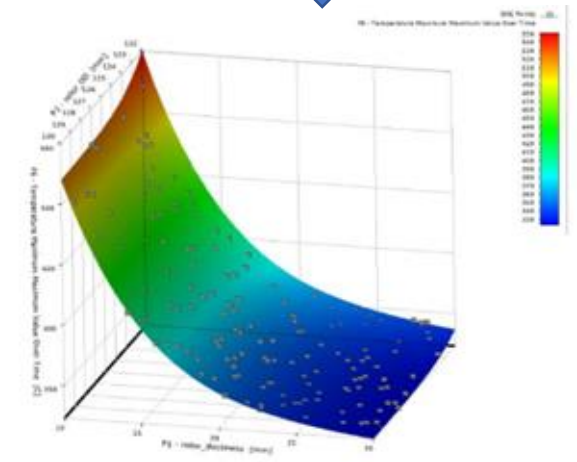
Before Optimization   After Optimization

Reduced volume by 8% with similar performance

Conducted Sensitive analysis study and used MOGA to optimize the design.
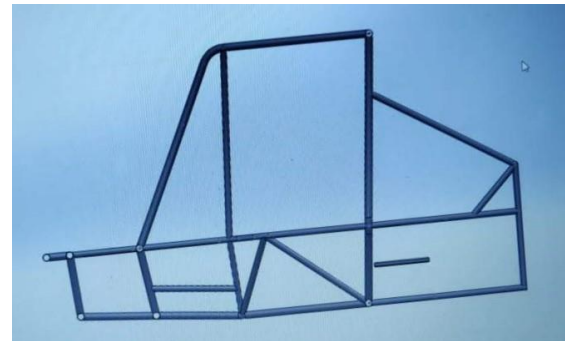
Arshnoor Singh| SAE BAJA

Objective: Design, analyze and manufacture an All-Terrain vehicle and compete in Endurance competition.

Role: Lead CAD modeling team and the powertrain team. Designed the rear suspension geometry with other team members, designed telescopic driveshafts, and participated in prototyping and manufacturing of the vehicle.

Rear Assembly & Telescopic Driveshaft
- Allowed for better articulation of the rear suspension assembly.


Chassis CAD Model

BAJA ATV at Competition

Arshnoor Singh| Wheelchair-Stretcher

Objective: Design and fabricate wheelchair-stretcher convertible for patients / specially-abled people.

Role:

- CAD modelled the wheelchair in Solidworks and produced the idea of mechanism for the conversion mechanism of the wheelchair.
- Participated in the FEA analysis and fabrication process by utilizing techniques like milling, drilling, cutting and welding.
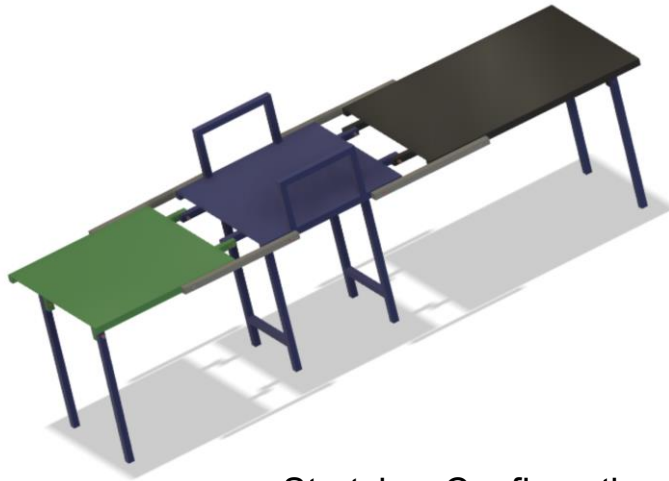
Stretcher Configuration

Wheelchair configuration

# Arshnoor Singh| Cardiovascular Stent

Objective: Design cardiovascular stent with minimum recoil percentage to be used for balloon angioplasty.

Role:

- CAD modelled a cardiovascular stent in Solidworks and setup the model in Ansys for FEA Analysis.
- Calculated the recoil of the stent after the inner balloon is removed and the stent was placed.
- The recoil percentage came about 6% which was comparable to the benchmark stent design provided.
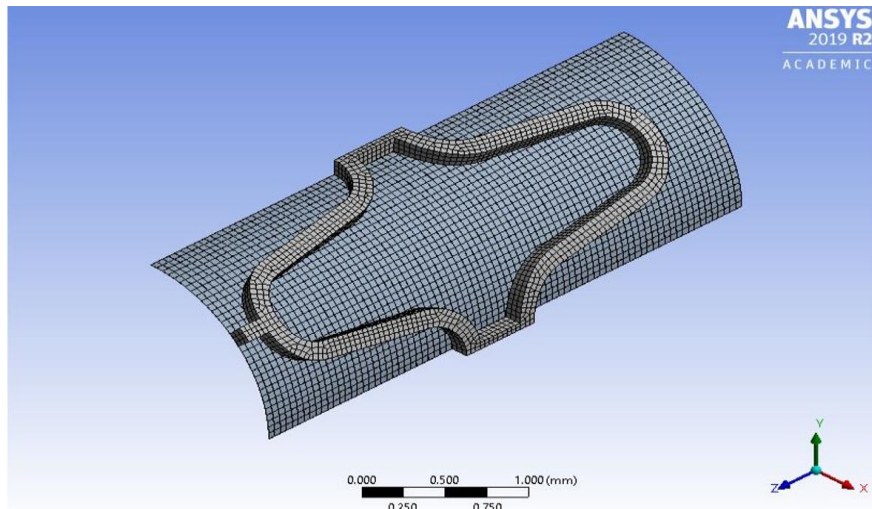
Benchmark Stent Mesh Model
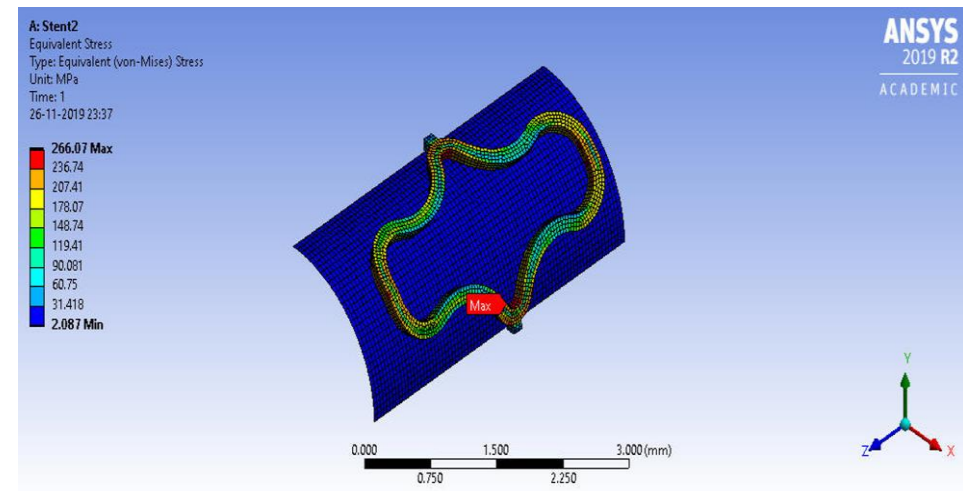
Design Stent Stress Analysis

Arshnoor Singh| NSF CPS Challenge

Objective: Develop control algorithms for the drone to make it flip in the air and throw a probe into moving vehicle.

Role:
- Utilized Gazebo for creating a virtual world with the drone and the vehicle.
- Implemented control algorithm using Pixhawk-4 and Robot operating System.
- Using Solidworks, CAD modeled the physical model of the drone and 3D printed / laser cut the components.
- Installed the hardware stack on the physical drone and implement flip using Q-Ground Control.
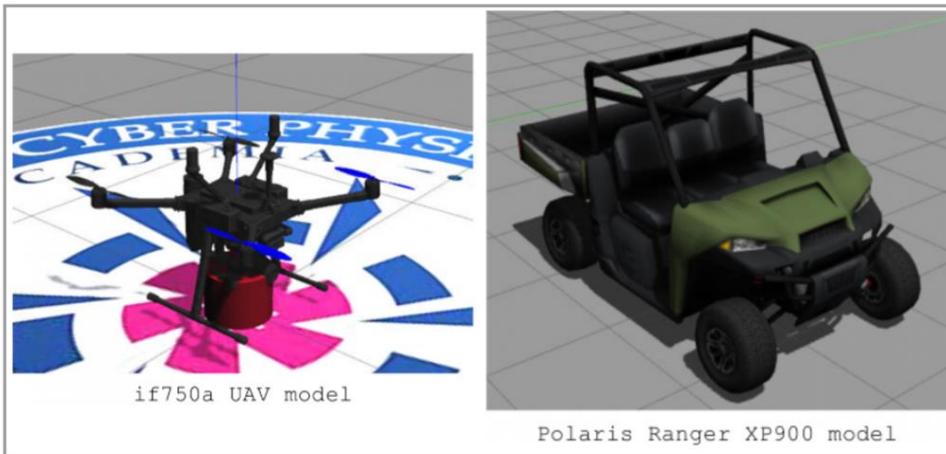

Gazebo World
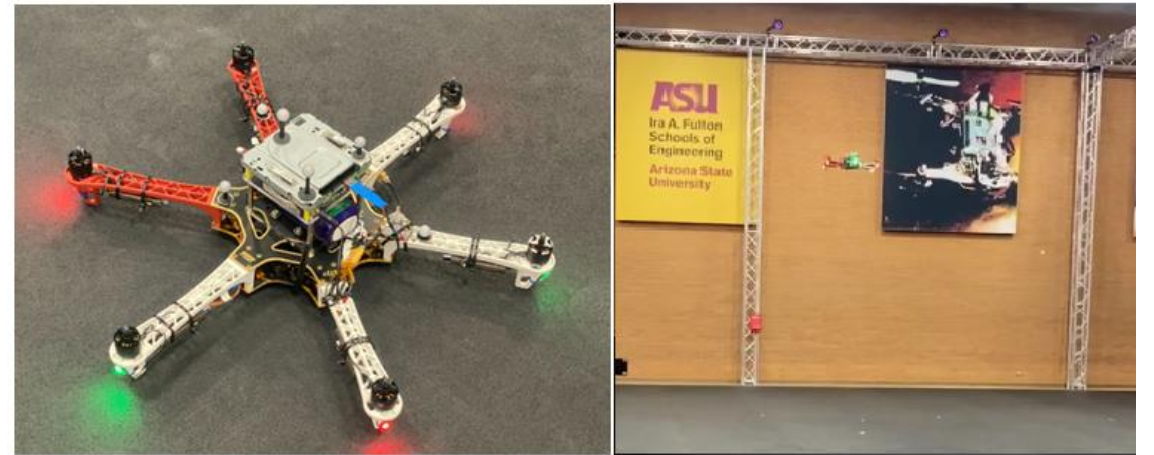
Physical Drone

Arshnoor Singh| MORE Scholarship

Objective: To understand the affects of Robot Intent Signaling on Human-Robot collaboration using Virtual reality.
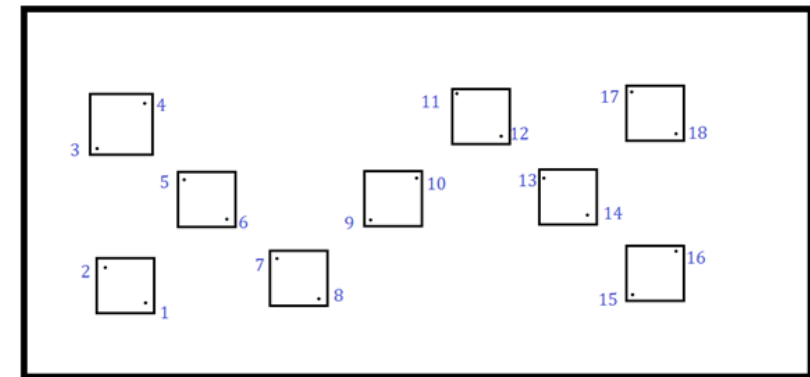
Role:
- Created a virtual reality application in Unity to conduct experiments and connected it to ROS and Gazebo.
- Imported Solidworks CAD models of tables, screws and blocks in the environment to conduct experiment.
- Devised an experiment to completely understand the affects: a) VR headset signals the next hole number b) The next hole is highlighted using light.
- The human collaborator had to place and turn the screws while the robot tightens them.
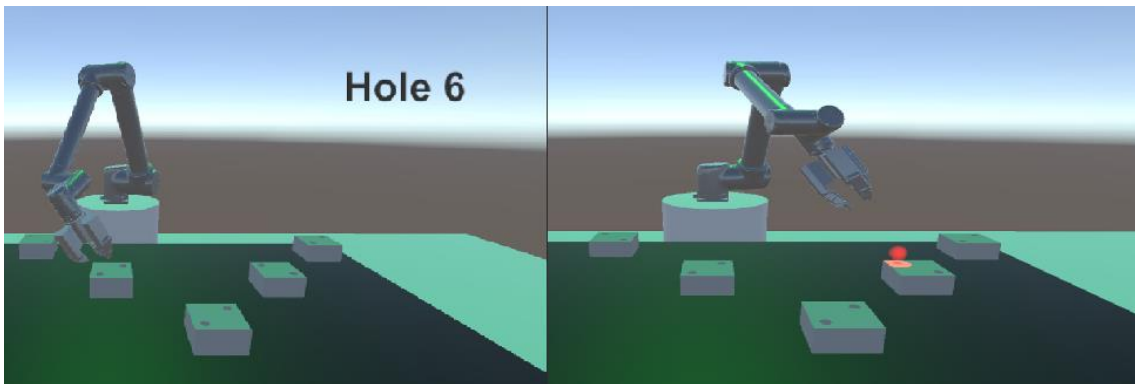
a) Hole No. Signal   b) Hole Light Signal

Designed Experiment

# Arshnoor Singh| Pursuer-Evader Problem

Objective: Improve the dynamical model and develop controllers for the homicidal-chauffeur problem with a fast pursuer and an agile evader.
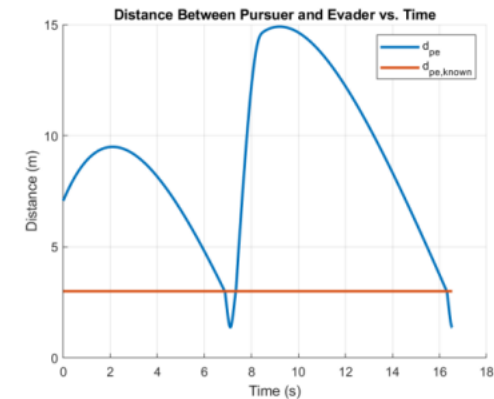
Role:
- Improved the dynamical model of the pursuer to incorporate acceleration and variable turning radius.
- Implemented a Manual controller and an Automatic controller to solve the problem
- Manual controller was just a Proportional only controller while the Automatic Controller used Successive Approximation Approach to estimate a non-linear system as a linear system.
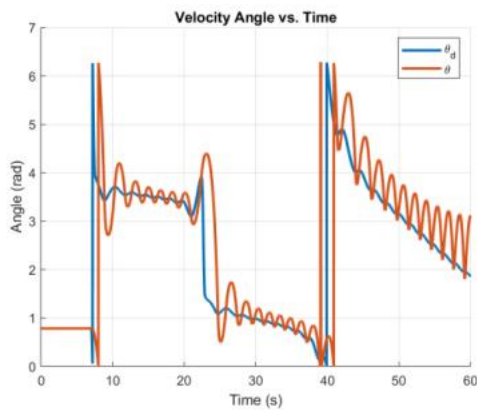
Manual Controller – Proportional
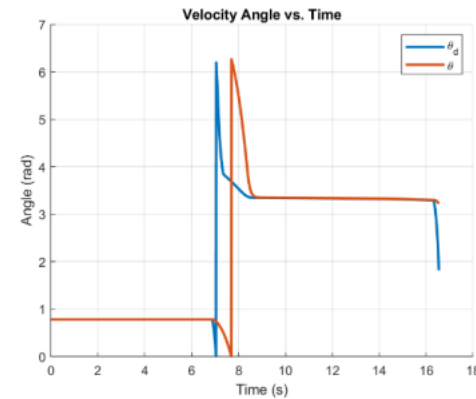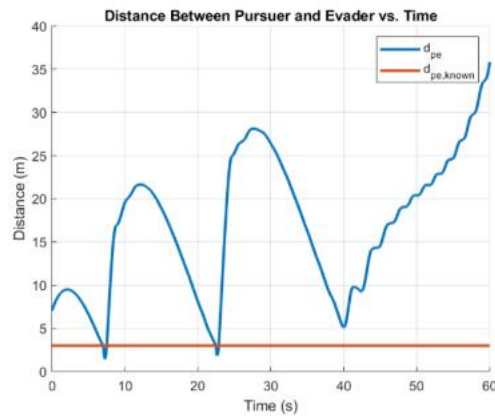
Automatic Control: SAA & PD control

Arshnoor Singh| Highway Decision Making

Objective: Train Reinforcement learning models for highway decision making and compare the results.
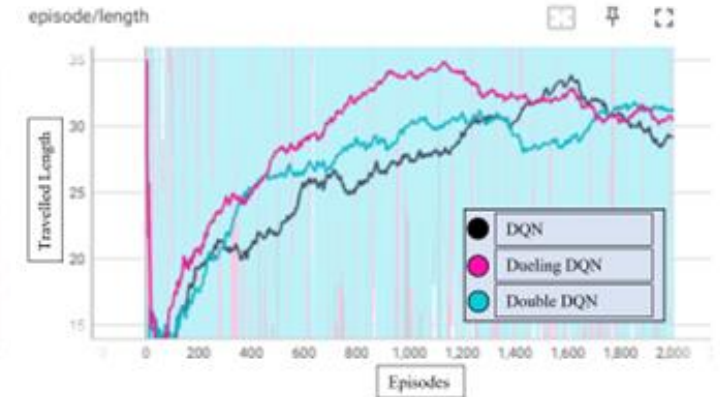
Role:
- Developed dynamical model for the ego vehicle and the surrounding vehicles and modelled their behavior.
- Used Open Ai Gym for creating the Highway environment for training the models.
- Trained reinforcement learning model for highway decision making: Deep-Q Network, Double DQN and Dueling DQN.
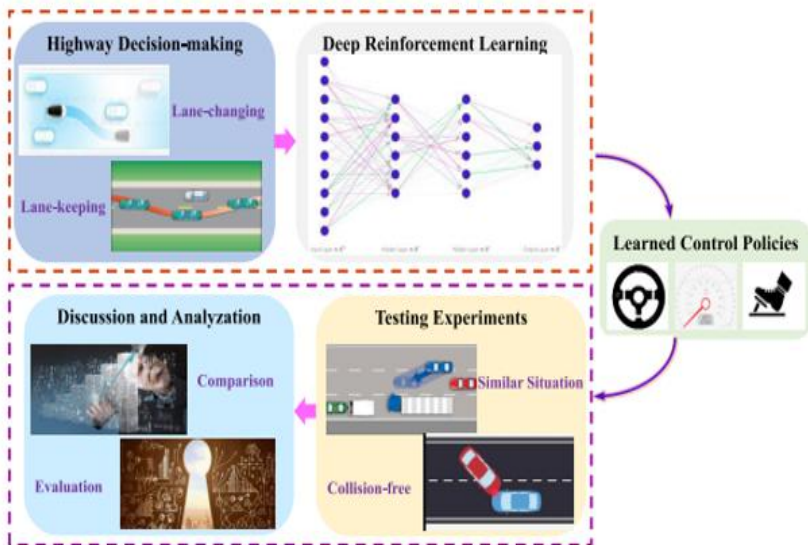
Overview of the Project
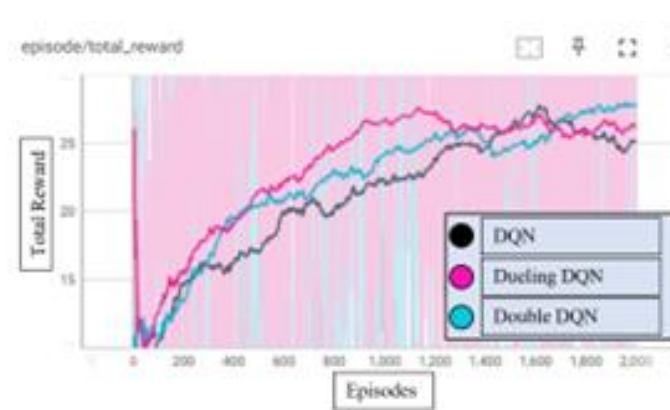

Total Rewards of each Algorithm

Total distance of Ego Vehicle

Arshnoor Singh | Robotics Arm Manipulator

Objective: Robotics Arm manipulation for pick-and-place purpose.

Role:
- Utilized Gazebo to create the virtual world for the simulation and connected it with ROS.
- Used Move-it Configurator to generate self-collision matrix for the robotic arm.
- Developed controller for the UR5 robot and conducted motion planning using RViz.
- Successfully implemented pick-and-place action with an object ball.
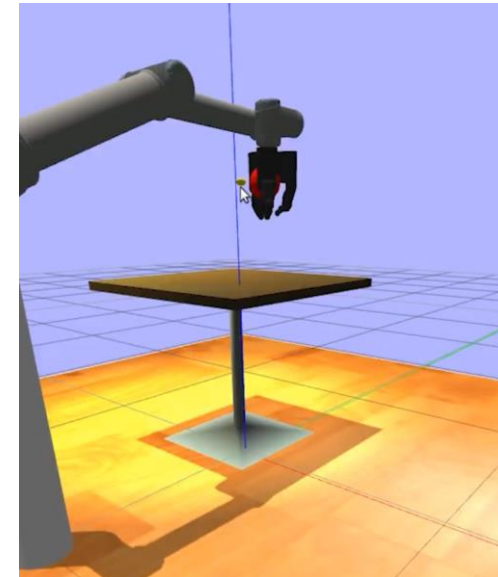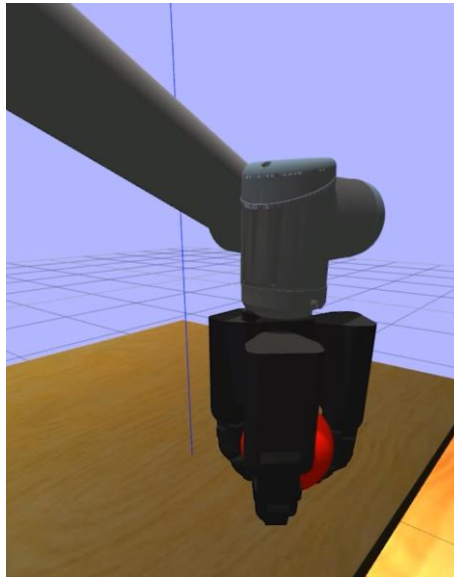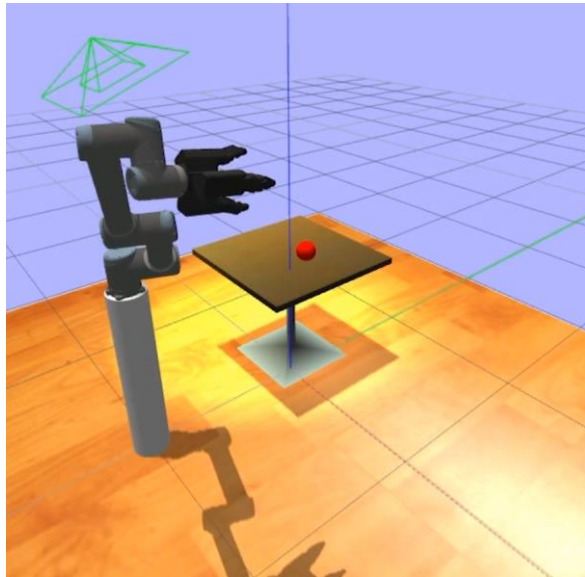
Pick – and – place action of the Robotic Manipulator
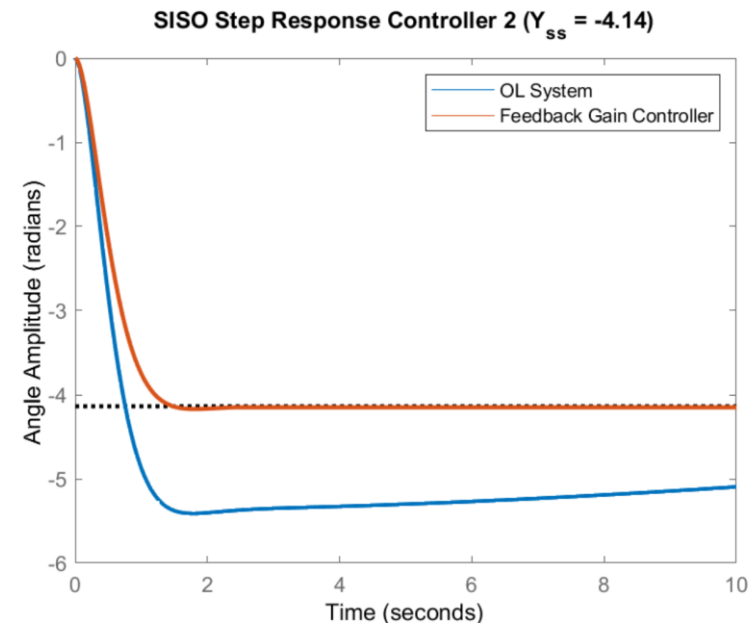
Arshnoor Singh| Airplane Controller

Objective: Develop controllers for supersonic airplane state-space model.

Role:
- Checked for controllability, observability and stability of the state space model.
- Developed SIMO Full State Feedback controller for the original dynamics model of the airplane.
- Reduced the Dynamical model to a SISO system and developed another Full-State Feedback Controller using pole placement technique.
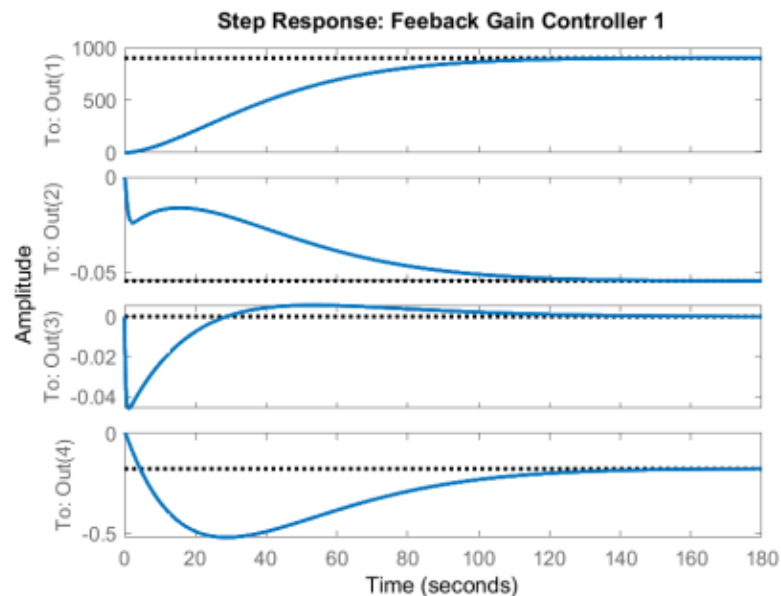
SIMO Full State Feedback Control

SISO Feedback Controller

Arshnoor Singh| Skills

Mechanical / Product Design

- CAD modeling (SolidWorks, Creo, AutoCAD)
- CAE (Ansys, Abaqus, LS-Dyna)
- Drafting and GD&T
- Rapid Prototyping / 3D printing
- Sheet metal design
- Mill, lathe, band saw, drill press, other power tools
- Soldering

Programming

- C++
- Python
- C#

Tools

- Matlab & Simulink
- Simscape Multibody
- Microsoft Office Suite
- ROS, Gazebo, RViz, Moveit, Unity
- Arduino

Interpersonal

- Client communication & vendor management
- Multidisciplinary teamwork
- Leadership training
- JIRA