

# TIMOTHY DODGE

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## Education

### Utah State University

Expected May 2025

*Master of Science in Electrical Engineering | Control Systems and Autonomy | GPA: 3.95*

*Logan, Utah*

### Utah State University

May 2023

*Bachelor of Science in Mechanical Engineering | Minor: Computer Science | GPA: 3.94*

*Logan, Utah*

## Experience

### Sandia National Laboratories | *Autonomous Sensing and Control Intern*

May 2024 – Present

- Led the transition from simulation to real-world application for multi-agent reinforcement learning with quadcopters
- Achieved conversion by integrating the Vicon motion capture system with ROS2 and BitCraze's Crazyflie 2.X platform
- Developed RL models for the pursuer team in pursuer-evader problems in PyTorch, surpassing the ProNav baseline
- Improved evader and pursuer policies through competitive self-play, allowing agents to train against each other effectively
- Integrated an IMU Simulink model into Rate Table simulations, elevating the precision of rate table dynamics analysis

### Aspire Research Center | *Multi-Agent Control Research Assistant*

May 2022 – Present

- Created a Python simulation platform to model building thermal properties using the DOE software package EnergyPlus
- Developed a MPC algorithm to optimally organize Distributed Energy Resources, reducing peak power consumption
- Generated datasets from Python simulation to generate regression model via MatLab's System-Identification Toolbox
- Developing grey-box system identification method that allowed for control and prediction of HVAC system's response
- Optimally coordinated fleets of electric buses by developing optimal charging schedules using the Gurobi library
- Improved hardware compatibility by migrating bus simulation libraries in C++ and Python from ROS 1 to ROS 2
- Collaborated with a multi-disciplinary research team across multiple universities and industry sponsors

### Utah State University | *Teaching Assistant*

Jan 2022 – May 2023

- Led lab sessions of 30 students focusing on interfacing with sensors including ultrasonic sensors and thermocouples
- Assisted students in designing and debugging LabView VIs for interfacing with various sensors and collecting data
- Developed automated grading scripts in Python and bash that compiled and ran student-submitted C++ code

## Projects

### Mars Rover Senior Design Project | *C++, C#, SolidWorks, Microcontrollers*

- \* Designed and implemented inverse kinematic controls for a robotic arm, allowing for efficient real-time operation
- \* Enhanced micro-controller software, reducing latency by 30% through integrating serial communication with ROS
- \* Worked with team to design novel 6-axis robotic arm design with worm-gears and linear rail actuation in SolidWorks

### Epsilon Point Controller | *Nonlinear Controls, Python, Numpy, ROS2, Gazebo*

- \* Engineered for a smooth differential drive robot, allowing for motion to track nonlinear and time-varying trajectories
- \* Optimized controller for the Turtlebot3 platform to respect velocity constraints by applying LQR techniques
- \* Streamlined control system, achieving convergence to the true trajectory within 2 seconds of receiving a new signal

### Power Consumption Forecasting | *PyTorch, Pandas, Neural Networks*

- \* Preprocessed a smart meter dataset of 5,000 homes to create optimal input for neural networks with the Pandas library
- \* Designed a deep residual network to serve as a baseline for comparison against other neural network models
- \* Developed a CONV-LSTM model that outperformed the baseline XGBoost model while reducing training time by 90%

### UAV RRT\* Path Planner | *ROS2, Python, Controls*

- \* Developed a Python UAV simulator with frame transformations and accurate force simulations for performance analysis
- \* Implemented the RRT\* algorithm to enhance the UAV's 2-D pathfinding capabilities over the standard RRT algorithm
- \* Conducted extensive testing to validate the planner's efficiency and reliability across various scenarios

## Relevant Coursework

- |                                 |                        |                        |                               |
|---------------------------------|------------------------|------------------------|-------------------------------|
| • Linear Multi-Variable Control | • Deep Neural Networks | • Robotic Intelligence | • Embedded System Programming |
| • Convex Optimization           | • UAV Control Systems  | • Nonlinear Control    |                               |
|                                 | • Robust Control       | • Distributed Control  |                               |

## Technical Skills and Certifications

**Certifications** : Engineer in Training (EIT), Reinforcement Learning Specialization (University of Alberta)

**Languages**: Python, C++, Matlab, Simulink, C, ARM-Assembly, Java

**Technologies/Frameworks**: Linux, ROS/ROS2, Git, Pytorch, Numpy, Pandas, Gurobi, Eigen, Boost, SolidWorks, Docker