S M NAHID MAHMUD

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Summary

- Interested to have robotics, control systems or autonomous systems related research based positions to get the exposure into industry trend and brainstorming research ideas to enhance and merge real-world challenges to my research expertise and developing mutual benefits.

- Research experience in control theory, system analysis, optimization theory, model based reinforcement learning, safety aware navigation and robotics.

- Strong understanding in Nonlinear systems analysis and control, Optimal Control, Reinforcement Learning, Stochastic system analysis and Nonlinear optimization etc.

- Professional expertise includes holding top-management positions in 6 profit/non-profit organizations.

Education

Oklahoma State University (OSU)   **Jan. 2019 - May 2021**
Masters of Science in Mechanical and Aerospace Engineering, 3.87/4.00   *Stillwater, Oklahoma*

Islamic University of Technology (IUT)   **Jan. 2012 - Dec. 2015**
Bachelor of Science in Mechanical Engineering, 3.74/4.00   *Dhaka, Bangladesh*

Relevant Coursework

Stochastic systems, Automatic control, Nonlinear Optimization, Optimal Control, Nonlinear systems control and Analysis.

Experience

Research Engineer   **Aug. 2021 - Current**
Systems, Cognition, and Control Laboratory, OSU   *Stillwater, Oklahoma*
- Currently, developing a local learning method for the deterministic continuous-time nonlinear systems.

Graduate Research Assistant   **May 2019 - May 2021**
Systems, Cognition, and Control Laboratory, OSU   *Stillwater, Oklahoma*
- Developed and implemented 2 novel Model-Based Reinforcement Learning frameworks for safety-critical nonlinear systems with parametric uncertainties and partial output feedback, respectively.
- The frameworks incorporate barrier transformation to guarantee 100 % safe navigation for nonlinear systems.

Graduate Teaching Assistant   **Jan. 2019 - August 2020**
Mechanical and Aerospace Engineering Department, OSU   *Stillwater, Oklahoma*
- Supported 150+ students to have a better understanding of dynamics and coached 4 students for a senior design project on autonomous robot for underground excavation.

Adjunct Lecturer   **Sep. 2017 - Dec. 2018**
Mechanical Engineering Department, Sonargaon University   *Dhaka, Bangladesh*
- Taught 300+ students dynamics and automatic control concepts and administered dynamical modeling simulations.

Technical Skills

Programming Languages	C, C++, Python, Arduino IDE, Ardupilot.
Web Language	HTML, CSS, JavaScript.
Design Software	Solid Works, Adobe Photoshop, Adobe Illustrator, 3D max.
Simulation software	Ansys, Matlab, Simulink, Comsol, Netlogo, Webot.
Hardware	Pixhawk, Arduino, Sonar, LCD, GPRS, Bluetooth, Wi-Fi.

Relevant Projects

Safety Aware Navigation | *MATLAB, GPOPS II*   **Oct. 2019 - April 2021**
- Developed 2 novel Model-Based Reinforcement Learning frameworks with parametric uncertainties and partially observable nonlinear systems, respectively.
- The frameworks incorporate barrier transformation to guarantee 100 % safe navigation for nonlinear systems.

Minimum Time-to-Climb of a Supersonic Aircraft | *Optimization, MATLAB, GPOPS II*   **Sep. 2020 - Dec. 2020**
- Demonstrated 2 optimal control methods such as Pontryagin maximum principle (PMP) and pseudospectral method (LQR) on the model of F-4 aircraft. PMP method was better by 21 times in terms of optimizing time.

Incremental quasi-newton method with local superlinear convergence rate | *Python*   **March 2020 - May 2020**
- Reconstructed the Incremental quasi-newton (IQN) method and applied IQN to a numerical experiment resulting in the gradient magnitude go to the order of 10^{-8}, significantly lower than algorithms such as Sequence Alignment by Genetic Algorithm (order of 10^{-5}).

Wind Aware Navigation | *POD, Modified A* Star, MATLAB*   **May 2019 - Oct. 2019**
- Conducted feasibility analysis of a novel modified A* star algorithm for trajectory generation using wind characteristics. Done Monte-Carlo analysis over 100+ generated trajectory to numerically verify the developed method and determine the gains' range.

Intruder UAVs avoidance using Grey Wolf Algorithm | *Heuristic Optimization, Netlogo*   **March'19 - May'19**
- Implemented Grey Wolf optimizing algorithm to avoidsigned a sample banking transaction system using Java to simulate the common functions of using a bank account.

Autonomous car collision avoidance using Q-learning | *Reinforcement Learning, MATLAB*   **Oct. 2018 - Dec. 2018**
- Implemented Q-Learning to train an autonomous car model to avoid collision while optimizing trajectory. 70 iterations were needed to learn the offline policy that can guarantee 100 % safe navigation within 1.5m vision.

Development of robots | *SolidWorks, 3D Max, Arduino IDE, PSpice*   **Jan. 2013 - Nov. 2015**
- Designed objective-directed 10+ IR sensor arrays, 3+ object grabbers, and necessary circuit boards to construct 7+ line following with obstacle avoidance and/or object grabbing autonomous robots and 3 object grabbing manual robots using Arduino Platform.

Publications

Accepted Conference Paper

- **S. M. N. Mahmud**, K. Hareland, S. Nivison, Z. I. Bell and R. Kamalapurkar, "A Safety Aware Model Based Reinforcement Learning Framework for Systems with Uncertainties," *Proc. Am. Control Conf.*, New Orleans, USA, 2021 pp. 1979-1984. DOI: **10.23919/ACC50511.2021.9482976**   **2021**

- R. V. Self, **S. M. N. Mahmud**, K. Hareland, and R. Kamalapurkar, "Online Inverse Reinforcement Learning with Limited Data," *IEEE Conf. Decis. Control*, Jeju Island, Korea (South), 2020, pp. 603-608.   **2020**
  DOI: **10.1109/CDC42340.2020.9303883**

Journal Papers under Review

- **S. M. N. Mahmud**, S. Nivison, Z. I. Bell and R. Kamalapurkar, "Safe Model-Based Reinforcement Learning for Systems with Parametric Uncertainties," *Frontiers in Robotics and AI*, 2021.
  Pre-print version: **https://arxiv.org/abs/2007.12666**   **2020**

- R. V. Self, M. Abudia, **S. M. N. Mahmud**, and R. Kamalapurkar, "Online Simultaneous State and Parameter Estimation," *IEEE Trans. Autom. Control.*   **2021**
  Pre-print version: **https://arxiv.org/abs/1703.07068**

- R. V. Self, M. Abudia, **S. M. N. Mahmud**, and R. Kamalapurkar, "Online Inverse Reinforcement Learning for Systems with Sub-Optimal Trajectories," *IEEE Trans. Neural Netw. Learn. Syst.*   **2020**

Volunteer Activities

President, Bangaldesh Student Association, OSU.	**Jan. 2021 - Current**
Public Relations Officer, Muslim Student Association, OSU.	**May 2020 - May 2021**
Student Representative, ASME OSU Chapter.	**Jan. 2020 - Dec. 2020**
Editor-in-Chief, CORE 2.0, Mecceleration.	**Jan. 2015 - Dec. 2015**
Head of publications, Mecceleration.	**Jan. 2015 - Dec. 2015**
Sub coordinator, Robotics, Mecceleration.	**Jan. 2014 - Dec. 2015**