ANDALIB SHAMS

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EDUCATION

Ph.D. Candidate, Civil Engineering   Expected: Fall 2023
Iowa State University, Ames, Iowa
Major Advisor: Christopher M. Day

M.S., Civil Engineering   August 2018
University of Wyoming, Laramie, Wyoming
Major Advisor: Milan Zlatkovic

Bachelor of Urban and Regional Planning   September 2015
Bangladesh University of Engineering and Technology, (BUET)

RESEARCH INTERESTS

Traffic Operations	Intelligent Transportation Systems	Transportation Systems Optimization
Traffic Signal Systems	Connected and Automated Vehicles	
Traffic Modeling and Simulation	Transportation Systems Decarbonization	

EXPERIENCE

Transportation System Research Assistant, National Renewable Energy Lab (NREL)   April 2022-Present
AI, Learning and Intelligent Systems Group, Computational Science Center

Mentors: Qichao Wang, Juliette Ugirumurera

Real-Time Data and Simulation for Optimizing Regional Mobility in the United States (a.k.a. "Digital Twin")
- Developed a framework to implement a previously developed "Model Predictive Control (MPC)" algorithm for signal optimization.
- Emulated sensor inaccuracies in simulation and tested the impact of inaccuracies on signal control.
- Used High-Performance Computing tools (slurm & w/supercomputer Eagle) to estimate fuel consumptions.

On-going project: **Integration of Building Energy with Electric Vehicle Charging Stations**
- Working on developing a framework to integrate discrete event simulator ASPIRE / micro-simulation software SUMO with Large-Scale Co-Simulation software (HELICS)

Graduate Research Assistant at Iowa State University   January 2019-Present

Trajectory-enabled traffic signal controller (Green Box Signal Controller) software
- "Digital twin" of real-world intersection can be modelled to integrate vehicle trajectory data with core signal control logic (similar to a V2I communication). No commercial signal controller can integrate trajectory data explicitly.
- Working on making this signal controller a stand-alone piece to be integrated with any simulation framework or to be deployed in the field.

New Traffic Signal Actuation Concepts using Advanced Sensor Data- A pooled fund project supported by FHWA, Iowa DOT, UDOT, Penn DOT, Georgia DOT
- Working on enhancing actuated control strategies by integrating vehicle trajectory data from advanced sensors (e.g., LiDAR/ RADAR/ Video Camera).
- Implemented several trajectory-based features (elimination of passage time, dilemma zone protection, queue clearance, progression for platoons) in GBSC and performed detailed analysis on performance benefits of each of the methods.

Comparison of Flow- and Bandwidth-Based Methods of Traffic Signal Offset Optimization
- Six flow-based and five bandwidth based offset optimization methods were compared and Hill-climb algorithm or Mixed Integer Linear Programming (MILP) were used to optimize offsets.

Identifying the Performance Potential for Intersection Control using Advanced Infrastructure Sensing-
Sponsored by National Renewable Energy Lab (NREL)
- Implemented and evaluated the performances of actuation-based and dynamic programming-based traffic signal control algorithms.

Graduate Research Assistant at the University of Wyoming   January 2017- August 2018

- Evaluated operational performances of innovative intersections and transit priority in Redwood Road Corridor at Salt Lake City, Utah. (Sponsored by Avenue Consultant)
- Used the driver model API from VISSIM to implement a driver behavior model for Connected and Automated Vehicles and evaluated the operational benefits.

Briefly worked as a **Short-Term Consultant at The World Bank Group** (December 2015 - June 2016) and as an **Intern at Dhaka Transport Corporation Authority (DTCA)** (January 2015 - February 2015)

TECHNICAL SKILLS

Programming Skills	Python, C++
Simulation Software	VISSIM (w/ COM interface, APIs), SUMO (w/ TraCI API), VISTRO, synchro, VISUM
Data Analysis/ Statistics Tools	Python, R, SQL
Data Visualization Tools	Python (Matplotlib), R (ggplot), Tableau
Optimization Tool	Pyomo
Deep Learning Tool	PyTorch
Other	Git, Latex, Bash, High-Performance Computing (slurm & w/supercomputer)

PUBLICATIONS

Journal Papers

1. **Shams, A.,** Mahmud, S., & Day, C. M. (2023). Comparison of Flow-and Bandwidth-Based Methods of Traffic Signal Offset Optimization. *Journal of Transportation Engineering, Part A: Systems*, *149*(5), 04023033.
2. **Shams, A.**, & Day, C. M. (2022). Advanced Gap Seeking Logic for Actuated Signal Control Using Vehicle Trajectory Data: Proof of Concept. *Transportation Research Record*, 03611981221108147.
3. Yang, Y., **Shams, A.,** & Day, C. (2021). Application of Pareto Front to Evaluate Adaptive Traffic Signal Timing for Multiple Objectives. *Journal of Modern Mobility Systems*, *2*.
4. **Shams, A.,** Zlatkovic, M., (2020). Effects of Capacity and Transit Improvements on Traffic and Transit Operations *Transportation Planning and Technology,* 43:6, 602-619, DOI: 10.1080/03081060.2020.1780710
5. **Shams, A.,** Zlatkovic, M., (2019). Platoon Signal Priority in Connected-Autonomous Vehicle Environments: Algorithm Development and Testing *Journal of Road and Traffic Engineering*, *65*(4), 1-9. https://doi.org/10.31075/PIS.65.04.01
6. **Shams, A.**, Emtenan, A. M .T., and Day, C.M.; A Taxonomy of Adaptive Traffic Signal Control **[Manuscript under review]**
7. **Shams, A.,** Wang, Q., Ugirumurera, J., Severino, J., and Jones, W., Sanayal, J.; Simulation Evaluation of a Large-scale Implementation of Virtual-Phase Link based Model Predictive Control *Accepted for presentations at 103rd Transportation Research Board Annual Meeting* **[For publication: manuscript under review]**
8. **Shams, A.,** Dobrota, N., Cesme, B., and Day, C.M.; Integration of Real-Time Vehicle Trajectories into Actuated Traffic Signals to Improve Local Intersection and Arterial Control *Accepted for presentations at 103rd Transportation Research Board Annual Meeting* **[For publication: manuscript under review]**

Peer-reviewed Conference Presentations

1. **Shams, A.,** Day, C.M., and Mahmud, S., (2023) Digital Twin of Physical Intersection to Trajectory-based Traffic Signal Controller *accepted for presentation at IEEE International Automated Vehicle Validation Conference 2023*
2. Mahmud, S., Carydis, M., **Shams, A.,** Day, C.M., (2023) Calibration of Robertson's Platoon Dispersion Model with Connected Vehicle Data *accepted for both presentation and publication at IEEE Intelligent Transportation Systems Conference 2023*
3. **Shams, A.,** Wang, Q., Ugirumurera, J., Severino, J., & Jones, W. (2023). Impact of On-line Traffic Signal Optimization on Operation and Energy Performance. Presented at the International Conference on Transportation & Development, June 14-17, Austin, TX, United States
4. **Shams, A.**, and Day, C.M. (2021) Impact of Sensing Range on Real-Time Adaptive Control of Signalized Intersections Using Vehicle Trajectory Information *Proceedings of the 100th Transportation Research Board Annual Meeting* 2021.

Talks and Presentations

1. **Shams, A.,** Wang, Q., and Ugirumurera, J., (2022) Impact of On-line Traffic Signal Optimization on Operation and Energy Performance. NREL Brown Bag Seminer, October 18, Virtual Meeting.
2. Day, C.M., and **Shams, A**. (2022) Concept of Operations for Trajectory-Based Actuation. Mid-Continent Transportation Research Symposium, September 14, Ames, IA.
3. **Shams, A.,** and Day, C.M. (2021 Vehicle Trajectory based Advanced Gap Seeking Logic for Actuated Signal Control: Proof of Concept PTV User Group Meeting, November 10, Atlanta, GA.
4. **Shams, A.,** and Day, C.M. (2021) Impact of Sensing Range on Real-Time Adaptive Control of Signalized Intersections Using Vehicle Trajectory Information PTV Student Talk 2021, March 17, Virtual Meeting.

Student Mentoring Experiences

Reshmi Jayashree Radhakrishnan (M.S. Student; Major: Computer Engineering; Summer' 23-Present)
Samuel Syrus (Undergraduate; Major: Computer Science; Spring' 23)

Journal Referee Services

Reviewer, Transportation Research Record
Reviewer, Journal of Transportation Engineering Part A: Systems
Reviewer, Transportation Research Board Annual Meeting Conference
Reviewer, Journal of Intelligent Transportation Systems: Technology, Planning, and Operations
Reviewer, Journal of Transportation Planning and Technology
Reviewer, IEEE Transactions on Intelligent Transportation Systems

Memberships

Student Member, American Society of Civil Engineers
Student Member, Institute of Transportation Engineers

Awards

ITS Minnesota Graduate Student Scholarship, 2021
Bangladesh-Sweden trust fund travel grant, Govt. of the People's Republic of Bangladesh, 2018