

# Akshar Chavan

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EAS Lab, The Ohio State University  
Department of Electrical and Computer Engineering  
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## EDUCATION

### **The Ohio State University**

Jan 2024 - Present

Ph.D. in Electrical and Computer Engineering

Dissertation: *Maximizing battery lifespan of autonomous systems*

Advisor: Dr. Marco Brocanelli

### **Wayne State University**

Aug 2020 - Dec 2023

Ph.D. in Computer Science (*Transferred*)

Advisor: Dr. Marco Brocanelli

### **Wayne State University**

Aug 2018 - May 2020

Masters in Industrial Engineering

### **Saraswati College of Engineering, Mumbai University**

Aug 2011 - May 2014

B.E. in Mechanical Engineering

## RESEARCH INTERESTS

Energy-aware systems, autonomous systems, robotics, parallel and distributed systems, edge computing, and graph theory.

## RESEARCH PROJECTS

- SEEAR [8] maximizes the performance of autonomous ground robots (AGRs) by optimizing the utilization of the given energy allowance for task execution. It dynamically regulates computing frequency and speed based on environmental dynamics to balance reactivity, efficiency, and performance. By considering centripetal forces to prevent oversteering and understeering, SEEAR further enhances speed control, minimizing deviations from the desired path. This approach enables AGRs to achieve their goals faster, with higher success rates and improved energy efficiency.
- CPGC [6] is a sequential lossless graph compression algorithm which compresses the graph while preserving path connectivity. The compressed graph can be used to lower the execution time of algorithms such as bipartite matching, edge connectivity, and vertex connectivity.
- PECC [4] minimizes the travel time of AGRs during task execution while ensuring reactivity to unknown obstacles and predictably consuming a specified energy budget. It achieves this by dynamically adjusting the computing frequency and locomotion speed of the AGRs, maximizing energy budget utilization for scheduled tasks, and enhancing overall performance.
- PAR-RCP [7] is a parallel randomized lossless graph compression algorithm which compresses the graph in  $O(n^\delta \log n)$  while preserving path connectivity. The compressed graph can be used to lower the execution time of algorithms such as bipartite matching, edge connectivity, and vertex connectivity.
- BA-LPWAN [2] is a novel Media Access Control (MAC) protocol designed to maximize the minimum battery lifespan of nodes in a Low-Power Wide-Area Network (LPWAN) based on LoRa. It utilizes a battery degradation estimation model to optimize energy regulation, minimizing battery degradation while maintaining data utility. By focusing on sustainable energy management, BA-LPWAN enhances the overall efficiency and longevity of network operations.
- MTC [3] is a maintenance-aware task and charging scheduler designed for fleets of AMRs in highly automated environments. It uses Linear Programming (LP) to optimize maintenance scheduling and the Kuhn-Munkres (Hungarian) algorithm to finalize task assignments and charging schedules, minimizing the combined costs of downtime and battery degradation.

- TCM [1] is a polynomial-time multi-period combined task and charging scheduling algorithm for high-quality battery life. It employs a greedy approach that periodically adapts its scheduling decisions to ensure robust energy modeling, optimizing energy usage for task execution rather than wasting it on travel without performing tasks. TCM achieves solutions with a performance ratio of 1.15.

## FELLOWSHIPS, AWARDS AND HONORS

Thomas C. Rumble University Graduate Fellowship Award, Wayne State University.

Aug 2023

## PUBLICATIONS

### Conference Papers

- [1] Towards High-Quality Battery Life for Autonomous Mobile Robot Fleets  
A. S. Chavan and M. Brocanelli.  
**Proc. of the IEEE 3rd International Conference on Autonomic Computing and Self-Organizing Systems (ACSOS 2022)**, pp. 61-70, virtual conference, September 19-23, 2022.
- [2] A Battery Lifespan-Aware Protocol for LPWAN  
S. Fahmida, A. S. Chavan, P. V. Modekurthy, S. Abusayeed, and M. Brocanelli.  
**Proc. of the IEEE 44th International Conference on Distributed Computing Systems (ICDCS 2024)**, pp. 1050–1061, Jersey City, NJ, USA, July 23-26, 2024.

### Journal Papers

- [3] A Maintenance-Aware Approach for Sustainable Autonomous Mobile Robot Fleet Management  
S. T. Atik, A. S. Chavan, D. Grosu, and M. Brocanelli.  
**IEEE Transactions on Mobile Computing**, vol. 23, no. 6, pp. 7394-7407, June 2024.

### Preprints and Papers Under Review

- [4] Rethinking Energy Management for Autonomous Ground Robots on a Budget  
A. S. Chavan, R. Joshi and M. Brocanelli.  
Available at: arXiv:2502.01858, 2025.  
Submitted to: **IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2025)**, Hangzhou, China. Expected submission: Feb 2025.
- [5] Brief Announcement: Speeding-up Graph Algorithms on Compressed Graphs via Parallel Randomized Clique Partitioning  
A. S. Chavan, S. Rabinia, D. Grosu and M. Brocanelli.  
Submitted to: **ACM Symposium on Parallelism in Algorithms and Architectures (SPAA 2025)**, Portland, Oregon. Expected submission: Feb 2025.
- [6] A Clique Partitioning-Based Algorithm for Graph Compression  
A. S. Chavan, S. Rabinia, D. Grosu, and M. Brocanelli.  
Available at: arXiv:2502.02477, 2025.  
To be submitted to: **ACM Transactions on Algorithms**. Expected submission: Mar 2025.

### Papers in Preparation

- [7] A Parallel Randomized Clique Partitioning-Based Algorithm for Graph Compression  
A. S. Chavan, S. Rabinia, D. Grosu, and M. Brocanelli.  
To be submitted to: **ACM Transactions on Parallel Computing**. Expected submission: Apr 2025.
- [8] Safety Ensured Energy Management for Autonomous Robots  
A. S. Chavan, R. Joshi, and M. Brocanelli.  
To be submitted to: **IEEE Transactions on Robotics**. Expected submission: Apr 2025.

## PRESENTATIONS

### Conference Presentations

1. A. S. Chavan and M. Brocanelli. (Sept, 2022). **2022 IEEE International Conference on Autonomic Computing and Self-Organizing Systems (ACSOS)**, Virtual Conference.  
Towards High-Quality Battery Life for Autonomous Mobile Robot Fleets

### Poster Presentations

1. A. S. Chavan, R. Joshi and M. Brocanelli. (Feb, 2025). **2025 Edward F. Hayes Advanced Research Forum**, OSU, OH, USA.  
Rethinking Energy Management for Autonomous Ground Robots on a Budget
2. A. S. Chavan, R. Joshi and M. Brocanelli. (Oct, 2024). **2024 Kraus Memorial Poster Competition**, OSU, OH, USA.  
Rethinking Energy Management for Autonomous Ground Robots on a Budget

### Workshop Presentations

1. A. S. Chavan, and M. Brocanelli. (July, 2024), **K-12 Outreach Program**, OSU, OH, USA.  
Understanding Robot Perception: Lidar and its Applications

## TEACHING EXPERIENCE

- The Ohio State University  
Mentor for graduate student Rudra Joshi. May 2024 - Present  
Rudra is exploring ideas for implementing an energy-efficient approach to AGRs, for optimizing power management, safety, and reliability and building AGR prototypes for the lab, and conducting experiments with them.
- Wayne State University, Detroit, MI, USA  
Part-time faculty Instructor for Computer Operating Systems (CSC 4420) Aug 2023 - Dec 2023  
SET Score (out of 5): mean 3.8; std: 1.3; median: 4.0  
Graduate Teaching Assistant for Computer Operating Systems (CSC 4420) Aug 2022 - Dec 2022  
Led lab sessions and graded assignments, quizzes, and exams for 30 students.
- St. John College of Engineering and Management, Palghar, MH, India Jun 2015 - May 2018  
Lecturer, Department of Mechanical Engineering (Diploma in Engineering)
- Government Polytechnic, Thane, MH, India Jan 2015 - May 2015  
Visiting Lecturer, Department of Mechanical Engineering (Diploma in Engineering)

## PROFESSIONAL AFFILIATIONS

- ACM (Association for Computing Machinery)
- IEEE (Institute of Electrical and Electronics Engineers)

## SERVICES

- Reviewer
  - IEEE Transactions on Cloud Computing
  - IEEE Transactions on Parallel and Distributed Systems

## OTHER ACTIVITIES

- **Organizer - State-Level Presentation Competition** Jan 2018  
Organized and led Presentania-2018, a state-level presentation competition with 64 teams from across Maharashtra, India.
- **Team Guide - (FKDC 2017 & 2018) Team Unicorn** Jun 2016 - May 2018  
Mentored the team throughout the competition, guiding design and testing.  
Overall 1st place in FKDC - Season 2 (2018)  
Overall 2nd place in FKDC - Season 1 (2017)
- **Team Manager (FORMULA STUDENT 2014) - Team Prahaar Racing** May 2013 – Feb 2014  
Coordinated cross-functional teams to optimize vehicle performance, reduce delays, and improve time control.
- **Suspension Team Lead (SAEINDIA BAJA 2013) - Team Prahaar Racing** May 2012 – Feb 2013  
Led the design and optimization of the suspension system, ensuring vehicle stability and performance on diverse terrains.

## Technical Skills

- **Programming Languages:** Python (4+ years), C (2+ years), C++ (2+ years)
- **Robotics and Embedded Systems:** Robot Operating System (ROS) (Proficient in developing ROS nodes and packages, experience with Gazebo simulation), Arduino (Experience with microcontroller programming and sensor integration), Mobile Robotics (Experience with control algorithms and sensor integration for wheeled robots)
- **Machine Learning:** Keras, TensorFlow, Reinforcement Learning
- **Data Analysis and Visualization:** Pandas, NumPy, Matplotlib, Plotly
- **Version Control:** Git, GitHub
- **Shell Scripting:** Bash scripting, Linux terminal commands
- **High-Performance Computing:** Parallel computing (MPI, OpenMP), Job scheduling (Slurm)

## CERTIFICATIONS

- ACM Certified Reviewer 2024