Akshar Chavan

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EDUCATION

The Ohio State University, Detroit — College of Engineering, *Detroit, MI*
Ph.D. in Electrical and Computer Engineering — GPA: 3.7 / 4.00   *Jan 2024 – August 2025(expected)*

Wayne State University, Detroit — College of Engineering, *Detroit, MI*
Ph.D. in Computer Science — GPA: 3.67 / 4.00   *Aug 2020 – Dec 2023*

Wayne State University, Detroit — College of Engineering, *Detroit, MI*
Master of Industrial Engineering — GPA: 3.51 / 4.00   *Aug 2018 – May 2020*

RESEARCH PROJECTS

Energy-Aware Autonomous Mobile Robots (AMRs)
Guide: Dr. Marco Brocaneli — Energy-aware Autonomous Systems Lab   *May 2022 – Present*

- **Studied** and **modified** the design of the existing prototype Autonomous Mobile Robot (**AMR**) to improve **localization** while **mapping** and navigating through obstacles.
- **Built** a prototype AMR operating on **Robot Operating System (ROS)**, equipped with **cameras, lidar, computing unit, power/current sensors, Arduino,** and **motors** to study and analyze the **energy-aware model**.
- **Studied** the **energy consumption** of the AMR under different operating conditions while performing objective tasks and its effect on **battery State of Health**.
- **Deployed** a **Task and Charging Schedule Manager** on a multi-purpose AMR to ensure **high-quality battery life**.

Maximizing Battery Lifespan in LoRaWAN Network
Guide: Dr. Abusayeed Saifullah, Dr. Marco Brocaneli — Energy-aware Autonomous Systems Lab   *Feb 2021 – July 2024*

- Used a semi-empirical non-linear battery degradation model to determine the **State of Health (SOH)** of the LoRaWAN node's battery based on the **State of Charge (SOC)** profile.
- Developed a **time slot selection algorithm** that considers **battery SOH** of LoRaWAN nodes and estimated **harvested energy** for data transfer to minimize the **battery degradation rate** of LoRaWAN network nodes.
- Simulation results showed an increase in the **lifespan** of the LoRaWAN network by **69.7%** with the proposed **time slot selection algorithm** over the traditional approach.

Task and Charging Schedule Manager for Autonomous Mobile Robots
Guide: Dr. Marco Brocaneli — Energy-aware Autonomous Systems Lab   *May 2020 – Nov 2022*

- Introduced and incorporated the concept of **Energy Usage Effectiveness** to achieve **high-quality battery life**.
- Designed, implemented, and investigated a **Mixed Integer Non-Linear Programming** model for joint **task allocation** and **charge scheduling** of a **fleet of AMRs**.
- **Investigated** the model for the trade-off between **task downtime** and **battery lifespan**, and **EEF** at different **SOC** thresholds for a high-quality battery life.
- **Designed** and **implemented** a **min-batch gradient descent greedy algorithm** that provides **task allocation** and **charge schedule** for AMRs with a **performance ratio of 1.16** executing in **polynomial time**.

Opportunistic maintenance scheduling of connected vehicles
Guide: Dr. Murat Yildirim — Cyber-Physical Analytics   *Feb 2019 – Dec 2019*

- Developed a unified **maintenance scheduling framework** for a large fleet of **connected vehicles** that integrates **multi-vehicle routing**, **maintenance**, and **predictive analytics** using **real-time sensor-driven data**.
- Modeled **mixed fleet dynamic vehicle routing problems (DVRP)** considering **uncertainties** and **drone delivery**.
- Investigated the impact of **disruptions** on **logistics** for **heterogeneous vehicle fleets**.

PUBLICATIONS

[1] Syeda Tanjila Atik, **Chavan, Akshar**, Daniel Grosu, and Marco Brocanelli. "A Maintenance-Aware Approach for Sustainable Autonomous Mobile Robot Fleet Management". en. In: *IEEE Transactions on Mobile Computing* 23.6 (Nov. 2023), pp. 7394–7407. ISSN: 1536-1233, 1558-0660, 2161-9875. DOI: 10.1109/TMC.2023.3334589.

[2] **Chavan, Akshar** and Marco Brocanelli. "Towards high-quality battery life for autonomous mobile robot fleets". In: *2022 IEEE International Conference on Autonomic Computing and Self-Organizing Systems (ACSOS)*. Sept. 2022, pp. 61–70. DOI: 10.1109/ACSOS55765.2022.00024. URL: https://ieeexplore.ieee.org/abstract/document/9935008.

[3] Sezana Fahmida, **Chavan, Akshar**, Venkata Prashant Modekurthy, Abusayeed Saifullah, and Marco Brocanelli. "A Battery Lifespan-Aware Protocol for LPWAN". In: *2024 IEEE International Conference on Distributed Computing Systems (ICDCS)*. Accepted and presented, to appear in proceedings.

SKILLS & CERTIFICATIONS

Programming Language: Python, ROS and C++
Certifications: IBM Data Science Specialization - Coursera