Shashwat Mudugur Ashok Kumar

West Lafayette, Indiana

ma.shashwat@gmail.com | +1 (765)-(694)-5374 | shashwat1524.github.io/Portfolio | linkedin.com/in/shashwatma | GitHub

Education

Purdue University — West Lafayette, IN, USA
Master of Science in Autonomy and Robotics GPA: 3.76/4.0 — *Aug. 2024 – (May. 2026)*
Relevant Coursework: Embedded Systems, Autonomous Systems, Vehicular Cyber Physical Systems

Manipal Academy of Higher Education — Manipal, Karnataka, India
Bachelor of Technology in Mechatronics, Minor in Electric Vehicle Technology — *Oct. 2020 – May 2024*

Skills

Languages : C, C++ (Modern C++17), Python, IEC 61131-3(Codesys)

Embedded Systems: RTOS (FreeRTOS), Bare-Metal Programming, Cross-Compilation, ESP-IDF, CMSIS-HAL

Communication Protocols: CAN(J1939, NMEA2000, CanOpen), Ethernet(TCP, UDP), I2C, SPI, UART.

Tools & Platforms: Docker, Linux, Shell Scripting, ROS2, Micro-ROS, Rviz, Gazebo.

Work Experience

Autonomy Intern — May 2025 – Present
Applied Industrial Technologies — *St Louis, MO, USA*

- Architected complete autonomy stack for **GPS-guided** differential-drive agricultural robots: GNSS localization, **Bézier curve** trajectory generation with real-time optimization (bisection method, Lagrange interpolation), and **Pure Pursuit** path tracking achieving 45cm localization accuracy over 100m+ orchard row-following missions.
- Integrated the autonomy stack with **LIDAR** based navigation along orchard rows and **RADAR**-based collision avoidance with deterministic timing on **ARMv7** controller via **CAN** bus, achieving less than **100ms latency**.

Technologies Used: C++, Docker, IEC611-3(ST), Python

Robotics Firmware Engineering Intern — May 2024 – July 2024
Algobotix — *Bangalore, Karnataka, India*

- Integrated MAVLink protocol in **C++** on **STM32** microcontroller to enable communication between the drone and ground station
- Designed a **ROS2 C++** node to interface with the **PX4** flight controller via XRCE-DDS to visualize drone telemetry in real-time GitHub

Embedded Research Intern - Bachelor's Thesis — Jan 2024 – May 2024
Robert Bosch Center for Cyber-Physical Systems, Indian Institute of Science(IISc) — *Bangalore, Karnataka, India*

- Designed real-time drone flight controller using **ESP32** with **Micro-ROS** stack for motion capture laboratory experiments. GitHub
- Implemented **FreeRTOS** scheduler to acquire Motion Capture System data and activate fail-safe mechanisms during communication loss
- Integrated MPU-6050 (via **I2C**) and Lidar (via **UART**) to enable autonomous safe landing under fail-safe conditions, programmed in **C and C++** using ESP-IDF.

Systems Engineering Intern — June 2023 – Aug 2023
Ola Electric — *Bangalore, Karnataka, India*

- Introduced **supercapacitors** into vehicle models to enhance regenerative braking performance and simulated the system using Gamma Technology Software, resulting in a **23%** increase in vehicle range
- Designed a flight controller using **Arduino** and **C**, implementing **PID** control for precise drone stabilization and integrating an MPU-6050 via **I2C** for real-time motion sensing.

Electronics and Powertrain Engineer / Team Leader — Nov 2020 – May 2023
Moto Manipal – Electric Superbike Team — *Manipal, Karnataka, India*

- Led the development and manufacturing of a 10kW PMSM-powered electric superbike for MotoStudent International, designing the Li-ion battery pack and performing powertrain modeling and range calculations using MATLAB/Simulink.
- Developed an interactive dashboard using **Python** and **RaspberryPi3** and collected data from the motor controller using **CAN (Controller Area Network)** communication along with data logging system for monitoring and analysis through **ESP32** controller GitHub

Research Experience and Projects

Gesture Controlled Robotic Arm GitHub — **C, FreeRTOS**

- Developed a gesture-controlled robotic arm using **MediaPipe** for real-time hand tracking, transmitting commands via **UART** to an **STM32** running **FreeRTOS**. Configured timers in **PWM mode** using **CMSIS and HAL** for precise servo control and deterministic task execution.

Traffic Sign Classification using Cross Stage Partial Network GitHub — **PyTorch, Python, Open CV , Matplotlib**

- Trained a traffic sign classification model on the **German Traffic Sign Recognition Benchmark** using **CSPNet** with **Mish** activation, boosting gradient flow and efficiency by 20% and achieving 87% accuracy with improved generalization.

RRT* Path Planning and Following for Obstacle Avoidance on TurtleBot3 GitHub — **Python, ROS2, Rviz, Gazebo, Matplotlib**

- Implemented RRT* algorithm for path planning and graph construction using KD-Tree; implemented path generation and tracking using a **PID** controller with simulations in RViz and Gazebo environments

A* Path Planning with PID Control on TurtleBot4 and Simulation on TurtleBot3 GitHub — **Python, ROS2, Rviz, Gazebo, Matplotlib**

- Developed and tested an A* path planning algorithm with **PID** control on TurtleBot4, achieving optimized navigation and trajectory following with obstacle avoidance.