Mainak Mondal

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Portfolio -https://crashxz.me

Work Experience

University of Connecticut (Cyber-Physical Systems Laboratory), Connecticut, USA.
Research Assistant 2022 – Present

- Designed and deployed MIND-CAVs, a browser-based CARLA orchestration system with LLM-assisted intent generation, FastAPI backend, React dashboard, and WebRTC streaming; supports real-time telemetry, scenario control, and dataset capture for closed-loop autonomy experiments.
- Researched and deployed open-source 5G stacks (OpenAirInterface and SRSRAN) on ARM-based SBCs (Nvidia Jetson TX2) integrated with autonomous robotic platforms (F1Tenth, Quanser QCar); enabled low-latency V2V and V2I communication and supported field testing of 3GPP-compliant 5G NR features across PHY–PDCP layers.
- Developed a Reinforcement Learning-based Charge-Scheduling Agent for Mobile Chargers in Wireless Powered Communication Networks, achieving a approximate 20% higher average sensor survival rate while reducing travel distance by 5%.
- Implemented autonomous driving features on a TurtleBot 3 platform using ROS, implemented Obstacle Avoidance, SLAM, and an Autonomous Waypoint Follower. Additionally, created an end-to-end control agent deployment pipeline using ROS.

NR Tomsk State University (High Performance Reconfigurable Systems Laboratory), Tomsk, Russia.
R&D Engineer 2018 – 2022

- Designed protocols and developed software for intercontinental Unmanned Aerial Vehicle (UAV) control and management, using ROS, Mavlink, Lightbridge and ZeroTier implementing a zero-trust network architecture to enable secure and remote operation.
- Designed an autonomous infrared-guided multirotor UAV landing system for safe landings in GPS-denied environments, improving landing precision by approximately 40% on mobile landing zones.
- Designed a control algorithm for UAVs using Haversine's Great Circle formula and PX4Flow, enabling autonomous Return-to-Home functionality in fail-safe conditions within GPS-denied environments.
- Developed prototype software and assembled multiple drones for automated medical and emergency supply delivery to quarantined areas during the COVID-19 pandemic, ensuring safe and efficient contactless distribution.
- Designed an Autonomous Scout/Attack UAV equipped with obstacle avoidance and autonomous flight routines. Integrated a low-altitude radar-based threat detection system that activates the UAV and initiates a scan upon object detection. Implemented an AlexNet-based CNN for real-time identification & interception of aerial threats, neutralization using a net-gun capture mechanism. (Scout Tank designed for search and rescue operations, capable of navigating radiation-affected terrain)

Spar Up Sports Technologies Limited, Pune, India.
Developer 2017 – 2018

- Developed APIs for web platform features using the MEAN Stack and optimized the Hybrid Ionic App, reducing load times by 300% for improved performance and user experience.
- Collaborated with clients to gather requirements, designed mockups, and developed personalized end-to-end features to enhance user experience and meet business needs.

Tata Technologies Limited, Jamshedpur, India.
Intern: Developer 2016 (Nov – Dec)

- Researched and analyzed the existing paper and desktop-based Plant Complaint Management System to design and transition it into a scalable web-based application, improving accessibility, efficiency, and integration with modern enterprise systems.
- Developed the Plant Complaint Management System with a C# backend and ASP.NET frontend, following SOLID principles for maintainability and scalability. Integrated the system with existing Inventory Management and General Management software to streamline operations and improve efficiency.

Technical Skills

Programming: Python, C++, C, Java, MEAN Stack (MongoDB, ExpressJS, AngularJS, NodeJS), JavaScript, PHP, JQuery, C#.
Robotic Stack: ROS (Robot Operating System), Gazebo (Simulation), Matlab, Mavlink, PX4, ArduPilot.
AI/ML Stack: Reinforcement Learning (DQN, PPO, A2C), PyTorch, TensorFlow, OpenAI Gym, Transformers, HuggingFace, AlexNet, LLMs (Qwen, LLaMA), Prompt Engineering, Scikit-Learn, NumPy, Pandas.
5G & Protocols: OpenAirInterface 5G, SRSRAN, 3GPP Stack (PHY, MAC, RLC, RRC, PDCP), Wireshark, FTM Tools.
Hardware Stack: Flight Controllers (DJI N3, M600, Pixhawk), Drive Stack (F1Tenth VESCs, Quanser QCar, Turtlebot 3), SBCs (Raspberry Pi, Jetson TX2/Xavier/Orin), Sensors (Velodyne VLP-16, FLIR Duo Pro R, Intel Realsense, OAK-D).

Education *(Published 15+ articles in peer-reviewed journals / conferences)*

Ph.D. in Computer Engineering (Robotics) 2026*
University of Connecticut, USA. **GPA: 3.96/4.0**

M.S. in Instrumentation Engineering (Robotics) 2020
Tomsk State University, Russia **GPA: 5.00/5.0**

Bachelor's in Computer Applications 2018
Velore Institute of Technology, India **GPA: 9.56/10.0**