

Md Munim Rayhan

Robotics Software and Systems Engineer

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Robotics software and controls engineer with a PhD in Mechanical Engineering and hands-on experience building physical robot systems for hazardous-environment applications. Integrates AI perception, motion planning, sensors, and operator controls using Python, C++, ROS 2, and MoveIt 2. Combines hardware debugging and experimental validation with manufacturing process-control research and technical training.

TECHNICAL SKILLS

Software Python, C++, Linux/Ubuntu, Docker, Git, VS Code development containers

Robotics ROS 2, MoveIt 2, URDF/Xacro, TF2, RViz, NVIDIA Isaac Sim, kinematics

Perception and sensing Intel RealSense RGB-D, LiDAR, OpenCV, point clouds, calibration, GroundingDINO, GraspSAM

Control and integration PI control, PWM, joint encoders, Raspberry Pi

PROFESSIONAL EXPERIENCE

Visiting Postdoctoral Associate

Jun 2025 - Present

Applied Research Center, Florida International University | Miami, FL

Perception guided robotic manipulation

- Integrated a UR16e waste-segregation system from text-prompt target selection through GroundingDINO identification, GraspSAM grasp generation, MoveIt 2 planning, and staged execution on the physical robot.
- Developed C++ ROS 2 nodes and services for approach, grasp, retreat, homing, and gripper control; connected depth-camera measurements and robot coordinate frames to the motion-planning workflow.
- Built an operator dashboard with RViz, live grasp previews, confidence and depth information, execution status, and logs; exposed stage controls and home overrides for supervised demonstrations.
- Delivered an integrated robot workflow and operator interface for the DOE system integration and baseline demonstration milestone.

Compact manipulators and experimental control

- Develop a four-joint cable-driven manipulator for inspection through 4-inch risers, integrating kinematic modeling, workspace analysis, external joint encoders, and Python/C++ control software.
- Built ROS 2, MoveIt 2, and Isaac Sim workflows for robot modeling, workspace analysis, motion planning, and simulation-driven control.
- Designed and analyzed breakaway trials to characterize the effects of PWM command and motion history; developed bounded assistance with encoder-confirmed release and timeout handling.
- Collaborate with Idaho National Laboratory and DOE project teams on robotic systems, experimental validation, technical reports, and demonstrations; mentor graduate and undergraduate researchers.

MANUFACTURING RESEARCH

Graduate Assistant

Aug 2019 - May 2025

Department of Mechanical and Materials Engineering, Florida International University

- Developed and experimentally evaluated an interlayer thermal feedback controller for wire-arc directed energy deposition, using temperature measurements to adjust dwell time during fabrication.
- Developed a physics-guided parameter estimation framework for cold-spray simulations and contributed to machine-learning-based multi-fidelity modeling for manufacturing process prediction.
- Integrated experimental sensing, data acquisition, and analysis with numerical models; translated the work into first-author publications on feedback control and parameter estimation.

TECHNICAL INSTRUCTION

Instructor in Robotic Systems

Fall 2026

EEL 1603, Florida International University | Miami, FL

- Teach introductory robotic systems, instrumentation, and control; develop hands-on exercises in ROS 2, Python, sensors, and teleoperation.
- Built a Raspberry Pi robot workflow with Docker development containers, UART motor communication, and bidirectional Wi-Fi telemetry and teleoperation using Zenoh; documented setup for Windows, macOS, and Linux.

EDUCATION

PhD in Mechanical Engineering

May 2025

Florida International University | Miami, FL

Doctoral focus: feedback control and sensor integration for wire-arc and cold-spray additive manufacturing.

MS in Mechanical Engineering

May 2024

Florida International University | Miami, FL

BS in Mechanical Engineering

Mar 2017

Khulna University of Engineering and Technology | Khulna, Bangladesh

SELECTED PUBLICATIONS

Rayhan, M. M., et al. *Dynamic Dwell Time Adjustment in Wire Arc-Directed Energy Deposition: A Thermal Feedback Control Approach*. Journal of Manufacturing and Materials Processing, 9(5), 143 (2025). DOI

Rayhan, M. M., et al. *A Physics-Guided Parameter Estimation Framework for Cold Spray Additive Manufacturing Simulation*. Coatings, 15(4), 364 (2025). DOI

Hamrani, A., Rayhan, M. M., et al. *Smart quadruped robotics: a systematic review of design, control, sensing and perception*. Advanced Robotics, 39(1), 3-29 (2025). DOI