Shakila Praveen Rathnayake

Robotics Research Engineer

Sri Lanka
GitHub | LinkedIn | Portfolio | shakilabeta@gmail.com | +94 71 27 35 664 / +94 71 244 666

SUMMARY

Specializing in Autonomous Navigation and Robotics System Architecture. Focused on solving state estimation, path planning and control challenges in unstructured environments. Experienced in designing sensor fusion pipelines and optimizing computational efficiency for real-time deployment, bridging the gap between theoretical mathematical models and physical hardware constraints.

SKILLS

- **Programming Languages**: C++, Python, MATLAB, Assembly
- **Robotics & Frameworks**: ROS 2 (Nav2, TF2), OpenCV, TensorFlow, PyTorch
- **Embedded Systems**: FreeRTOS, ESP32, Arduino, Raspberry Pi, 8051, UART, I2C
- **Simulation & Tools**: Gazebo, SolidWorks, AutoCAD, Proteus, Simulink, PlatformIO, Linux, Git
- **Key Concepts**: SLAM, Path Planning, Localization, Sensor Fusion, PID Control, MPC, Fuzzy Logic, Deep Learning

EXPERIENCE

Robotics Related Freelancer | Self-Employed
2024 - Present

- Developing custom robotics solutions for international clients.
- Implementing systems using IoT, ROS2, Embedded Systems, Machine Vision, and Deep Learning.
- Focusing on robust localization and path planning algorithms for autonomous platforms.

RESEARCH

Hierarchical Supervisory Motion Planning for Frontal Following Robots using Guided-MPPI & DVR *(Ongoing Research)*
ROS 2, PyTorch (with CUDA), MPPI, YOLO v11, Custom State Estimation (EKF, CTRV, ego-motion), Path Planning, Python, C++

- Developing a governance system for stable human-following robot navigation on ROS 2.
- Implemented **KPC**, **Guided-MPPI** and **Dynamic Virtual Rail (DVR)** to decouple trajectory geometry from human kinematics.
- Designed a Curvature-Preserving Velocity Filter to ensure geometric validity at varying speeds.

Enhancing Accuracy in Automated Solid Waste Segregation *(Research Proposal)*

- Investigates the potential for improving accuracy in automated solid waste segregation systems.
- Proposes a multi-sensor approach with cross-verification to handle complex non-organic waste streams.
- Aims to reduce contamination rates and improve recycling efficiency compared to single-method technologies.

PROJECTS

Three-Tier Mobile Robot Architecture: Real-Time Control via FreeRTOS and Lightweight Non-DDS Transport for ROS 2 Integration
ESP32, FreeRTOS, C++, Python, UART, PlatformIO

- Designed a modular, scalable mobile robot platform utilizing a 3-tier architecture.

- Integrated high-level decision-making (Pi Zero 2W) with low-level hardware control (ESP32) via a reliable UART bridge.
- Implemented FreeRTOS for deterministic timing of critical tasks like motor control and sensor acquisition.

SLAM-Teleop: Real-time ROS2 SLAM on Android
Android, React Native, Expo, ROS2, WebSocket, JavaScript

- Developed a specialized Android app for mobile robots providing joystick teleoperation and real-time SLAM mapping.
- Implemented zero-dependency WebSocket communication with rosbridge_server for low-latency control.
- Enables mapping without bulky laptop-based ground control stations.

Hybrid LSTM-ANFIS MagLev Control
MATLAB, Deep Learning, LSTM, ANFIS, Fuzzy Logic

- Designed an advanced control system combining **LSTM neural networks** and **ANFIS** for nonlinear magnetic levitation stability.
- Leveraged deep learning for temporal pattern recognition and fuzzy logic for interpretable control rules.
- Achieved superior tracking performance and disturbance rejection compared to standalone methods.

Ping Pong Ball Levitation PID Control
Arduino, C++, MATLAB, Simulink, Python

- Engineered a PID-controlled aerodynamic system to levitate a ping pong ball at precise heights.
- Implemented real-time control loops on **Arduino UNO** with feedback from an ultrasonic sensor.
- Performed system identification and tuning using **MATLAB/Simulink** models.

PipeRover - Tube Climbing Robot *(Group Project)*
Robotics, Mechanical Design, Embedded Systems, CAD

- Designed a PVC pipe climbing robot for inspection and maintenance of pipe networks.
- Developed a unique wheel design with flexible polyurethane foam for enhanced traction.
- Validated performance on varying diameters and obstacle traversal.

Handwritten Character Recognition
Python, TensorFlow, OpenCV, Deep Learning

- Built a deep learning model for recognizing handwritten characters using **Python** and **OpenCV**.
- Trained Convolutional Neural Networks (CNNs) on the **EMNIST** dataset for high generalization accuracy.

Neuro-Fuzzy MagLev Control
MATLAB, ANFIS, Fuzzy Logic, Simulink

- Implemented an Adaptive Neuro-Fuzzy Inference System (ANFIS) to stabilize nonlinear maglev systems.
- Utilized hybrid learning algorithms to tune fuzzy membership functions.

8051 Dumbwaiter Controller
Assembly, Proteus, Microcontrollers, 8051

- Designed an 8051-based control system for a 3-floor service lift with intelligent routing.
- Implemented low-level Assembly logic for bi-directional motor control and PWM speed regulation.
- Integrated safety mechanisms including load cell monitoring and door interlocks.

EDUCATION

B.Sc. (Hons) in Mechatronics Engineering
Open University of Sri Lanka | *Undergraduate (Coursework Completed – Pending Industrial Training)*

G.C.E. Advanced Level (Physical Stream)
St. Thomas College, Matale | *Passed*