Hassan Shahzad

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Mobile robotics engineer with extensive hands-on experience developing autonomous systems using ROS2, Nav2, and SLAM technologies. Proven expertise in integrating LLM agents for autonomous robot control in simulation environments. Strong background in hardware-software integration, from low-level microROS implementations to complete autonomous navigation stacks. Currently pursuing Integrated Master's in Robotics and AI at UCL with focus on mobile robotics research and development.

Experience

ROS2 Robotics Engineer *January 2024 — January 2024*

Year 2 Industry Placement

- Developed ROS2 Humble autonomous navigation system with Nav2, AMCL localization, and SLAM Toolbox functionality
- Built Gazebo simulation environment with 1:1 accurate robot physics and sensor modeling
- Generated URDF robot models from STEP files for precise mechanical representation
- Integrated Flutter mobile app with ROS2 service communication for remote robot control

Founder *January 2025 — Present*

Innovation tech startup

- Founded Silkun Innovations, an innovation tech startup with multiple projects under development
- Leading entrepreneurial ventures across food service and hospitality technology sectors
- Developed and commercialized MeSnap innovation with online sales platform at mesnap.app

Projects

A24 - Autonomous SLAM Research Platform *Present — Present*

Comprehensive educational autonomous mobile robot with complete ROS2 navigation stack

- 3-year development of modular autonomous mobile robot platform for SLAM research
- Complete ROS2 implementation with Nav2 stack and SLAM Toolbox integration
- Three-stage modular design: mobility platform, computing hub, and sensing platform
- RP-LiDAR A1 360° environmental scanning with custom mounting and connectivity
- Differential drive system with sensored DC motors and L298N control
- microROS integration for efficient microcontroller-ROS2 communication
- Custom URDF modeling with fusion2urdf plugin for accurate simulation
- Sim2Real capabilities for seamless simulation-to-hardware deployment
- Laser-cut acrylic chassis with professional assembly and power management

OpenBase2 - Low-Cost Autonomous Mobile Platform *Present — Present*

Cost-effective autonomous mobile robot built from repurposed components with advanced navigation

- Innovative £240 autonomous mobile robot using repurposed hoverboard components
- Complete ROS2 core with Nav2 stack for autonomous navigation
- RTAB-Map ROS implementation for simultaneous localization and mapping
- ESP32 with microROS for precise motor control and sensor interfacing
- Intel D415 depth camera integration for advanced perception
- WebRTC teleoperation capabilities for remote control
- Modular DIN rail and aluminum extrusion framework for rapid reconfiguration
- Advanced obstacle avoidance and dynamic path planning algorithms
- Demonstrated cost-effective approach to professional-grade autonomous robotics

BiStable - Self-Balancing Robot with Multi-Modal Control *Present — Present*

Advanced 2-wheeled robot with ROS2 architecture, computer vision, and autonomous balancing

- Complete ROS2 implementation with 4 custom packages in 2-week UCL project timeline
- Multi-modal control: hand-following, gamepad control, and autonomous balancing
- ESP32 WROOM32 with microROS bridge for distributed processing architecture
- Google MediaPipe integration for real-time hand tracking and distance estimation
- Dual-core ESP32 processing: Core 1 for balance, Core 2 for motor control
- PyBullet physics simulation for PID algorithm validation and testing
- Advanced PID-based stabilization with real-time IMU (MPU6050) feedback
- NEMA17 stepper motors with DRV8825 drivers for precise differential control
- Solved motor velocity control instability through innovative parallel processing

Nav2 Agent - LLM-Controlled Robot Navigation *Present — Present*

Natural language robot navigation system using LLM agents and ROS2 Nav2 integration

- Revolutionary natural language interface eliminating complex coordinate-based robot commands
- OpenAI GPT integration with LangChain for sophisticated natural language understanding
- Custom tool-calling framework enabling AI-driven robot action execution in simulation
- Complete ROS2 Nav2 stack integration for professional-grade autonomous navigation
- Advanced command processing: 'Go to kitchen', 'Navigate to living room' natural language parsing
- Pre-mapped environment database with intelligent coordinate translation algorithms
- LangChain-ROS2 bridge for seamless AI-robotics communication and control
- Demonstrated feasibility of conversational robotics for practical applications
- Proof of concept for agentic robot control in simulated environments

radioROS - Universal ROS2 Wireless Controller *Present — Present*

Professional wireless controller for ROS2 robots with custom PCB and dual-core processing

- Universal ROS2-compatible wireless controller for research robotics applications
- ESP32-S3 dual-core architecture with hardware interrupt PWM processing
- Complete ROS2 driver package with modular node structure and robust communication
- Custom PCB designed in EasyEDA with professional JLCPCB manufacturing
- Thread-safe inter-core communication using mutex-based data handling
- Real-time PWM-to-Twist message conversion for standard robot control interface
- Robust wireless protocol with custom start/stop byte communication
- Professional SMD assembly with stencil-assisted soldering at 138°C

Education

University College London (UCL) *September 2023 — June 2027*

MEng (Integrated Master's) in Robotics and AI (Current Student)

- Advanced Machine Learning & Neural Networks
- Autonomous Robotics & Control Systems
- SLAM & Computer Vision
- Embedded Systems & Real-time Programming
- Reinforcement Learning for Robotics
- Multi-robot Systems & Navigation

Altrincham Grammar School for Boys *September 2016 — June 2023*

Secondary Education in STEM Focus

- Mathematics
- Further Mathematics
- Physics
- Computer Science

Skills

Mobile Robotics Frameworks:	ROS2 Humble, Nav2 Navigation Stack, SLAM Toolbox, AMCL Localization, microROS, ROS2_control, Gazebo Simulation, PyBullet Physics

SLAM & Navigation:	RTAB-Map, Simultaneous Localization and Mapping, Path Planning Algorithms, Obstacle Avoidance, Occupancy Grid Mapping, Sensor Fusion, Multi-robot SLAM
AI & LLM Integration:	LangChain Robotics Integration, OpenAI GPT Tool Calling, Natural Language Robot Control, Speech-to-Action Systems, Agentic Robot Control, LLM-driven Navigation, Conversational Robotics
Hardware & Embedded Systems:	ESP32/ESP8266 Programming, Raspberry Pi Integration, Motor Control (Stepper/Servo/DC), Sensor Integration (LiDAR/IMU/Cameras), PCB Design & Manufacturing, 3D Printing & Mechanical Design, Real-time Systems (FreeRTOS)
Programming & Software:	Python (Primary), C++ (ROS2/Embedded), Arduino Framework, Git/GitHub, Docker Containerization, WebRTC Communications, MQTT Protocols, Flutter Mobile Development

Interests

Mobile Robotics Research:	Autonomous Navigation, SLAM Algorithms, Multi-robot Systems, Real-world Robotics Applications
AI-Robotics Integration:	LLM Agent Control, Natural Language Robotics, Simulation-to-Reality Transfer, Conversational Robot Interfaces
Augmented Reality:	WebXR Development, AR Navigation Systems, Browser-based AR, Multi-user AR Interactions
IoT & Distributed Systems:	Physical MCP Implementation, Centralized IoT Control, Speech-to-Action Systems, Edge Computing Architecture
Entrepreneurship & Leadership:	Technology Commercialization, Product Development, Market Validation, Innovation Management