

PERSONAL PROFILE

Applied AI & Robotics Engineer with 8+ years of international industrial automation and AMHS cleanroom engineering depth, now completing the **Master of Applied Computing at Lincoln University** (Christchurch, New Zealand). Combines proven factory-floor precision with hands-on modern software delivery: trained custom Detectron2 Mask R-CNN models for optical defect inspection, engineered standalone Android APKs via automated CI/CD, deployed hybrid RAG pipelines with dense vector search, and commercialized autonomous mobile robots (MiR AMRs / Universal Robots). Co-inventor of granted Indian Patent No. 439813 and recipient of the 2024 ST STAR Award at STMicroelectronics. Actively seeking a summer internship or industry project placement to deliver measurable engineering value to New Zealand industry.

CORE TECHNICAL COMPETENCIES

Languages & Core:	Python, C# (Unity XR), SQL (PostgreSQL, SQLite), HTML5, CSS3, C++.
AI, Vision & RAG:	PyTorch, YOLOv8, Detectron2 (Mask R-CNN), OpenCV, GrabCut Segmentation (37 px/cm defect sizing), LangChain, FAISS Vector Store, BM25 Search, Reciprocal Rank Fusion (RRF), Claude Vision API, Gemini 3.5 Flash OCR.
Software & Mobile:	Flask REST APIs, Capacitor 8 (Standalone Android APK, Android Auto), Progressive Web Apps (PWA), MapLibre GL, OSRM Routing, Responsive Web UI, IndexedDB.
DevOps, QA & Cloud:	Docker, Docker Compose, 85 automated unit tests (Pytest/Unittest), GitHub Actions CI/CD, Git, Linux/WSL2, PythonAnywhere.
Robotics & Automation:	MiR Autonomous Mobile Robots (AMRs), Universal Robots (UR cobots), Akribis precision motion stages, Automated Material Handling Systems (AMHS), Semiconductor Cleanrooms (Class 10/100), PLC/HMI basics.
Methodologies:	Agile Software Development (COMP639 Studio), Scrum Sprint Cycles, Backlog Management, Jira, Client Presentations, Technical Documentation.

APPLIED COMPUTING & ENGINEERING PROJECTS

- Kiwi Sorter: AI Fruit Quality & AR Spatial Inspection - Flagship AI System** github.com/baboo-balan-1173535/ai-fruit-quality-inspection-ar

 - Engineered an autonomous two-stage computer vision inspection system for New Zealand packhouses: Stage 1 YOLOv8 filters sound produce; Stage 2 custom Detectron2 Mask R-CNN (transfer-learned on Colab T4 GPU, loss 2.36 -> 0.33) segments subtle surface defects.
 - Developed OpenCV GrabCut optical defect measurement calibrated at 37 px/cm, cross-validated via Claude Vision multimodal API.
 - Built world-anchored AR visualization in Unity 2022.3 (C#) on XReal One glasses, projecting hands-free bounding boxes directly onto fruit.
 - Integrated Flask REST API backend, PostgreSQL database, and dark-themed web dashboard for real-time packhouse quality grading.
- Ropu Mapi: Multi-Modal Convoy Navigation & Native Voice Engine - Standalone Android APK** github.com/baboo-balan-1173535/ropu-mapi

 - Authored open-source convoy navigation application compiled to standalone Android APK via automated GitHub Actions CI pipeline.
 - Engineered an unblockable quad-redundant native TTS voice bridge in Capacitor 8, overcoming mobile OS WebView audio throttle constraints.
 - Integrated speed limit alerts, turn-by-turn spoken guidance, offline solo routing via OSRM, and real-time convoy sync over WebSockets.
- SmartShop: Retail Price Intelligence & Multi-Store Optimizer - Canterbury PWA** github.com/baboo-balan-1173535/smartshop

 - Architected a progressive web application (PWA) for Canterbury grocery price optimization using OpenStreetMap Overpass API (zero API costs).
 - Implemented Traveling Salesperson Problem (TSP) multi-store route solver, calculating optimal travel routes when savings exceed \$0.50.
 - Integrated Gemini 3.5 Flash receipt OCR vision pipeline; built 85 automated unit tests; containerized with Docker Compose and PostgreSQL 15.
- DocMindAI: Enterprise Hybrid RAG Engine - Production RAG Architecture** github.com/baboo-balan-1173535/docmindai-rag-chatbot

 - Constructed hybrid retrieval architecture fusing FAISS dense semantic vector search with BM25 keyword matching via Reciprocal Rank Fusion (RRF).
 - Delivered hallucination-resistant document intelligence with inline source citations, per-document scoping, and natural language SQL analytics.
- Modular Cobot + AMR Mobile Platform - Skymech Automation (Singapore)** **Commercial Deployment**

 - Designed and built modular mobile manipulator combining MiR autonomous base with Universal Robots arm; achieved 30-minute rapid swap.
 - Successfully commercialized with 3-4 standard units deployed to Singapore manufacturing customers, including aerospace engine inspection.
- Power Line Inspection Robot (Hexarotor Crawler) - Indian Patent No. 439813** **Granted Patent (20-Yr Term)**

 - Invented teleoperated hexarotor crawler that lands on live high-voltage transmission lines and traverses conductors with rubber-coated rollers.
 - Integrated high-voltage EMI shielding and real-time wireless video downlink, eliminating hazardous human climbing and helicopter inspections.

WORK HISTORY & PROFESSIONAL EXPERIENCE

Senior Industrial Engineer & AMHS Automation - **Tata Electronics** (India / Taiwan) Feb 2025 - Jan 2026

- Part of the core automation engineering team deploying Automated Material Handling Systems (AMHS) for a greenfield semiconductor facility.
- Optimized AMHS overhead hoist transport (OHT/OHB) and cleanroom stocker integration, coordinating technical delivery across 6 international vendors.
- Led root-cause failure investigations and continuous improvement initiatives, boosting equipment reliability and fab-wide operational uptime.

Global Field Application Engineer - Machine Vision & AI - **Solomon Technologies** (Taiwan) Aug 2024 - Feb 2025

- Deployed and tuned industrial AI vision inspection systems and optical defect sorting cells across international customer manufacturing sites.
- Integrated robotic inspection cells and vision algorithms, troubleshooting complex hardware-software communication protocols and camera calibrations.
- Trained client technical teams, authored standard operating procedures (SOPs), and delivered technical demonstrations across Asia-Pacific markets.

Automation Project Manager & Industrial Engineer - **STMicroelectronics** (Singapore / Malaysia) Aug 2022 - Jul 2024

- **Awarded ST STAR Award (2024)** for leading automation redesign that achieved **30%+ production efficiency gains** in semiconductor fabrication.
- Managed Class 10/100 wafer stockers and cleanroom Automated Material Handling Systems (AMHS), ensuring zero-defect handling of silicon wafers.
- Built and deployed an AR proof-of-concept application on Microsoft HoloLens, visualizing live machine telemetry and sensor data directly on the factory floor.
- Supervised cross-functional vendor teams, capital equipment budgets, and end-to-end commissioning from factory acceptance to production sign-off.

Micro Actuators Team Lead & Precision Motion - **Akribis Systems** (Singapore) Feb 2022 - Aug 2022

- Led high-precision robotics and micro-actuator development, reducing manufacturing cycle time by 25% and improving positioning precision by 30%.
- Reduced pre-development engineering lead times by 20% through standardized motion tuning and modular mechanical design practices.

Senior Application Engineer (Robotics & AMRs) - **Skymech Automation** (Singapore / Malaysia) Mar 2019 - Feb 2022

- Designed and commercialized the Modular Cobot + AMR mobile platform; personally secured sales and delivered 3-4 standard production units.
- Deployed autonomous mobile inspection robot at a major Singapore aerospace maintenance facility, automating engine component inspection.
- Delivered 50+ automation system integration projects across Southeast Asia, achieving 30%+ efficiency gains in semiconductor handling lines.

R&D Project Engineer (Cleanroom AMHS) - **Chiff Technologies** (Taiwan) Jun 2017 - Jul 2018

- Supervised high-precision cleanroom wafer Stocker machine installations, accelerating delivery milestones by 20%.
- Collaborated with Taiwanese precision mechanical suppliers, improving procurement lead times by 25% and maintaining strict cleanroom standards.

EDUCATION & ACADEMIC QUALIFICATIONS

Master of Applied Computing - **Lincoln University** (Christchurch, New Zealand) Feb 2026 - Jul 2027 (In Progress)

- Specialization: Applied machine learning, computer vision, full-stack software development, and agile project delivery.
- Lincoln COMP639 Agile Studio: Scrum team leadership, sprint ceremonies, client reviews, and full-stack software delivery.
- Preparing for COMP693 industry placement project (Feb - Jun 2027); eligible for 3-Year Open Post-Study Work Visa (PSWV).

Master of Science in Mechanical Engineering - **National Cheng Kung University (NCKU)** (Taiwan) Sep 2014 - Jun 2016

- Master's Thesis: Humanoid bipedal robot replicating human kinematics captured via multi-camera optical vision data. GPA: 3.8 / 4.0.

Bachelor of Engineering in Mechanical Engineering - **Veltech Technical University** (India) Sep 2010 - May 2014

- Final-year capstone project: Live Power Line Inspection Robot crawler, directly resulting in granted Indian Patent No. 439813.

PATENTS, HONORS & PROFESSIONAL AFFILIATIONS

- **Granted Patent:** Indian Patent No. 439813 - *Power Line Inspection Robot* (Co-inventor: Baboo Balan; 20-year term granted July 2023).
- **ST STAR Award (2024):** Recognized by STMicroelectronics for semiconductor automation excellence and 30%+ throughput gains.
- **National Competition:** 1st Place, Gridtech National Robotics Competition (India).
- **Professional Affiliation:** Member, Canterbury Tech (Christchurch, New Zealand).

REFEREES

Professional and academic referees available upon request.