Hoashalarajh Rajendran

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Brief Summary

Electrical engineer with 3+ years of combined research and practical experience in electrical engineering fundamentals, programming, computer systems, robotics and automation, AI applications, and Modeling and Simulation. Industry exposure at Ceylon Electricity Board (CEB), Lakdanavi, and LTL Transformers; international engineering research experience in Canada.

Education

- **University of Moratuwa** *Oct 2022 – Jul 2024*
  Master of Science (Major Component of Research)
  Department of Electrical Engineering
  Thesis : Situation-aware Proactive Service by Observing User Behaviors for Service Robots
  Grade: A

- **University of Moratuwa** *Aug 2017 - Jul 2022*
  Bachelor of the Science of Engineering (Honours)
  Department of Electrical Engineering
  Academic standing: Second Class Upper Division

Professional Experience

University of Prince Edward Island, Canada Feb 2025 – Dec 2025
Role: Research Assistant
Responsibilities:

- Conducted research on socially compliant mobile robot navigation in crowded environments.
- Modeled robot navigation using Partially Observable Markov Decision Processes (POMDP).
- Designed belief-space planning approaches using Monte Carlo Tree Search.
- Modeled crowd dynamics including density, pedestrian flow, and robot proximity.
- Performed simulations and system modeling for autonomous navigation.

Impact:

- Enabled long-horizon decision making for robots in uncertain crowd environments.
- Improved robot navigation strategies through probabilistic crowd modeling.

University of Moratuwa Oct 2022 – Dec 2024
Role: Graduate Research Assistant
Responsibilities:

- Conducted research on situation-aware proactive services for service robots.
- Developed systems to analyze user behavior patterns for intelligent interaction.
- Designed context-aware conversational systems integrating voice, vision, and text modalities.
- Implemented proactive interaction management for personalized suggestions.
- Developed hierarchical state transition networks for conversational task management.

Impact:

- Developed intelligent service robot interaction frameworks for personalized assistance.
- Produced multiple peer-reviewed research publications in Scopus Indexed IEEE conferences.

Ceylon Electricity Board May 2021 – Jun 2021
Role: Electrical Engineering Trainee at Upper Kothmale Hydropower Station
Responsibilities:

- Observed daily plant operations, including unit start-up/shut-down procedures and grid synchronization via SCADA systems.
- Assisted in the monitoring and analysis of synchronous generators, excitation systems, and step-up transformers.
- Reviewed electrical single-line diagrams, control schematics, and operational manuals for hydropower generation equipment.
- Supported engineers during routine maintenance, condition monitoring, and safety inspections of switchgear and auxiliary systems.
- Assisted with compiling daily generation logs and technical documentation for preventive maintenance schedules.

Impact:

- Gained practical, hands-on exposure to large-scale hydropower generation, switchyard operations, and high-voltage equipment maintenance.

Lakdhanavi (Pvt) Ltd – Yugadanavi Combined Cycle Power Plant Apr 2021 – May 2021
Role: Electrical Engineering Trainee
Responsibilities:

- Monitored and analyzed real-time electrical telemetry data for a 300MW combined cycle facility using Distributed Control Systems (DCS).
- Conducted routine field inspections and condition monitoring on heavy industrial electrical machines, including generators, large induction motors, and high-voltage switchgear.
- Collaborated with plant engineers to execute preventive maintenance schedules and investigate operational anomalies in electrical subsystems.
- Compiled technical performance reports and updated critical system documentation, including maintenance logs and single-line diagrams.

Impact:

- Contributed to the operational readiness and maintenance tracking of a major 300MW power plant.

LTL Transformers (Pvt) Ltd Jan 2021 – Apr 2021
Role: Electrical Engineering Trainee
Responsibilities:

- Monitored the end-to-end distribution transformer manufacturing lifecycle, including core building, coil winding, active part assembly, and vacuum oil-filling processes.
- Conducted routine and type testing on distribution transformers (such as winding resistance, insulation resistance, and dielectric tests) to verify compliance with international IEC standards.
- Evaluated shop-floor production workflows and quality control checkpoints, assisting with defect tracking and process optimization.
- Reviewed engineering design blueprints, CAD models, and technical specifications related to transformer production.

Impact:

- Validated product quality for commercial distribution transformers, successfully bridging the gap between theoretical design specifications and practical factory acceptance testing.

Research Experience

- **Research Assistant** *Feb 2025 - Nov 2025*
  Topic: *Socially Compliant Mobile Robot Navigation* *University of Prince Edward Island, Canada*
  Research Overview: Human internal states such as motion patterns and awareness are not directly observable, which introduces uncertainty when a robot navigates in crowded environments. Reactive navigation strategies often operate over short time horizons and can lead to socially suboptimal decisions. To address this, I modeled socially compliant robot navigation as a Partially Observable Markov Decision Process (POMDP), enabling strategic decision-making under uncertainty. The robot maintains a belief over an abstract crowd state capturing crowd proximity, pedestrian flow, density, and robot position, inferred through noisy observations. Socially informed rewards encourage compliant behaviors, and Monte Carlo Tree Search is applied for belief-space planning, enabling longer-horizon, non-reactive navigation decisions in dynamic crowd settings.
  Preliminary modeling and simulation

- **Master's Research - Graduate Research Assistant** *Oct 2022 - Dec 2024*
  Intelligent Service Robotics Group, Department of Electrical Engineering *University of Moratuwa*
  Supervisor: Prof.A.G.B.P. Jayasekara (PhD, Japan)
  Topic: Situation-aware proactive services by observing user behavior for service robots

  Research component 1: Investigate user behavior patterns to initiate and maintain personalized interactions, considering modalities such as vision, voice, and text, while adapting to evolving user preferences
  Research Component 2: Model user-centered task-oriented conversation system by observing user behavior for a short-term human-robot interaction
  Research Component 3: Identify the significance of context-aware conversation in everyday domestic environment and methods for updating unknown information in a regular conversation through interacting with the users

  - **Outcome 1**: System for identifying the emotion intensity levels from voice response of the human, [Slides], [Paper]
  - **Outcome 2**: Development of proactive interaction manager for providing intelligent suggestions to the users regarding the reading material they prefer to read during their leisure time considering the mood of the user, [Slides], [Paper]
  - **Outcome 3**: A context-aware conversation management system suitable for domestic service robots with a response cloud structure for dynamically updating the unknown information about the user by interacting with the user, [Slides], [Paper]
  - **Outcome 4**: A user-centred information gathering with task-oriented conversation management system using a novel method of hierarchical state transition network with a state switching algorithm for changing between interaction modes.
    [Task-oriented Conversation System: Code_repository]

Engineering Projects

- **Smart face detection and emotion estimation system for social robots using ROS2 Ecosystem** 2025
  A modular ROS2 (Humble) based Python ecosystem that bridges live video feeds with computer vision for human frontal face detection. It features a publisher-subscriber architecture to broadcast video frames, perform real-time face detection and emotion estimation, and stream the estimation. This serves as an ideal vision subsystem for social robotics and humanoid robotic platforms. [Face detection pkg] , [Estimator pkg]

- **Humanized task-oriented conversational agent** *Jun 2023 - Dec 2024*
  Task-oriented conversational agent asks a series of questions about a particular topic to receive the opinions from the participants. Due to the continuous queries the participant may be tired, fatigue and frustrated. In this project we proposed a survey chat-bot that can monitor the user opinion and user engagement over fixed number of interactions and can switch the interaction mode to support and care the user to answer more comfortably.
  [Poster], [Code base]

- **Emotion intensity classification from human speech** *Oct 2022 - Apr 2023*
  Emotions are widely classified from images and speech signals and even from multi-modalities. However, intensities of those emotions were studied only as a continuous scale such as emotion temperature. It is really hard to understand rationale behind such continuous scale, on the other hand we have a rapidly growing data in the social media and internet of speech signals with a variety of emotional intensities. We classified the emotion intensities only from speech signals into four different categories such as Neutral, Onset, Offset and Apex by utilizing machine learning algorithms. [Code], [Theoretical guarantee]

- **Digital Twin of an Intelligent Production Line with Adaptive Resource Handling** *Jul 2021 - Jun 2022*
  Digital twin is a digital representation of a physical system or process. We modeled the electrical transformer production line and its processes in digital platform using Siemens Tecnomatix Plant Simulation. We proposed a fuzzy logic based decision-support system to increase the throughput of the production line. The proposed system was able to choose the best machine to handle the current production demand and remove the least performing machine. Finally, with the experiments on the simulation environment demonstrated an improvement in

throughput of the production line by 12.5%. [Project page]
Target users: Production line managers of semi-automated production lines

- **Precision Lamp Illumination Control** Nov 2019
  Developed a open-loop control system for precise lamp lux regulation by calibrating current and modulating PWM signals using Arduino. Achieved discrete brightness control by regulating lux levels at 25%, 50%, 75%, and 100% of full intensity to ensure linear illumination steps.

Publications

Published Work (Full Paper)

- **Hoashalarajh Rajendran**, H. M. R. T. Bandara, A. G. B. P. Jayasekara, D. P. Chandima, "Context-aware Conversational Management System for Human-robot Interaction by Incorporating User Query-based Context Classification", *IEEE 11th Region 10 Humanitarian Technology Conference (R-10 HTC 2023)*,2023, Marwadi University, Rajkot, India, doi: 10.1109/R10-HTC57504.2023.10461845

- **Hoashalarajh Rajendran**, H. M. R. T. Bandara, D. P. Chandima, A. G. B. P. Jayasekara, "Voice Response Based Emotion Intensity Classification for Assistive Robots," *2023 IEEE 17th International Conference on Industrial and Information Systems (ICIIS)*, Peradeniya, Sri Lanka, doi: 10.1109/ICIIS58898.2023.10253609

- **Hoashalarajh Rajendran**, H. M. R. T. Bandara, A. G. B. P. Jayasekara, D. P. Chandima , "User Profiling Based Proactive Interaction Manager for Adaptive Human-robot Interaction", *9th International Interdisciplinary Moratuwa Engineering Research Conference (MERCon 2023)*, University of Moratuwa, Moratuwa, Sri Lanka, doi: 10.1109/MERCon60487.2023.10355527

- H. M. R. T. Bandara, K. S. Priyanayana, **Hoashalarajh Rajendran**, D. P. Chandima and A. G. B. P. Jayasekara, , "Hand Gesture Classification Model for Intelligent Wheelchair with Improved Gesture Variance Compensation", 2023 IEEE International Conference on Systems, Man, and Cybernetics (SMC), Honolulu, Oahu, HI, USA, doi: 10.1109/SMC53992.2023.10394033

- S. A. T. N. Sudasinghe, I. K. S. Sooriyabandara, A. H. M. D. P. M. Banadara, **Hoashalarajh Rajendran** and A. G. B. P. Jayasekara, "Vision Attentive Robot for Elderly Room", *9th International Interdisciplinary Moratuwa Engineering Research Conference (MERCon 2023)*, University of Moratuwa, Moratuwa, Sri Lanka, doi: 10.1109/MERCon60487.2023.10355403

Works In Preparation

- **Hoashalarajh Rajendran**, A. G. B. P. Jayasekara, "Understanding the Significance of Incorporating Human-observable Cues in a Task-oriented Dialogue System for Improved Human-computer Interaction: A Text-based Interaction Study", *In Preparation (IEEE Transactions on Human-Machine Systems)*, 2026

Honors and Awards

- **Recipient of UPEI Research Fellowship in Engineering - 2025**
  Throughout Feb 2025 to Dec 2025, I was supported by UPEI Research Fellowship and NSERC research grants to cover living expenses during my stay in Canada

- **Best Paper Award in Robotics and Intelligent Automated Systems Track - November 2023**
  At 9th International Interdisciplinary Moratuwa Engineering Research Conference (MERCon 2023) [h5-index: 18]
  Paper Title: User profiling based proactive interaction manager for adaptive human-robot interaction
  [Best Paper Award - Certificate]
  Authors: Hoashalarajh Rajendran; H. M. Ravindu Tharaka Bandara; A.G.B.P Jayasekara, D.P. Chandima

- **SRC/LT/2020/12 University of Moratuwa Senate Research Council Grant for Research Assistant**
  Receiving from January 2024 to December 2024 - Research Assistantship granted by Senate Research Council (SRC) of University of Moratuwa. Grant extended as a result of successful research and publication outcomes.

- **SRC/LT/2020/12 University of Moratuwa Senate Research Council Grant for Research Assistant**
  Received from October 2022 to September 2023 - Research Assistantship for M.Sc (Major component of research) granted by Senate Research Council (SRC) of University of Moratuwa

- **Dean's List, Faculty of Engineering, University of Moratuwa - 2020** For excellent academic performance in semester 5 (Semester GPA of 3.80 or above) [Certificate]

Skills Summary and Certifications

- **MOOC course certifications**: Probabilistic Graphical Models 1: Representation (Stanford Online) | Game Theory (Stanford Online, UBC) | Game Theory II: Advanced Applications (Stanford Online, UBC) | Mathematical Thinking in Computer Science (University of California San Diego) | Introduction to Internet of Things (Stanford Center for Professional Development) | Machine Learning(Stanford Online) | Image Processing for Engineering and Science - Specialization(MathWorks) | Programming in Python: A Hands-on Introduction - Specialization(Codio) | HRI01.1ucX: Introduction to Human-Robot Interaction (UCX,EdX) | AI for Scientific Research (*LearnQuest*) | DS102X: Machine Learning for Data Science and Analytics (ColumbiaX,EdX) | Methods for Quantitative Research in Psychology (American Psychological Association)
- **Diploma**: Diploma in AutoCAD, [ESoft], [Pearson] | Diploma in Web Designing, [ENET]
- **English Language**: International English Language Testing System (IELTS) Overall Band Score 7.0; (Speaking 7.5, Reading 7.0, Listening 7.0, Writing 6.5); [CEFR Level: C1 (proficient user)], [TRF]
- **Programming Languages**: Python, MATLAB, C++
- **Hardware Components**: RGB-Depth Camera, Arduino, Ultrasonic sensors, Inertial Measurement Unit, L298 Motor Controller, Siemens S7-1200 PLC
- **Softwares**: ROS2, Power World Simulator, Siemens Power System Simulator for Engineering, Siemens S7-1200 PLC TIA Portal, PSCAD, MATLAB and Simulink, LaTex, AutoCAD, Siemens Tecnomatix Plant Simulation, Minitab
- **AI Frameworks & Libraries**: TensorFlow, Keras, Scikit-Learn, spaCy, SciPy, Statsmodels, Transformers
- **Data Tools & Platforms**: Jupyter Notebooks, VS Code, GenAI for programming, Orange AutoML

Teaching Experience

- **Grad Lab Instructor**: Faculty of Sustainable Design Engineering, University of Prince Edward Island (2025)
  - **ENGN 2810**: Electric Circuits (UG, Fall 2025)
- **Visiting Instructor**: Department of Electrical Engineering, University of Moratuwa (2022-2024)
  - **EE 5208** : Industrial Robotics (Postgraduate Diploma in Industrial Automation, 2024)
  - **EE 5207** : Industrial Controllers & PLC Programming (Postgraduate Diploma in Industrial Automation, 2023)
  - **EE 4183** : Laboratory Practice (UG Semester 7 , 2022 & 2023)
- **Teaching Assistant (TA)**: Department of Electrical Engineering, University of Moratuwa (2023, 2024)
  - **EE 2044** : Electrical measurements and Instrumentation (UG Semester 4, 2024)
  - **EE 3204** : Engineering Systems Design (UG Semester 3, 2023)
  - **EE 2904** : Theory of Electricity (UG Semester 1, 2023)

Mentorship

- **Mentoring Undergraduate Final Year Projects (Semester 7 & 8)**
  Department of Electrical Engineering *Jun 2022 - Jun 2023*
  - **Research Project**: Vision attentive robot for elderly caring *University of Moratuwa*
  - **Research component**: Investigate and develop a novel feature extraction method leveraging RGB-D camera for the recognition of falling activities, with the capture of skeletal data, joint angles, and coordinates, extraction of informative features, and a method to ensure continuous and effective person monitoring (Applicable to elderly)
  - **Project supervisor**: Prof. A.G.B.P. Jayasekara (PhD, Japan)
  - **Outcome**: The research work was presented at the 9th International Interdisciplinary Moratuwa Engineering Research Conference (MERCon 2023)

Professional Memberships

- **IEEE Graduate Student Membership** (Member Number: 99455028) *2022 - 2026*
- **IEEE Young Professionals** *2022 - 2026*
- **IEEE Computational Intelligence Society Membership** *2022 - 2026*
- **IEEE Systems, Man, and Cybernetics Society Membership** *2024 - 2026*

Volunteering and Extracurricular activities

- **Reviewer:** 5th International Conference on Advanced Research in Computing (ICARC 2025)
  Track: Digital Transformation in Healthcare
  [Letter of Appreciation]
- **Reviewer:** 4th International Electrical Engineering Conference (EECon 2024)
  Track: Robotics & Intelligent Systems
  [Letter of Appreciation]
- **Reviewer:** 9th International Interdisciplinary Moratuwa Engineering Research Conference (MERCon 2023)
  Track: Sustainable Energy & Environment
  [Letter of Appreciation]
- **Editorial support team member at MERCon 2023**: Checked and finalized the camera-ready paper submissions (archived in IEEE Xplore) for their formatting accuracy at 9th International Interdisciplinary Moratuwa Engineering Research Conference (MERCon 2023), [Editorial team page - MERCon 2023]
- **Reviewer:** Annual Engineering Research Unit Symposium (ERU Symposium 2023) 2023, University of Moratuwa
  Track: Electrical Engineering
  [Letter of Appreciation]
- **Field Familiarization 2023**: Gave an introduction to application of robotics, robotics research and tour of Robotics and Automation Lab, Department of Electrical Engineering, University of Moratuwa
  Audience: Semester 01 Engineering Students of University of Moratuwa, Intake 2022
- **Technical Assistant:** Being the lead of the team in installing the online video conferencing device in the lecture hall to facilitate online learning in the Department of Electrical Engineering at the University of Moratuwa.
- **Active member:** Tamil Literary Association - University of Moratuwa
- **Prefect:** Trincomalee Sri Koneswara Hindu College (2012/2013)

References

- **Prof.A.G.B.P. Jayasekara, Ph.D. (Saga University, Japan), B.Sc. Eng, M.Sc (University of Moratuwa)**
  Professor, Department of Electrical Engineering, University of Moratuwa, Sri Lanka
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- **Prof. Ruwan Gopura, Ph.D. (Saga University, Japan), B.Sc. Eng, M.Sc (University of Moratuwa)**
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