

Senthurbavan Kirubaharan

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RESEARCH INTERESTS

My research interest revolves around robotics and AI. I am currently working on mobile robot exploration of unknown areas and have previous research experience in power optimization for ROS-based autonomous mobile robots.

EDUCATION

University of Moratuwa (UOM)

BSc., Electronic & Telecommunication Engineering with First class Honors

GPA: 3.81/4.2 (3.77/4.0)

Moratuwa, Sri Lanka

Feb. 2016 – Jan. 2020

RESEARCH EXPERIENCE

Intellisense Lab, Computer Science & Engineering, UOM

Research Engineer, E-consulate. Working in Intellisense Lab

Supervised by Dr. Sulochana Sooriyaarachchi & Dr. Chandana Gamage

Moratuwa, Sri Lanka

July 2021 – Present

In Intellisense Lab, I am currently working on the development of mobile robot systems for the exploration of an unknown area.

- * Built RTAB-Map SLAM system with a 3D LiDAR and an RGB-D camera
- * Developed and tested navigation algorithms in ROS in C++ (based on ROS navigation stack)
- * Utilized A* algorithm in BFS frontier exploration to improve next best frontier selection
- * Experience with navigation parameter tuning, point cloud processing and ray-tracing for 2D projection, robot hardware, and robot modeling with physical properties for simulation
- * Currently migrating the code base from ROS to ROS2

Electronic & Telecommunication Engineering, UOM

Undergraduate Researcher, supervised by Dr. Peshala Jayasekara

Moratuwa, Sri Lanka

Feb. 2019 – Jan. 2020

My research was on the power-optimized navigation of autonomous mobile robots.

- * Designed hardware-software co-design for the Trajectory Rollout planner of the ROS navigation stack
- * parallelized parts of the trajectory simulation and collision avoidance algorithm and implemented the design in FPGA
- * I published (oral presentation) the work as a first author at ACRA 2020

WORKING EXPERIENCE

Research Engineer

SenzMate (Pvt) Ltd

August 2020 – April 2021

Colombo, Sri Lanka

During the pandemic, I worked on an AI COVID-19 Wristband that detects the handwashing patterns of the user from the on-board IMU data

- * Designed and developed associated firmware and contributed to data collection
- * Setup the complete sensing-prediction pipeline for real-time operation
- * Trained and tested CNN, RNN, and LSTM models to predict hand movements with real-time constraint
- * Implemented high-pass filter to remove gravity from acceleration data to increase prediction accuracy

Research Intern

SenzMate (Pvt) Ltd

June 2018 – December 2018

Colombo, Sri Lanka

I designed the entire communication protocol for multipoint to multipoint reliable communication in LoRa and implemented it as a finite-state machine in the EFM8 microcontroller in C.

SELECTED UNDERGRADUATE PROJECTS

EEG Amplifier for Long-Term Brain Monitoring 2019

- Final year group project supervised by *Dr. Simon Lind Kappel*
- Developed the digital front-end to acquire and process signals from the analog-to-digital converter
- Developed firmware for high-speed signal acquisition, data storage, and Bluetooth communication with a mobile phone for real-time monitoring

Processor Design for Image Downsampling 2018

- Designed a processor for downsampling an image by a factor of two
- Designed instruction set architecture based on RISC-V
- Designed the microarchitecture of the processor and implemented it in FPGA

GPS Navigated Robot 2017

- Participated in a robotic competition, and built a mobile robot with a microcontroller that should navigate through obstacles toward a GPS goal location, identify a box and get the ring placed inside
- Developed obstacle avoidance with 3 ultrasonic range sensors and built navigation component to reach the box

Analog Line Following Robot 2017

- Designed a mobile robot solely with analog electronic circuits to follow a white line on a black surface
- Employed IR emitter and receiver for line detection and designed a PID controller with operational amplifiers for motor speed control

PUBLICATIONS

Senthurbavan Kirubaharan, Peshala Jayasekara & Dilan Weerakkody. Low Power FPGA-based Hardware Accelerator for Autonomous Navigation of Mobile Robots. In 2020 *Australasian Conference on Robotics and Automation (ACRA 2020)*. [Paper link](#)

AWARDS

Dean's List (2016, 2019)

Mahapola Higher Education Merit Scholarship (2016)

SKILLS AND CERTIFICATIONS

Languages: English, Tamil

Programming: Python, C/C++, MATLAB, VHDL, \LaTeX

Tools and Libraries: ROS, ROS2, NumPy, TensorFlow, Keras, Pandas, Matplotlib, Git

Others: STM32Cube, SolidWorks, Altium, Atmel Studio