# AYANGA IMESHA KALUPAHANA

## Personal Information


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| UNIVERSITY: | National University of Singapore |
| MAJOR: | Computer Science |
| EMAIL: | ayangaim@comp.nus.edu.sg |
| ADDRESS: | Systems and Networking Lab, School of Computing, NUS |
| PERSONAL WEBPAGE: | https://ayanga1991.github.io |
| LINKEDIN PAGE: | https://www.linkedin.com/in/ayanga-kalupahana-7b131151/ |


## Research Interests

Wearable computing/sensing, application of privacy and security to wearable, wearable energy harvesting, wearable power and latency optimization

## Education

2020-Feb 2025 — Ph.D. Candidate in Computer Science
National University of Singapore
Advisor : Prof. Peh Li-Shiuan
CAP: **4.08/5**

2011-2016 — BSc. Eng. (Hons) specialized in Electronics and Telecommunication Engineering
University of Moratuwa (UoM), Sri Lanka
FYP Advisor: Dr. Ajith Pasqual
CGPA: **3.57/4.2 (34$^{th}$ of 101)**

## Work Experience

Jan 2023 - May 2023 — **Graduate Teaching Assistant -CS4222/CS5222 Wireless Networking**
@ School of Computing, NUS
**Module Instructor:** Prof. Ambuj Varshney

- Conducted tutorials and provided consultation for Final-year undergraduate and postgraduate students
- Evaluated assignments and course projects of 150 enrolled students

Aug 2019 - Dec 2019 — **Research Intern** @ LSP Group, NUS
**Advisors :** Prof. Peh Li-Shiuan and Prof. Xiaokui Xiao
Evaluated Rastogi et al.s' Distributed Differential Privacy algorithm's performance and limitations on off-the-shelf smartwatches

May 2016 - July 2019 — **Research Engineer** @ Synergen Technology Labs LLC, USA
(Headquarters in Dallas, Texas, USA, Innovation center in Sri Lanka)

- Designed a 4-layer PCB (36mmx19mm) for a spine care wearable patch with inductive wireless charging circuit
- Developed a single IMU-based smoke detection mechanism
- Developed an algorithm for de-noising Ambulatory ECG by fusion with accelerometer data and activity detection for Synergen's now FDA-approved Scio-Cardio ambulatory ECG monitor
- Developed a respiration estimation algorithm for the PPG signal input taken from the infant's ankle-worn wearable in patented Synergen Baby monitor
- Developed a cry detection algorithm

- Supervised six UoM undergraduate engineering students' internships related to wearable stress monitor, smoke detection, baby monitor and hydration monitor in 2016, 2018 and 2019

Nov 2014 - March 2015

**Research & Development Engineering Intern**
@ Integrated System Development (ISD) Ltd, UK
(Headquarters in London, UK, Research & Development center in Sri Lanka) Now ISD is operated as Verox Labs Ltd
**Mentor:** Mr. Harin De Silva, Managing/Technical Director

- Assisted in developing their next version of the "Heated Glass Stage Device", which is used to inject sperm into egg cells in-vitro fertilization process
- Researched, experimented, and developed algorithms to provide even heat signature to the living cell
- Designed a heated glass stage protection circuit

## Journal Publications

1. SeRaNDiP - Leveraging Inherent Sensor Random Noise for Differential Privacy Preservation in Wearable Community Sensing Applications
   **Ayanga Kalupahana**, *Ananta Narayanan Balaji, Xiaokui Xiao and Li-Shiuan Peh*
   Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies 2023 (IMWUT/Ubicomp)
   Project webpage : SeRaNDiP: Leveraging Inherent Sensor Random Noise for Differential Privacy Preservation in Wearable Community Sensing Applications

## Conference Publications

1. FPAA and FPGA Based Universal Sensor Node Design
   **Ayanga Kalupahana**, *Nisal Hemadasa, Nipun Wijerathne, Anuranga Ranasinghe and Ajith Pasqual*
   Proceedings of the 11th International Conference on Sensing Technology (ICST 2017), Sydney, Australia

## PhD Thesis

**Advisor: Prof. Peh Li Shiuan, Dept. of Computer Science, NUS**

Under my Ph.D. thesis, I am studying and solving problems, gaps, and bottlenecks in implementing privacy and security algorithms for wearable devices in both community sensing and remote monitoring.
First I have proposed SeRaNDiP which is a framework that leverages low-power wearable sensors' inherent noise for varying Differential Privacy noise requirements without hardware modification. As per our knowledge, this is the first inherent noise-based Differential Privacy-providing framework applicable to existing smartwatches and fitness trackers. It resulted in 1.4X-1.8X computation/communication speedup and 1.2X-1.5X energy savings against state-of-the-art DP implementation.
Secondly, I am exploring the potential of EEG sensor noise and external environmental noise to provide privacy for users wearing EEG headsets.

## Reviewer

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| 2023 | ACM Conference on Human Factors in Computing Systems(CHI) |
| 2023 | Moratuwa Engineering Research Conference (MERCon) |
| 2022 | ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies(IMWUT) |

## Awards and Scholarships

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| 2023 | SOC Research Incentive Award worth SGD 2,500 (One-time award) |
| 2023 | Graduate Student Travel Grant worth SGD 4,000 (To attend Tier 1 ACM Ubicomp 2023) |
| 2020-2024 | NUS Research Scholarship Award |
| 2017 | Presentation Award- 2nd Runner up (Student Category), 11th International Conference on Sensing Technology, ICST 2017, Sydney, Australia |
| 2011 | 18 plus Scholarship 2010 Award<br>For the outstanding academic performance of G.C.E. Advanced Level 2010 |

## Programming Skills

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| Proficient: | C/C++ (Embedded software development), Python, Java, Matlab, Bluetooth Low Energy |
| Basic Knowledge: | Differential Privacy, Verilog, Altium, Solid Works, Eagle, R language |
| Development Boards: | Raspberry Pi, Beaglebone, Odroid, Pynq FPGA, ESP-32, Spartan 3E FPGA, AN231E04 FPAA etc. |
| Sensors: | PPG, ECG, Temperature, Accelerometer, Barometer sensors, GSR and microphones |

## References

1. Dr. Li-Shiuan Peh
   Provost's chair professor, School of Computing, National University of Singapore.
2. Dr. Ajith Pasqual
   Senior Lecturer, Department of Electronic & Telecommunication Engineering,
   University of Moratuwa, Sri Lanka