

# Amitha Saleem

Highly motivated, Reliable, and Innovative Software & Electronics Engineer working towards a PhD in Systems Engineering aspects of modular and reconfigurable small satellites at SaRC/NTU, Singapore.

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## PROFESSIONAL EXPERIENCE

### Satellite Research Center (SaRC), NTU Singapore

PhD Scholar

April 2019 – Till Date

I am working in SaRC/EEE NTU for design and development of:

- System Engineering for Small Satellites.
- CubeSat Attitude Determination System (ADS) Design.
- Distributed Electrical Power System for small satellites.
- Soft-reconfigurable FPGA based Flexible pin-router for universal PC104 interface card.
- FPGA & Embedded Flight Software Design for Satellite OBC.
- Nano & Micro Satellite FM Hardware Integration & Testing.
- nanoSMAD Tool for rapid satellite system configuration design.
- Modular, Scalable & Reconfigurable Systems Design for nano & micro satellites.

### Energy Research Institute @ NTU Singapore

Research Associate

February 2019 – July 2019

I worked in collaboration with Government Technology Agency (GovTech), Singapore:

- Conducted a literature review to develop an Eco-Smart Zero-Energy Street Lamp post.
- Considered various scenarios for the street lighting strategy, to save energy.
- Design goal was to reduce urban light pollution and keep a high level of safety.
- The strategy can be based on different parameters such as weather conditions, or object approach detection.
- Gained knowledge in wireless communication technology (Zigbee, BLE, Mesh Network) and smart street lighting.

### Incredible Visibility Solutions Private Limited, India

.NET Developer

July 2016 – July 2017

- Designed web application and website using MVC (Model-View-Controller) technology; Controller receives all requests from the application and instructs the model to prepare information required.
- IDE – Visual studio; Programming Language – C#.
- Database Administrator – Created, processed, and updated the stored procedure in SQL server.

## TECHNICAL SKILLS

- \* Nano Satellite System Design.
- \* System Engineering for Satellites.
- \* Embedded System Design.
- \* Analog/Digital System Design.
- \* FPGA Design & Board-Bring Up.
- \* Machine Learning using KNN.
- \* Digital Signal Processing using MATLAB and GNURadio.
- \* PCB Design: Altium, KiCad 6.
- \* Embedded C, RTOS and Linux Development.
- \* Python, Java, C#, PHP, JavaScript Programming.
- \* Android Framework.
- \* SQL / MongoDB Database administration.
- \* Antenna Design & Testing.
- \* Power / Data / RF Harness design, Fabrication & Testing.
- \* Avionics Testing/Qualification.
- \* Strong Hardware Design, Prototyping & Debugging Skills.
- \* SMD Fine Pitch Soldering.
- \* Project Management & Technical Documentation.

## PERSONAL DETAILS

Gender: Female

Date of Birth: 31 May 1994

Nationality: Indian

Languages: English, Malayalam

## EDUCATIONAL BACKGROUND

### **Nanyang Technological University, Singapore - Doctor of Philosophy – PhD, Space Engineering [July 2019 - July 2023]**

Specialized in Space System Engineering & Development of Modular, Scalable & Reconfigurable Systems for Nano and Micro satellites.

**PhD. Thesis:** A system Study on Scalable Nanosatellite Platforms for Mass Manufacturing.

### **Nanyang Technological University, Singapore - Master of Science – MSc, Electrical and Electronics Engineering [July 2017 - October 2018]**

Specialized in Electronics & Communication Engineering, CGPA: 4.03/5

**MSc. Thesis:** Development of Android apps for antenna analysis.

### **Mahatma Gandhi University, India - Bachelor of Technology – BTech Electronics Engineering [June 2012 - June 2016]**

Specialized in Electronics & Communication Engineering, CGPA: 8/10

**B.Tech. Thesis:** Design of Floating-Point Arithmetic Unit using VHDL.

## PROJECTS / SYSTEMS DEVELOPED at SaRC, NTU

### **SCOOB-I 3U Nano Satellite**

- Attitude Determination System (ADS) Design, Development, Testing, and Integration.
- EPS Characterization, Testing and Firmware Modification.
- Orbit Simulation using Solar Array Simulator and MATLAB.
- STM32 Based OBC Peripheral Interface Testing using Bare Metal C Code.
- Interface Board I2C Multiplexer, I2C GPIO Expander and Load Switch Debugging and Testing.
- Coarse Sun Sensor (CSS) Testing.
- FreeRTOS based Flight Software module development & Testing.
- Flight Model Hardware Integration and Testing.
- Long Duration Outdoor Testing.
- Fine Sun Sensor (FSS) Characterization using Sun Simulator and Turntable.
- Post Launch Tracking and Telemetry Reception using a handheld Yagi-Uda Antenna.

### **SCOOB-II 3U Nano Satellite**

- Attitude Determination System (ADS) Version 1 PCB Design using ALTIUM Designer.
- Body Mounted and Deployable Solar Array PCB Design Using KiCad.
- EPS solar panel input threshold adjustment for MPPT.
- FM Ground Support Equipment (GSE) Cable Harness Fabrication.
- Reaction Wheel BLDC Motor Testing using Faulhaber Evaluation Board.
- Magnetic Torque Rod Polarity Test and PWM Test.
- 2S-2P FM Battery Pack Fabrication, heater/thermistor bonding and Testing.
- Full loop EPS testing with solar panel and battery charging validation.
- Interface harness for CubeSpace COTS ADCS module.
- RBF and Deployment SNAP switch wiring, testing and assembly.
- Satellite FM hardware integration, testing & staking.
- Deployable Tape String Monopole Antenna tuning and impedance matching.
- FM Satellite TVAC, Vibration & End-End Outdoor Testing.
- Telemetry Decoding & Telecommand Encoding using HYDRA.

### **ARCADE 27U Micro Satellite**

- 7S-3P Deployable & Body Mounted Solar Array PCB Design using KICAD, Integration & Testing.
- Microsatellite Power & Signal Harness Design, Fabrication & Testing.
- EPS Battery Charging Unit MPPT Voltage / Current Characterization & Testing.
- EPS Thruster High Current Boost Converter Load testing.

- EPS Main & Thruster Battery Charging Changeover Testing.
- EPS Load Switch Testing & I2C voltage/current sensor address scan & read-out.
- EPS Power Distribution Card pass MOSFET Testing for Deployment switch & System RESET.
- EPS PDU Buck/Boost DC-DC convertor Load Testing.
- EPS PDU I2C voltage/current sensor address scan & read-out.
- SoC FPGA based CDH Board testing and programming via JTAG.
- FM EPS/CDH/Interface Card Integrated Performance Characterization.
- ARCADE avionics stack testing with ADCS, X-Band & payloads such as Gecko, ATMOLITE, CIP & AToX.
- Deployable Monopole tape string antenna tuning and impedance matching.
- X-band Monopole pickup antenna Tuning & Testing.
- Satellite Telemetry Reception & Commanding via UHF radio.
- Long Duration payload operation for system endurance testing.
- Microsatellite Sub-assembly level integration, harnessing & routing, Integrated Testing & TVAC.

## Modular Spacecraft Subsystems

- Universal software programmable FPGA based low power flexible pin router board with zig-zag connectors for stacking of two CubeSat COTS system boards with incompatible pin map definition.
- Zig-Zag board allows flexible routing of data along with power by employing a cross-point switch matrix.
- FPGA based adapter cards offer the unique feature of protocol translation logic by using memory mapped UART/I2C/SPI/CAN IP cores to mitigate interface inadequacy in CubeSat COTS OBC/CDH.
- Modular power system design employs the concept of tiles for MPPT, PDU, Smart BMS and Deployment Switch which allows configuring a motherboard with required number of tiles to meet the solar array power or load current conditions.
- Modular power system also has the feature of soft configuring the parameters like threshold voltage, current etc. through a CAN bus interface allowing inflight reconfigurability and field settability of operating parameters.
- SmartBMS allows the scaling of the battery pack for required voltage and current through power ORing diodes. Smart BMS offers a self-contained design with battery heaters, thermistors and SoC monitoring fuel gauge ICs.
- Each tile has a microcontroller-based design to handle CAN bus communication, initialization and control of peripherals like ADC, DAC, digital potentiometer, optocoupler based voltage range selection network.

## Misc. Projects

- Python firmware and boot-code modification for raspberry pi zero based embedded system to stream a captured color image from picamera as monochrome image via RS422 UART.
- Python GUI for receiving the serial image stream over USB-UART COM port for displaying reconstructed images.
- Multi node CAN bus system with MCP2515 SPI-CAN controller for address filtered data packet transmission to slave nodes.
- Web Server Application python-flask framework for blockchain application with mongoDB database.
- Flatsat PCB with parallel mapping of 104 pins for CubeSat PC104 standard board integration, testing & characterization.
- AFSK/FM 1200 bps Transceiver module testing, RF harmonic suppression low pass filter testing.

## PUBLICATIONS/ACHIEVEMENTS

### PUBLICATIONS

- NanoSMAD - A Satellite Mission Analysis and Design tool for LEO Nano Satellites, IAC 2022 Congress Proceedings, 73rd International Astronautical Congress (IAC), Sep 20, 2022
- A 'SMAD' Tool for Nano and Micro Satellites, Proceedings of the AIAA/USU SmallSat Conference, Jul 9, 2021
- Development of Android apps for antenna analysis, DR-NTU (Digital Repository of NTU), EEE Thesis, Oct 5, 2018
- Floating Point Arithmetic Unit using VHDL, International Journal of Science Technology and Engineering (IJSTE), Apr 8, 2016

### ACHIEVEMENTS

- Merit-cum-Means Scholarship Scheme, Ministry of Minority Affairs, Government of India, 2012-2016

## REFERENCES

1. **Dr. Amal Chandran**, *Laboratory for Atmospheric and Space Physics, University of Colorado, Boulder*, Mail ID: [Amal.Chandran@lasp.colorado.edu](mailto:Amal.Chandran@lasp.colorado.edu)
2. **Joji John Varghese**, *Research Engineer, Department of Electrical and Electronics Engineering, Nanyang Technological University*, Mail ID: [jojijohn.varghese@ntu.edu.sg](mailto:jojijohn.varghese@ntu.edu.sg)
3. **Asst. Prof Dhanusha P.B**, *Department of Electronics and Communication Engineering, SaintGits College*, Mail ID: [dhanusha.pb@saintgits.org](mailto:dhanusha.pb@saintgits.org)

## SOFTWARE TOOLS

- **FPGA EDA Tools**: Microsemi Libero & SoftConsole, Xilinx Vivado & ISE
- **System IDEs**: PyCharm, Visual Studio, Atmel AVR Studio, Arduino IDE, Android Studio, Dot Net Framework
- **Programming Languages**: Python, Embedded C, VHDL, Java, C#, HTML.
- **PCB EDA Tools**: Kicad, Altium Designer.
- **Databases**: MongoDB, SQL.
- **Simulation**: MATLAB, GNURADIO, LTSPICE.
- **OS**: Windows, Linux, Android.
- **Documentation**: Microsoft Office Tools, Google Docs, Latex.
- **Misc. Utilities**: Putty, TeraTerm, GITHUB for version control.

## HARDWARE TOOLS

- **FPGA**: IGLOO2, Microsemi Smart Fusion 2.
- **Microcontrollers**: AVR, 8051, STM32, MSP430, ARM-Cortex M4, ESP32.
- **Protocol Bus**: UART, I2C, SPI, CAN, RS232, RS485, RS422, JTAG, Ethernet.
- **Prototyping**: Bread board, Dot/Line PCB Wiring, SMD Soldering, connector crimping, microD soldering.
- **Test Equipment**: Oscilloscope, Function Generator, Digital Multimeter, Programmable Power Supply, Electronic Load, Digital Logic & Protocol Analyzer, Spectrum Analyzer, Vector Network Analyzer, RF Vector Signal generator & Analyzer, RF Vector Voltmeter.
- **Development Boards**: Arduino Uno/Nano/Micro/Mega, STM32 Nucleo F401RE, Raspberry Pi, SmartFusion II SoC starter kit.

## CERTIFIED ONLINE COURSES

- A beginner's guide to the concepts of RTOS. – *Udemy*.
- Model-Based Systems Engineering – *The State University of New York*.
- New Space: Access to Space-Basics – *ISAE SUPAERO*.
- Electric Power System – *University at Buffalo*.
- Data Science – *IBM*.
- Altium Designer- Arduino FIO – *Udemy*.

## MANAGERIAL CONTRIBUTIONS

- Project Guidance for UG Students.
- IEEE Women in Engineering International Leadership Conference (WIE ILC), Member in Website Design Committee.
- EEE Graduate Student Club (GSC), Director of Outreach Social, Member in Graduate Research Showcase.
- TED x NTU, Member of the Operations Committee.
- Horizon Technical & Techno Cultural Fest, Head and Event Coordinator.

## CONFERENCES

- Participated in 5<sup>th</sup> COSPAR Symposium 2023 held at Nanyang Technological University, Satellite Research Centre Singapore.
- Participated in 73<sup>rd</sup> International Astronautical Congress (IAC) Conference 2022 Held at Paris, France and presented a paper titled "NanoSMAD - A Satellite Mission Analysis and Design tool for LEO Nano Satellites".
- Participated in 35<sup>th</sup> Annual Small Satellite Conference 2021 held in Utah, USA and presented a paper titled "A SMAD Tool for Nano and Micro Satellites".