Joji John Varghese

Passionate Electronics Engineer with expertise in Design and Realization of RADAR/SDR/RF/Embedded/SATCOM Systems.

LinkedIn **https://www.linkedin.com/in/joji-john-varghese-62291883/**

Address Thejas, Alayamon P.O
Anchal, Kollam 691306
Kerala INDIA

Mobile +91-8547274758

Email ID **thejasjoji@gmail.com**

Website **https://joji-john.github.io/**

PROFESSIONAL EXPERIENCE

Indian Institute of Space Science & Technology , ISRO
Project Engineer
December 2017 – PRESENT

I am currently working with Small Spacecraft Systems and Payload Centre (SSPACE Lab), IIST for design and development of :

- Software Defined Radio design using GNURadio Ecosystem
- SDR based VHF/UHF/S/Ku-Band Satellite TTC Ground Station
- Fault-Tolerant SoC FPGA based On-Board Computer Design
- Satellite On-board Telemetry/Telecommand Modem Design
- SDR based Ionospheric RADAR System Design
- Reliable Avionics System Design using COTS Components
- HF/VHF/UHF Antenna Design & Development

Space Physics Laboratory, VSSC/ISRO
Contract Engineer
June 2016 – December 2017

I was responsible for design and development of :

- FPGA based Digital Receiver & Controller For HF Ionospheric Pulsed Doppler Weather Radar Situated at Thumba Equatorial Rocket Launch Station , VSSC
- Software Defined Radio based Telemetry Receiver for Weather Balloon Experiments carrying iMet UHF Radiosonde and Ozonesonde
- SDR based Riometer for Ionospheric Studies

EDUCATIONAL BACKGROUND

MBCET, University of Kerala, India— *Bachelors Degree in Electronics Engineering*
June 2012 – June 2016

Specialized in Electronics & Communication Engineering , CGPA: 8.1
B.Tech. Thesis: 12 Lead ECG Monitor using ADS1298

VVHSS, Kerala State Board, India — I*ntermediate Studies*
March 2010 – April 2012

Specialized in Computer Science, Physics, Chemistry, Maths,98.25%.

Central Board of Secondary Education, India — *AISSE*
March 2000 – March 2010

Specialized in Physics, Maths, English,GPA: 9.8

TECHNICAL SKILLS

* Embedded System Design

* Software Defined Radio

* RF System Design

* Analog/Digital System Design

* Ionospheric RADAR Design

* SATCOM Earth Station Design

* FPGA Design & Board-Bring Up

* Digital Signal Processing

* EDA Schematic/PCB Design

* Embedded C, Linux & Python

* Project Management

* Antenna Design & Testing

* Nano Satellite System Design

* SMD Fine Pitch Soldering

* Automated Checkout Design

* EMI/EMC/Vibration/TVAC

* Technical Documentation

*Avionics Testing/Qualification

* Strong Hardware Design, Prototyping & Debugging Skills

* System Engineering for Satellites & Launch Vehicles

PERSONAL DETAILS

*Gende*r : Male

Marital Status : Unmarried

Date of Birth : 28 Sept, 1993

Nationality : Indian

Languages : English,Malayalam

Interests : Listening Music

PROJECTS / SYSTEMS DEVELOPED & INSTALLED at SPL/IIST

- FPGA based Digital Receiver and Controller for **SPL HF RADAR** .
  (18.1MHz pulsed coherent monostatic doppler radar with 50kW peak power for EEJ/ESF study)
- SDR Based 150/400 MHz **Digital Beacon Receiver** for ionospheric TEC measurement.
- Software Defined Radio based **RIOMETER** for Ionospheric studies .
- Passive **Oblique Mode Digital IonoSonde Receiver** using modern USRP X310 SDR.
- Low power **Coded CW Spread Spectrum Active IonoSonde** using SDR.
- Multimode VHF/UHF **Satellite Telemetry TeleCommand Ground Station** for cubesats.
- PrimeFocus **Parabolic Dish Antenna** S/Ku band System for GEO Satellites.
- Low Cost Satellite Onboard VHF/UHF 1200bps **AFSK TM/TC Communications Module** (TRL-6).
- Microsemi SmartFusion-II based **Radiation tolerant SoC FPGA Cubesat OBC** (TRL-7).
- Satellite modem using analog devices **AD9361 Transceiver & Zynq7000 FPGA** .
  (70MHz to 6GHz, CCSDS , AM/FM/PM/ASK/FSK/GMSK/BPSK/QPSK Modes with
  FEC-viterbi/RS/Turbo/LDPC Ethernet TCP/UDP Interface)
- Miniature Reception system for balloon borne **UHF Radiosonde Telemetry**.
- Low Cost Modular **RADAR Tx waveform/Control Signal Generation** using REDPITAYA board.
- Azimuth/Elevation **Antenna Tracking System** for TLE based LEO satellite auto tracking.

MODULES / SUB-SYSTEMS DEVELOPED, TESTED & INTEGRATED

- LDMOS based **1kW HF RF SSPA** (Solid State Power Amplifier) for pulsed radar.
- **Broadband Terminated Folded HF Dipole Antenna** for 2-30MHz .
- Low cost **Broadband Active HF Magnetic Loop Antenna** for low noise reception.
- Mast Mounted **VHF & UHF LNA** with integrated BPF, Limiter & DC Injection.
- PIN Diode High **Power RF TR Switch** with builtin receiver blanking & protection.
- High Gain Multistage **S band LNA Module** with Filter & DC Injector.
- High Power Wilkinson Balanced **Power Combiner / Divider**..
- Switched delay line phase shifter for radar **beam steering module.**
- VHF/UHF High power harmonic suppression **low pass cavity filter.**
- Circularly polarised high **gain Yagi-Uda antenna** for 145 & 436 MHz.
- **Helix feed assembly** with integrated amplifier for 2250MHz.
- Custom FPGA board using **Microsemi & Xilinx FPGA** for DAQ / Control.
- Miniature **HF Transmit Receive Module** for Phased Array RADAR Prototype.
- Distributed Control & Monitoring System using **CAN/RS485 & Ethernet**.

ACADEMIC TRAINING/PUBLICATIONS/PROJECTS/ACHIEVEMENTS

- Attended the Course "Integrated Design of Space Vehicle" at IIST by Dr. B. N. Suresh, ISRO .
- Published IEEE Paper "UPASANA: Diagnostic Toolkit for ASHA Worker".
- *Bachelor's Degree Main Project:* ADS1298 Based 12 Lead ECG Monitor Design.
- *Bachelor's Degree Seminar Topic:* ADS1298 Based ECG System.
- *Bachelor's Degree Mini Project:* Automatic College Bell.
- Received Academic Proficiency Prize for year 2012-13.

REFERENCES

1. **Prof. S. Viswanatha Rao** , *HoD Electronics Department , MBCET.* Mail ID : rao-sv@hotmail.com
2. **M Shajahan**, *Scientist 'SF' , Vikram Sarabhai Space Centre , ISRO.* Mail ID: m__shajahan@vssc.gov.in
3. **Nazeer M**, *Engineer 'SD', Space Physics Laboratory, ISRO .* Mail ID: mohammed__nazer@vssc.gov.in
4. **Dr. Priyadarshnam**, *Associate Professor, Dept. of Avionics, IIST.* Mail ID: priyadarshnam@iist.ac.in
5. **Dr. Raveendranath** , *Adjunct Professor, Dept. of AeroSpace*, IIST. Mail ID: raveendranath@iist.ac.in

INDUSTRIAL VISITS

- *IISU* – ISRO Inertial Systems Unit, *Kerala, INDIA.*
- *TERLS* – Thumba Equatorial Rocket Launching Station, *Kerala, INDIA.*
- *ISTRAC* – ISRO Telemetry, Tracking and Command Network, *Bangalore, INDIA.*
- *LPSC* – Liquid Propulsion Systems Centre, *Kerala, INDIA.*
- *VSSC* – Vikram Sarabhai Space Centre, *Kerala, INDIA.*
- *URSC* – U R Rao Satellite Centre, *Bangalore, INDIA.*
- *ISITE* – ISRO Satellite Integration and Test Establishment, *Bangalore, INDIA.*
- *INMCC* – Indian Mission Control Centre, *Bangalore, INDIA.*
- *BSNL* – Bharat Sanchar Nigam Limited, *Kerala, INDIA.*

SOFTWARE TOOLS

- *FPGA EDA Tools* : Xilinx Vivado HLS / ISE, Microsemi Libero SoC, Altera Quartus Prime, Modelsim.
- *Embedded System IDEs* : Atmel AVR Studio, Microchip MPLAB IDE, Arduino IDE, TI Code Composer Studio.
- *Programming* : VHDL, Embedded C, C++, Python, FreeRTOS, MBED Online.
- *PCB EDA Tools* : Kicad, Altium Designer,Eagle , Proteus.
- *Simulation* : MATLAB, Simulink, LabView, GNU-Radio, ADS, NEC.
- *OS* : Windows, Linux, Android.
- *Documentation* : Microsoft Office Tools, Google Docs, Latex.
- *Misc Utilities* : WireShark, Putty, TeraTerm, WinSCP.

HARDWARE TOOLS

- *FPGA* : Xilinx Zynq 7000 APSoC, Spartan 6, Virtex 6, Artix 7, MicroSemi SmartFusion 2, ProASIC 3.
- *Microcontrollers* : 8051, AVR, PIC, STM32,MSP430, ARM-Cortex M4, ESP32, Renesas RX63 ,Tiva C series.
- *Protocol Bus* : UART, I2C, SPI, CAN, RS232. RS485, RS422, Ethernet, Mil-Std 1553
- *Prototyping* : Bread board, Dot/Line PCB Wiring, SMD Soldering, PCB Etching, 3D Printing,PCB Engraving.
- *Test Equipments* : Digital Oscilloscope, Function Generator,Digital Multimeter,Programmable Power Supply, Electronic Load,Source Measure Unit, Arbitrary Waveform Generator, Digital Logic & Protocol Analyser, Spectrum Analyser, RF Power Meter, Vector Network Analyser, RF Vector Signal generator & Analyser, RF Vector Voltmeter.
- *Development Boards* : Intel Galileo, Intel Curie, Intel Edison, Intel Joule, NVIDIA Jetson Nano,TI BeagleBone Black, Raspberry Pi 4, Raspberry Pi Zero, Raspberry Pi Compute Module, Arduino Uno/Nano/Micro/Mega/101, ESP8266, ESP32, FreeScale FRDMKL25Z, PSOC6, TMS320C5515, STM32 IoT Node,TM4C123G,TM4C1294,MSP430G2,TI C2000, TI CC3220, TI CC2640R2-LAUNCHXL.
- *SDR* : ADALM Pluto SDR, REDPITAYA SDR, USRP X310/USRP N210/USRP 1 with UBX160,TwinRX, LFRX/TX, Analog Devices ADRV9361-Z7035/ ADRV9364-Z7020 PicoZed SDR on ADRVBOB/ADRVFMC, FmComms3.

CERTIFIED ONLINE COURSES

- Introduction to FPGA Design for Embedded Systems – *University of Colorado Boulder.*
- Model-Based Systems Engineering – *University at Buffalo.*
- Introduction to Embedded Systems Software and Development – *University of Colorado Boulder.*
- Introduction to Power Electronics – *University of Colorado Boulder.*
- Classify Radio Signals from Space using Keras – *Coursera Project Network.*
- Introduction to Satellite Communications – *Institut Mines-Télécom France.*
- Architecting a Real-Time Radar Recorder – *Keysight Technologies.*
- Essential RF Power Measurements – *Keysight Technologies.*
- Network Analyzer Fundamentals – *Keysight Technologies.*
- RF Field Testing Basics 101 – *Keysight Technologies.*
- Signal Analyzer Fundamentals – *Keysight Technologies.*
- High-Density EW Threat Simulation from Lab to System – *Keysight Technologies.*
- Rapid Prototyping , Innovation & Entrepreneurship Course – *Massachusetts Institute of Technology.*

MANAGERIAL CONTRIBUTIONS

- Indented & Procured Equipments/Components worth 1.5 Crore INR.
- Managed a Team of Students, Engineers & Technicians for RADAR / Ground Station Installation.
- Configuration Document / Technical Report Generation.
- SSPACE LAB Equipment Layout & Floor Planning.
- Satellite Ground Station LAB Layout & Floor Planning.
- Lab Inventory Management.
- Training / Project Guidance for UG/PG Students.

AWARDS & ACHIEVEMENTS

- **2021** : Shortlisted among Top-100 in Swadeshi Microprocessor Challenge by MeitY for the project "Fault Tolerant Reliable Integrated Avionics System for Drones".
- **2020** : National Winner for the Defence India Startup Challenge 3 for a project titled "Portable Spoof Emitter for Radiations" in the DEFEXPO 2020.
- **2019** : Co-founded a hardware start-up company AiDrone Private Limited along with Ani Sam Varghese for multipurpose high endurance Search & Rescue Drone Development.
- **2018** : Recognized as Distinguished Alumni from MBCET.
- **2017** : People Choice Award for the project "LEOTIS: Low Earth Orbit Thermal Imaging Cubesat" in NASA INTERNATIONAL SPACE APPS CHALLENGE 2017.
- **2017** : Project titled "PEACHSAT: A CubeSat Technology Demonstrator" won the Second prize in Renesas National Embedded Design Contest.
- **2016** : As part of Nypunyam 2015, organized by Kerala Government, got selected as Most Skilled Electronics Worker & is selected to represent Kerala in National Skill Fest 2016 to be held at New Delhi.
- **2016** : The project "UPASANA, A Diagnostic Tool Kit for ASHA workers" received funding of 500$ as part of All IEEE Younger Engineers Humanitarian (AIYEHUM) Challenge 2015.
- **2015** : The project "UPASANA, A Diagnostic Tool Kit for ASHA workers" Won the MARIAN Award of Technical Excellence 2015 instituted by Marian Engineering College.
- **2015** : Selected for sponsored Singapore Industrial Visit as part of Yuva Mastermind 2015 organized by Malayala Manorama , IBS & Amal Jyothi College of Engineering & Technology for winning the best project prize in the category "Making Life Easy for Women". The visit was held in July 2015.
- **2015** : The project titled "UPASANA, A Diagnostic Tool Kit for ASHA workers" won the First prize in Renesas National Embedded Design Contest 2015 .
- **2014** : The project titled "NEOSYNC: -Low cost EEG Development Platform" was selected for Texas Instruments Innovation Challenge India Design Contest 2015 and qualified for the Quarter finals.
- **2014** : Got People Choice Award for the project "ROVINO: Mars Rover Prototype" in NASA INTERNATIONAL SPACE APPS CHALLENGE 2014 .
- **2013** : Won first prize for the project, "Electrical Safety System", in SPECTRUM 2013, A National Level Project Competition organised by MBCET.
- **2012** : Won State Level First Prize in Kerala State Science Fair (Working Model) Category for the Project " Electrical Safety System".
- **2011** : Won State Level First Prize in Kerala State Science Fair (Working Model) Category for the Project " Train Security System".

CONFERENCES & WORKSHOPS

- Participated in MIT-TATA Center workshop on Innovation, Fabrication & Entrepreneurship , organised by **MIT Media Lab** .
- Participated in the 17th National Conference on "E-Governance" , held at Ernakulam as being selected from MIT Workshop.
- Participated in a workshop on Designing Robots for a Better Living organized by IEEE SB, Amrita Vishwa VidyaPeetham.
- Participated in 2012 International Conference on Green Technologies jointly organized by Mar Baselios College of Engineering & Technology & University of Dayton Held at Trivandrum.
- Participated in Kerala Road Safety Hackathon held at Techno-park, Trivandrum.

भारतीय अंतरिक्ष विज्ञान एवं प्रौद्योगिकी संस्थान

(वि.अ.आयोग अधिनियम 1956 की धारा-3 के अधीन भावी मानित विश्वविद्यालय घोषित)

भारत सरकार, अंतरिक्ष विभाग, वलियमला पोस्ट, तिरुवनंतपुरम 695 547 भारत

Indian Institute of Space Science and Technology

(A Deemed to be University u/s 3 of the UGC Act, 1956)
Government of India, Department of Space
Valiamala P.O., Thiruvananthapuram 695 547 India

www.iist.ac.in

To Whomsoever It May Concern

This is to certify that **Mr. Joji John Varghese** has been working at IIST as Junior Project Fellow on Contract (*Appointment No: IIST/Admn/RMT/7/27/2015 dated 08.12.2017 with consolidated pay of Rs.20000/-*) in the **SSPACE** (**S**mall **S**pacecraft systems and **PA**yload **CE**ntre) laboratory from **18th December 2017** and **still continuing**, for design and development of Nano Satellites Subsystems and VHF/UHF/S-Band TTC ground Station Facility.

During his tenure at IIST, he has carried out following in-house R&D activities:

1. **Establishing of UHF-VHF TTC Satellite Ground Station**
   - I. Design, Realization & Testing of VHF & UHF Crossed Yagi-Uda Antenna
   - II. Design & Implementation of SDR Based Telemetry Receiver & Ground Operation Console
   - III. Design of TLE based Antenna Auto-tracking system for EL over AZ antenna rotator Controller
   - IV. Design of Solid State LDMOS RF Power Amplifier based Tele-Command Transmitter
   - V. Design, Realization & Testing of RF Front End (LNA,BPF, TR Switch)
   - VI. System Link budget validation through LEO Satellite transponder Uplink/Downlink Test

2. **System Engineering for AAReST – IIST Mirror Satellite (Caltech-JPL,IIST &UoS Collaboration)**
   - I. Generation of Satellite Operation Sequence Specification to meet the mission objectives
   - II. Design of Mirror Sat Sub-Systems including OBC, EPS & ADCS
   - III. Hardware Implementation of ADCS Reaction wheel and Magnetorquer Actuators
   - IV. Design of Electrical Interface & Satellite Checkout System

3. **Design of IIST Nano-Satellite Subsystems**
   - I. Test Setup for ADCS Hardware In-loop Simulation using Helmholtz Coil
   - II. Realization of 1.2kbps AFSK/FM Onboard Telemetry Tele-command VHF/UHF RF Modem
   - III. EMC/EMI Testing for satellite onboard communication system

4. **Hardware Implementation & Prototyping Support**
   - I. Design of SF2 SoC FPGA, Atmel, PIC and ARM Processor based Embedded systems
   - II. PCB Layout, Fine pitch SMD soldering, cable harnessing, Integration and subsystem Testing

5. **Design, Implementation & Validation of Technology Demonstration Projects**
   - I. LAN based stand-alone Network Ground Station
   - II. 1.2m prime focus dish antenna system with S–band helix feed on EL over AZ mount for Telemetry Downlink & Tele-Command Uplink of LEO/GEO Satellites
   - III. Offset Fed Dish with Ku band LNBF for GEO Telemetry/Data Reception
   - IV. RS485 & CAN Bus Implementation for Instrumentation Support

6. **SSPACE - LAB layout & Facilities Requirement Design**
   - I. Equipment Layout & Floor planning
   - II. Inventory Management and Component Purchase

During the period, I found him very hardworking and sincere. I wish him all success in the entire endeavor that he may undertake in the future.

July 18, 2019

डॉ.मनोज बी. एस./Dr. Manoj B. S.
आचार्य एवं अध्यक्ष/Professor & Head
एविओनिकी विभाग/Department of Avionics
भारतीय अंतरिक्ष विज्ञान एवं प्रौद्योगिकी संस्थान
Indian Institute of Space Science and Technology
अंतरिक्ष विभाग, भारत सरकार
Department of Space, Government of India
तिरुवनंतपुरम/Thiruvananthapuram - 695 547

Dr. Priyadarshanam

Principal Investigator,
IIST Satellite Projects, SSPACE Lab
डॉ. प्रियदर्शनम / Dr. Priyadarshnam
सह आचार्य / Associate Professor
एविओनिकी विभाग /Department of Avionics
भारतीय अंतरिक्ष विज्ञान एवं प्रौद्योगिकी संस्थान
Indian Institute of Space Science and Technology
अंतरिक्ष विभाग, भारत सरकार
Dept. of Space, Govt. of India
तिरुवनंतपुरम / Thiruvananthapuram

भारत सरकार
अंतरिक्ष विभाग
विक्रम साराभाई अंतरिक्ष केन्द्र
तिरुवनन्तपुरम-695 022
केरल, भारत
फोन : (0471) 256 3637
फैक्स : (0471) 256 6535
तार/Gram: SPACE

ई-मेल/E-mail

Government of India
Department of Space
Vikram Sarabhai Space Centre
Thiruvananthapuram-695 022
Kerala, INDIA
Telephone : (0471) 256 3637
Fax : (0471) 270 6535
: m_shajahan@vssc.gov.in

SPACE PHYSICS LABORATORY

CERTIFICATE

To Whomsoever It May Concern

This is to certify that **Mr. Joji John Varghese**, Thejas, Alayamon PO, Anchal, Kollam, Kerala, India - 691320 has been working in our organization as Contract Scientist/Engineer during the period from **8th June 2016 and still continuing** for the **Development of Digital Receiver for High Frequency Radar System and SDR based Balloon Borne Radiosonde Receiver**. His activities include designing of VLSI system, implementing the system in Xilinx Virtex-6 FPGA (Avnet ML605 board) using Xilinx ISE tools, microcontroller based system design, developing scripts to communicate, operate and analyze data in MATLAB, GUI in Python (Linux platform). During this period I found him very hardworking and sincere.

I wish him all success in the entire endeavor that he may under take in the future.

March 06, 2017

SHAJAHAN M
वैज्ञानिक / इंजीनियर/Scientist / Engineer
अंतरिक्ष भौतिकी प्रयोगशाला/Space Physics Laboratory
भारत सरकार, अंतरिक्ष विभाग/Govt. of India, Dept. of Space
विक्रम साराभाई अंतरिक्ष केंद्र/Vikram Sarabhai Space Centre
तिरुवनन्तपुरम/Thiruvananthapuram-695 022

भारतीय अंतरिक्ष अनुसंधान संगठन   Indian Space Research Organisation

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