Nikhil Gaikwad

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Academic Education

July 2016 to Present — **Doctor of Philosophy (PhD)**, *Visvesvaraya National Institute of Technology (VNIT), Nagpur*.
Electronics and Communication Engineering *CGPA*: 9/10 *Advisor*: Prof. Avinash Keskar
Thesis Title: Hardware Design And Implementation of ANN Based Inference IP Cores for Efficient Sensor Data Analytics at Edge Gateway of Internet of Battlefield Things (IoBT) Wearables.

July 2013 to July 2015 — **Master of Technology**, *Veermata Jijabai Technological Institute (VJTI), Mumbai, India (An autonomous institute fully funded by the Government of Maharashtra)*.
Electronics Engineering *CGPA*: 7.64/10 *Advisor*: Prof. R. D. Daruwala
Thesis Title: Digital System Design and Implementation for Lightning Detection Sensor Node.

July 2008 to June 2012 — **Bachelor of Engineering**, *Kavikulguru Institute of Technology and Science (KITS), Ramtek*.
Electronics and Communication Engineering *Percentage*: 62.84% *Advisor*: Dr. Pankaj Ashtankar
Thesis Title: ATMEGA16 based Human Controlled Wireless Programmable Robot Arm.

Technical Skills

OS Windows and Linux.

Programming Languages C, C++, Embedded C, VHDL, Assembly Language, Python.
Graphical Programming: LabVIEW, Simulink, Flowcode, PLC Ladder Logic.

Softwares Tools MATLAB, Arduino IDE, Proteus, NI Multisim, Orcad, Matrix Flowcode, Keil, OSCAD, Microwind, Eagle, Atmel Studio, NI LabVIEW, PLC WPLsoft, MIT App Inventor, MPLAB, Quartus, ModelSim, Jupyter, IO, Firebase, AWS Cloud.
Xilinx: Vivado, SDK, System Generator, Model Composer, HLS, ISE, ChipScope.

Hardware Platforms Arduino(Uno, Micro, Nano), ESP32, ESP8266, MyRIO, MyDAQ, Feather HUZZAH.
Micro-controllers: 8051, PIC18, PIC16, ATMEGA16, ATMEGA32A, ATMEGA328.
Xilinx FPGA: Digilent Arty (Artix-7), LX9 MicroBoard (Spartan-6), Zynq ZC702.

Laboratory Instruments NI VirtualBench, NI ELVIS, Logic Analyzer, Spectrum Analyzer, DSO, CRO, Multimeter, Xilinx's Integrated Logic Analyzer (ILA).

Doc. Tools LaTeX, JabRef, Google Docs, Microsoft Word, Excel, PowerPoint, Visio.

Work Experience

July 2016 to Present — **Doctoral Researcher**, *Visvesvaraya National Institute of Technology (VNIT), Nagpur, India*.

- **Basic ANN Classifier IP Core:** Dedicated hardware design has been developed, implemented and tested on FPGA for efficient soldier activity recognition. It uses an Artificial Neural Network (ANN) to incorporate edge intelligence on the Internet of Battlefield Things (IoBT) wearables.
- **Adaptive ANN Classifier IP Core:** This second version can analyze four types of heterogeneous sensor data. Four distinct ANN models are integrated efficiently in single hardware design for ECG, blood pressure, soldier activity and toxic gas classification at the IoBT edge.
- **IoBT based Novel Enemy Localization Method:** The soldierś own locations and their gunshot direction based novel enemy localization technique has been demonstrated. The proposed algorithm is faster, computationally simple, consistent, and reliable than PSO and KNN. It enables IoBT wearables to achieve situational awareness during combat operations.
- **Multi-agent ANN based Regression IP Cores:** It is an advanced version of IP cores that predict gun shoot direction based on the sensor-enabled wearable glove. These flexible IP cores can be configured from the military cloud to achieve effective edge intelligence.

- **Other Projects:** ML-based Tracking of a Soldier in GPS-denied Areas, IoT enabled Anti-tampering Camera, PIC microcontroller based Audio to USB Converter.
- **Other Activities:** Teaching assistant, project mentor for more than ten students, presented in two international conferences, attended two poster competitions, attended three workshops.

Sponsoring Agency: MHRD and TEQIP- II funded Centre of Excellence (CoE) on Commbedded Systems.
Project Investigators: Prof. Avinash Keskar (VNIT, Nagpur) and Dr. NC Shivaprakash (IISc, Bengaluru)

Sept 2015 to July 2016 **Research Scientist**, *Society for Applied Microwave Electronics Engineering & Research (SAMEER), IIT Bombay Campus, Mumbai, India*.

- **Lightning Detection and Localisation Network:** This indigenous system is developed to monitor and track the lightning pattern to alleviate problems caused due to lighting and storms. *Contributions:* Development of lightning trigger algorithm and prototyping of digital front-end of the sensor node includes its FPGA implementation, debugging, interfacing and testing.
- **SAMEERDU Digital Ionosonde:** This RADAR is used for monitoring ionospheric conditions, which affect ionospheric communications like GPS and Skywave. *Contributions:* Troubleshooting of Eight layers LNA PCB Cards. System field installation, interfacing and testing.
- **Digital Barograph System:** This system has been developed to record the meteorological parameters like atmospheric temperature, pressure and humidity. It uses a conventional sensor with an embedded system, currently deployed for the field trials. *Contributions:* Prototyping of sensor interface circuit from scratch, development of embedded systems, testing and debugging.

Sponsoring Agency: Ministry of Electronics and Information Technology (MeitY), India.
Project Investigators: Mr. Ajay Khandare (Scientist-E) and Mr. Anil Kulkarni (Scientist-F)

July 2014 to May 2015 **Project Trainee**, *Society for Applied Microwave Electronics Engineering & Research (SAMEER), IIT Bombay Campus, Mumbai, India*.

- **Digital Front-End of Lightning Detection Sensor Node:** It converts pre-processed analog lightning signals (3 kHz to 30 kHz) into the digital format (16-bit precision), then filtered using the FIR digital filter and time-stamped using precise GPS signals. This complete digital system was implemented on the Xilinx Spartan-6 FPGA and tested using a customized LabVIEW GUI.

Project Investigators: Mr. Ajay Khandare (Scientist-E) and Prof. R. D. Daruwala (VJTI)

July 2013 to July 2015 **Teaching Assistant**, *Veermata Jijabai Technological Institute (VJTI), Mumbai, India*.
Conducted Mini-project practical Labs for undergraduate students. Attended four workshops on various recent technical topics organized by IIT, Bombay. *Other Projects*: LabVIEW Simulation of Smart Earphone, PIC based Motion Display.

Journal Publications

1 **Nikhil B Gaikwad**, Hrishikesh Ugale, Avinash Keskar and NC Shivaprakash, "*The Internet of Battlefield Things (IoBT) based Enemy Localization using Soldiers Location and Gunshot Direction,*" in ***IEEE Internet of Things Journal***, June 2020. **(SCIE, Q1, IF - 9.94)**

2 **Nikhil B Gaikwad**, Varun Tiwari, Avinash Keskar and NC Shivaprakash, "*Efficient FPGA Implementation of Multilayer Perceptron for Real-Time Human Activity Classification,*" in ***IEEE Access***, February 2019. **(SCIE, Q1, IF - 4.64)**

3 **Nikhil B Gaikwad**, Varun Tiwari, Avinash Keskar and NC Shivaprakash, "*Heterogeneous Sensor Data Analysis Using Efficient Adaptive Artificial Neural Network on FPGA Based Edge Gateway,*" in ***KSII Transactions on Internet and Information Systems***, October 2019. **(SCIE)**

Conference Publications

1 **Nikhil B Gaikwad**, Varun Tiwari, Avinash Keskar and NC Shivaprakash, "*FPGA Implementation of Real-Time Soldier Activity Detection based on Neural Network Classifier in Smart Military Suit,*" in ***IEEE Bombay Section Signature Conference (IBSSC)***, IIT Bombay, India, 2019.

2 **Nikhil B Gaikwad** and Ajay Khandare, Miheer Mayekar and Avinash G Keskar, "*Design and implementation of digital system for cost effective lightning detection sensor node,*" in ***8th International Conference on Computing, Communication and Networking Technologies (ICCCNT)***, IIT Delhi, India, 2017.

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3 Yogesh Sherki, **Nikhil B Gaikwad**, Jayalakshmi Chandle and Anil Kulkarni "*Design of real time sensor system for detection and processing of seismic waves for earthquake early warning system,*" in ***International Conference on Power and Advanced Control Engineering (ICPACE)***, Bangalore, India, August 2015.

Communicated Paper

1 **Nikhil B Gaikwad**, Hrishikesh Ugale, Avinash Keskar and NC Shivaprakash, "*Hardware Implementation of Glove based Gunshot Direction Estimation using Multi-agent MLP Regression in IoBT Edge Gateway,*" in ***IEEE Transactions on Neural Networks and Learning Systems.*** **(SCIE, Q1, IF - 8.793)** *Status*: Under review

Honors and Awards

July 2016 to Present — Received Teaching Assistant Scholarship for the PhD program from Ministry of Human Resource Development, Government of India.

July 2019 — Received travel grants to present research papers in IEEE ICCCNT 2017 and IBSSC 2019.

July 2013 to July 2015 — Qualified GATE-2013 exam with 97.57 percentile and received scholarship for Master of Technology program from Ministry of Human Resource Development, India.

March 2011 — Secured first position for the project titled "Motion Display: Persistence of vision-based LED display on the fan" in a nationally recognized project competition organized by YCCE, Nagpur.

Feb 2011 — Secured first position in Circuit Puzzle event and won a special prize in all India project competition at ElectroCom-11 that organized by JD College of Engineering, Nagpur.

Jan 2011 — Won first prize in PRATIKRUTI that was a national level project competition organized at Priyadarshini College of Engineering under the banner of JIGYASA-11.

Jan 2011 — Won first prize worth of 1.5 lakh rupees in the national level hardware project competition held under QUARK-11 at TGPCET, Nagpur.

Dec 2010 — Secured second position in science exhibition organized by NIT, Nagpur.

March 2005 — Third rank in 10^{th} exam among the regional schools with top in mathematics. Two times secured the first position in debate competition at the school level.

Other Activities

- Reviewed four research papers for the IEEE access journal.
- Conducted a hands-on training on LabVIEW for undergraduate batches of ECE, VNIT, Nagpur.
- Assisted Prof. Avinash Keskar for the academic courses (Microprocessor and Digital Circuits).
- Certifications in HPC, PLC & SCADA, Embedded Systems Design using Vivado, MS-CIT.
- Attended industrial training on Embedded Systems and BSNL Summer Training.
- Attended in the following workshops organized by IIT Bombay: Applications of Signals and Systems, Introduction to Oscad, Pedagogy and Research Trends for Electromagnetics, etc.
- Participated in more than fifteen project competitions and other technical events.

References

Prof. Avinash Keskar, Senior Professor, *ECE Department, VNIT Nagpur, India*
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