Nikhil Gaikwad

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Academic Education

July 2016 to Present — **Doctor of Philosophy (PhD)**, *Visvesvaraya National Institute of Technology (VNIT), Nagpur, India*.
Electronics and Communication Engineering — *CGPA*: 9/10
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. — *Advisor*: Prof. Avinash Keskar

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
Thesis Title: Digital System Design and Implementation for Lightning Detection Sensor Node. — *Advisor*: Prof. R. D. Daruwala

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

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 Integrated Logic Analyzer (ILA).

Document-ation 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 real-time and power-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 of the Basic IP core 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 using the hardware prototype and software simulations. The proposed algorithm is faster, computationally simple, consistent, and reliable than Particle Swarm Optimization (PSO) and K-Nearest Neighbor (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. This multi-agent regression algorithm outperforms compared with the conventional multilayer perceptron, SVM and linear regression algorithms. 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:** Presented the research works in two international conferences and two poster competitions. Attended workshop on High Performance Computing (HPC), Attended short training on Role of Optimization in Engineering Applications, Attended a short course on Role of Mathematics in Engineering (RME) and several other training programs. Also, worked as a Teaching Assistant.

Sponsoring Agency: Indian Ministry of Human Resource Development (MHRD) and Technical Education Quality Improvement Program (TEQIP- II) funded Centre of Excellence (CoE) on Commbedded Systems.

Project Investigators: Prof. Avinash Keskar 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*.

- **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. Five units of Lightning Detection Nodes were handed over to Tripura University for field trials under MeitYś North East program. *Contributions:* Development of lightning triggering algorithm and its FPGA implementation. Digital Front-end prototyping of the sensor node includes hardware implementation, Debugging, Interfacing and Testing.
- **SAMEERDU Digital Ionosonde:** This RADAR is used for monitoring ionospheric conditions, which affect ionospheric communications like GPS and Skywave. Ionosonde was developed to suit India's equatorial and low latitude regions. *Contributions:* Debugging and Troubleshooting of Eight layers LNA PCB Cards. System Field Installation, Interfacing and Testing.

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- **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 handed over to the IMD Pune for field trials. *Contributions:* Prototyping of sensor interface circuit for 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), Industrial & Meteorological Systems Division (IMSD), SAMEER, Mumbai

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

- **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*. 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***, Early access, June 2020. **(SCIE, Impact Factor :- 9.936)**

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, Impact Factor :- 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)***, VMCC, IIT Bombay, India, July 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, July 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.

Posters

1 **Nikhil B Gaikwad**, Varun Tiwari, and Avinash Keskar, "*Heterogeneous Sensor Data Analysis Using Dynamically Configurable ANN on the Edge Gateway of the Smart Military Suit,*" in ***Research Scholar Day(RSD), VNIT, Nagpur, Feb 2019.***

2 **Nikhil B Gaikwad**, Varun Tiwari, and Avinash Keskar, "*Design and Implementation of Real-Time Multilayer Perceptron (MLP) Classifier for the Smart Military Suit Gateway,*" in ***Research Scholar Day(RSD), VNIT, Nagpur, March 2018.***

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, Impact Factor :- 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 a research paper in IEEE IBSSC 2019.

July 2018 — Received travel grants to present a research paper in IEEE ICCCNT 2017.

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 ICON-11.0 organized by YCCE, Nagpur.

Feb 2011 — Secured first position in Circuit Puzzle event at ElectroCom-11 that organized by JD College of Engineering, Nagpur.

Feb 2011 — Won a special prize in ElectroCom-11 that was all India project competition organized at 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.

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Certifications

May 2018 "High Performance Computing (HPC)" C-DAC Pune and VNIT Nagpur.

Dec 2014 "Embedded Systems Design using Vivado" CoreEL Technologies and VJTI Mumbai.

July 2013 "Industrial Training on Embedded systems" iLabs Research Pvt. Ltd. Nagpur.

June 2013 "PLC and SCADA" with A^+ Grade, Government Polytechnic, Nagpur.

April 2010 "BSNL Summer Training for Engineering Students" RTTC Nagpur.

July 2006 "Maharashtra State Certificate in Information Technology" with Distinction, Maharashtra State Board of Technical Education, Mumbai.

Key Coursework

- Fuzzy Logic and Neural Networks by Prof. A. G. Keskar
- Neural Networks for Machine Learning by Prof. Geoffrey Hinton
- Pattern Recognition and Application by Prof. P.K. Biswas
- Machine Learning by Dr. Andrew Ng
- Digital System design with PLDs and FPGAs by Prof. Kuruvilla Varghese
- Embedded Systems by Dr.Santanu Chaudhury and Prof. Pramod Borole
- Virtual Instrumentation and Electronics in medicine by Prof. Meena Panse
- Introduction to Research by Prof. Prathap Haridoss and Prof. Arun Tangirala.

Teaching and Mentoring Experience

Teaching Assistant, *Visvesvaraya National Institute of Technology*, Nagpur.

KEY SUBJECTS: Microprocessor and Interfacing, Digital Circuits, Digital System Design, Measurement & Instrumentation, Electronic Product Engineering Workshop, Analog Circuit Design Lab, Digital Signal Processing Lab etc.

Mentoring of Undergraduate Students,

- Major Projects: Aparna Ravula, Ruchitha Sai, Pranavi Nanawath, Sai Charan.
- Research Projects: Hrishikesh Ugale, Apurva Jirafe, Purva Ragit, Sravya Challa.
- Minor Projects: Rushikesh Sangekar, Battu Bharathi.

Other Activities

- Reviewed four research papers for the IEEE access journal.
- Conducted a hands-on training programs on "Introduction to LabVIEW based Instrumentation" for the undergraduate batch of the ECE department VNIT Nagpur.
- Assisted senior Prof. Avinash Keskar during the academic courses like Microprocessor and Digital Circuits.
- Attended in the following workshops organized by IIT Bombay:
Applications of Signals and Systems, Introduction to Oscad, Pedagogy and Research Trends for Electromagnetics, Current Trends in Ocean and Atmospheric Sciences.
- Participated in more than fifteen project competitions and other technical events during undergraduate education.

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Research Interests

- Edge Intelligence for Internet of Things (IoT)
- Artificial Neural Networks (ANN) for Smart Sensor Systems
- FPGA, ACAP and Reconfigurable SoC technologies based Edge/Fog Computing
- Implementations of Machining Learning(ML) algorithms on the heterogeneous computing platforms

Personal Details

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LinkedIn https://linkedin.com/in/nikhil-gaikwad

G-Scholar https://scholar.google.co.in/citations?hl=en&user=5Kyp3wwAAAAJ

Publons https://publons.com/researcher/3277154/nikhil-b-gaikwad/publications/

R-Gate https://www.researchgate.net/profile/Nikhil_Gaikwad9

References

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Dr. N. C. Shivaprakash
Senior Scientist, *IAP, Indian Institute of Science (IISc), Bengaluru, India*
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Dr. Varun Kumar Tiwari
Technical Lead, *Wipro Technologies, Bengaluru, India*
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Dr. Nitin Satpute
Researcher, *Aarhus University, Denmark*
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Declaration

I hereby declare that the above mentioned information is correct up to my knowledge and I bear the responsibility for the correctness of the above mentioned particular.

Date: September 21, 2020
Place: Nagpur (India)

Nikhil Gaikwad