Manoj Gulati

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APPLIED RESEARCHER | HANDS-ON ENGINEER

SUMMARY

Ph.D. Scholar with a demonstrated history of working in the industry and academia, having more than 10 years of hands-on experience in Hardware Design including top MNCs like Hewlett-Packard Educational Services, Noida (India). Skilled in Embedded Software, PCB Designing, Microprocessors and Embedded C. Strong research professional with a Doctor of Philosophy (Ph.D.) focused in Embedded Sensing and Energy Sustainability from IIIT, Delhi (India) along with 1 year research experience in Paul G. Allen Center for Computer Science and Engineering at University of Washington, Seattle (USA).

RESEARCH INTERESTS

Embedded System Design • Signal Processing • Cyber Physical Systems • Embedded Sensing

EDUCATION

IIIT-DELHI | Ph.D. in Electronics and Communication Engineering
July 2013 - Dec 2019 | New Delhi, India • Major GPA: 8.3/10

MDU UNIVERSITY | B.Tech. (Hons.) in Electronics and Communication Engineering
Conc. in Embedded Systems, College of Engineering | 2007 - 2011 | Rohtak, HR, India • CPI: 75%

Publication Statistics:
3 Journals | 4 Conference Papers | 1 Workshop Paper | 2 Poster Papers | 5 First Authored | 1 Best Paper Award.

RESEARCH EXPERIENCE

LIVING ANALYTICS RESEARCH CENTER | SMU | Research Scientist
Dec. 2019 - Present | Singapore
Working with Prof. Archan Misra to design and implement ultra low-power acoustic and image sensors. We are trying to incorporate state-of-the-art technologies available at the intersection of material science and electronics to enable novel self-powered sensors and systems.

UBICOMP LAB | UNIVERSITY OF WASHINGTON | Visiting Researcher | IUSSTF BHAVAN Fellow
Aug. 2017 - March 2018 | Seattle, WA, USA
Worked with Prof. Shwetak N. Patel [UW] and Dr. Sidhant Gupta [Microsoft Research] to design and implement an ultra low-power energy harvesting system using stray electric field from AC power lines. Also, designed an ultra power current measurement system. Publication accepted for ACM IMWUT'18.

UBICOMP LAB | UNIVERSITY OF WASHINGTON | Visiting Research Intern
Feb. 2016 - Sep. 2016 | Seattle, WA, USA
Worked with Prof. Shwetak N. Patel [UW] and Dr. Sidhant Gupta [Microsoft Research] to design and implement a contact less current sensor for current sensing at MCB level. Also, refined existing signal processing pipeline to compensate for phase non-linearities.

ENERGY GROUP | MUC LAB | IIIT-DELHI | Graduate Researcher | TCS Research Fellow
July 2013 - Oct 2018 | New Delhi, India
Worked with Dr. Amarjeet Singh and Dr. Shobha Sundar Ram to design and implement high frequency (HF) electromagnetic interference (EMI) filters for measuring EMI from electronic appliances. Also, deployed HF and low frequency (LF) sensing systems in multiple office and residential buildings for energy monitoring and released several real-world LF and HF energy datasets as part of our work at energy group at IIIT-Delhi.

MOBILE AND UBIQUITOUS COMPUTING LAB | IIIT-DELHI | Research Assistant
Aug. 2012 - June 2013 | New Delhi, India
Worked with Dr. Amarjeet Singh to design and deploy Wi-Fi based WSN testbed for monitoring ambient parameters in office buildings. Also, designed ethernet based sensor network testbed for residential dorms.

EMBEDDED SYSTEMS AND ROBOTICS GROUP | HEWLETT PACKARD EDUCATIONAL SERVICES | Undergraduate Research Intern
June 2010-Aug 2010 | Noida, UP, India
Worked with Sourabh Sankule to design a low-cost embedded web-server for energy grid automation using IoT. Also, designed breakouts for DTMF controller, DC motor driver, pre-arduino AVR Dev board, Ethernet/RS-232 interface.

INDUSTRIAL EXPERIENCE

AEROGRAM, IIT DELHI | Consultant | Lead Solution Architect
August 2019 - Oct 2019 | New Delhi, India
Lead and served as a solution architect at Aerogram (an IIT Delhi incubated startup) focused on distributed air quality monitoring across Delhi. Addressed some of the key challenges in the existing hardware design. Helped in recruitment and expansion of the technical team including senior developers and hardware designers. Also, demonstrated and pitched some of our products to the potential customers and investors.

CHILD HEALTH IMPRINTS INDIA PVT. LTD. | Research Scientist | Hardware Design Lead
Oct 2018 - April 2019 | New Delhi, India
Lead the hardware team to improve existing IoT data aggregator used with the medical devices and designing a low-power wearable band for neonates for disease specific monitoring of vital signals. Also, supported the team efforts to draft the first clinical publication currently under review in Journal of Pediatrics.

HEWLETT PACKARD EDUCATIONAL SERVICES | Consultant and Mentor
June 2012 - Aug. 2012 | Noida, UP, India
Led entire embedded systems group for summer training program (STP)'12 for advanced embedded systems course.

INDRION TECHNOLOGIES PVT. LTD. | Embedded Design Engineer
Aug. 2011 - June 2012 | Bangalore, KA, India
Worked with Satyam trivedi and Sourabh Sankule to design tiny sensor motes for sensing ambient temperature, light & humidity meant to be deployed in 2-3 Tier-I companies in around 500 cubicles. Also, designed prototype for smart energy meter based around ADE7763 (AD) Energy Metering IC having on board PT and CT for voltage and current sensing and isolators.

HEWLETT PACKARD EDUCATIONAL SERVICES | Embedded Design Engineer
May 2011 - July 2011 | Noida/Lucknow, UP, India
Worked with Sourabh Sankule to design a platform (WiNet) for advanced ES course having 8-Bit RISC MCU with built-in support for wireless data transmission, ethernet, Serial communication via USB, digital temperature and light Sensor, LCD, GPIOs. Also, wrote drivers for I2C based sensors, ported TCP/IPv4 Stack.

TEACHING EXPERIENCE

ICT ACADEMY, IIT KANPUR | Visiting Faculty | IoT Course
May 2019 - July 2019 | Kanpur, India
Lead and taught a summer course in Embedded Systems and IoT to around 70 students from all our India covering 8-bit, 16-bit and 32-bit micro-controllers along with peripherals and wireless interfaces. Also, helped them design a short-term capstone project on completion of the course in a team size of four.

HEWLETT PACKARD EDUCATIONAL SERVICES | Lead Trainer
May 2010 - Aug. 2012 | Noida, UP, India
Taught ES Course to around 1200 students (500+ students in 2012, 400+ students in 2011 and 280 students in 2010).

IIIT-DELHI | Embedded Logic Design (ECE212/612) | Head Teaching Assistant
Fall 2013 | New Delhi, India
Head TA for ELD course taught by Alexander Fell. Primary roles included designing course assignments, taking tutorials sessions for freshly induced TAs, resolving queries and having doubt clearing sessions for students, doing manual evaluations for all coding assignments to avoid plagiarism.

IIIT-DELHI | Introductory Engineering Design (DES130) | Teaching Assistant
Spring 2014 | New Delhi, India
Helped Prof. RN Biswas in designing course assignments and class experiments. Also, took 3 guest lectures on "Introduction to Embedded Systems and Arduino programming", mentored 10 student groups for design projects, evaluated coding exams for a total of 160 students.

IIIT-DELHI | Introductory Engineering Design (DES130) | Teaching Assistant
Fall 2017 | New Delhi, India
Mentored six groups (having four students each) for their projects for entire duration of IED course along with Alexander Fell. All groups were able to successfully complete their projects in predefined time-line. Also, took garage lab sessions.

AWARDS AND HONOURS

i ACM UbiComp Student Travel Grant'18 and MSR India Travel Grant'18
Awarded UbiComp/ISWC 2018 student travel grant and Microsoft Research India travel grant to attend and present at UbiComp/ISWC 2018 to be held in Singapore. The grant will cover the registration of the main conference and up to $1300 for accommodation and airfare.

ii IUSSTF BHAVAN Fellowship'17
Awarded prestigious Building Energy Efficiency Higher & Advanced Network (BHAVAN) Fellowship'17 worth $20,000 supported by the Department of Science and Technology, Govt. of India, and the Indo-U.S. Science and Technology Forum (IUSSTF) for interning at University of Washington, Seattle for a period of six months.

iii NILM-W: Best Paper Award'16
Awarded best paper award at Non-intrusive Load Monitoring Workshop'16 held in Vancouver, Canada.

iv Google Technology Research Award'16
Awarded Internet of Things (IoT) Technology Research Award by Google Research in 2016.

v Overseas Research Fellowshop'16
Awarded $12,000 worth support from Ubicomp Lab (UW) and as part of ORF from IIIT-Delhi, for six months research internship at Ubicomp Lab, University of Washington, USA.

vi ST UDC Most Popular Prototype Award'15
Our team wins Most Popular Prototype Award at ST Microelectronics University Design Contest'15.

vii TCS Research Ph.D. fellowship'15
TCS Research Ph.D. fellowship (covering tuition fees and stipend for 4 years, support for participation in 1 International conference and 2 Indian conferences and contingency, starting January 2015).

viii MSR Techvista'15 | Travel and Lodging Grant
Full travel and lodging grant by Microsoft Research India to present our work at PhD poster session at Microsoft Techvista - 2015.

ix IIITD Best Idea Proposal'13
Best idea proposal selected at five-year ceremony (Nov'13) of IIIT-Delhi for setting up a dedicated hardware design club at IIIT-Delhi.

x HP | Consultant & Mentor | STP'12
Selected as consultant and mentor for Embedded Systems Group at Hewlett Packard Educational Services, Noida during Summer training program 2012.

xi WBWGC shortlisted for WiNet's Design'11
Web Based Wireless Grid Control (WBWGC) selected as fundamental design for WiNet (Wireless sensor network board), a platform for Advanced Embedded Systems Course at HP, taken by more than 2000 undergraduates every year.

xii Best Design Award | 1^{st} Position | 2011
BTP: Web Based Wireless Grid Control (WBWGC) awarded 1st position at university level in Maharishi Dayanand University, Rohtak along with Best Design Award in Kurukshetra University in 2011.

xiii Best Hardware Design Award | 2^{nd} Position | 2010
Second Best Hardware Design Award at university level in MDU University for Secure Access using Handheld Automated System (SAHAS) in 2010.

PROFESSIONAL SERVICE

1. Session chair for two RTES (Real-time Embedded Systems) sessions in IEEE WECON'16.
2. Reviewer for IEEE Pervasive Computing (Feb'16), IEEE WECON'16/WECON'18, IEEE IoT Journal'18.

3. External reviewer for ACM Ubicomp'15, ACM UIST'16, ACM Ubicomp'16, ACM Ubicomp'17, Ubicomp'18, IEEE SECON'20, IEEE ICDCS'20, ACM Sensys'20.
4. PC for NILM Workshop'16, NILM Workshop'18, NILM Workshop'20, IIITD's Annual Research Showcase RS'15, RS'16 and RS'17.

PROFESSIONAL ACTIVITIES

- 2017.01 | Co-organized 7th Annual Research Showcase (RS'17) at IIIT-Delhi as Technical Program Chair.
- 2015.07 | Co-founded D-I-Y Lab 'Dexter Inside' at IIIT-Delhi along with Sanchit Agarwal (B.Tech IIIT-D ECE'12). The purpose is to promote maker-culture at IIIT-Delhi.
- 2015.01 | Organized 5th Annual Research Showcase (RS'15) at IIIT-Delhi in a team size of 3 and lead 6 management and design teams. Also, introduced 2 new events for the first time (Elevator Pitch and IoT Hackathon) within the existing theme of RS and also channelized the funding from corporate partners.
- 2013.11 | Wrote the first proposal for a dedicated hardware design club at IIIT-Delhi (with a vision of long term projects like cubeSAT). Also, awarded a token of appreciation from the director for the same on five-year ceremony of IIIT-Delhi.

TECHNICAL SKILLS

PROGRAMMING
Embedded C • C (along with Graphics and Inline assembly) • Assembly language programming (x51, x85, x86 processors) • Python (Numpy, Pandas) • Verilog • LaTeX.

EDA & SIMULATION TOOLS
Matlab • PSpice (MicroSim) • LT-Spice • ISIS Proteus • Microcap • Advanced Design Systems (Agilent) • AVR-GCC • WINAVR • GCC-MinGW • AVR-Studio • GNU-Makefiles • GNU-Radio • Xilinx ISE • Cadsoft Eagle • Orcad Capture.

HARDWARE MODULES
ENC28J60 Ethernet Controller • Zigbee (Xbee PRO) • CC2500 (TI) • MRF24J40MA (802.15.4 Wireless Radio) • MRF24WB0MB (Microchip 802.11 b/g Wi-Fi) • RN-42 (Bluetooth Roving networks) • Graphic LCD (KS0108, T6963C).

DATA ACQUISITION AND COMPUTING PLATFORMS
USRP N200 (ETTUS-SDR) • Redpitaya • Raspberry Pi • MDO-4104 (Tektronix) • Spectrum Analyser N9000A CXA (Agilent), NI USB 6259, Keithley Source meter.

MICROCONTROLLER PLATFORMS
Atmel (AVR ATmega, AT-Tiny) • Microchip PIC24F • NXP LPC1768 • TI CC1350 • nRF52832.

DIGITAL SENSORS
TMP275 (TI) • APDS-9300 (Avago) • ISL29101 (Intersil) • OPT101 (TI) • TSL235R (TAOS) • HDC1000YPA (TI) • TMP007/107/117 (TI) • OPT3001 (TI) • MAX3010x (MAXIM)

PUBLICATIONS

C.1 N. Batra, M. Gulati, A. Singh, and M. B. Srivastava, "It's Different: Insights into home energy consumption in India", in Proceedings of the 5th ACM Workshop on Embedded Systems For Energy-Efficient Buildings, pp. 1-8, ACM, 2013.
[ACM BuildSys][Rank: Core-A][Acceptance Rate: 41%]

P.1 P. Arjunan, M. Saha, M. Gulati, N. Batra, A. Singh, and P. Singh, "SensorAct: Design and Implementation of Fine-grained Sensing and Control Sharing in Buildings", accepted as Poster at 10th USENIX Symposium on Networked Systems Design and Implementation, 2013.
[ACM NSDI][Rank: Core-A*]

C.2 M. Gulati, S.S. Ram, and A. Singh, "An in depth study into using EMI signatures for appliance identification", in Proceedings of the 1st ACM Conference on Embedded Systems for Energy-Efficient Buildings, pp. 70-79, ACM, 2014.
[ACM BuildSys][Rank: Core-A][Acceptance Rate: 27%]

P.2 N. Batra, M. Gulati, P. Jain, and K. Whitehouse, "Bits and Watts: Improving energy disaggregation performance using power line communication modems", accepted for poster publication in 1st ACM International Conference on Embedded Systems For Energy-Efficient Buildings, ACM, 2014.
[ACM BuildSys][Rank: Core-A]

C.3 P. Arjunan, M. Saha, H. Choi, M. Gulati, A. Singh, P. Singh, and M.B. Srivastava, "SensorAct: A Decentralized and Scriptable Middleware for Smart Energy Buildings", in Proceedings of the 12th IEEE International Conference on Ubiquitous Intelligence and Computing, pp. 11-19, IEEE, 2015.
[IEEE UIC][Rank: Core-B][Acceptance Rate: 30%]

W.1 M. Gulati, S.S. Ram, A. Majumdar, and A. Singh, "Detecting IT and Lighting loads using Common Mode Conducted EMI Signals", in Proceedings of the 3rd International Workshop on Non-Intrusive Load Monitoring, 2016.
[NILM Workshop][Best Paper Award]

J.1 M. Gulati, V. Singh, S. Agarwal, and V. Bohara, "Appliance Activity Recognition Using Radio Frequency Interference Emissions", accepted for publication in IEEE SENSORS Journal, 16(16), pp.6197-6204, IEEE, 2016.
[IEEE SENSORS][Impact Factor: 2.512]

J.2 M. Gulati, S.S. Ram, A. Majumdar, and A. Singh, "Single Point Conducted EMI Sensor With Intelligent Inference for Detecting IT Appliances", accepted for publication in IEEE Transactions on Smart Grid, IEEE, 2016.
[IEEE TSG][Impact Factor: 7.364]

C.4 P. Bhattacharjee, S. Banerjee, M. Gulati, S.S. Ram, and A. Majumdar, "Supervised Analysis Dictionary Learning: Application in Consumer Electronics Appliance Classification", in Proceedings of the Fourth ACM IKDD Conference on Data Sciences, pp. 2, ACM, 2017.
[ACM CODS][Rank: Core-B]

J.3 M. Gulati, F.S. Parizi, E.M. Whitmire, S. Gupta, S.S. Ram, A. Singh, and S.N. Patel, "CapHarvester: A Stick-on Capacitive Energy Harvester Using Stray Electric Field from AC Power Lines", accepted for publication in ACM IMWUT, ACM, 2018.
[ACM IMWUT (Ubicomp)][Rank: Core-A*][Acceptance Rate: 27%]

C.5 A. Sharma, V. Subasharan, M. Gulati and A. Misra, "CollabCam: Utilizing Collaborative Inference & Mixed-Resolution Imaging for Energy-Efficient Vision Sensing", under review in ACM Conference on Information Processing in Sensor Networks, 2021.
[ACM IPSN][Rank: Core-A*][Acceptance Rate: XY%]

PATENTS

1. Filed Full Indian patent (Ref. No. 201811033277) and US patent (Application Number: 16675028) "Capacitive Energy Harvester from AC Power Lines" along with Prof. Shwetak N. Patel.

REFERENCES

Prof. Shwetak N. Patel
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