

Nivedita Arora

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RESEARCH FOCUS

My research focuses on re-imagining the future of mobile and ubiquitous computing by embracing an alternative view of computing where the physical surfaces would be covered with a “computational material” which can self-sustain itself to sense, compute, actuate and communicate as well as have the capability of being manufactured at large scale. I am a multi-disciplinary researcher who often collaborates with researchers in material science, chemical engineering, mechanical engineering, electronics and design to explore the challenges and solutions for the exciting new age of Internet of Materials.

EDUCATION

Ph.D. Computer Science

Aug. 2016 - May 2022

Georgia Institute of Technology, Atlanta

GPA : 4.0/4.0

Area : Intelligent Systems (Machine learning and Ubiquitous Computing)

Advisor: Gregory D. Abowd, Thad Starner

M.S. Human Computer Interaction - Interactive Computing

Aug. 2014 - May 2016

Georgia Institute of Technology, Atlanta

GPA : 3.85/4 Area : Mobile and Ubiquitous Computing

Thesis : ASSCI – Adaptive Switch for Scanning Control Interface

Advisor: Gregory D. Abowd, Thad Starner

B. Tech. Information Technology

Aug. 2008 - May 2012

Institute: Netaji Subhas Institute of Technology (NSIT), Delhi University

Thesis : Drishti – Realtime Multilanguage Snapshot Translation and Speech system

PUBLICATIONS

- C11. **(Under Review)** D. Zhang, C.F. Hernandez, Y. Li, J.W. Park, Y. Wang, Y. Zhao, **N. Arora**, A. Mirzazadeh, Y. Do, T. Cheng, T. Starner, and G.D. Abowd. **Flexible Computational Photodetectors for Self-Powered Activity Sensing**. NPJ Flexible Electronics.
- C10. **(Under Review)** A. Curtiss, B. Rothrock, A. Bakar, **N. Arora**, J. Huang, Z. Englhardt, A. Empedrado, C. Wang, S. Ahmed, Y. Zhang, N. Alshurafa, J. Hester. **FaceBit: Smart Face Masks Platform**. Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies.
- C9. **N. Arora**, A. Mirzazadeh, I. Moon, C. Ramey, Y. Zhao, D. Rodriguez, G. D. Abowd and T. Starner. **MARS: Nano-Power Battery-free Wireless Interfaces for Touch, Swipe and Speech Input**. Proceedings of the 34th Annual ACM Symposium on User Interface Software and Technology, October 2021. [video](#) [**Honoree, Fast Company’s Innovation by Design**]
- C8. **N. Arora**, T. Starner and G. D. Abowd. **SATURN: An Introduction to the Internet of Materials**. Communications of the ACM, January 2021. [**Research Highlights : 16000 downloads**]
- C7. A. Waghmare, Q. Xue, D. Zhang, Y. Zhao, S. Mittal, **N. Arora**, C. Byrne, T. Starner and G. D. Abowd . **UbiquiTouch: Self-Sustaining Ubiquitous Touch Interfaces**. Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies, March 2020. [video](#)
- C6. Y.K. Meena, X.D. Yang, M. Löchtfeld, M. Carnie, N. Henze, S. Hodges, M. Jones, **N. Arora** and G.D. Abowd. **Self-Sustainable CHI: Self-Powered Sustainable Interfaces and**

- Interactions.** In Extended Abstracts of the 2020 CHI Conference on Human Factors in Computing Systems, April 2020.
- C5. **N. Arora, J. Yu, H. Oh, T. Starner and G. D. Abowd. SATURN: Technical and Design Challenges in Building a Self-sustainable Sound and Vibration Sensing Material.** GetMobile: Mobile Computing and Communications. January 2020.
[\[ACM SIGMOBILE Research Highlights\] article](#)
- C4. **N. Arora, Q. Xue, D. Bansal, P. McAughan, R. Bahr, D. Osorio, X. Ma, A. Sample, T. Starner and G. D. Abowd. Surface++ – A Scalable and Self-sustainable Wireless Sound Sensing Surface.** In Proceedings of the 17th ACM Annual International Conference on Mobile Systems, Applications, and Services, MobiSys (pp. 543-544), June 2019.
[\[Best Poster\] pdf](#)
- C3. **N. Arora, and G. D. Abowd. ZEUSSS: : Zero Energy Ubiquitous Sound Sensing Surface Leveraging Triboelectric Nanogenerator and Analog Backscatter Communication** Adjunct Publication of the 31st Annual ACM Symposium on User Interface Software and Technology, October, 2018. [\[Best Poster\] pdf](#)
- C2. **N. Arora, S. L. Zhang, F. Shahmiri, D. Osorio, Y.-C. Wang, M. Gupta, Z. Wang, T. Starner, Z. L. Wang, and G. D. Abowd. SATURN: A thin and flexible self-powered microphone leveraging triboelectric nanogenerator.** Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies (IMWUT), Volume 2 (2), June 2018.
[\[Distinguished Paper \(Top 3% of accepted papers\)\] pdf video](#)
- C1. **N. Arora, L. Freil, I. Walker, T. Starner, M. M Jackson. Towards Mobile and Wearable Brain-Computer Interfaces.** Proceedings of the 6th International Brain-Computer Interface Meeting, organized by the BCI Society, May 2016 [pdf](#)

PATENTS

- P3. Systems And Methods For Multi-Channel Ambiently-Powered Real-Time Sensing. Filed: April, 2021. Patent Application: 63/231,930, GT provisional: 8734
- P2. Self-powered Wireless Identification Barcode based on Triboelectric Nanogenerator and Backscatter Communication. Filed: Dec, 2020, GT provisional: 8653
- P1. A Thin and Flexible Self-Powered Microphone Designed on the Principle of Triboelectric Nanogenerator. Granted: US Patent 10,932,063

POSTERS and DEMOS

- D9. Microsoft Research Internship Showcase, Redmond, WA. CO-SENSE: Self-sustainable Carbon-Monoxide Gas Sensing Material. August, 2019.
- D8. ACM MobiSys - Annual International Conference on Mobile Systems, Applications, and Services. Surface++ – A Scalable and Self-sustainable Wireless Sound Sensing Surface. June, 2019. **[C4, P1]**
- D7. Career, Research and Innovation Development Conference, Georgia Tech, Atlanta, GA. Self-sustainable Water Leak Detection System. November, 2018. **[1nd Position, P2]**
- D6. ACM Symposium on User Interface Software and Technology. ZEUSSS: : Zero Energy Ubiquitous Sound Sensing Surface Leveraging Triboelectric Nanogenerator and Analog Backscatter Communication. October, 2018. **[C3, P1]**
- D5. ACM UbiComp Conference, Singapore, 2018. SATURN: A thin and flexible self-powered microphone leveraging triboelectric nanogenerator. October, 2018.
- D4. Career, Research and Innovation Development Conference, Georgia Tech, Atlanta, GA. SATURN: A thin and flexible self-powered microphone leveraging triboelectrification. November, 2017 **[2nd Position, P1]**
- D3. NextFlex: Powering the Internet of Everything by Georgia Electronic Design Center (GEDC), Atlanta, GA. SATURN: A thin and flexible self-powered microphone leveraging triboelectrification. September, 2017 **[2nd Position]**

- D2. CRNCH (Center for Research into Novel Computing Hierarchies) Center Summit, Atlanta, GA. SATURN: A thin and flexible self-powered microphone leveraging triboelectrification. September, 2017
- D1. GVV Center Research Showcase, Georgia Institute of Technology ASSCI : Adaptive Switch for Scanning Control Interface. April, 2016

AWARDS and FELLOWSHIPS

- A18. Winner, Ubiquitous Computing Gaetano Borriello Outstanding Student Award, 2021
- A17. Scholarship recipient, Richard Tapia Celebration of Diversity in Computing Conference, 2021
- A16. EECS Rising stars, Massachusetts Institute of Technology, 2021
- A15. Finalist, GVV foley Scholars, Georgia Institute of Technology, 2021
- A14. Honoree, Fast Company Design Innovation Competition in Experimental Category, 2021
- A13. \$180,000 grant given by Cisco for my Ph.D. dissertation, 2021
- A12. Young researchers, Heidelberg Laureate Forum, 2020
- A11. \$1000 Travel Scholarship by College of Computing, Georgia Tech, 2019
- A10. Distinguished Paper, ACM UbiComp conference, 2019
- A9. \$50,000, NSF I-Corps Commercialization grant for Self-sustainable Building Water Leak Detection project 2019
- A8. Best Poster, ACM MobiSys conference, 2019
- A7. \$2000 Provost Award Travel grant, Career Research and Innovation Development Conference (CRIDC), Georgia Tech, 2019
- A6. Best Poster, ACM UIST conference, 2018
- A5. Qualcomm Innovation Fellowship, Shortlisted Abstract, 2018
- A4. \$1500 Travel grant, Career, Research and Innovation Development Conference (CRIDC), Georgia Tech, 2018
- A3. 2nd position in Poster Presentation, Powering Internet of Things, NextFlex Workshop, 2017
- A2. \$18,000 American Association of University Women (AAUW) International Fellowship, 2016
- A1. Georgia Tech Faces of Inclusive Excellence, 2015

INDUSTRY EXPERIENCE

Research Intern, Urban Innovation Initiative, Microsoft Research Lab Summer 2019
Manager: Vaishnavi Ranganathan, Victor Bahl *Microsoft Research, Redmond*
 Working on building cheap, wearable, low power gas sensor to allow democratization of air quality for increased awareness about environment.

Research Intern, Anticipatory Computing Lab, Intel Research Lab Summer 2015
Manager: Lama Nachman *Intel Research, Santa Clara*
 Designed a ring based prototype that integrates an accelerometer sensor to enable people with Motor Neuron Diseases (MND) to use their computer's capabilities using Intel's ACAT. Developed the algorithm needed to ensure robustness of the gesture detection in realistic settings, like recurring changes of the hand pose, variability in the range of finger motion or speed of motion.

Software Developer, designer and early employee in HealthifyMe: India's First Nutrition and Fitness Tracker (Unicorn in 2021) July 2012 - June 2013
Microsoft Ventures Accelerator (Batch 1)
 As early employee, instrumental in designing and developing alpha version of HealthifyMe android app which allowed users to continuously monitor their food intake, set goals and monitor progress towards these goals, allow them to reflect on their trends over an extended period of time, and draw some actionable conclusion. Helped Healthifyme acquire seed funding.

Indie-Developer, Spellathon: Nov 2011- May 2012
400,000+ Play Store downloads, 4+ rating

Anagram game with aim to form 4-7 letter words from given set of 7 letters, necessarily including the central letter in the hexagon. Single-handedly developed, designed, launched and maintained android app.

Indie-Developer, World Newspapers:

Nov 2010 - May 2012

Ranked 1 in Google Play Store 4+ rating

In team of two, developed mobile directory of newspapers, magazines and RSS which was ranked 1 in News Category on Play Store and amongst Top 20 Apps on Google Play Store in February 2011.

Undergraduate Researcher, Health Log Manger : Texas Instruments Analog Design Contest 2011 final round Automated system for storing patient health record. The data is transferred from bluetooth enabled medical instrument to mobile which sends data to the server and displays on website.

TEACHING EXPERIENCE

- Teaching Assistant, Artificial Intelligence CS6601 Fall 2020
- Teaching Assistant, Artificial Intelligence CS6601 Summer 2020
- Teaching Assistant, Mobile and Ubiquitous computing Spring 2019
- Teaching Assistant, Graduate Group Orientation course Fall 2018
- Teaching Assistant, Introduction to Artificial Intelligence Summer 2018
- Teaching Assistant, Mobile and Ubiquitous computing Spring 2017
- Mentor, Texas Instruments Summer Internship Workshop, Delhi University(DU) 2014.
- Student Mentor for Mobile Applications, Google Developer Group (GDG), Delhi 2014.
- Teacher, Each one Teach One, Times of India initiative to teach poor children in Delhi, India 2009

INVITED TALKS

- T5. Building self-sustainable gas sensing material, University of Washington, Molecular Information Systems Lab Aug 2019
- T4. How to give good poster presentations, Ubicomp Lab, Georgia Tech Sept 2019
- T3. 5th generations of computing : Computational Materials, Guest Lecture, Mobile and Ubiquitous Computing, Georgia Tech, April 2019
- T2. HP Labs, Towards Printable Self-sustainable Sensing Jan 2019
- T1. Ubicomp Conference, SATURN: A thin and flexible self-powered microphone leveraging triboelectrification Oct 2019

SERVICE

- **Paper Reviewer:** UbiComp (2016, 2017, 2019), Mobile HCI (2018), ISWC (2017), CHI(2018, 2019, 2020), IUI(2021), TEI(2021)
- **Program Committee** for the Work-in-Progress track of ACM Tangible, Embedded and Embodied Interaction (TEI) 2021
- **Student Volunteer** for ACM Ubicomp Conference, Virtual Event 2020
- **Founding Member** , Science for a Billion (SFAB), [website](#) 2020-Present
- **Group Meeting Coordinator**, Computational Materials Group, Georgia Tech 2017-2020
- **Workshop Co-Organiser**, ACM CHI Virtual, Self-SustainableCHI: Sustainable Self-Powered Interfaces and Interactions [website](#) 2020
- **Panelist** for Georgia Tech MS HCI Seminar, Getting a Ph.D 2019
- **Workshop Co-Organiser**, ACM Ubicomp Conference in Singapore, Broadening Participation Workshop [website](#) 2018
- **Georgia Tech Grad Group leader** 2018

- **Instructor**, Girls Who Code Georgia Tech Chapter 2017
- **Group meeting coordinator**, Ubiquitous Computing Lab, Georgia Tech 2016-2018
- **Student Volunteer** at Ubiquitous Computing Conference in Osaka Japan 2015
- **Founder**, Mobile Development Group, Delhi University 2011 - 2012

OTHER RESEARCH PROJECTS

CO-SENSE : Self-sustainable Cheap Thin Wireless Patch for Carbon Monoxide gas Sensing 2019

CO-sense, a cheap thin material that allows for self-sustainable sensing and communication of carbon monoxide. Unlike general gas sensors that use heating coils, the novelty of the sensor lies in the detection of carbon monoxide using a room temperature reversible electro-chemical reaction, that saves extreme power which traditional sensors require. CO-sense can be easily embedded in objects and surfaces, and also inspires the general gas sensing framework.

Proximity based Adaptive Switch for Intel's Assistive Technology Platform 2015-2016

Designed proximity based cheek switch and developed algorithm for it to dynamically adapt to the user's condition like - fatigue, smile, swallow. Conducted user study with patients to evaluate usability of the switch for triggering Assistive Context Aware Toolkit (ACAT). Funded by Intel Science and Technology Center.

Ear EEG-based Brain-Computer Interfaces 2015-2016

Performed exploratory study to assess the potential of using customized ear electrodes for ear-EEG based mobile wearable Brain-Computer Interfaces (BCIs) using Google Glass. As lead researcher, showed the possibility of LED based Steady State Visually Evoked Potential (SSVEP) and Auditory Steady State Response (ASSR) at multiple frequencies. Project funded by Google for \$80,000.

Brain Computer Interface(BCI) for Google Glass 2014-2015

Steady State Visually Evoked Potential (SSVEP) based Mobile BCI for Head Mounted Displays. Responsible for designing research study, performing user study and analysing data.

BBCS (Bio-behavior Capture System) for Children with Autism Spring 2014

Developed BBCS Android tablet application for video recording autistic children at home and annotating video stream to flag and review content. Pilot tested BBCS in home of autistic children and conducted unstructured interview of family members. Funded by Simons Institute.

STUDENTS ADVISED

Daniela C. Rodriguez (UG CS)	Jan 2021-present
Injoo Moon (UG EE)	Jan 2021-present
Ali Mirzazadeh (UG CS)	Sept 2019-present
Qiuyue Xue (MS CS): Graduate student at University of Washington	Feb 2018- 2019
Peter McAugen (MS CS) : Software Engineer at Microsoft	Sept 2018- 2019
Dhruv Bansal (UG CS) : Graduate student at Stanford	Sept 2018- May 2019
Michelle Ma (MS-HCI) : UX designer at Amazon	Sept 2018- May 2019
Diego Osorio (MS-HCI) : UX Engineer at SimSpace	Sept 2017 - May2019

REFERENCES

Dr. Gregory Abowd, Regents'Professor and J.Z. Liang Chair, School of Interactive Computing, Georgia Institute of Technology , abowd@gatech.edu

Dr. Thad Starner, Technical Lead/Manager on Google's Glass and Professor, School of Interactive Computing, Georgia Institute of Technology, thadstarner@google.com