Nivedita Arora
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RESEARCH FOCUS

My research envisions creating **sustainable computational materials and things** that operate by harvesting energy from the environment and, at the end of their life cycle, can be responsibly composted or recycled. For this, my research process involves working at the intersection of device fabrication, low-power systems, and design. I actively look to apply my work to application domains like smart homes, health, accessibility, biodiversity, and urban infrastructure monitoring.

My first realized example of sustainable computational material, **interactive stickers**, has appeared in ACM IMWUT, ACM UIST, ACM MobiSys, and Communications of the ACM. It has won **2 best papers** (ACM IMWUT, ACM SenSys-ENSsys), **2 best poster awards (MobiSys, UIST)** and research highlights in Communications of the ACM and SIGMOBILE GetMobile Magazine. I was named the winner of the **Gaetano Borriello outstanding student** award in the ACM Ubicomp and ISWC community, **Foley scholar** in Georgia Tech's GVU Center, **Outstanding GRA** in Georgia Tech's College of Computing and MIT rising stars in EECS.

EDUCATION

Ph.D. Computer Science - Intelligent Systems Aug. 2016 - Dec 2022 (expected)
Georgia Institute of Technology, Atlanta
Thesis: *Sustainable Interactive Wireless Stickers: From Materials to Devices to Applications*
Advisor: Gregory D. Abowd, Thad Starner

M.S. Human-Computer Interaction - Interactive Computing Aug. 2014 - May 2016
Georgia Institute of Technology, Atlanta
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 Multi-language Snapshot Translation and Speech System*
Advisor: Mohinder P.S. Bhatia

AWARDS

A15. **Best position paper**, International Workshop on Energy Harvesting & Energy-Neutral Sensing Systems, 2022

A14. Finalist, Fast Company Design Innovation Competition in Experimental Category for work on a computational facemask, 2022

A13. **Outstanding Graduate Research Assistant Award** in Georgia Tech's College of Computing, 2022

A12. **GVU foley Scholar**, Georgia Institute of Technology, 2021

A11. Winner, **ACM Ubiquitous Computing Gaetano Borriello Outstanding Student Award**, 2021

A10. Scholarship recipient, Richard Tapia Celebration of Diversity in Computing Conference, 2021

A9. **EECS Rising stars**, Massachusetts Institute of Technology, 2021

A8. Honoree, Fast Company Design Innovation Competition in Experimental Category for work on self-powered stickers, 2021

A7. Young researchers, Heidelberg Laureate Forum, 2020

A6. **Distinguished Paper**, ACM Ubicomp conference, 2019

A5. **Best poster**, ACM MobiSys conference, 2019

A4. **Best poster**, ACM UIST conference, 2018

A3. Final round, Qualcomm Innovation Fellowship, 2018

A2. 2^{nd} position in powering internet of things poster presentation, NextFlex Workshop, 2017

A1. **Faces of Inclusive Excellence**, Georgia Tech, 2015

FELLOWSHIPS

F8. $550 travel grant by GT's GVU and SGA for attending ACM MobiSys Conference, 2022

F7. $30,000, graduate research assistant position sponsored by HEERF Covid funds, Georgia Tech, 2022

F6. **$180,000 research grant** by Cisco for my Ph.D. dissertation, 2021

F5. $1000 Travel Scholarship by College of Computing, Georgia Tech, 2019

F4. $50,000 NSF I-Corps Commercialization grant for Self-sustainable Building Water Leak Detection project 2019

F3. $2000 provost travel grant, Career Research and Innovation Development Conference (CRIDC), Georgia Tech, 2019

F2. $1500 Travel grant by Career, Research, and Innovation Development Conference (CRIDC), Georgia Tech, 2018

F1. $18,0000 international research fellowship, American Association of University Women (AAUW), 2016

PUBLICATIONS

C12. **N. Arora**, V. Iyer, H. Oh, G.D. Abowd and J. Hester. **Circularity in Energy Harvesting Computational T̈hings:** In The 20th ACM Conference on Embedded Networked Sensor Systems (SenSys22), November 6–9, 2022. **[Best Position Paper, ENSsys Workshop]**

C11. 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, January 2022

C10. 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, December 2021. **[Finalist, Fast Company's Innovation by Design Competition, Featured in Scientific American]** article link project website

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. short video talk video **[Honoree, Fast Company's Innovation by Design Competition]**

C8. **N. Arora**, T. Starner and G. D. Abowd. **SATURN: An Introduction to the Internet of Materials.** Communications of the ACM. January 2021. **[20,000 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. Löchtefeld, M. Carnie, N. Henze, S. Hodges, M. Jones, **N. Arora** and G.D. Abowd. **Self-Sustainable CHI: Self-Powered Sustainable Interfaces and Interactions.** Extended Abstracts of CHI Conference on Human Factors in Computing Systems. April 2020. workshop link

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

D10. MARS: Nano-Power Battery-free Wireless Interfaces for Touch, Swipe, and Speech Input. ACM Symposium on User Interface Software and Technology. October, 2021

D9. CO-SENSE: Self-sustainable Carbon-Monoxide Gas Sensing Material. Microsoft Research Internship Showcase, Redmond, WA. August, 2019.

D8. Surface++ – A Scalable and Self-sustainable Wireless Sound Sensing Surface. ACM MobiSys - Annual International Conference on Mobile Systems, Applications, and Services, South Korea. June, 2019.

D7. Self-sustainable Water Leak Detection System, Career, Research and Innovation Development Conference, Georgia Tech, Atlanta, GA. November, 2018. **[Winner $2000 grant]**

D6. ZEUSSS: : Zero Energy Ubiquitous Sound Sensing Surface Leveraging Triboelectric Nanogenerator and Analog Backscatter Communication. ACM Symposium on User Interface Software and Technology. October, 2018. **[Winner]**

D5. SATURN: A thin and flexible self-powered microphone leveraging triboelectric nanogenerator. ACM Ubicomp Conference, Singapore. October, 2018.

D4. SATURN: A thin and flexible self-powered microphone leveraging triboelectrification. Career, Research, and Innovation Development Conference, Georgia Tech, Atlanta, GA. November, 2017 [2^{nd} **Position**]

D3. SATURN: A thin and flexible self-powered microphone leveraging triboelectrification. NextFlex: Powering the Internet of Everything by Georgia Electronic Design Center (GEDC), Atlanta, GA. September, 2017 [2^{nd} **Position**]

D2. SATURN: A thin and flexible self-powered microphone leveraging triboelectrification. CRNCH (Center for Research into Novel Computing Hierarchies) Center Summit, Atlanta, GA. September, 2017

D1. ASSCI : Adaptive Switch for Scanning Control Interface. GVU Center Research Showcase, Georgia Institute of Technology. April, 2016

RESEARCH EXPERIENCE

- **Postdoctoral researcher, Kamoamoa Ubicomp Lab**
  Georgia Tech Jan 2023 - Aug 2023(expected)
  Advisors: Josiah Hester
  Designing and building future sustainable computational things for applications spanning biodiversity monitoring, health, and smart homes.
- **Graduate Research Assistant, Ubicomp Lab**
  Georgia Tech Aug 2016- Dec 2022
  Advisors: Gregory Abowd, Thad Starner
  Responsible for carrying out research on sustainable interactive stickers.
  Project funded by Cisco $180,000
- **Research Intern, Urban Innovation Initiative**
  Microsoft Research Lab, Redmond Summer 2019
  Manager: Vaishnavi Ranganathan, Victor Bahl
  Working on building cheap, wearable, low-power gas sensor to allow the democratization of air quality for increased awareness about the environment.
- **Research Intern, Anticipatory Computing Lab**
  Intel Research Lab Summer 2015
  Manager: Lama Nachman
  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 the 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.
- **Graduate Research Assistant, Brain Lab**
  Georgia Tech Aug 2014 - May 2016
  Advisors: Thad Starner, Melody Moore Jackson
  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.
- **Graduate Research Assistant, Ubicomp Lab**
  Georgia Tech Jan 2015 - May 2015
  Advisors: Gregory Abowd
  Developed BBCS Bio-behavior Capture System) Android tablet application for video recording autistic children at home and annotating video streams to flag and review content. Pilot tested BBCS in homes of autistic children and conducted unstructured interviews of family members. Funded by Simons Institute.

TEACHING EXPERIENCE

- Teaching Assistant, Artificial Intelligence Summer 2020 , Fall 2020
- Teaching Assistant, Mobile and Ubiquitous Computing Summer 2022 , Spring 2017, Spring 2019
- Teaching Assistant, Graduate Group Orientation Course Fall 2018
- Teaching Assistant, Introduction to Artificial Intelligence Summer 2018
- Mentor, Texas Instruments Summer Internship Workshop, Delhi University 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

- *Self-powered Acoustic Vibration Sensing Stickers: Devices, Systems and Applications*
  Amazon Lab 126 (Host: Wontak Kim) Aug, 2022
- *Towards Self-powered Interactive Material for Mixed Reality Experiences*
  HCI Seminar series, Meta Reality Labs (Host: Kashyap Todi) July, 2022
- *Self-powered Acoustic Vibration Sensing Material*
  1^{st} ACM International Workshop on Intelligent Acoustic Systems and Applications Workshop, MobiSys, Portland July, 2022
- *Designing for Sustainability in Computing: Self-Powered Computational Material*
  Brown Bag, GT's GVU Center May, 2022
- *Self-Powered Vibration Sensing Material*
  Emerging Tech and Incubation group, Cisco (Host : Ramana Kompella) May, 2022
- *Self-sustainable Wireless Interface Stickers*,
  Systems and Networking Research Group (SyNRG),
  UIUC (Host: Romit Roy Choudhury) Dec, 2021
- *Self-sustainable Computational Stickers*,
  Responsive Environment Group,
  MIT Media Lab (Host: Joe Paradiso) Oct, 2021
- *Self-sustainable Computational Stickers*,
  HCI Engineering Group,
  MIT CSAIL (Host: Stefanie Mueller) Oct, 2021
- *Building self-sustainable gas sensing material*,
  Molecular Information Systems Lab,
  University of Washington (Host: Luis Ceze) Oct, 2019
- *How to give good poster presentations, Ubicomp Lab*, Georgia Tech Sept, 2019
- 5^{th} generations of computing: Computational Materials, Guest Lecture,
  Mobile and Ubiquitous Computing, Georgia Tech April, 2019
- *Towards Printable Self-sustainable Sensing*,
  HP Labs (Host: Tico Ballagas) Jan 2019

SERVICE

- **Program Committee** Work-in-Progress ACM Tangible, Embedded and Embodied Interaction (TEI) (2021), CHI Late-Breaking-Work (2022), ACM MobiSys Workshop Digibiom (2022)
- **Conference Session Chair** ACM UIST On-Body Interaction, 2021
- **Paper Reviewer:**
  UbiComp (2016, 2017, 2019),
  Mobile HCI (2018),
  ISWC (2017,2022),
  CHI (2018, 2019, 2020,2021, 2022),
  IUI (2021),
  TEI (2021)
- **Student Volunteer** ACM UbiComp Conference, Virtual Event (2020), Ubiquitous Computing Conference in Osaka Japan (2015)
- **Founding Member**, Science for a Billion (SFAB)
  Initiative to promote RnD initiatives in India
- **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
- **Founder**, Mobile Development Group, Delhi University 2011 - 2012

STUDENTS MENTORED

Material Science

- *Sutikshan Bansal* (MS) Aug 2022-Present
- *Philothei Sahinidis* (UG) Aug 2022-Present
- *Yazan Binnasser* (UG) Aug 2022-Present
- *Harsh Kumar Verma* (MS) Aug 2022-Present
- *Sriram Srirangan* (MS) Aug 2022-Present

Electrical Engineering

- *Anfisa Bogdanenko* (UG) Aug 2022-Present
- *Injoo Moon* (UG): Research Engineer at MIT Langer Lab Jan 2021-May 2022

Mechanical and Aerospace Engineering

- *Bill Yen* (UG) Oct 2022-Present
- *Mohit Gupta* (Ph.D.): Research Scientist at Apple Aug 2018-Aug2019

Computer Science and Engineering

- *Zhihan Zhang* (UG): Graduate student at UW Oct 2021-May 2022
- *Ali Mirzazadeh* (BS/MS): Graduate student at MIT Sept 2019-May 2022
- *Yunzhi Li* (MS): Graduate student at CMU Jan 2021-May 2021
- *Qiuyue Xue* (MS): Graduate student at UW Feb 2018- May 2019
- *Peter McAugen*(MS) : Software Engineer at Microsoft Sept 2018- May 2019
- *Dhruv Bansal* (UG): Graduate student at Stanford Sept 2018- May 2019

Design and HCI

- *Daniela C. Rodriguez* (UG): UX Designer Adobe Jan 2021-July 2021
- *Jin Yu* (MS): Graduate student at Gatech Aug 2019-Feb 2020
- *Michelle Ma* (MS): UX designer at Amazon Sept 2018- May 2019
- *Diego Osorio* (MS): UX Engineer at SimSpace Sept 2017 - May 2019
- *Fereshteh Shahmiri* (MS): Graduate student at Gatech Sept 2017 - May 2019

REFERENCES

Dr. Gregory D. Abowd, Dean of the College of Engineering and Professor in Electrical and Computer Engineering, Northeastern University, g.abowd@northeastern.edu

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

Dr. Hyunjoo Oh, Assistant Professor, College of Design and School of Interactive Computing, Georgia Institute of Technology hyunjoo.oh@gatech.edu

Dr. Josiah Hester, Associate Professor, Interactive Computing and Computer Science, College of Computing, Georgia Institute of Technology josiah@gatech.edu

Dr. Canek Fuentes, Associate Professor, Department of Electrical and Computer Engineering, Northeastern University c.fuentes@northeastern.edu