Nivedita Arora

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RESEARCH FOCUS

My research envisions creating **sustainable computational materials** such that everyday objects and surfaces have computational properties integrated into them with a sustainability-first approach throughout their entire life-cycle, from manufacturing to operation and to disposal or reuse. 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 - Jan 2023

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. 2nd 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

EMPLOYMENT

- **Postdoctoral researcher, Kamoamoa Ubicomp Lab**
  Georgia Tech   Jan 2023 - Aug 2023 (expected)
  Advisors: Josiah Hester
  Designing 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
  Built sustainable interactive stickers for indoor sensing applications.
  Project funded by Cisco $180,000

- **Research Intern, Urban Innovation Initiative**
  Microsoft Research Lab, Redmond   Summer 2019
  Manager: Vaishnavi Ranganathan, Victor Bahl
  Built 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 finger motion sensing ring and its algorithm to enable people with Motor Neuron Diseases (MND) to type using Intel's ACAT.

- **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. Project funded by Google for $80,000.

- **Graduate Research Assistant, Ubicomp Lab**
  Georgia Tech   Jan 2015 - May 2015
  Advisors: Gregory Abowd
  Developed and tested the usability of software that video records autistic children at home
  and annotates video streams to flag and review content. Funded by Simons Institute.

PUBLICATIONS

C14. (Under review ACM IMWUT) B. Yen, P. Sahinidis, S. Bernstein, L. Jaliff, G. Marcano, C. Josephson, P. Pannuto, W. Shuai, G. Wells, **N. Arora**, J. Hester. Soil-Powered Computing: Application-Driven Design Space Exploration for Sustainable Computing Futures

C13. (Under review ACM USENIX) Y. Do, **N. Arora**, et. al. Powering for Privacy: Improving User Trust in Smart Speaker Microphones with Intentional Powering and Perceptible Assurance

C12. **N. Arora**, V. Iyer, H. Oh, G.D. Abowd and J. Hester. **Circularity in Energy Harvesting Computational Things:** 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 [2nd **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 [2nd **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

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

- *Building Sustainable Computational Materials*
  UMass CS (Host: Ravi Karkar)   Mar, 2023
  UC Berkeley EECS (Host: Sarah Chasins)   Feb, 2023
  University of Chicago CS (Host: Pedro Lopez)   Feb, 2023
  Northwestern University ECE (Host: Russ Joseph)   Feb, 2023
  University of Mich EECS (Host: Alanson Sample)   Feb, 2023
  Tufts University ECE (Host: Thomas Vandervelde)   Feb, 2023
  North Carolina State University CS (Host: Muhammad Shahzad)   Feb, 2023

- *Designing Sustainable Computational Things*
  9th International Conference on Networking, Systems and Security
  Bangladesh University of Engineering and Technology   Dec, 2022

- *Circularity in Energy Harvesting Computational "Things"*
  10th International Workshop on Energy Harvesting Energy-Neutral
  Sensing Systems, Boston   Nov, 2022

- *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*
  1st 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

- 5th *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

- **Organising Committee** Publicity Social Media Chairs, ACM Ubicomp 2023

- **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 Engineering

Rachel Hobby (UG)	Jan 2023-Present
Julia Fleischman(UG)	Jan 2023-Present
Claire Joo (UG)	Jan 2023-Present
Harsh Kumar Verma (MS)	Aug 2022-Present
Sutikshan Bansal (MS)	Aug 2022-Dec 2022
Sriram Srirangan (MS)	Aug 2022-Dec 2022
Philothei Sahinidis (UG)	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 Engineering

Nicolas Cai (UG):	Jan 2023- Present
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