

# AMITABHA GHOSH

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## OBJECTIVE

Looking for a summer internship position in the area of Computer Networks and Pervasive Computing.

## RESEARCH INTEREST

Design and analysis of algorithms, mathematical modeling, and performance evaluation of ad hoc wireless and sensor networks.

## EDUCATION

**University of Southern California** Los Angeles, CA, Aug 05 - Present  
Ph.D., Electrical Engineering; Expected Spring 2010; Member of the Autonomous Networks Research Group.  
Specialization: Wireless Sensor Networks, Embedded Systems, Security.  
Minor: Computer Science.  
Advisor: Dr. Bhaskar Krishnamachari.

**Indian Institute of Science** Bangalore, India, Aug 96 - Jul 00  
Master of Engineering (Integrated), Computer Science and Engineering.

**Indian Institute of Technology** Kharagpur, India, Aug 93 - Jul 96  
Bachelor of Science (Hons.), Physics.

## SKILLS

- *Programming*: C, C++, Java, Perl, NesC, Tcl/Tk
- *Operating Systems*: Linux/Unix, Windows, TinyOS
- *Simulation Tools*: MATLAB, Mathematica, GNU R, TOSSIM
- *Miscellaneous*: TCP/IP, CVS/SVN, Eclipse, JBuilder, m4, gdb/g++, Mica2, TmoteSky, Sun SPOT

## ACADEMIC EXPERIENCE

### Relevant Course Work

- (EE465) Probabilistic Modeling and Queuing Theory; (EE 549) Queuing Theory for Performance Modeling; (CSCI 570) Analysis of Algorithms; (EE 450) Computer Networks; (CSCI 402) Operating Systems; (EE 652) Wireless Sensor Networks; Wireless Security; Database Systems; Computational Geometry; (CSCI 551) Computer Communications; (EE 532) Wireless Pervasive Computing; (EE 555) Broadband Network Architecture; (Math 425a, 425b) Principles of Mathematical Analysis.

### Relevant Graduate Research

(Please refer to publications for details)

- **Algorithms for Fast Aggregated Convergecast and Topology Design:**  
Designed constant factor approximation and randomized algorithms for topology construction and TDMA scheduling using multiple frequency channels to study the throughput-delay trade-off for aggregated convergecast in wireless networks. One of the first algorithmic works exploiting the benefits of multiple frequency channels to eliminate interference.
- **Sensor Coverage & Connectivity Issues in Wireless Networks:**  
Designed a distributed algorithm using Voronoi diagrams for maximizing the coverage with guaranteed connectivity for mobile ad hoc networks. One of the first works that considers the possibility of hybrid networks using both static and mobile sensor devices.
- **Peer-to-Peer Networks:**  
Designed and implemented a peer-to-peer system similar to Bit Torrent using socket programming in C. Evaluated impact of different user behaviors and network conditions.

- **Topology Control in 3D Wireless Networks:**

Designed distributed topology control algorithms catered to three dimensional wireless networks with time complexity  $O(d \log d)$  compared to the state-of-the-art  $O(d^3 \log d)$ , where  $d$  is the average node degree. Optimization of transmission power levels using local geometric information.

- **Analysis of Slotted ALOHA/CSMA:**

Analyzed the stability region for multi-user wireless broadcast networks using constrained optimization formulation under the collision channel model. State-of-the-art techniques are limited to only two user case in finding closed form expressions for the stability region.

- **Structural Health Monitoring:**

Analyzed node deployment strategies and designed routing topologies to reliably diagnose the health of civil infrastructures with minimum energy consumption. The idea is to use local excitation and high-resolution measurements of responses to detect damages and collaboratively analyze through a spatially dense network of sensors.

## Teaching and Mentoring

- Mentored graduate students through hands-on tutorial sessions to program Mica2 and Tmote Sky motes in NesC on TinyOS platform for developing sensor network protocols and applications.
- Mentored directed research students to program Sun SPOT devices for design and implementation of RICER/TICER protocol.
- Conducted tutorial sessions and gave a lecture in Broadband Network Architecture (EE 555) class.

## RELEVANT INDUSTRY EXPERIENCE

### Siemens Corporate Research (*Summer Intern*)

Princeton, NJ, May 07 - Aug 07

- Automation Controls Group (RFID & Sensor Networks Lab): Designed and implemented an RF localization algorithm on Mica2 motes. Proposed a security solution for providing authentication, data confidentiality, and integrity of messages by applying Elliptic Curve Cryptography (ECC) and  $\mu$ -TESLA broadcast authentication protocol.

### Eaton Corporation (*Summer Intern*)

Milwaukee, WI, May 06 - Aug 06

- Embedded Systems & Communications Group: Modeling wireless sensor network architectures using AADL. Implemented a network-latency analysis plug-in under Bernoulli and Markovian wireless channel models. Recommendations to the AADL Standards committee and collaboration with SEI at Carnegie Mellon University for WSN specific extensions to AADL in the form of annexes.

### Honeywell (*Principal Research Engineer*)

Bangalore, India, Sep 03 - Dec 04

- Ubiquitous Computing Group (Embedded Security): Analysis and characterization of ciphers, hash algorithms (AES, DES, MD5, RC5, RC6, TEA), key management, and authentication protocols applicable in wireless sensor networks. Embedded programming in C on MSP 430 TI DSP processor.
- Wireless Sensor Networks: Designed and implemented algorithms for optimal node deployment to improve network coverage and connectivity in the context of target tracking; distributed sorting of network data; aggregation and re-programmability of sensor networks.

### Lucent Technologies Bell Labs (*Software Engineer*)

Bangalore, India, Jul 00 - Feb 02

- GSM Group: Developed algorithms in C to manage load distribution between circuit switched and packet switched traffic in GSM base stations. Developed an SNMP interface in C to monitor LAN switches. Developed features in C++ and Java for ATM switches. Implemented the functionality of Frame-SPVCs over PNNI routing protocol.

## AWARDS / CERTIFICATES

- Recipient of Research Assistantship with full tuition waiver at USC for Ph.D. studies, Aug 05 - present.
- Recipient of Teaching Assistantship at USC in Fall 07 (EE 652), Spring 08, 09, Fall 08 (EE 555).
- Recipient of GATE scholarship at Indian Institute of Science, Feb 99, India.

- Project Innovation Award from Honeywell Labs for the innovation titled: *A deterministic method using Voronoi diagrams to calculate exact coverage holes under random deployment of nodes in ad-hoc wireless sensor networks*, Jul 2004, Bangalore, India.
- Project Innovation Award from Honeywell Labs for the innovation titled: *COVEN: A collaborative COV-erage ENhancing algorithm in ad-hoc wireless mixed sensor networks*, Aug 2004, Bangalore, India.
- Runner's-up Young I.T. Professionals trophy from Computer Society of India for the paper titled: *A Distributed Sorting Framework for Ad Hoc Wireless Sensor Networks*, Amitabha Ghosh, Balamurugan Mohan, Dec 2004, Bangalore, India.
- DFSS & Six Sigma Green Belt Certification from Honeywell Labs.

## PUBLICATIONS

1. Amitabha Ghosh, Ozlem Durmaz Incel, V.S. Anil Kumar, Bhaskar Krishnamachari, *Algorithms for Fast Aggregated Convergecast in Sensor Networks*, CENG Technical Report CENG-2008-8, (under submission). [http://anrg.usc.edu/www/publications/papers/CENG-2008-8\\_TechReport.pdf](http://anrg.usc.edu/www/publications/papers/CENG-2008-8_TechReport.pdf).
2. Ozlem Durmaz Incel, Amitabha Ghosh, V.S. Anil Kumar, Bhaskar Krishnamachari, *Multi-Channel Scheduling for Fast Aggregated in Wireless Sensor Networks*, CENG Technical Report CENG-2008-9, (under submission). [http://anrg.usc.edu/www/publications/papers/CENG-2008-9\\_TechReport.pdf](http://anrg.usc.edu/www/publications/papers/CENG-2008-9_TechReport.pdf).
3. Amitabha Ghosh and Sajal K. Das, *Coverage and Connectivity Issues in Wireless Sensor Networks: A Survey*, Journal of Pervasive and Mobile Computing, vol. 4, no. 3, pp. 303–334, June 2008.
4. Sang Won Lee, Dukhee Yoon and Amitabha Ghosh, *Intelligent Parking Lot Application using Wireless Sensor Networks*, International Symposium on Collaborative Technologies and Systems (CTS), pp. 48–57, May 2008.
5. Amitabha Ghosh, Luis Pereira, Ting Yan and Hui Cao, *Modeling Wireless Sensor Network Architectures using AADL*, 4th European Congress on Embedded Real Time Software (ERTS), Toulouse, France, Jan 2008.
6. Amitabha Ghosh, Yi Wang and Bhaskar Krishnamachari, *Efficient Distributed Topology Control in 3-Dimensional Wireless Networks*, 4th Annual IEEE Communications Society Conference on Sensor, Mesh and Ad Hoc Communications and Networks (SECON), pp. 91–100, San Diego, CA, June 2007.
7. Amitabha Ghosh and Sajal K. Das, *Coverage and Connectivity Issues in Wireless Sensor Networks*, Book Chapter: Mobile, Wireless and Sensor Networks: Technology, Applications and Future Directions, John Wiley & Sons, 2006.
8. Amitabha Ghosh and Sajal K. Das, *A Distributed Greedy Algorithm for Connected Sensor Cover in Dense Sensor Networks*, 1st IEEE/ACM International Conference on Distributed Computing in Sensor Systems (DCOSS), pp. 340–353, Marina del Ray, CA, Jul 2005.
9. Amitabha Ghosh, *Estimating Coverage Holes and Enhancing Coverage in Mixed Sensor Networks*, 29th Annual IEEE International Conference on Local Computer Networks (LCN), Tampa, FL, pp. 68–76, Nov 2004.
10. Subhas K. Ghosh and Amitabha Ghosh, *A Plan-Commit-Prove Protocol for Secure Verification of Traversal Path*, 12th IEEE International Conference on Networks (ICON), pp. 458–462, Singapore, Nov 2004.

## PROFESSIONAL ACTIVITIES

- Reviewer of: JSAC, Ad Hoc Networks, EmNetS-II, MASS '05 '08, SECON '05, IWDC '05, EWSN '07, Globecom '07, ICC '07, DCOSS '07 '08, WiOpt '08, HotMobile '08, TPDS, TMC.
- Member of Technical Program Committee: LCN '06.

## EXTRACURRICULAR

- Member and event coordinator of the USC Table Tennis men's varsity team; USA T.T. rating  $\approx$  1800; (<http://www.pingpongposse.com>).
- Play an Indian musical percussion instrument, Tabla. Active member of USC music group "Anubhavan".
- Lateral thinking puzzles, Brain-teasers, Rubik's Cube (2 mins average), Chess, Sketching (<http://anrg.usc.edu/~amitabhg/Sketching.html>).
- General Secretary of Maintenance and Convener of T.T. club in IIT Kharagpur and IISc.

## REFERENCES

1. Prof. Bhaskar Krishnamachari  
Associate Professor  
Ming Hsieh Department of Electrical Engineering  
USC Viterbi School of Engineering  
Email: bkrishna@usc.edu  
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2. Prof. John Silvester  
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