

Megha Gupta

Department of Computer Science
Rensselaer Polytechnic Institute
110 Eighth Street
Troy, NY 12180

Tel: (518) 207-5103
Email: guptam@rpi.edu
<http://www.cs.rpi.edu/~guptam>

Education:

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| 2006 - present | M.S. in Computer Science (in progress)
Rensselaer Polytechnic Institute, Troy, NY
GPA: 3.95/4.0 (till date) |
| 2001 – 2005 | B. Tech. in Electrical Engineering
Indian Institute of Technology, Bombay, India
CPI: 8.09/10.0 |

Key projects undertaken:

- **Graduate Research** (Aug 2006 – till date): I am currently working on automation of **Digital Microfluidic Systems (DMFS)** with Prof. Srinivas Akella at RPI. DMFS are a class of lab-on-a-chip systems that manipulate discrete droplets for automated biochemical analysis. A DMFS controls individual droplets of chemicals on a planar array of electrodes and the chemical analysis is performed by moving, mixing and splitting droplets. We aim to exploit the tremendous flexibility and parallelism inherent in a DMFS by designing algorithms that automatically enable the coordination of hundreds or even thousands of droplets on the array in order to improve processing of biochemical assays dramatically. My goal is to develop **routing and scheduling algorithms for bus-phase hardware design**, in which a set of electrodes is controlled by the same signal to reduce hardware complexity. Some of our results have been published in the proceedings of 2007 IEEE/RSJ International Conference on Intelligent Robots and Systems. In addition, we have developed the capability to produce and test DMFS chips at RPI and are now working on interfacing our algorithms with DMFS hardware.
- **Course Project** (Nov 2006): As part of the **Robotic Manipulation** course at RPI, I used the Barrett Arm and Hand to do stable block stacking. The Barrett Hand is a multi-fingered grasper that can secure objects of different sizes, shapes and orientations. It uses industry-standard serial communication, on-board microprocessors and Grasper Control Language (GCL) to adapt to a wide variety of target objects. The blocks were of same shape but different sizes. The manipulator arm picked up the blocks and stacked them on top of one another in such a way that the resultant pile did not tumble. The DaVinci Simulator was also used to simulate the stacking process using different forces applied by the robot fingers.
- **Project as Research Engineer** (Aug 2005 – Jan 2006): Worked on the design of a mobile **sensor network**, under the guidance of Prof. Prabhat Ranjan at Dhirubhai Ambani Institute of Information and Communication Technology (DA-IICT), Gandhinagar, India. Our aim was to emulate the behavior of ants by designing light-following nodes which detect their local maxima, convey the information amongst themselves to find out the global maximum, and finally swarm towards the brightest source of light present. The first version of a testbed consisting of five modules: power, sensing, processing, communication and mobility; was developed successfully.
- **B. Tech. Project** (Aug 2004 – Apr 2005): Conceptualized the design of a **Counter-torque Control FPGA** under the guidance of Prof. S.S.S.P. Rao, IIT Bombay and in collaboration with Cadence Design

Systems, Bangalore, India. The objective was to control the angular rotation of two motors so as to minimize their backlash error. Verilog coding, compilation, verification and simulation of the codes were done for the same. Synthesis and hardware implementation of the design is being carried out at Cadence.

- **Project as Summer Intern** (May – July 2004): **Electronic Design Automation** (Cadence Design Systems, Bangalore) Gained expertise in Verilog coding and simulation. Worked extensively with the Cadence RTL synthesis tool, RC. Understood the fundamentals of top-down design flow in a constrained environment. A new micro-processor was designed for DSP applications which could perform 17-bit signed and unsigned operations including trigonometric functions. The various synthesis issues were studied and resolved.
- **Seminar** (Spring 2004): Did a literature survey on **navigation of mobile robots** under the guidance of Prof. K. Kurien Issac and Prof. Subhasis Chaudhuri. It involved an analytical study of the various techniques employed by robots for path-planning, obstacle detection and avoidance, given a partial map of the environment to be traversed. The techniques largely used laser range finders and stereo vision. The Voronoi graphs and cell-decomposition methods for path-planning were examined.
- **Electronic Design Project** (Spring 2004): Designed a **random noise generator** making use of pseudo-random sequence generator implemented using shift-registers. It also involved the design of discrete time filter and audio amplifier, with digitally selectable bandwidth, spectrum and output level. The random noise generator has applications in CDMA, anti-jamming techniques for security, testing circuits and various other fields.

Other Projects/ Assignments:

- Implemented several **computer vision** and **machine learning algorithms** in Matlab as part of the coursework at RPI. These included edge detection, contour tracking, stereopsis, classification, etc.
- Implemented a transmitter using **Frequency Hopping Spread Spectrum (FHSS)** technique, in the range of 100-200 MHz (Autumn 2004), **Square Wave Oscillator with variable gain and frequency** (Autumn 2003) and **Table Tennis game** using digital circuits (Spring 2002).
- Demonstrated **Parallel Searching and Sorting** implemented using *Pthreads* Library in Linux (Autumn 2003). Implemented Boolean Function reduction of n-variables using **Karnaugh Map** in C++, generation of SOP & POS forms included (Spring 2003).

Publications:

- M. Gupta and S. Akella, "A Scheduling and Routing Algorithm for Digital Microfluidic Ring Layouts with Bus-phase Addressing", 2007 IEEE/RSJ International Conference on Intelligent Robots and Systems, San Diego, CA, October 2007.

Computer Skills:

- Programming Languages: C, C++, Verilog, 8085 Microprocessor.
- Software: Matlab, RC(RTL Compiler), Keil, Eagle (for PCB design), Ansys.

Relevant Courses:

- Computer Algorithms
- Machine Learning
- Computability and Complexity

- Robotic Manipulation
- Computational Vision
- Linear Algebra
- Complex Analysis and Partial Differential Equations
- Calculus
- Control Systems
- Digital Circuits
- Analog Circuits
- Microprocessors

Academic Achievements :

- 158th rank in IIT-JEE 2001. Stood amongst the top 0.1% of students who appeared for this examination.
- 100% in the AISSCE Mathematics Examination, 2001. Stood amongst the top 0.1% of students who appeared for this examination.
- National Talent Search Scholar, Government of India, 1999 – 2005.
- State Talent Search Scholar, State Government of Rajasthan, India, 1999.

Extra Curricular Activities:

Organizational:

- Hostel citation for organizational and cultural contribution from July 2001 – May 2005 at IIT Bombay.
- Hostel student mentor for the period July 2004 – April 2005.
- General Secretary of the Electrical Engineering Students' Association from Mar 2004 to Feb 2005 and Joint Secretary for the period Apr 2003 - Mar 2004.
- Overall Coordinator of the hostel team in the Performing Arts Festival 2005.
- Coordinator in the Marketing Department of Techfest 2003, Asia's biggest technical festival.
- SPIC MACAY volunteer and chief coordinator for artistes performing at IIT Bombay (2003).

Others:

- Participated in the second level of **Yantriki**, the biggest robotics competition in India, in 2003. Made a machine that played Table Tennis. The machine was ranked amongst the top ten machines.
- Participated in the first level of **Yantriki**, 2002. Made a machine that jumped from a platform onto a sand-bed, traversed it, went up an incline and finally parked in a garage.
- Successfully completed the Basic Mountaineering Course conducted by the Directorate of Mountaineering and Allied Sports, Manali, in 2003. Trained in trekking, rock climbing, rapelling, jumaring, snow and ice climbing, glissading and survival tactics. Scaled 15,000 ft in the Himalayas.