Siddharth Swaminathan

MS Applicant in Mechanical Engineering

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Research Interests

Manipulation, Planning and Scheduling, Mobile Robots, Human-Robot Interaction, Haptics.

Education

- **Indian Institute of Technology Madras, Chennai** Aug 2009 – Present
  BTech. in Mechanical Engineering; **CGPA:** 9.10/10 (Top 10% in a class of 67)
  - Minor: **Operations Research**
  - **Key Courses:** Robotics and Robot Applications, Mechatronic Systems, Control and Instrumentation, Theory of Mechanisms, Advanced Operations Research, Kinematics and Dynamics of Machinery, Probability Statistics and Stochastic Processes, Basic Electrical Engineering, Computational Engineering
  - **GRE:** 326/340 [1390/1600] (Quant: 167/170 [800/800]; Verbal: 159/170 [590/800]; Analytical Writing: 4.5/6)
  - **TOEFL:** 117/120 (R: 29/30 W: 30/30 L: 30/30 S: 28/30) | **IELTS:** 8.5/9 (R: 9.0/9 W: 8.0/9 L: 9.0/9 S: 8.0/9)

Scholastic Achievements and Awards

- Recipient of the **Singapore Technologies Scholarship** for outstanding academic and co-curricular performance. Awarded to **only 6 students out of 700** from the '09 batch. Entire **undergraduate studies funded** by the same.
- Awarded **Certificate of Merit and Gold Medal** by the Indian Association of Chemistry Teachers for being in the **top 35 selected from all over India out of 29165 students** to attend the International Chemistry Olympiad training camp.
- **Outstanding performance award** for being in the **top 28** students selected **from all over India** to attend the national level training camp for International Olympiad in Informatics (IOI), **from over 2,800 candidates** enrolled.
- **National Winner**, GE Edison Challenge 2011 (India's largest engineering competition) among over **70 participating teams** in providing a holistic solution for water management in building complexes.
- **Ranked 7^{th}** in the National round of the ACM Inter-Collegiate Programming Contest in a team of 3. **Represented IIT Madras** in the regional round at Amritapuri in 2009.
- Placed among the **top 1%** in the National Standard Examinations in Physics, Chemistry and Astronomy **among over 35000, 29000 and 8000 candidates** respectively in 2008-09.
- **One among the 400** students qualified to write the Indian National Mathematics Olympiad during 2008-09.
- **Ranked 368^{th} among 400,000** candidates in the IIT Joint Entrance Examination 2009.
- **Ranked 126^{th} among 1,000,000** candidates in the All India Engineering Entrance Examination 2009.
- **Awarded the Certificate of Merit** in recognition of **excellence in academics** by the Government of India (Commissioner of Customs) in Grades X and XII.

Projects and Research Experience

- **Mobile Extensible Robotic Inspection System (MERIS)** Sep 2012 – Present
  Mentor: Prof. Krishnan Balasubramanian, IIT Madras
  - Objective: To design a remotely operated mobile robotic inspection system with a linear actuator whose stroke length is 30 times its nominal height; actuator to be equipped with cameras to provide real time video feedback.
  - Initial design of a statically stable structure assembled with metal strips that can be coiled has been made.
- **Machine Vision: Position control of Servo using hand gestures** April 2012
  Mentors: Professors Singaperumal M, Manivannan P V and Somashekhar S, IIT Madras. *Course: Mechatronics*
  - Developed an image processing system using Eigenimages, Kalman filter and the CamShift algorithm in C++/OpenCV to recognize multiple hand gestures; interfaced an Arduino via Serial Communication.
  - Implemented PID control to position a servomotor based on the signal generated by the gesture.
- **Autonomous Robot: Pick and place objects in known terrain** Sep 2010 – Mar 2011
  Mentor: Prof. Sandipan Bandyopadhyay, IIT Madras
  - Designed and developed an autonomous robot capable of solving a known grid in the shortest time, while picking and placing cylindrical objects as part of the International Robotics Contest, ABU Robocon 2011.
  - Developed strategies to communicate with other robots in the field in performing coordinated tasks.
- **Ultrasonic Ray Propagation in Inhomogeneous Anisotropic Media** Aug 2012 – Present
  Mentor: Prof. Krishnan Balasubramanian, IIT Madras
  - Objective: To model ultrasonic wave propagation in anisotropic, inhomogeneous media (qP, qS_1 and qS_2 modes).
  - Quantification of material properties (inverse problem) from the results of a A-scan using genetic algorithms.

- **Assistive Mechanism design for Human Walking Gait** Nov 2012
  Mentor: Prof. Sujatha Srinivasan. *Course: Theory of Mechanisms*
  - Designed a single degree of freedom planar linkage to be used in a device (exoskeleton) that enables walking for people with locomotor disabilities by coupler curve synthesis. Modeled and analyzed the same in MSC Adams.
- **Energy Efficient, Smart Water Management System** Sep 2011 – Dec 2011
  Mentor: Prof. Swaminathan T, IIT Madras
  - Conceptualized a multi-level water storage system for buildings. Estimated reduction of 40% in pumping energy requirement for a 5-storied building; well received by the research community at GE Global Research Center.
  - Developed control logic and simulated the same using MathWorks Simulink for automated, intelligent water level maintenance in multiple tanks. Modeled further improvements such as use of machine learning techniques to identify consumption patterns, optimized scheduling of valve operations and fluid flow, etc.
  - Designed and fabricated a commercially feasible device to measure consumption of water in an apartment using force transducers as opposed to conventional flow sensors, leading to an improved accuracy of measurement.

Industrial Research

- **Defect location in Isotropic media for Ultrasonic Testing** May 2011 – Jul 2011
  General Electric, Global Research Center, John F. Welch Technology Center
  - Developed a 3D visualization technique to represent the location of defects onto the actual inspection geometry using C++ and OpenGL. Implemented algorithms to combine the Amplitude and Time of Flight data from 80 probe channels, cross-reference and accurately locate the source of reflections.
  - Designed and conducted experiments to validate the accuracy of the simulation results.
- **Improvement of packing accuracy of volumetric filling machines** May 2012 – Jul 2012
  ITC Ltd. (Leading FMCG manufacturer in India)
  - Developed an Event-based PID controller using the open-source electronics platform, Arduino to provide real time feedback for a bulk-material packaging process.
  - Used Control Charts to identify and mitigate sources of variation by applying Western-Electric and Nelson rules.
  - Designed mechanical attachments to the Volumetric Feeder to improve accuracy by 50%, after a comprehensive study of the dynamics of the machine and bulk flow properties of the material being packaged; led to potential annual savings of **INR 45 million** when fully implemented.

Teaching and Leadership Experience

- **Head of Web-Operations, Shaastra, IIT Madras** 2011
  - **Nominated by the Dean of Students to lead a team of 21 members** in designing and developing mobile applications and the website for Shaastra 2011, which had more than 100,000 unique visitors.
  - **Conceptualized and initiated** the IIT Madras Enterprise Resource Planning solution, a centralized web-based platform to manage all the resources and functions of Shaastra, Saarang[1], and Campus Recruitments.
  - Instituted IIT Madras' first ever Web-Operations club to train students in mobile and web development.
- **Technical Affairs Secretary, Mandakini Hostel, IIT Madras** 2011 - 2012
  - Conducted workshops on practical Autonomous and Manual Robotics and other basic engineering skills for more than 60 participants. Led the hostel in all its technical activities as part of the technical society of IIT Madras.
- **Advanced Chemistry classes for high school students** 2009
  - Trained a class of 90 high school students towards IIT Joint Entrance Examination for 2 months.
  - Designed assignments, conducted discussion forums and problem solving sessions.

Technical Skills

- **Languages:** C/C++, Python, MATLAB, LaTeX, Bash, HTML, CSS, PHP, MySQL, Ajax
- **Electronics:** 8-bit AVR micro-controllers (Atmega 8/16/32), Arduino
- **Software:** OpenGL, OpenCV, SolidWorks, Pro/ENGINEER, Simulink, Adams, Eagle, R, Visual Studio, Django
- **Operating Systems:** Proficient in Windows, Linux and OS X environments.

Extra-Curricular Activities

- **Finalist,** NASSCOM Social Innovation Honors 2013. National top 3 in the **Student Innovators** category.
- **Sports:** Member of IIT Madras Basketball team; selected for National Sports Organization training program.
- **Community Service:** Active member of Sri Sathya Sai Organization since 2001, involved in activities such as reading to the blind, organizing health check-up camps, etc.
- Winner of **Image Processing and Autonomous Robotics** contest at Shaastra 2011 among over 55 participating teams.

[1] Shaastra and Saarang are IIT Madras' student organized technical and cultural festivals respectively