

Saurav Agarwal

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Summary: Entrepreneurial engineer with experience in Robotics (SLAM, Motion Planning, Estimation and Control, Computer Vision). Published 5 papers and 5 patents. Currently 1 publication and 1 provisional patent under review. On track to graduate from Ph.D. in December 2017.

Education

Doctor of Philosophy | Texas A&M University | USA Jan '13- Present

Major: Aerospace Engineering **GPA:** 3.8/4

Research Areas: Robotics, SLAM, Motion Planning, Estimation and Control

Awards: 2015 Roberto Padovani Scholarship for Technical Excellence (Qualcomm Inc.), \$50,000
NSF I-CORPS grant for technology commercialization

M.Sc by Research | Cranfield University | United Kingdom Jan '11-Jan '12

Major: Aerospace Engineering

Research Areas: Robotics, Computer Vision, Simultaneous Localization and Mapping

Bachelor of Technology | Indian Institute of Technology, Bombay | India Aug '06-May '10

Major: Aerospace Engineering **GPA:** 7.13/10

Courses: Mechatronics, Dynamics & Controls, Aerodynamics/CFD, Structural Mechanics

Research Experience

Planning, Estimation and Control for Mobile Robots | Texas A&M University, USA Jan '13-Present

Currently working on a novel SLAM algorithm that reduces computation complexity while removing inaccuracies due to initial guess error in existing non-linear optimization-based SLAM methods. Previously developed a multi-modal motion planner (M3P) that enables a lost robot to recover from kidnapped situations. Further, I actively develop and maintain an **open source C++** library for belief space motion planning which has been successfully implemented on physical mobile robots and the results published in international conferences. Code available: <https://github.com/sauravag/edpl-ompl>

Robotics Research Intern | Qualcomm Research Center, San Diego May '15-Dec '15

Developed a Simultaneous Planning and Mapping algorithm for unknown environments using stereo vision enabling full on board autonomy for micro-aerial vehicles. Also developed flight control applications for autonomous vision based target following. Awarded scholarship for excellence in research, submitted 5 inventions for patents.

Autonomous Quadrotor Aerial Vehicle | Cranfield University, UK Jan '11-Jan '12

Successfully designed, developed and flight tested a quadrotor micro-aerial vehicle capable of autonomous navigation and mapping of unknown environments. Single handedly programmed all embedded stability, guidance and navigation software including communication protocols. To accurately estimate position and orientation, an EKF based visual Simultaneous Localization and Mapping (SLAM) algorithm was implemented in C++.

Research Developer | Self-Driving Car | Hi-Tech Robotic Systemz Ltd., India Mar-Apr '12

Implemented navigation control systems simulator in MATLAB and ground control station software modules for India's first industrial **self-driving car** program.

Research Assistant | Satellite Based Navigation | IIT Bombay, India Oct-Dec '10

Developed a MATLAB toolbox to simulate GPS. Implemented a new positioning algorithm that enables automatic aircraft landing without ground based systems. (**results published*)

Entrepreneurship/Professional Experience

Founder/CEO | GuideBuddy.me

May '13-May '15

Launched crowdsourcing travel platform for booking local guides online. Led business operations, developed website backend (Python/Django) and spearheaded user growth to 15+ cities worldwide.

Application Engineer | Altair Engineering Ltd. | United Kingdom

May '12 - Jan '13

Delivered custom vehicle modeling (multi-body dynamics) and numerical analysis solutions along with technical support and training to auto/aero OEMs across UK. Successfully assisted sales in growing customer base for Altair's MotionView/MotionSolve/HyperMath packages.

Selected Publications

- **Saurav Agarwal**, Vikram Shree and Suman Chakravorty, “*RFM-SLAM: Exploiting Relative Feature Measurements to Separate Orientation and Position Estimation in SLAM*,” In Proc. IEEE International Conference on Robotics and Automation (ICRA), Singapore, May 29 - June 3, 2017.
- A. Agha-mohammadi, **Saurav Agarwal**, Suman Chakravorty and Nancy Amato, “*Simultaneous Localization and Planning for Physical Mobile Robots via Enabling Dynamic Replanning in Belief Space*,” submitted to IEEE Transactions on Robotics (TRO).
- **Saurav Agarwal**, Amirhossein Tamjidi and Suman Chakravorty, “*Motion Planning for Active Data Association and Localization in Non-Gaussian Belief Spaces*,” In Proc. Workshop on the Algorithmic Foundations of Robotics (WAFR), San Francisco, USA December 2016.
- A. Agha-mohammadi, **Saurav Agarwal**, Suman Chakravorty, “*Periodic-node Sampling-Based Framework for Stochastic Motion Control of Small Aerial Vehicles*,” The ASME Journal of Dynamic Systems, Measurement and Control, Special Issue on Stochastic Models, Control and Algorithms in Robotics, 137(3), 031005, 2014.
- A. Agha-mohammadi, **Saurav Agarwal**, Aditya Mahadevan, Suman Chakravorty, Daniel Tomkins, Jory Denny, Nancy Amato, “*Robust Real-time Planning in Belief Space using Multi-query Graphs: Application to Physical Mobile Robots*,” In Proc. IEEE International Conference on Robotics and Automation (ICRA), Hong Kong, China, May 2014.
- **S Agarwal** and H B Hablani., “*Automatic Aircraft Landing over Parabolic Trajectory using Precise GPS Measurements*,” IJCA Proceedings on International Conference and workshop on Emerging Trends in Technology (ICWET) (7):38-45, 2011
- **Agarwal, S.** and Hablani, H.B., “*Precise Positioning Using GPS for CAT-III Aircraft Operations Using Smoothed Pseudorange Measurements*,” International Conference and Workshop on Emerging Trends in Technology, February 25-26, 2011, Mumbai, India

Submitted Patents

- *Stochastic Map-Aware Stereo Vision Sensor Model*, United States Patent Application 15/192,603, Qualcomm Inc.
- *Simultaneous Mapping and Planning by a Robot*, United States Patent Application 15/192,719, Qualcomm Inc.
- *Map Generation Based on Raw Stereo Vision Based Measurements*, United States Patent Application 15/192,874, Qualcomm Inc.
- *Stochastic Map Generation and Bayesian Update Based on Stereo Vision*, United States Patent Application 15/192,944, Qualcomm Inc.
- *Rapidly-Exploring Randomizing Feedback-based Motion Planning*, United States Patent Application 15/192,881, Qualcomm Inc.
- *A Method and System for Accurate Long term Localization and Navigation Using On-Board Sensors*, United States Provisional Patent Application, Texas A&M University

Technical Skills

Languages	C++ (5+ years), Python (5+ years), Objective-C (proficient), MATLAB/Simulink (6+ years)
Robotics	Robot Operating System (ROS), OpenCV, Gazebo
Embedded	Arduino, Gumstix, ODROID
Miscellaneous	Django, Xcode, Eclipse, Code::Blocks, Mac, Linux, Windows, Git, Subversion

Teaching/Leadership Experience

Team Mentor | Miniature Autonomous Robots for Pipeline Inspection **Fall 2016-Present**
Leading a team of 14 undergraduate students to develop an autonomous natural gas pipeline inspection robot. Project involves building novel robot mechanical design in Solidworks and developing software for; (i) wireless communications, (ii) sensor fusion for state estimation and (iii) machine learning for automated corrosion and weld analysis.

Research Mentor | TAMU-IIT Kanpur Summer Exchange Program **2013-Present**
Teach fundamentals of system modeling and control in robotics and guide undergraduate visiting researchers in identifying suitable projects and achieving targets. I am responsible for regular progress assessments and liaising with faculty advisers.

Student Leader | 3 Day Startup | Texas A&M University **Fall '13**
Helped over 40 students at the TAMU 3 Day Startup entrepreneurship program mature their ideas into viable business models. Provided assistance in mobile/web development and investor pitches.

Independent Projects

SupaCamX | Independent iOS Camera App **Sep-Dec '12**
Fully developed and published a multi-effects camera app with social media integration.

BCRadio | iOS Music Streaming App **Sep-Dec '12**
Fully developed and published a music streaming app for Indian indie music platform BCRadio.in

Awards/Activities/Short-Courses

Summer School at London School of Economics, studied Intermediate Macro-Economics **Summer '08**

Ranked 7th in Ramanujan Math Olympiad from amongst 10,000 students all over India **Apr '04**

Avid guitar player, recorded 4 original songs with college band **2008-2010**