

Yash Mulgaonkar



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Education

University of Pennsylvania, Philadelphia, PA, U.S.A.
Ph.D., Mechanical Engineering and Applied Mechanics, August 2019
Advisor: Prof. Vijay Kumar
Dissertation: Small, Safe Quadrotors For Autonomous Flight

University of Pennsylvania, Philadelphia PA, U.S.A.
M.S., Robotics, March 2012
Advisor: Prof. Vijay Kumar
Thesis: Automated Recharging for Persistence Missions with Multiple Micro Aerial Vehicles

University of Mumbai, Mumbai, India
B.E., Electronics Engineering, May 2010
Capstone Project: SAINTs: Satellite Aided Intelligent Navigation and Tracking System.

Experience

Professional

Zoox, Inc., California, CA, U.S.A.
Mechatronics Engineer, October 2019 - present

Research and Vocational

DJI Research, LLC, Philadelphia, PA, U.S.A.
Robotics Engineering Intern, August 2017 - October 2017

Conceptualized and designed an open-source, lightweight micro aerial vehicle based on the NVIDIA Jetson TX2 single-board computer and a monocular vision based inertial navigation system capable of fully autonomous flight in confined, GPS-denied spaces.

The design files will be released shortly under a open hardware license.

KMel Robotics, LLC, Philadelphia, PA, U.S.A.
Acquired by Qualcomm Technologies, Inc.
Mechatronics Engineer, August 2012 - August 2013

Responsible for mechanical and electrical design of autonomous UAVs for academic research in academics and use in the entertainment industry. Played a leading role in the design and development of airframes for UAVs and hardware peripherals for ground stations and communication modules.

Robosoft Systems, Mumbai, India.
Design Engineering Intern, May 2008 - July 2008

Contributed to and lead a team for rapid prototyping of new concepts for educational robots and DIY electronics kits for academics and hobbyists. Development involved PCB design, mechanical fabrication and product assembly.

Teaching

Teaching Assistant, Performance and Design of Unmanned Aerial Vehicles - Spring 2016
Teaching Assistant, Mechanical Engineering Design - Fall 2015
Teaching Assistant, Feedback Controls - Spring 2015
Judge, MED-X Medical Devices Hackathon - 2014
Mentor, NSF Research Experiences for Undergraduates (REU) - Summer 2012
Teaching Assistant, Robotics & Automation - Spring 2012
Teaching Assistant, Mechatronic System Design - Fall 2011
Teaching Assistant, Medical Devices - Spring 2011
Teaching Assistant, Electrical Systems Lab II - Spring 2011
Teaching Assistant, Electrical Systems Lab I - Fall 2010
Technical Advisor & Judge, Indian Institute of Technology, Bombay, Techfest - 2008, 2010

Awards / Honors

- [A2] Featured on the “**2016 Forbes 30 Under 30 List for Science**,” for breakthrough contributions in the field of Robotics, including hardware development and cooperative control.
- [A1] Robot Design Award for “**The Pico-Quadrotor: An Autonomous 20g Micro Aerial Vehicle**,” at the ASME Student Mechanism and Robot Design Competition, Buffalo, NY 2014.

Patents

- [P2] V. Kumar, G. Cross, C. Qu, J. Das, A. Makineni and **Y. Mulgaonkar**, “Systems, devices, and methods for robotic remote sensing for precision agriculture,” U.S. Patent No. US10395115B2 Granted, August 2019.
- [P1] V. Kumar, G. Loianno, **Y. Mulgaonkar**, “Systems, devices, and methods for on-board sensing and control of micro aerial vehicles,” U.S. Patent No. US10037028B2. Granted, July 2018.

Research Grants

- [G8] **Fast Lightweight Autonomy (DARPA-FLA)** (HR001151626, HR0011516850)
 Defense Advanced Research Projects Agency (DARPA)
- [G7] **Flying Smartphones**
 Qualcomm Technologies, Inc. (QTI)
- [G6] **Rapid Response Research (NSF-RAPID)** (1138110)
 National Science Foundation (NSF)
- [G5] **Micro Autonomous Systems and Technology (MAST)** (W911NF-08-2-0004)
 U.S. Army Research Laboratory (ARL)
- [G4] **Printable Programmable Machines** (IIS-1138847)
 National Science Foundation (NSF)
- [G3] **Robot Swarms For Persistent Monitoring Of Specialty Crops** (2015-67021-23857)
 U.S. Department of Agriculture (USDA)
- [G2] **Robotics Collaborative Technology Alliance** (W911NF-10-2-0016)
 U.S. Army Corps of Engineers (USACE)
- [G1] **Multidisciplinary University Research Initiatives (MURI)** (N00014-07-1-0829, N00014-09-1-1051)
 U.S. Office of Naval Research (ONR)

Publications

Book Chapters

- [B3] S. Shen , **Y. Mulgaonkar**, N. Michael and V. Kumar, “Initialization-Free Monocular Visual-Inertial State Estimation with Application to Autonomous MAVs,” in *Experimental Robotics* Vol. 109, Pg. 211-227, Springer 2016.
- [B2] T. Özaskan, S. Shen, **Y. Mulgaonkar**, N. Michael and V. Kumar, “Inspection of Penstocks and Featureless Tunnel-like Environments Using Micro UAVs,” in *Field and Service Robotics*, Vol. 105, Pg. 123-136, Springer 2015.
- [B1] **Y. Mulgaonkar**, C. Powers, V. Kumar, “Kinematic Analysis of Quadrotors with Manufacturing Errors,” in *Mechanisms and Machine Science : Advances in Mechanisms, Robotics and Design Education and Research*. Vol. 14, Pg 205-214, Springer 2013.

Refereed Journal Publications

- [J6] M. Quigley, K. Mohta, S. Shivakumar, M. Watterson, **Y. Mulgaonkar**, et al., 2018. “The Open Vision Computer: An Integrated Sensing and Compute System for Mobile Robots,” arXiv preprint arXiv:1809.07674.
- [J5] **Y. Mulgaonkar**, A. Makeneni, L. Guerrero-Bonilla and V. Kumar, “Robust Aerial Robot Swarms Without Collision Avoidance,” *IEEE Robotics and Automation Letters*, vol. 3, no. 1, pp. 596-603, Jan. 2018.
- [J4] G. Loianno, **Y. Mulgaonkar**, C. Brunner, D. Ahuja, A. Ramanandan, M. Chari, S. Diaz, and V. Kumar, “Autonomous Flight and Cooperative Control for Reconstruction using Aerial Robots Powered by Smartphones,” *The International Journal of Robotics Research*, IJRR, 2018, 37(11), 1341-1358.
- [J3] K. Mohta, M. Watterson, **Y. Mulgaonkar** et al. “Fast, autonomous flight in GPS-denied and cluttered environments,” *Journal of Field Robotics*. vol. 35, no. 1, pp. 101-120, 2018.
- [J2] K. Sun, K. Mohta, B. Pfrommer, M. Watterson, S. Liu, **Y. Mulgaonkar**, C. J. Taylor, V. Kumar, “Robust Stereo Visual Inertial Odometry for Fast Autonomous Flight,” Submitted to RAL and ICRA 2018. vol. 3, no. 2, pp. 965-972, 2018.
- [J1] N. Michael, S. Shen, K. Mohta, **Y. Mulgaonkar**, V. Kumar, K. Nagatani, Y. Okada, S. Kiribayashi, K. Otake, K. Yoshida, K. Ohno, E. Takeuchi, and S. Tadokoro. “Collaborative mapping of an earthquake-damaged building via ground and aerial robots,” *J. Field Robot.*, 29(5):832-841, Sept. 2012.

Refereed Conference Proceedings

- [C18] **Y. Mulgaonkar**, W. Liu, D. Thakur, K. Daniilidis, C. J. Taylor and V. Kumar, ”The Tiercel: A novel autonomous micro aerial vehicle that can map the environment by flying into obstacles,” 2020 IEEE International Conference on Robotics and Automation (ICRA), Paris, France, 2020, pp. 7448-7454.
- [C17] K. Mohta, K. Sun, S. Liu, M. Watterson, B. Pfrommer, J. Svacha, **Y. Mulgaonkar**, C. J. Taylor, and V. Kumar, “Experiments in fast, autonomous, gps-denied quadrotor flight,” *IEEE International Conference on Robotics and Automation (ICRA)*, 2018, Brisbane, Australia, 2018, pp. 7832-7839.
- [C16] J. Koh, D. Aukes, B. Araki, S. Pohorecky, **Y. Mulgaonkar**, M. Tolley, V. Kumar, D. Rus, R. J. Wood, Robert, “Modular Folded Laminate Robot Capable of Multi Modal Locomotion,” *International Symposium on Experimental Robotics (ISER)*, October 2017, Tokyo, Japan.
- [C15] T. Özaskan, K. Mohta, J. Keller, **Y. Mulgaonkar**, C. J. Taylor, V. Kumar, J. Wozencraft, T. Hood, “Towards fully autonomous visual inspection of dark featureless dam penstocks using MAVs,” *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)* 2016, pp. 4998-5005, Daejeon, South Korea.
- [C14] **Y. Mulgaonkar**, B. Araki, J. Koh, L. Guerrero-Bonilla, D. Aukes, A. Makeneni, M. Tolley, D. Rus, R. Wood, and V. Kumar, “The Flying Monkey: a Mesoscale Robot that can Run, Fly, and Grasp,” *IEEE Int. Conf. on Robotics and Automation*, Stockholm, Sweden, May, 2016.
- [C13] G. Loianno, **Y. Mulgaonkar**, C. Brunner, D. Ahuja, A. Ramanandan, M. Chari, S. Diaz and V. Kumar, “SmartPhones Power Flying Robots,” *Intelligent Robots and Systems (IROS)*, 2015 IEEE/RSJ International Conference on, Hamburg, 2015, pp. 1256-1263.

- [C12] J. Das, G. Cross, C. Qu, A. Makineni, P. Tokekar, **Y. Mulgaonkar** and V. Kumar, “Devices, Systems, and Methods for Automated Monitoring Enabling Precision Agriculture,” 2015 IEEE International Conference on Automation Science and Engineering (CASE), Gothenburg, 2015, pp. 462-469.
- [C11] **Y. Mulgaonkar**, T. Kientz, M. Whitzer and V. Kumar, “Design and Fabrication of Safe, Light-Weight, Flying Robots,” ASME IDETC/CIE 2015, Boston, MA.
- [C10] **Y. Mulgaonkar**, G. Cross and V. Kumar, “Design of small, safe and robust quadrotor swarms,” IEEE ICRA, 26-30 May 2015, Seattle, WA.
- [C9] G. Loianno, G. Cross, C. Qu, **Y. Mulgaonkar**, J. A. Hesch and V. Kumar, “Flying Smartphones: Automated Flight Enabled by Consumer Electronics,” in IEEE Robotics & Automation Magazine, vol. 22, no. 2, pp. 24-32, June 2015.
- [C8] S. Shen, **Y. Mulgaonkar**, N. Michael, and V. Kumar, ”Initialization-free monocular visual-inertial estimation with application to autonomous MAVs”, in Proc. of the International Symposium on Experimental Robotics (ISER), Marrakech, Morocco, June 2014.
- [C7] **Y. Mulgaonkar**, V. Kumar, “Autonomous charging to enable long-endurance missions for small aerial robots”. Proc. SPIE 9083, Micro- and Nanotechnology Sensors, Systems, and Applications VI, 90831S (June 4, 2014).
- [C6] **Y. Mulgaonkar**, M. Whitzer, B. Morgan, C. M. Kroninger, A. M. Harrington, V. Kumar, “Power and weight considerations in small, agile quadrotors”. Proc. SPIE 9083, Micro- and Nanotechnology Sensors, Systems, and Applications VI, 90831Q (June 4, 2014).
- [C5] S. Shen, **Y. Mulgaonkar**, N. Michael, V. Kumar, “Multi-sensor fusion for robust autonomous flight in indoor and outdoor environments with a rotorcraft MAV,” Robotics and Automation (ICRA), 2014 IEEE International Conference on, pp.4974,4981, May 31 2014-June 7 2014.
- [C4] A. M. Mehta and D. Rus; K. Mohta, **Y. Mulgaonkar**, M. Piccoli, and V. Kumar, “A Scripted Printable Quadrotor: Rapid Design and Fabrication of a Folded MAV,” in Proc. 16th International Symposium of Robotics Research (ISRR '13), Singapore, December, 2013.
- [C3] T. Özaslan, S. Shen, **Y. Mulgaonkar**, Nathan Michael, and V. Kumar, “Inspection of Penstocks and Feature-less Tunnel-like Environments using Micro UAVs,” International Conference on Field and Service Robotics, 2013.
- [C2] S. Shen, **Y. Mulgaonkar**, N. Michael, and V. Kumar. “Vision-based state estimation and trajectory control towards high-speed flight with a quadrotor,” In Proc. of Robot.: Sci. and Syst., Berlin, Germany, June 2013.
- [C1] S. Shen, **Y. Mulgaonkar**, N. Michael, and V. Kumar. “Vision-based state estimation for autonomous rotorcraft MAVs in complex environments.” In Proc. of the IEEE Intl. Conf. on Robot. and Autom., pages 17501756, Karlsruhe, Germany, May 2013.

Workshops / Tutorials

- [W1] J. Thomas, **Y. Mulgaonkar**, M. Whitzer and V. Kumar, “T3: Kinematics, Dynamics and Control of Quadrotors,” ASME 2014 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference (ASME-IDETC), August 2014.

Invited Talks / Seminars

- [TS6] G. Loianno, **Y. Mulgaonkar** and V. Kumar, “A Swarm of Flying Phones,” International Consumer Electronics Show (CES2016), Las Vegas, Nevada. January 2016.
- [TS5] V. Kumar, **Y. Mulgaonkar**, G. Loianno, S. Liu, “The future of flying robots,” TEDxPenn, Philadelphia, USA. April 2015.
- [TS4] V. Kumar, **Y. Mulgaonkar**, S. Liu, “The future of flying robots,” Drones for Good, Dubai, UAE. February 2015.
- [TS3] G. Loianno, **Y. Mulgaonkar** and V. Kumar, “Smartphones Control Flying Robots,” International Consumer Electronics Show (CES2015), Las Vegas, Nevada. January 2015.
- [TS2] V. Kumar and **Y. Mulgaonkar**, “Aerial Robot Swarms,” TEDxGateway, Mumbai, India. November 2014.
- [TS1] **Y. Mulgaonkar** and V. Kumar, “Open-Source, Printable Pico-Quadrotor,” Robot Makers, Robotics Science and Systems (RSS), Berkeley, California. July 2014.

Certifications / Licenses

- [L2] FAA Remote Pilot Certification (14 CFR Part 107)
- [L1] FCC H.A.M. Radio Technician License

Last updated: February 25, 2021