

MICHAEL BENSON

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EDUCATION

Villanova University: Villanova, PA
Doctor of Philosophy, Engineering
Research Advisor: Garrett Clayton, PhD
GPA: 3.69

Expected Completion 2019

Villanova University: Villanova, PA
Bachelor of Science, Mechanical Engineering
Minor in Mechatronics & Concentration in Dynamic Systems and Controls

May 2015

DISSERTATION

Adaptive Scanning of a Nodding 3-Dimensional Lidar

In Progress

This work aims to improve vertical resolution of modern Lidar sensors by placing the Lidar on a nodding platform. Lissajous-like scanning trajectories are used to create a trade-off between scan time and vertical resolution. Current work aims to develop relationships that determine nodding parameters to generate scans with desired resolution, and longer-term goals aim to generate adaptive scanning patterns to allow a nodding Lidar system to generate scans of evolving resolutions when deployed on robotic platforms.

RESEARCH INTERESTS

- Primary interest in mechatronics, sensors, and algorithm applications in:
 - Unmanned robotic systems, especially in aerospace and naval applications.
 - Autonomous behavior and methodologies for robotic platforms.
 - Localization methods alternative to GPS dependency, such as visual odometry and SLAM.
- Additional interests in computer vision and machine learning, especially when related to aforementioned interests.

RELEVANT SKILLS

- **Coursework:** Primarily focused on modeling and control of dynamic systems and traditional robotics. Additional courses in signal processing, system identification, machine learning, and design and analysis of algorithms.
- **Programming experience:** Expertise with MATLAB, Simulink, C/C++, Arduino, ROS, and Latex. Proficiency with Python, Java, and openCV. Significant experience developing with version control software (Git).

JOURNAL PUBLICATIONS

- Benson, Michael, et al. “An experimental autonomous surface vehicle with vision based navigation, obstacle avoidance, & SLAM.” In *Naval Engineers Journal*. December 2014.

CONFERENCE PUBLICATIONS

- Benson, Michael, Nikolaidis, Jonathan, and Clayton, Garrett. “Lisajous-like scan pattern for a nodding multi-beam lidar”. In *Dynamic Systems and Control Conference (DSCC2018), Processings of 2018 ASME*. ASME, 2018.
- Benson, Michael and Clayton, Garrett. “A tracked double-bodied vehicle for use in outdoor environments”. In *Dynamic Systems and Control Conference (DSCC2017), Proceedings of 2017 ASME*. ASME, 2017.
- Fracchia, Matthew, [et al, including Benson, Michael]. “Low-cost explosive ordnance disposal robot for deployment in southeast asia.” In *Humanitarian Technology Conference (IHTC2015), Proceedings of 2015 IEEE Canada International*. IEEE, 2015.

TECHNICAL REPORTS

- Benson, Michael and Clayton, Garrett. “A discussion on the feasibility of a multirobot solution to humanitarian demining”. *Villanova University Internal Document*. October 2015.

POSTER PRESENTATIONS

- A. Lebbad et al, presented by Michael Benson. “Color Analysis and Data Fusion with a LIDAR/Video Vision System for ASVs.” At *2017 Maritime RobotX Forum*. AUVSI Foundation, December 2017.
- M. Benson et al. “Humanitarian EOD Robot”. At *Villanova University Mechanical Engineering Senior Poster Presentation*. Villanova University, June 2015.

AWARDS

- Competition Semi-Finalist, Maritime RobotX Challenge, 2016. *Awarded to Team WORX, a joint Villanova University-Florida Atlantic University team*.
- Second Place, Student Oral Presentation Competition, IEEE International Humanitarian Technology Conference, 2015. *Awarded to Michael Benson and Alexander Poultney*.
- Competition Finalist, Maritime RobotX Challenge, 2014. *Awarded to Team WORX, a joint Villanova University-Florida Atlantic University team*.

PROJECT EXPERIENCE

VU Mechatronic Systems Laboratory
Graduate Research Assistant

June 2015 - Present
Villanova, PA

- Primarily consists of work towards my dissertation, described above.
- Additional focus in prototyping and development of a multi-bodied, unmanned ground vehicle for use in heavily-vegetated environments.
- Study of visual odometry methods, specifically using depth information for 3D-to-3D matching.
- Literature review of the current state of humanitarian demining technologies, including relevant sensing technologies, as well as robotic innovations applied within that space.

VU RobotX Team

Systems Integration Engineer

September 2016 - December 2016

Villanova, PA

- Implemented software integration of computing and sensor subsystems within the ROS framework on an autonomous surface vehicle for the 2016 AUVSI Maritime RobotX Competition.
- Developed software package to create an RGB-D image by fusing information from a camera with information from a nodding 2-dimensional Lidar.
- Developed software to provide control of and retrieve sensor information from a commercially available underwater remotely operated vehicle.
- Served a leadership role primarily managing team member responsibilities while at competition, as well as developing strategies for mission completion.

VU Low-Cost Explosive Ordnance Disposal Robot

Student Advisor & Software Lead

August 2014 - Present

Villanova, PA

- Developed control, vision, and communication software within the ROS framework for a teleoperated low-cost EOD robot for counter-IED operations.
- Responsible for advising undergraduate students toward the development of a low-cost EOD robot to respond to IEDs. This includes advising iterative design of the physical platform as well as progress toward adding semi-autonomous functionality.

RESEARCH ADVISEES

Undergraduate Collaborators for Dissertation Research

Co-Advised with Garrett Clayton

- Erik Reiman, “Design and Manufacture of a Novel Robot for Mine Detection”
- Maria Manfredi, “Nodding and Rotating LIDAR Design”
- Jonathan Nikolaidis, “Resolution of 3-Dimensional LIDAR Systems”
- Alexander Garrett, Omar Hussain, and Chris McGee, “Assembly and Implementation of a Nodding LIDAR System”

Senior Design Project Advisees

Co-Advised with Garrett Clayton and Jordan Ermilio

- Nathan Yasuda, Julia Spilane, and Nick Ferrante, “Production Prototype of a Low-Cost EOD Robot”.
- Kyle Graham, Anthony Marone, Thomas Muccifori, Gian Prospero, Ian Stankosh, and Samantha Tropeano, “Coordination of Quadcopter and EOD Robot for Counter-IED Applications”

TEACHING EXPERIENCE

ME 5411 Mechatronics

Teaching Assistant

January 2017 - May 2017

Villanova, PA

POPULAR MEDIA

- Appeared in Villanova University national commercial, 2016-2017. “Villanova Engineering EOD Robot”
- Quoted in the Cambodia Daily, 5/31/2016, “Experts Tout Cheap Robots For Explosives Removal.”
- Quoted in the Robotics Business Review, 3/18/2015. “University, NGO Develop Low-Cost Mine Removal Robot.”

WORKSHOP, TRAINING, AND EVENT ATTENDANCE

- Raven's Challenge ASEAN DTI Technology Day. Bangkok, Thailand. July, 2017.
- Geneva International Center for Humanitarian Demining 6th Mine Action Technology Workshop. Lyon, France. November, 2016.
- Inaugural Conference on Robotics in Cambodia. Phnom Penh, Cambodia. June, 2016.

OTHER WORK-RELATED TRAVEL

- National Science Foundation funded research in Phnom Penh Cambodia. Working on applications of sensing and robotics to EOD topics. June 2018 - August 2018.
- Internship with Golden West Humanitarian Foundation in Phnom Penh, Cambodia, working on an unmanned robot for landmine detection. June 2017 - August 2017.
- Demonstrating improvements on EOD robot to Golden West Humanitarian Foundation in Phnom Penh, Cambodia, for VU EOD Robot. June 2016.
- Demonstrating new prototype of EOD robot to Golden West Humanitarian Foundation in Phnom Penh, Cambodia, for VU EOD Robot. December 2014-January 2015.

EXTRACURRICULAR ACTIVITIES

MATE Regional ROV Competition
Volunteer

May 2015 - Present
Villanova, PA