

Saptadeep (Sapta) Debnath

Portfolio: saptadeb.github.io
Github: github.com/saptadeb

Email: saptadeep.deb@gmail.com
Mobile: (734) 353-5634
LinkedIn: linkedin.com/in/saptadeep-deb

WORK EXPERIENCE

- Equipment Technologies, Inc.** Mooresville, IN, USA
Robotics Engineer Mar 2021 - Present (3+ years)
 - Project in charge of the vision-guided L3 Operator Assisted Autonomy System for agricultural machines.
 - Deployed a CNN semantic segmentation network that predicts crop rows for a J1939 CAN-linked machine steering; achieved a 45% increase in f-score and 67% in IOU scores.
 - Built a ROS architecture pipeline from scratch, establishing a seamless flow of messages from prediction software to steering control manager; optimized operations and reduced response time, resulting in enhanced system performance and efficiency.
 - Designed and executed comprehensive V&V plans, including rigorous field tests on the Apache machine under real-world conditions to validate software performance.
 - Provided mentorship to interns and junior engineers, offering valuable training and insights into computer vision algorithms and ROS fundamentals.
 - Collaborated with the company's patent attorney to research existing patents, draft new claims, and ensure comprehensive protection of intellectual property rights. (*Patent Pending*)

SKILLS SUMMARY

- Concentration Areas:** Robotic System Design, Machine Vision, Deep Learning, Control Systems, Motion Planning
- Tools and Technologies:** C++, Python, ROS, OpenCV, PyTorch, NVIDIA Jetson, 2D/3D Cameras
- Leadership Experience:** Project Lead @ ET Works (2021 - Present), Team Lead @ IFOR - UAV Team (2016 - 2018)

EDUCATION

- University of Michigan** Ann Arbor, MI, USA
Master of Science in Electrical and Computer Engineering (Robotics specialization) 2019 - 2020
- BITS, Pilani – Dubai Campus** Dubai, UAE
Bachelor of Engineering in Electronics and Communication Engineering 2014 - 2018

ACADEMIC PROJECTS

- Object Tracking for Safety:** Engineered an object tracking module to detect and conclude the distance of the moving object from the camera; issued warnings based on the object's proximity to the camera. Tech: YOLO, DeepSORT, RGB-D (November '20) ([link](#))
- Slam and Path Planning implementation on MBot:** Explored and implemented advanced mapping, path planning, and motion control algorithms for a differential drive robot simulation model. Tech: C++, IMU, 2D LIDAR, SLAM, A-star, path planning (April '20) ([link](#))
- Invariant Extended Kalman Filtering for Robot Localization using IMU and GPS:** Developed an Invariant EKF-based localization system and conducted comparative analysis with Extended Kalman Filter-based localization system and a GPS-alone dataset. Tech: MATLAB, In-EKF, IMU, GPS (April '20) ([link](#))
- 6-DOF Serial Link Robotic Manipulator:** Produced a Python codebase for autonomous operation of serially connected motors, integrating object detection using a Kinect camera suite to facilitate efficient pick-n-place operations. Tech: Python, manipulators, object detection, OpenCV, path planning-smoothing, state machines (March '20) ([link](#))
- Mobile Inverted Pendulum System:** Designed a cascaded control architecture for a two-wheeled robot, achieving balance and autonomous navigation along pre-defined trajectories. Tech: C, inverted pendulum, trajectory following, IMU, PID, Beaglebone, Robot Control Library (February '20) ([link](#))
- Hand Gesture Control of a Robot using Intelligent Techniques:** Created a ROS pipeline enabling real-time free hand gesture translation to motion instructions for a TurtleBot, powered by an Intel Atom processor. Tech: ROS, C++, Python, RNN, TensorFlow, SLAM, TurtleBot (July '18) ([link](#))

IFOR (UAV TEAM) AT BITS PILANI, DUBAI CAMPUS (2014 - 2018)

- Leadership Responsibilities:** Team Lead (2016-2018), Technical Lead (2015-2016), Hardware Systems Lead (2015)
- International Aerial Robotics Competition AUVSI:** ([link](#)) Integrated aerial and ground robots for obstacle navigation without 3D cues, relying on touch interaction. Devised strategic solutions to prevent ground robot exit amidst dynamic movement and obstacle challenges. (['17 submission](#)) (['15 submission](#))
- SorbDrone – An Oil Spill Solution:** (*Submission for Drones for Good 2017*) A solution for modernizing the Oil Spill clean-up process. Inspection of the affected area by the UAV equipped with a thermal camera. Use special pads filled with hydrophobic oil-absorbing material, to clean oil spills. ([video](#))
- Smart Inspection of Solar Panels:** (*Semi-Finalist Submission for Drones for Good 2016*) Detection of faulty solar panels in a solar farm via UAVs. Use of thermal camera; geo-tagging the images and communicating to a control station. Trial and tested prototype. ([video](#))

PUBLICATIONS

- **Design and Development of a Non-Linear Controller for Quadrotor type Unmanned Aerial Vehicle:** IEEE International Conference on Inventive Computation Technologies. Authors: Saptadeep Debnath and Mary Lourde R (Coimbatore, India - November '18) ([link](#))
- **Image-based Biomechanical Case study of an International Archer:** International Conference on Sports Engineering. Authors: Saptadeep Debnath and Subir Debnath (Jaipur, India - October '17) ([link](#))
- **Visual Odometry Data Fusion for Indoor Localization of an Unmanned Aerial Vehicle:** IEEE International Conference on Power, Control, Signal & Instrumentation Engineering. Authors: Saptadeep Debnath and Jagadish Nayak (Chennai, India - September '17) ([link](#))

HONORS AND AWARDS

- **Winners, Drones for Good University Challenge:** Issued by Mohammed Bin Rashid Space Centre and Government of Dubai, Nov 2015
- **2nd Place, International Space Settlement Design Competition:** Issued by NASA Ames Research Center, Apr 2012