Jaskaran Singh Sodhi

Rajendra Prasad Hall of Residence, IIT Kharagpur, Kharagpur, West Bengal - 721302, India
sodhi.jaskaransingh@gmail.com jssodhi.in thisisjaskaran Jaskaran Singh Sodhi

Education

Indian Institute of Technology Kharagpur West Bengal, India

Major : B.Tech. Manufacturing Science and Engineering (Mechanical Engineering Dept.) Apr 2023
Minor : Computer Science and Engineering **Specialization** : Embedded Control & Software Design
GPA : 9.19/10 – **Ranked 1st in Major**, out of 58 students

Publications

[1] Shivam Sood, **Jaskaran Singh Sodhi**, Parv Maheshwari, Karan Uppal, Debashish Chakravarty, **"Multiple Waypoint Navigation in Unknown Indoor Environments"**, 2022 International Conference on Control and Robotics, ICCR (Guangzhou, China)

Experience

Autonomous Mobile Robotics Laboratory UT Austin
Guide : Prof Joydeep Biswas Sep 2021 – Present

- Extended MPC-MPNet architecture to kinematically constrained local planning in indoor cluttered scenarios.
- Developed I-RRT* global planner for non-holonomic constraints and achieved 900Hz average planning frequency.

Autonomous Ground Vehicle Research Group IIT Kharagpur
Undergraduate Researcher [certificate] Mar 2020 – Present

- Benchmarked and tested various SLAM algorithms such as ICP, VINS-Fusion, ORBSLAM and LeGO-LOAM.
- Developed multi-LiDAR and GPS based localisation module for race cars in pre-mapped environment using ICP.

Preimage Bangalore, India
Computer Vision Intern Sep 2021 – Dec 2021

- Developed tracks-validation module for testing of feature matching pipeline for UAV-based offline 3D reconstruction
- Implemented adaptive inlier thresholds for homography-based feature matching and removed intrinsic dependency.

Vecros Technologies Private Limited New Delhi, India
Computer Vision Intern [certificate] May 2021 – Jul 2021

- Implemented altitude planning and surface tracking algorithms on UAVs using one dimensional LiDAR scans.
- Developed depth mapping based obstacle avoidance and planning algorithms for UAVs in indoor environments.

Projects

DRDO UAV-Guided UGV Navigation Challenge DRDO & IIT Kharagpur
Inter IIT Tech Meet 10.0 [Presentation] Mar 2022

- Developed RGBD normal estimation and plane segmentation for road detection in snowy mountain conditions
- Optimised tree-based UAV planner for precise motion control and next waypoint prediction of unmanned UGV.

GPS Denied Localisation Pipeline for Autonomous Car IIT Kharagpur
Guide : Prof Debashish Chakravarty Aug 2020 – Feb 2022

- Developed pipeline for Stereo-Camera Localisation in Mapped Environment using prior-map matching technique.
- Implemented photometry based residual minimisation between projected LiDAR data and Stereo Depth Mapping.

Unmanned Rover for Astronaut Assistance IIT Kharagpur
University Rover Challenge 2022 — Guide : Prof Debashish Chakravarty Mar 2020 – Dec 2021

- Developed the wheel, chassis and suspension system for rover prototype for the University Rover Challenge 2021.
- Performed static and dynamic simulations of the rover to optimise for load carrying, gradeability and handling.

Racecar Localisation in Mapped Environment Indiana Motor Speedway, Indiana
Indy Autonomous Challenge 2021 — Guide : Prof Sohel Anwar May 2021 – Oct 2021

- Integrated the BVS sensor and testing stack for the Indy Autonomous Challenge 2021 IUPUI-IITKGP-USB team.
- Designed tightly/loosely coupled *high-speed localisation in mapped environment* and **reduced bank error to 0.1°.**

[1] Navigation and Manipulation in Unknown Environments — Prague, Czech Republic
IROS-RSJ Navigation and Manipulation Challenge 2021 [Link] — July 2021 – Sep 2021

- Integrated global and local planning modules to TiaGO Base bot for multiple waypoints traversal in shortest time.
- Developed novel probabilistic travel distance minimization algorithm for traversal in unknown environments.

Tightly Coupled Integration of GPS, INS and IRNSS — IIT Kharagpur
Guide : Prof Susmita Bhattacharya — Nov 2020 – Aug 2021

- Implemented tightly coupled integration of GPS and INS using Kalman Filter and simulating it on a UAV dataset.
- Integrated random walk based models to simulate real-time sensor noise and atmospheric signal attenuation.

DRDO DGRE's Vision Based Obstacle Avoidance Drone — DRDO & IIT Guwahati
Inter IIT Tech Meet 9.0 [Presentation] — Mar 2021

- Implemented recognition and localisation algorithms for pose estimation and landing using AruCo markers.
- Optimised contour detection and kmeans clustering algorithms for motion planning and obstacle avoidance.
- Integrated path planning algorithms like gbplanner with AruCo detection and landing in an FSM based model.

Achievements

INTERNATIONAL COMPETITIONS

2022	**Team Lead**, in University Rover Challenge	Utah, USA
2021	**Winner**, in IROS Navigation and Manipulation Challenge [certificate]	Prague, Czech Republic
2021	**Participant**, in Indy Autonomous Challenge	Indiana, USA

DOMESTIC COMPETITIONS

2022	**Winner**, in Inter IIT Tech Meet 10.0.0 [certificate]	DRDO/IIT Kharagpur
2021	**1st Runner Up**, in Inter IIT Tech Meet 9.0 [certificate]	DRDO/IIT Guwahati
2021	**Winner**, in Open IIT Data Analytics [certificate]	IIT Kharagpur
2021	**Finalist**, in Anadigix, Top 15 among 422 participants [certificate]	IIT Kharagpur

ACADEMIC ACHIEVEMENTS

2019	**Ranked in Top 0.3%**, out of 1.3 million candidates	JEE (Main) 2019

Technical Skills

Languages C, C++, Python, MATLAB || **Frameworks** ROS, ArduPilot, RealSense, Webots, Atmel Studio
Libraries OpenCV, Open3D, OpenMP, PCL, Ceres, Eigen, Keras, Arduino, multiprocessing, dronekit
CAD/CAE Simulink, Solidworks, ANSYS Static Structural, ADAMS, Altair Suite, LTSpice
Simulation CARLA, gazebo, Mission Planner, LGSVL || **Other Languages** AVR, HTML, CSS, LaTeX

Relevant Coursework

* indicates MOOC

Software Systems & Control, Deep Learning*, Soft Computing, Introduction to OpenMP*, Data Structures
Robotics Control of Mobile Robots*, Image Processing, Introduction to Computer Vision*, Controls Bootcamp*
Mechatronics Fundamentals of Embedded Control and Software, Principles of Automotive Dynamics & Control

Teaching Experience

Mars Rover Team Lead and SLAM Mentor — IIT Kharagpur
Autonomous Ground Vehicle Research Group — May 2021 – Present

- Leading a team of 15 freshmen for the mechatronics design of the University Rover Challenge 2022 rover prototype.
- Leading a team of 8 first-year students for training in *localisation in mapped environment* pipeline (SLAM module).

Computer Vision Mentor — IIT Kharagpur
IEEE Winter Workshop [certificate] — Mar 2021

- Mentored 160+ first-year students in by teaching them about Image Processing and Computer Vision algorithms.

Extracurriculars

Governor and Actor - English Dramatics Society, IIT Kharagpur **Quizzing** - National Semi-Finalist, 2017
Volunteer - NSS, IIT Kharagpur (2019-21), TYCIA Foundation (2018) **Debating** - State Level Winner, 2017