Sourojit Saha

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EDUCATION

Carnegie Mellon University — Pittsburgh, PA
Master of Science in Mechanical Engineering - Research Program - **GPA: 3.88/4.00** — May 2023
Relevant Coursework: Modern Control Theory, Advanced Control System Integration, Planning and Decision-Making in Robotics, ML/AI for Engineers, Robot Localization and Mapping, Learning for 3D Vision

Birla Institute of Technology and Science — Pilani, India
Bachelor of Engineering in Manufacturing Engineering - **GPA: 8.20/10.00** — May 2020
Relevant Coursework: Machine Learning, Data Mining, Mechatronics, Robotics

SKILLS

Programming: ROS, C++, Python, Numpy, PyTorch, Pandas, OpenCV, Qt, PyQt, AWS, SAS (Certified), Git, Docker
Software: MATLAB, Simulink, SolidWorks, AutoCAD, Qt Designer, Siemens TIA portal
Technologies: Control Systems, Motion Planning, Computer Vision, Machine Learning, Artificial Intelligence, Simultaneous Localization and Mapping

EXPERIENCE

Carnegie Mellon University, Pittsburgh, PA — Jan 2022 - May 2023
Graduate Research Assistant, Biorobotics Lab (Link)

- Developed a **decentralized communication multiplexer** using **ROS** for **multi-robot** inspection operations, enabling **real-time** exchange of information; Tested on a system of **7 robots**
- Co-Developed "**Make Way**" behavior to allow **collision-free** movement of multiple robots in **narrow passageways**
- Developed **Transfer-Control** checks preventing inadvertent transfer of robot control among operators
- Developed **contingency behavior** for robots in case of **communication loss** with base-station
- Improved **AutoCalibration** module, enabling robots to **align maps** to world frame, thereby improving **multi-robot multi-operator** collaboration; Tested on a fleet of **4 heterogeneous (3 wheeled, 1 legged) robots** and **2 operators**
- Designed interactive GUI for **Human Robot Interaction (HRI)** using **Qt framework**, enabling multi robot control
- Performed regular **sensor calibration** of payload housing **RGB/Thermal camera** and **IMU** using **Kalibr Toolbox**
- Planned and executed **field tests** for demonstrating technical capabilities to sponsors and stakeholders

VVF India, Baddi, India — Aug 2020 - March 2021
Engineering Management Trainee

- Reduced defective soap manufacturing by **5%** by implementing **5-WHY analysis** and **Kaizen**
- Executed pipeline inspection, resulting in identification of **24** retrofitting defects
- Member of the core team responsible for **designing** and laying out **new production line**, identifying feasible locations, coordinating with OEMs, and implementing **inventory management** plans
- Created, documented and updated **Standard-Operating-Procedures (SOP)** for machines and processes

ACADEMIC PROJECTS

3D Reconstruction using Learning Based Methods (Course: Learning for 3D Vision) **(Link)** — Jan 2023

- Created and trained deep neural net to **predict 3D point cloud** of an object from single image with an accuracy of **87%**
- Synthesized 3D visualization from multi view images of an object using **Neural Radiance Fields (NeRF)**
- Trained and evaluated **PointNet** architecture for **classification** and **segmentation** of point clouds

Safe Parking for Wheeled Robots (Course: Planning and Decision-making in Robotics) **(Link)** — Sept 2022

- Developed a **lattice based planner** in **C++** to generate **collision-free** path for safe parking of autonomous wheeled robot in unstructured environments and adversarial situations
- Optimized and deployed the planner on RC trucks for **real time** application to find best parking spot within **1 sec**

Path Planning for n-DoF Manipulator Arm (Course: Planning and Decision-making in Robotics) — Sept 2022

- Implemented **sampling-based** planning algorithms in **C++** to generate the path of **5-DoF** manipulator arm under **1 sec**
- Optimized the planner to generate **collision-free** path for manipulator arm with arbitrary number of joints (**n-DoF**)
- Evaluated **RRT**, **RRT*** and **RRT Connect** planning algorithm on **5-DoF** manipulator arm in simulation

Drone Control (Course: Advanced Control System Integration) **(Link)** — Sept 2022

- Created mathematical model of **drone dynamics**; Used this to derive a linearized state space model for **LQR** controller
- Implemented LQR controller on hardware after testing in **MATLAB** and **Pybullet** drone simulation

Object Tracking using Optical Flow (Course: Computer Vision) — Jan 2022

- Implemented fixed template object tracking using **Lucas-Kanade** method for **Optical Flow**
- Improved object tracking by incorporating **template correction**

Collaborative SLAM (Course: Robot Localization and Mapping) **(Link)** — Jan 2022

- Designed and developed a **4-step** algorithm to merge heterogeneous sensor maps among multiple robots. Steps involved- sharing point-clouds, feature extraction & matching, global transform computation and map-merging
- Implemented **GICP** algorithm in **C++** to merge **Lidar** point clouds from **2 robots** to generate a master map for multi-robot SLAM

Cyber Physical Production System (TU Braunschweig, Germany - DAAD Exchange Student) **(Link)** — Aug 2019

- Upgraded **autonomous** cold storage unit as part of **Industry 4.0** research under the JInGEL project
- Implemented **PID** controller for temperature control; Integrated **PLC**, **sensors**, **peltier elements** and **power supply** unit
- Integrated **pick & place** functionality for **3-DoF** gripper for storing and extracting workpieces from cold storage unit