

Cover Letter

Robotics and Artificial Intelligence is a field I have always been passionate about. In that, I am really interested in how robots navigate, understand their environment and take decisions. Since I got into RIT, I got the opportunity to get involved in a variety of projects related to robotics and AI. The first project which made me more eager about robotics was the one in which we had to implement a path planning algorithm using A* to mimic the sport of orienteering. I was impressed with the way A* worked and it felt like it was in a way that the mind worked too. So this taught me or rather reinforced in me that we need to look at how nature or the human mind works to be able to program robots. Now since I had dipped my toe in the pool of AI, I wanted to get the taste of robotics and I got that opportunity by working as an instructor at UC Berkeley and Stanford for a company called iD Tech which conducts educational summer camps where I taught teens Robotics and Neural Networks. I was originally meant to only teach Neural Networks but since my colleague wasn't available due to an emergency, someone had to take over their position and so I stood up to that challenge. I spent a day figuring out how to set up the robots and program them by interfacing various sensors like the sonar and camera. The brain of the robot was a NVIDIA Jetson board. So first I had to learn how to flash Ubuntu into it and then from there conduct experiments to see how the sensors worked together. The biggest challenge was to understand the Robot Operating System(ROS) and also learn the C++ basics as I was new to both of them. I had to do it all by myself so that I could force myself to get into problems so that I would know how to solve them in case the kids got into the same problem while assembling their own robots. It was a lot of fun and learning and the camp went well both for kids and me as we were able to experiment with a lot of different configurations of sensors on the robot. And that is how I was exposed to ROS and C++. Then after I got back to RIT, since I had some experience with ROS and robotics in general, I was able to join a lab which was working on automating forktrucks and since then I am a part of that lab. Here, I have worked on a number of different technologies like sensor fusion, robot navigation and object detection. For object detection, we worked with a couple of algorithms with different vision sensors including depth sensors to see which performed well. Then I also worked with a LiDAR sensor for emergency braking in the forktruck and also to get raw data from it so that we could use it later. I was also involved in the development of kinematic equations for the forktruck in simulation and test various scenarios with obstacles.

Between this, I interned at a forklift company where I worked with the automation team on various LiDARs. I researched various LiDARs and how they work and also how we could make the forktruck safer and help it get more information by the proper placement of LiDARs.

Working on these technologies motivated me to further look into how the robot performs navigation in unfamiliar environments. That lead me to study the Extended Kalmann Filter Simultaneous Localization and Mapping(EKF-SLAM) as an independent study at RIT. By doing that I understood the mathematical working of the SLAM and

implemented the same on MATLAB. I then attempted to port that implementation to a real Pioneer robot and for the sensor I used a Kinect 360. I used the laser scan data to identify various landmarks in the environment by using a library called Falkolib. It was a pretty interesting project as it gave me deep insights on how navigation works.

I have always been very curious about how the robotic rovers function on other planets. That curiosity has led me to participate in a NASA challenge where we need to come up with a mechanical sensor design which would help the Venus rover detect obstacles, slopes and holes on the surface. Hopefully, this will give me more insights about perception and would help me understand how one can design better sensing algorithms.

Also, I am currently working as a Computer Vision Research Assistant at RIT where we are doing research for Kodak. There we are helping Kodak use Deep Learning and Computer Vision for photography applications.

The reason I want to work in the field of Robotics and Machine Learning is that I want to apply what I have learnt till now and also learn more as I work.