# SWAAYATT ROBOTS

## Sanjeev Sharma, Founder and Director

## Certificate of Internship

**Date:** September 20, 2020
**Company CIN: U72200MP2015PTC034222**

To whom it may concern,

This is to certify that Utkarsh Mishra interned at Swaayatt Robots for the duration of April 11 – July 10, 2020, fulfilling all the terms of agreement for an internship at Swaayatt Robots. The topic of the internship was in reinforcement learning, controls and path planning.

During his internship, Utkarsh worked primarily in reinforcement learning (RL) for development of robust control software for outdoor robotic and autonomous driving applications. Utkarsh, along with team members, also in parallel worked on writing software interface with CARLA simulator, to build a local high-dimensional lattice representation for a simulated autonomous driving vehicle, which encoded and projected the information around a vehicle, to build a projected non-temporal lattice representation of the environment which could be used by RL agents as state-representation for the control and prediction problems. In particular, for the RL work, Utkarsh, along with team members, implemented both the classical and deep RL algorithms (Q-Learning, DQN) for automating some key control parameters of a path tracker to minimize the cross track error at both the low and high-speeds. Furthermore, towards the end the internship, he was also tasked with creating an RL agent that computes target velocities along a trajectory for an autonomous vehicle, however, the duration of the internship was not sufficient to fully conduct this experiment, and is still an on-going research at Swaayatt Robots.

Utkarsh proved himself to be a hard worker over the internship. I am very impressed by his enthusiasm, dedication and ability to read and understand fairly mathematical research papers and implement them. He has been a team player, and was working in a group of both undergrad and grad students and finished whatever task assigned to him without any hesitation. I wish him all the best in his future endeavours.

Sincerely,
Sanjeev Sharma, Founder and Director
Swaayatt Robots Pvt. Ltd.