

# Sandip Sharan Senthil Kumar

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## Education

- **University of Maryland, College Park** Aug 2022 - May 2024\*  
*Professional Master of Engineering in Robotics; CGPA: 3.85 / 4.00*  
Maryland, USA  
**Courses:** 3D Vision, Perception for Autonomous Robots, Planning for Autonomous Robots, Fundamentals of Artificial Intelligence
- **Anna University, Chennai** Aug 2018 - Jul 2022  
*Mechanical Engineering, B.E, CGPA: 8.67/10 (Distinction)*  
Tamilnadu, India  
**Courses:** Object Oriented Programming (Python), Mechatronics, Kinematics and Dynamics, Statistics and Numerical Methods, Linear Algebra

## Research Experience

- **Research Assistant** Maryland, USA  
*Bio-Imaging and Machine Vision Lab, UMD — Advisor: Dr. Yang Tao*  
Sep 2023 - Present
  - **Obstacle Detection:** Developed a robust computer vision system to efficiently process live GoPro camera video, enabling real-time tracking of the boat's path using object detection and object tracking
  - **Anomaly Detection:** Deployed a highly effective anomaly detection model for identifying obstacles and dredge underwater and determining their precise positions based on sonar scan data through image analysis techniques, enhancing navigational safety
- **Research Assistant** Maryland, USA  
*GAMMA Lab, UMD — Advisor: Dr. Ming. C. Lin*  
Aug 2023 - Present
  - **Scenario Creation:** Fabricated 9 collision scenarios from NHTSA precrash typology by integrating Road Runner, SUMO & Unity3D for computer graphics and also conducted a user study for human driver data collection by incorporating VR for eye tracking using Meta SDK
  - **Path Planning:** Developed an LSTM model to classify driving styles from trajectory data and currently working on a machine learning model forecasting trajectories based on driving style for mixed autonomy situations proposing enhanced safety and reliability

## Work Experience

- **Robotics Software Engineer Intern** May 2023 - Aug 2023  
*Void Robotics* Marathon, USA
  - Re-Engineered the project repository through containerization using docker for seamless operation on the NVIDIA Jetson Nano, enhancing compatibility and leveraging GPU acceleration through cuda for optimized performance
  - Leveraged ROS 2 to establish efficient communication with ZED2 4.0 stereo cameras on NVIDIA Jetson Nano via Docker, enabling access to camera data and cross-device RViz data visualization for robotic systems
- **Student Design Intern** Dec 2021 - Feb 2022  
*Defence Research and Development Organisation (DRDO)* Chennai, India
  - Designed and validated a conceptual fixture, improving automation testing the compatibility of the Armoured Fighting Vehicle's track guard, skirt, and subsystems, resolving dimension issues before system integration

## Skills

- **Programming Languages and Platforms:** Python, C++, C#, MATLAB, Linux, Windows, Docker, Git
- **Libraries and Softwares:** OpenCV, PyTorch3D, PyTorch, TensorFlow, ROS & ROS2, Gazebo, Unity, SolidWorks, Numpy, Matplotlib, Pandas

## Projects

- **3D Surface Inspection || NerF, Pytorch3D, Pytorch** : Formulated a novel 3D inspection framework integrating modified HF-NeuS for intricate surface rendering, incorporating design patterns, and DeepCrack for precise crack segmentation through 3D reconstruction
- **Underwater Image Restoration || TensorFlow, UNet, PIL, OpenCV** : Developed a deep learning model architectures to accurately predict depth maps from underwater images and utilizing the predictions to effectively eliminate attenuation effects, successfully de-hazing underwater imagery
- **Gesture-Based Virtual Car Driving System || OpenCV, MediaPipe, CNN, ROS2, TensorFlow, Scikit-Learn** : Constructed a gesture-based virtual car driving system using Google's Media Pipe and trained a Feed Forward Neural Network for gesture classification & used gazebo, TurtleBot for real time simulation and visualization
- **Weighted A-star algorithm for Turtle Bot || ROS2, PyGame, Gazebo, Lidar** : Implemented the Weighted A-star path planning algorithm for TurtleBot navigation in a custom map using ROS2, integrating it lidar for obstacle avoidance and visualized it with Gazebo simulation
- **Wall-following algorithm for a Maze solving robot || C++, OOP, Doxygen, HTML, Cmake** : Programmed a wall-following algorithm code in C++ for a maze-solving robot, enabling it to navigate towards a goal while marking walls node and loop back to its initial location
- **Martian Rover || Solidworks, Gazebo, ROS** : Designed, simulated, and controlled a Martian rover, formulating kinematics and dynamics models for each link of the rover to operate effectively in a simulated Martian environment can be used for various use cases based on end effectors

## Publications

- **TRAVERSE** : Traffic-Responsive Autonomous Vehicle Experience & Rare-event Simulation for Enhanced safety, submitted to IROS 2024