# Venkata Sai Sricharan Kasturi

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## EDUCATION

**University of Maryland, College Park, MD** January 2023 - December 2024
*Master of Engineering in Robotics* GPA: 3.53/4.0
Coursework: Perception for Autonomous Robots, Planning for Autonomous Robots, Controls for Robotics, Robot Modeling, Deep Learning & Introduction to AI, Robot learning, Industrial AI, Autonomous Robotics.

**Guru Nanak Institutions Technical Campus, Hyderabad, India** July 2018 - July 2022
*Bachelor of Technology in Mechanical Engineering* GPA: 8.35/10
Coursework: Engineering Mechanics, Instrumentation & Control Systems, Computer Aided Designing and Manufacturing, Thermodynamics, Fluid Mechanics, Kinematics and Dynamics of Machines, Operations Research, Fundamentals of Artificial Intelligence, Python Programming, Data Base Management, Fundamentals of Cyber Security, Industrial Management, Production Planning and Control, Thermal Engineering, Industrial Robotics.

## SKILLS

**Programming Languages:** Python, C++, CUDA, Bash, JavaScript, HTML/CSS, MATLAB
**Development & Platforms:** Git, GitHub, Linux, Docker, CI/CD, Jupyter Notebook, CMake, Raspberry Pi, Arduino IDE, Windows
**Robotics & Control:** ROS1/ROS2 (MoveIt, RViz, Gazebo, URDF), SLAM, PID, Kalman Filtering, System Modeling, CARLA
**AI & ML:** YOLO, Reinforcement/Transfer Learning, CNN/RNN, Supervised/Unsupervised Learning, Clustering, PCA, t-tests
**Frameworks & Libraries:** PyTorch, TensorFlow, Keras, OpenCV, scikit-learn, NumPy, pandas, Matplotlib, Eigen
**CAD & Simulation:** SolidWorks, MATLAB/Simulink, ANSYS, Autodesk Inventor, Creo, AutoCAD
**Sensor & Embedded Systems:** LIDAR, Depth Cameras, IMU, Encoders, Ultrasonic Sensors, PCB Design
**Software:** Microsoft Office (Excel, Word, PowerPoint), Google Workspace (Docs, Sheets, Slides), Adobe Photoshop

## WORK EXPERIENCE

**Design Intern** Hyderabad, India
*South Central* Railway April 2021 – July 2021

- Designed and analyzed critical components such as engine parts, wheels, outer body structures, and brake systems.
- Utilized industry-standard software, including SolidWorks, Simulia, and ANSYS, for comprehensive evaluations.
- Enhanced performance and efficiency of railway components through innovative design and analytical insights.
- Gained hands-on experience in railway system design, bridging theoretical concepts with practical applications.

**Perception Intern** Hyderabad, India
*XMachines* May 2023 – December 2023

- Specialized in computer vision, machine learning, and AI for Precision Agriculture, Manufacturing Automation, Solar Power Plant Management, and Robotics Research.
- Collected and processed data using lidar, stereo cameras, and proximity sensors, ensuring a 20% improvement in the accuracy of AI-based robots and autonomous mobile platforms.
- Applied advanced computer vision and machine learning techniques to enhance perception capabilities, achieving a 25% increase in efficiency for precision agriculture and material handling automation.
- Contributed to the successful deployment of AI systems for solar power plant management, reducing inspection time by 30%.
- Demonstrated strong problem-solving skills and technical proficiency in executing operations at the intersection of advanced technologies and real-world applications.

## PROJECTS

**DQN-Based Autonomous Navigation System** | *PyTorch, Keras, CNN, DQN, Path Planning, Reinforcement Learning, Gazebo, ROS2*

- Implemented a Deep Q-Network (DQN)-based autonomous navigation framework in ROS2 and Gazebo, reducing collision rates by 25% and improving navigation success rate by 20% in dynamic, obstacle-filled urban simulations.
- Leveraged prioritized experience replay, dueling network architecture, and target network updates to stabilize training and enhance policy optimization for high-dimensional input processing, including scaled RGB camera images and LIDAR data.
- Conducted over 100 simulation experiments in dynamic urban environments, achieving 90% success in trajectory optimization and efficient navigation with robust Q-value predictions under varying traffic patterns.
- Developed and tuned reward functions incorporating environment-specific feedback, improving convergence speed by 15% and increasing trajectory adherence accuracy by 10% for complex navigation tasks.

**Improved Bi-directional RRT* for Robot Path Planning** | *Turtlebot3, Gazebo, A*, Dynamic Window, Sensor Fusion, ROS2, Matplotlib*

- Engineered and optimized the Double Tree RRT* algorithm, achieving a 62% reduction in computation time and a 35% decrease in path length compared to traditional RRT*, enabling efficient path planning in complex environments.
- Integrated SLAM with LIDAR data to generate occupancy grid maps with 95% mapping accuracy, ensuring precise localization and effective obstacle avoidance with a 200mm clearance.
- Successfully tested the algorithm on a TurtleBot3 Burger robot, achieving a 98% success rate in navigating unknown environments and reducing path planning failure rates by 40%.
- Deployed in ROS and Gazebo, enabling real-time simulations with a 30% improvement in algorithm convergence speed and demonstrated seamless adaptability to dynamic environmental changes.

**Integrated Obstacle Recognition and Autonomous Navigation System** | *SLAM, YOLOv8, OpenCV, Raspberry Pi, Embedded Control*

- Directed a team of 5 to design an autonomous differential drive robot with real-time pick-and-place functionality, achieving 92% detection accuracy and reducing YOLOv8 training time by 15% through mosaic augmentation and custom datasets.
- Integrated multi-sensor fusion (RGB camera, IMU, encoders, and ultrasonic sensors) with landmark-based SLAM, enhancing navigation precision by 30% and enabling dynamic trajectory adjustments in complex environments.
- Developed a multi-threaded system on Raspberry Pi for concurrent sensor processing and motor control, achieving stable 10 FPS obstacle recognition and reducing task execution time by 25% through optimized path planning and autonomous recalibration.
- Ensured 98% reliability in odometry estimation and precise motion control with closed-loop feedback, enabling seamless navigation in challenging environments with 92% path-following accuracy.
- Conducted experimental validation, achieving a 35% reduction in trajectory deviations and processing sensor data with latency under 50ms, ensuring real-time performance in diverse.

**Mobile Manipulator Robot Design & Control |** *ROS2, MATLAB, SolidWorks, UR10, LIDAR, URDF, Kinematics, Dynamics Gazebo*

- Designed and implemented a 6-DOF mobile manipulator combining a UR10 arm with a differential drive, achieving a 20% enhancement in load stability through optimized chassis design and steerable L-joints.
- Developed ROS2-based navigation integrated with LIDAR fusion, enabling precise real-time control with 20ms latency, validated in Gazebo simulations for complex industrial environments.
- Attained 98% pick-and-place accuracy (±1 mm) and a 30% improvement in motion stability using Denavit-Hartenberg parameters and Jacobian-based trajectory planning for high-precision industrial tasks.
- Optimized end-effector functionality by transitioning to a vacuum gripper, increasing grasp reliability by 25% and reducing task execution errors during manipulative operations.

**LQR and LQG Controllers for Dual-Load Crane System** | *MATLAB, Kalman Filtering, System Modeling, Lyapunov Stability*

- Developed and implemented LQR and LQG controllers for a dual-suspended load crane system in MATLAB, achieving a 30% reduction in oscillations and a 25% improvement in response time using Lyapunov stability analysis.
- Conducted 100+ simulations on linear and nonlinear models, utilizing Kalman filtering to achieve 98% trajectory tracking accuracy under ±15° displacements and 15% load variations, reducing state estimation noise by 5% in low signal-to-noise environments.
- Designed state-space representations and derived system dynamics through Euler-Lagrange equations, ensuring controllability and observability for varying load and system configurations.
- Validated system performance under disturbances up to 10% of input force, achieving robust stability and precise control in challenging operating conditions.

**My Derma: Mobile Deep Learning for Skin Cancer Detection |** *TensorFlow Lite, ResNet-50, InceptionV3, DenseNet201, Flutter*

- Designed an ensemble deep learning model combining ResNet-50, InceptionV3, DenseNet201, and MobileNetV2, achieving 97.15% test accuracy and 98.46% validation accuracy on the HAM10000 dataset by leveraging advanced data augmentation and weighted sampling techniques.
- Implemented the model as a TensorFlow Lite application with a Flutter-based mobile interface, achieving a 30% reduction in latency through model compression and quantization while ensuring real-time diagnostic accuracy for on-device skin cancer detection.
- Enhanced classification robustness with an F1-score of 0.99 for melanoma detection, addressing class imbalance through SMOTE and augmentation strategies to ensure balanced model performance across seven lesion types.
- Conducted comprehensive evaluations, including ablation studies and hyperparameter optimization, to refine model generalization, achieving a 25% improvement in computational efficiency compared to baseline methods.

**Machine Learning for Bearing Fault Diagnosis |** *MATLAB, Predictive Maintenance, Time-Domain and Frequency-Domain Features*

- Developed an advanced bearing fault diagnosis system leveraging machine learning models, including SVM, SOM, RF, and KNN, achieving up to 100% classification accuracy across eight fault scenarios through optimized feature selection and model training.
- Extracted and analyzed time- and frequency-domain features such as RMS, kurtosis, and harmonic factors, enabling precise identification of roller, inner-race, and outer-race defects in SKF tapered roller bearings.
- Conducted 5-fold cross-validation with SVM, SOM, RF, and KNN, ensuring robust model performance with average accuracies exceeding 99.9%, validated across diverse fault combinations and operating conditions.
- Integrated feature importance analysis via Random Forest, reducing computational complexity by 20% while maintaining diagnostic precision, and validated results with confusion matrices and F1-scores.

**Chatter-Free Sliding-Mode Control with Disturbance Rejection |** *MATLAB, State Observers, First-Order and Second-Order Systems*

- Implemented a discrete-time sliding-mode control system using the implicit Euler method, achieving chatter-free stabilization and reducing disturbance effects by a factor of the sampling time (h), validated across 100+ MATLAB simulations.
- Designed controllers for first- and second-order perturbed systems, achieving a 30% improvement in system stability under disturbances up to 10% of input force, with trajectory tracking accuracy exceeding 98%.
- Integrated advanced state observers and disturbance compensation techniques, reducing tracking error by 20% and enhancing control precision for nonlinear systems in discrete-time domains.
- Conducted performance analysis against classical and twisting sliding-mode controllers, achieving 25% faster response times and superior disturbance rejection with zero-order-hold (ZOH) methods.

## ACTIVITIES

**Robotics President** Hyderabad, India

*Team Roboccon,* ***Guru Nanak Institutions Technical Campus*** 2020 - 2022

- Runner-up in the Inter-College Robotics Competition (Pick and Place) "Robout-2k19" and finalist in Aliens Tech-Robo Competition (ATRC); participated in multiple Roboveda events including Robo Soccer, Robo Sumo, Tug of War, and Drone competitions at Sreenidhi University and BITS.
- Served as President of Team Roboccon, mentoring and training over 50 students while demonstrating strong leadership in robotics projects and competitions.

## CERTIFICATIONS

**A Deep Understanding of Deep Learning** - *Udemy* October 2024
**Aerial Robotics –** *Coursera-Upenn* June 2023