

# NIRAJ BASNET

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## TECHNICAL SKILLS

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**Robotics:** Motion planning, Trajectory Optimization, Controls, Data structures and algorithms, AI, Optimization, Mapping, Localization, Sensor Fusion, Machine learning, Deep learning, Reinforcement Learning

**Programming Languages:** C/C++, Python, MATLAB, Latex

**Software Tools:** ROS, ROS2, Gazebo, CARLA, OMPL, Tensorflow, Pytorch, OpenCV, Git, Linux, Gitlab, Docker

## EXPERIENCE

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**Robotics Software Engineer II, Dorabot Inc., Peachtree Corners, GA** May 2021 – Present

- Developed various simulation and debugging tools for the palletizing robots and ran workcell simulation of various sites in gazebo before deploying on site.
- Remodeled the system architecture to improve cycle time and throughput requirement by parallelizing planning, pose estimation, and scene monitoring processes.
- Refactored the project controller code that drives the business logic of the palletizing robots
- Implemented and tested both automated and manual recovery mechanism for the palletizing robots in case of system and operation issues like package drop, power failure, unwanted human entry in workcell and so on.
- Improved grasp planning and motion planning to generate effective grasps and trajectories that eliminate box overlaps in palletizing and depalletizing operation.
- Developed the plc controller ros2-package for Allen Bradley plc, capable of using both tags and socket communication to write and read data between plc and palletizing application.
- Assisted in training operators on the site for general operation, maintenance and debugging of palletizing workcell.

**Graduate Research Assistant, Oregon State University** Jun 2019 – Dec 2020

- Developed motion planning and controls stack of OSU team for autonomous F1/10 cars racing competition.
- Engineered a real-time(40Hz) model predictive contouring controller for generating and tracking dynamically feasible high speed racing trajectories while avoiding obstacles and opponents in the race track.
- Developed a real-time hierarchical planner comprising state lattice planner and Nonlinear MPC(for tracking).
- Automated racetrack mapping and its relevant data extraction and pre-processing for autonomous cars racing, thereby slashing preparation time before the race, by almost half.
- Adapted an evolutionary algorithm(CMA-ES) for raceline-optimization of a given racetrack.
- Evaluated trajectory tracking performance of various control strategies like PID, LQR, MPC and Pure Pursuit.

**Graduate Teaching Assistant, Oregon State University** Sep 2018 – May 2019

- Conducted various workshops on version control, interfacing sensors, ROS, etc. as an IOT community coordinator to garner students' interest in IOT and automation.
- Provided course support and assisted in development of new course material for Autonomous car racing course.

**Robotics Software Engineer, Co-founder, Paaila Technology, Nepal** Dec 2016 – Sep 2018

- Co-led a team of 4 engineers for development of motion planning and control stack, collaborated with mechanical and electrical hardware teams, to create initial prototypes for waiter and service robots within 9 months.
- Deployed a multi-robot global path planner to plan collision-free paths for waiter robots.
- Improved integration testing of various components of navigation stack by running simulation tests on dockerized Gazebo, thereby reducing the code deployment time by over 30%.

## PUBLICATION

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- **A. Momtaz, N. Basnet, H. Abbas, B. Bonakdarpour, "Predicate Monitoring in Distributed Cyber-Physical Systems ". In: Feng L., Fisman D. (eds) Runtime Verification. RV 2021, Lecture Notes in Computer Science, vol 12974. Springer, Cham. (Best paper Award)**
- **N. Basnet and H. Abbas, "Logical signal processing: A fourier analysis of temporal logic," in Runtime Verification, (Cham),pp. 359–382, Springer International Publishing, 2020. (Best paper nominee)**

## PROJECTS

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- Motion planning for Self-driving cars in city traffic using CARLA simulator** | *Python, CARLA* Oct 2020
- Integrated finite state machine(FSM) based behaviour planner and conformal lattice planner to plan collision-free trajectories for self-driving car in city traffic. Learnt CARLA to simulate planning in realistic driving scenarios.
- Mapping, Localization and Motion planning algorithms** | *C++, Python, ROS* Feb 2019 – Jun 2020
- Coded planning algorithms like Hybrid A\*, PRM, RRT, RRT\*, BIT\*, and potential fields for learning.
  - Implemented occupancy grid mapping and particle filter(Monte Carlo Localization(MCL)) on simulated vehicles.
- Investigation of sampling techniques for RRT\* motion planning of quadrotor** | *C++, OMPL* Mar 2019
- Benchmarked sampling methods like uniform, obstacle-based, gaussian, and max-clearance in maps of varying obstacles density to find the dominant method in each type of map, in order to reduce planning time.
  - Found thresholds for using various methods based on occupancy ratio of obstacles to free-space in a map.
- Multi-robot task allocation for warehouse environment** | *Python, Pytorch* Dec 2018
- Explored cooperative co-evolutionary algorithms for distributed task-allocation in a warehouse environment.
  - Attained a 7% improvement over the centralized sequential task allocation approach.
- Autonomous badminton playing robots** | *C++, Python, Arduino, ROS* Jul 2015
- Tuned PID controller for holonomic control of robot and also coded shuttlecock trajectory predictor.
  - Achieved Best Idea and Mabuchi Motor awards in ABU-Robocon, an International robotics competition.

## EDUCATION

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- Oregon State University(OSU)** Corvallis, OR  
*Masters of Science in Computer Science, GPA: 3.71/4.0* Sep 2018 – Dec 2020
- Pulchowk Campus, Institute of Engineering, Tribhuvan University** Lalitpur, Nepal  
*Bachelors in Electronics and Communication Engineering, GPA: 3.8/4.0* Sep 2012 – Sep 2016