Harsh Bharat Kakashaniya

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EDUCATION

University of Maryland, College Park, MD Expected May 2020

Master of Engineering, Robotics ***(GPA 3.88)***

MIT College of Engineering, Pune, India June 2016

Bachelor of Engineering, Mechanical Engineering *(First Class with Distinction)*

WORK EXPERIENCE

Robotics Intern, **ARCBEST technologies (Remote Co-op)** Aug'19 - Present

- Successfully designed pipeline for multi-agent path planning.
- Implemented Algorithm for robot to robot collision at global level.
- Working on Communication of multi-agents with master server using gRPC.
- Successful multi-agent simulation on Gazebo.

Robotics Intern, **ARCBEST technologies** May'19 - Aug'19

- Successful Bidirectional Path planning algorithms implementation on vehicle for dynamic environment.
- Worked on localization in known environment using Aruco Tags and odometry using Kalman filter.
- Implemented Pose estimation technique in order to attach autonomously.
- Simulation of complete warehouse scenario and navigation using ROS and Movebase package.

Research Assistant, **Maryland Robotics Center** Sep'18 - Apr'19

- Design and implementation of autonomous Hydroponic system (Cultivation without Substrate) with monitoring of plant health and yield along with cultivation using Robotic End Effectors.

Design Engineer, ACG Worldwide Jul'16-Aug'18

- Developed "Robotic Pick-and-Place" (3D SCARA of RRP type) resulting in a market revolution; we were the first company in India to have a robotic transfer system. The company showcased this work at 'P-Mech Exhibition 2018'
- Launched a Special Biscuit transfer attachment for packing 110 biscuits per minute which led to opening of completely new business avenue for ACG in the FMCG market.
- Led 'Value addition and Value Engineering' in the Design department which caused a high reduction in overall costs due to the design optimizations.
- Improved o/p efficiency by 15% yielding a record break in the total number of machines produced by the company in Sep'16.

TECHNICAL SKILLS

Programming: Python, C++, Linux, ROS (Robot Operating System), PCL, OpenCV, TensorFlow , Keras, Sklearn, OpenAI
Software: Pro-E, SolidEdge, SolidWorks, Gazebo, Rviz, Geogebra, MATLAB, Ansys, LabView
Engineering: Advanced Machining Process, Surface treatment, GD&T, Dynamics of Machine, Sensors, Mechanism analysis.
Hardware: Arduino, Raspberry Pi, Turtle Bot , Drones

GRAD. PROJECTS

Automating robotic solution for last-mile delivery with multiple drones - ***(TSP, Python/C++, ROS, Gazebo/AirSim)***

- *Simulated Gazebo environment with multiple Drones.*
- *Working on solution for last-mile delivery problem with optimal drone paths and considering dynamic environment.*

Localization of mobile robot in indoor crowded environment - ***(SLAM, Python/C++, ROS, Gazebo)***

- *Implemented AR tag detection even in adverse conditions.*
- *Working on solution for indoor localization of robot using features and AR tag.*

Implementation of path planning algorithms on normal and differential constraints using turtle bot - ***(OpenCV,Python,ROS)***

- *Simulated and implemented path planning algorithms like A* , dijkstra , BFS on turtle bot in known obstacle space.*
- *Optimized algorithm to suit different sized robot and different inflated radius of obstacles.*

Frontier Exploration - ***(RViz, C++, ROS, Gazebo, PCL)***

- *Used ROS turtle-bot to explore unknown map with assistance of Gazebo, PCL, Rviz, Kinect sensor.*
- *Implemented optimal path algorithm for covering maximum unknown environment in the least time.*
- *Mapped unknown given environment in RViz and saved map as png.*

Design and simulation of a controller for Gantry Crane System - ***(MATLAB, Simulink)***

- *Derived mathematical Nonlinear System and linearized it around Equilibrium point.*
- *Designed LQR and LQG controller to stabilize crane pendulums with controlled cart motion. The project provided hands on experience for designing of Controller with feedback*.

Modelling of fruit picking robot - ***(MATLAB, Solidworks)***

- *Formulated 6 DOF robot with its modelling in SolidWorks.*
- *Implemented Forward Kinematics and Inverse Kinematics for simulation of system using MATLAB and Simulink.*

Implementation of Visual Odometry for estimating trajectory of robot - ***(ORB/SIFT, Structure from Motion, Python)***

- *Implementation of the SFM Algorithm involving ORB feature detection and estimation of Fundamental and Essential Matrix.*
- *Computation of the relative translation and rotation from depth positivity using epipolar geometry.*

Design of Algorithm for Traffic Lane Detection - ***(OpenCV,Python)***

- *Video Processing along with implementation of Homography and Perspective Transform to detect and mark lanes on roads.*

Detection and Tracking of AR tags - ***(OpenCV,Python)***

- *Detection and decoding of AR tag with homography transformation and feature detection.*
- *Superimposition of images and virtual 3D objects on AR Tags in video using Pose Estimation.*

House price prediction using machine learning techniques - **(*Python, Machine Learning)***

- *Received a rank in the top 25% on Kaggle. Used linear regression with LASSO and Neural network for house price prediction.*

Color segmentation using Gaussian Mixture Models and Expectation Maximization Techniques - ***(OpenCV,Python)***

- *Specific object detection underwater with color segmentation using GMM instead of hard thresholding of colour spaces.*
- *This technique can be substituted to color thresholding for difficult colour sampling problems.*

Zoomba Roomba Robot - ***(ROS, Gazebo)***

- *Designed and simulated obstacle avoiding robot algorithm in virtual environment with Gazabo and Rviz.*
- *ROS turtle-bot was deployed with Kinnect sensor for point cloud data acquisition.*

Object detection using YOLO algorithm - ***(Python, Tensorflow, OpenCV*)**

- *Used 5 anchors points and 80 classes with 19 X 19 windows on an image.*

LEADERSHIP EXPERIENCE

- Co-founder at vtweak.in (2015-17), a company which delivered customized gifts created using advanced manufacturing processes and modern design tools.
- Mechanical Team Lead for college in the competition named Robocon (Team of 40). Was responsible for finalizing Robot design and Competition strategy. We secured 15th rank out of 90+ college teams all over India.