# MANTHAN PATEL

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## EDUCATION

**Indian Institute Of Technology Kharagpur, India** **CGPA: 9.61/10.00**
B.Tech in Mechanical Engineering *(expected May 2021)* *Academic Rank 2 among 150 students*

## RESEARCH INTERESTS

SLAM, Exploration, Control Systems, Micro Aerial Vehicles, Field and Service Robots

## RESEARCH PUBLICATIONS

**M Patel**, et al. (2020).*"A Proposal of FPGA-based Low Cost and Power Efficient Autonomous Fruit Harvester"* In: 6th International Conference on Control, Automation and Robotics(ICCAR), Singapore **[Publication]**

**M Patel**, et al. (2019).*"A Prototype of an Intelligent Ground Vehicle for constrained environment: Design and Development"* In: 2nd International Conference on Control and Robot Technology, South Korea **[Publication]**

A Patnaik, **M Patel**, V Mohta, H Shah, S Agrawal, et al. (2019). *"Design and Implementation of Path Trackers for Ackermann Drive based Vehicles" Preprint* **[Publication]**

## RESEARCH EXPERIENCE

**Collaborative mapping of archaeological sites** **Max Planck Institute for Intelligent Systems**
*Guide:- Dr. Aamir Ahmad, Robot Perception Group* *April 2020 - present*

- Developed and opensourced a novel archaeological simulation environment for AirSim along with a monocular camera Dataset consisting of 13 sequences for evaluation of collaborative SLAM algorithms [Link]
- Performed a comparative analysis of the collaborative SLAM approach with monocular SLAM algorithms
- Demonstrated the mapping of a real archaeological site in India with multiple UAVs and currently working on offline dense mapping of the site using the collaborative sparse map and camera poses

**Collaborative active SLAM for UAVs** **IIT Kharagpur**
*Guide:- Dr. Aamir Ahmad, Co Guide:- Prof. Aditya Bandopadhyay* *August 2020 - present*

- Developing a novel active SLAM approach for collaborative exploration and mapping of unknown regions
- The objective is to minimize the collaborative exploration time while preserving and improving the map accuracy as opposed to the current approaches using visual odometry for localisation which drift with time

**Autonomous Ground Vehicle Research Group** **IIT Kharagpur**
*Guide:- Prof. Debashish Chakravarty, Dept. of Mining Engineering* *Feb 2018 - present*

- Designed and implemented control strategies for efficient path tracking of Ackermann steering based vehicles using **optimal control** methods like Linear Quadratic Regulator, and Model Predictive Control [Link]
- Designed the control systems, localization and sensor integration for Mahindra e2o driverless car [Link]
- Worked on controls, planning, localization and electronics for a differential robot which could autonomously navigate in constrained environments while avoiding obstacles and following GPS waypoints [Link]

**Advanced Coordination Robotics Group** IIT Kharagpur
*Guide:- Prof. Aditya Bandopadhyay, Dept. of Mechanical Engineering* *August 2019 - present*

- Established the group which aims at developing novel algorithms for coordinated exploration of GPS-denied environments while considering the factors of time-optimality, probabilistic homing and failure recovery
- Designed and developed a multi-purpose Hex-copter test platform with a heavy payload capacity
- Implemented a receding horizon-based planner and visual odometry to perform information gain-based time-bounded multi-agent exploration with failure recovery in simulation and real test platforms [Link]

## PROJECTS

**D.R.D.O. SASE's UAV Fleet Challenge** IIT Roorkee
*Mission Strategy, simulation and path planning developer* *Oct 2019 - Dec 2019*

- Conceptualized and implemented efficient mission planing strategy, finite state machine and path planning algorithm for a UAV fleet to scan and search described targets in given arena in least time. [Link]
- Contributed to the hardware design and development of four quadrotors; simulated and tested the pipeline

**Inspired Automation Future Technologies** Ahmedabad
*Robotics Intern* *June 2019 - July 2019*

- Designed and developed a 1/10th model RACECAR with a sensor setup of RGBD camera, 2D Lidar, IMU and encoders; also implemented mapping, particle-filter based localisation and planner for the vehicle. [Link]
- Implemented algorithms for UAV stabilisation, localization and navigation in an indoor environment [Link]

**Autonomous Agricultural Robot** IIT Bombay
*Control Systems and Embedded Team* *Nov 2018 - Dec 2018*

- Developed a low-cost autonomous agri-robot with capabilities of autonomous fruit plucking and seed-sowing
- Designed the controller for the 4-DOF Robotic arm and overall electronic architecture, along with implementing Kalman-filter based localization and path tracking for following a predefined trajectory [Link]

## TEACHING EXPERIENCE

- **IEEE Winter Workshop Mentor**: Mentored a batch of 40 students in a week-long workshop on concepts of autonomous robotics. Supervised them to solve the problem statement of building a self-balancing robot.
- **KRAIG Mentor**: Designed and delivered classes on basic concepts of robotics and arduino programming to an audience of 150 freshmen as a part of the Kharagpur Robotics and Artificial Intelligence Group

## HONORS AND AWARDS

2020 **DAAD WISE Scholar** *German Academic Exchange Service*
Recipient of the prestigious scholarship to perform a research internship at a German Research Institute

2020 **Smart India Hackathon** *Govt. of India*
Winner of the round 1 hardware hackathon for work on Coordinated robotics for search-rescue missions

2020 **COVID-19 Relief Challenge** *Govt. of India*
Among the top 22 finalists out of 850+ teams for proposal on contact-less delivery of essential goods

2019 **Inter-IIT Tech Meet 8.0** *IIT Roorkee*
First Runners up (developed a UAV swarm solution for the given problem statement on search mission)

2019 **27th Intelligent Ground Vehicle Competition(IGVC)** *Michigan, USA*
Secured the second position in the AutoNav Challenge among 40+ participating international teams

2019 **M B Scholarship** *IIT Kharagpur*
Awarded with the prestigious scholarship for being institute's best all rounder among 1400 students

2019 **Hardware Modelling General Championship** *IIT Kharagpur*
Captained a team of 10 students to build a semi-autonomous fire fighting robot (stood 5th in the event)

2018 **Inter-IIT Tech Meet 7.0** *IIT Bombay*
Second Runners up (developed a prototype autonomous agricultural robot for respective event)

2018 **Department Change** *IIT Kharagpur*
Awarded with change of department to Mechanical Engineering due to outstanding academic performance

2017 **National Service Scheme (NSS)** *Kharagpur*
Awarded with silver medal for impeccable social service during the 7-day annual NSS camp

## TECHNICAL SKILLS

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| **Programming Languages** | C, C++, Python, MATLAB |
| **Libraries and Environments** | ROS, Airsim, Gazebo, OpenCV, PCL,Numpy, Git, PX4, Ardupilot |
| **Hardware** | Nvidia Jetson TX2/Nano, PixHawk, APM, Ras-Pi, Arduino, Odroid |
| **Other Software** | Unreal Engine 4, Solidworks, AutoCAD, Cura engine, Mission Planner |