

# MANTHAN PATEL

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## EDUCATION

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**Indian Institute Of Technology Kharagpur, India**  
B.Tech in Mechanical Engineering (*expected May 2021*)

**CGPA: 9.61/10.00**  
*Academic Rank 2 among 170 students*

**Ahmedabad International School, Ahmedabad**  
Higher Secondary Certificate, Gujarat Education Board

*June 2015 - April 2017*  
Percentage: 96.33

## RESEARCH INTERESTS

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

## RESEARCH PUBLICATIONS

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**M Patel** (2020) "Collaborative SLAM for UAVs and its application for Archaeological Mapping" [Bachelor Thesis](#)

A Patnaik, **M Patel**, V Mohta, H Shah, S Agrawal, et al. (2020). "Design and Implementation of Path Trackers for Ackermann Drive based Vehicles" [ArXiv Preprint](#)

**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 [IEEE Xplore](#)

**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, S Korea [ACM Digital Library](#)

## RESEARCH EXPERIENCE

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**Collaborative mapping of archaeological sites**

**Max Planck Institute for Intelligent Systems**

*Guide:- Dr. Aamir Ahmad, Robot Perception Group*

*April 2020 - Nov 2020*

- Developed and open-sourced a novel archaeological simulation environment for AirSim [\[Link\]](#)
- Implemented a collaborative SLAM approach for a team of UAVs and extended it for archaeological mapping
- Prepared a first archaeological dataset consisting of 17 sequences for evaluating collaborative SLAM methods
- Demonstrated the collaborative mapping of the Sadra Fort (13th Century Indian Fort) with multiple UAVs
- Generated the first 3D dense map of the site using the collaborative sparse map and camera poses [\[Thesis\]](#)

**Collaborative active SLAM for UAVs**

**IIT Kharagpur**

*Guide:- Dr. Aamir Ahmad, Co Guide:- Prof. Aditya Bandopadhyay*

*Oct 2020 - present*

- Developing a novel active SLAM approach for collaborative exploration and mapping of unknown regions
- The objective is to minimize the exploration time while preserving and improving the map accuracy

**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 [\[Link\]](#)
- Built an autonomous differential-drive robot which could navigate in constrained environment [\[Link\]](#)

**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, agricultural automation and industrial inspection
- Designed and developed a swarm of four UAVs (3 Quadcopters and 1 Hexcopter) for testing and evaluation
- 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

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### D.R.D.O. SASE's UAV Fleet Challenge

IIT Roorkee

*Mission Strategist, simulation and path planning developer*

*Oct 2019 - Dec 2019*

- Conceptualized and implemented efficient mission planning 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, simulation and testing of four quadrotors

### Inspired Automation Future Technologies

Ahmedabad

*Robotics Intern*

*June 2019 - July 2019*

- Designed and developed a 1/10 model RACECAR with a sensor setup of RGBD camera, 2D Lidar and IMU
- Implemented indoor 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
- Implemented Kalman-filter based localization and path tracking for following a predefined trajectory [\[Link\]](#)

## TEACHING EXPERIENCE

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- **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

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2020	<b>DAAD WISE Scholar</b>	<i>German Academic Exchange Service</i>
	Recipient of the prestigious scholarship to perform a research internship at a German Research Institute	
2020	<b>COVID-19 Relief Challenge</b>	<i>Govt. of India</i>
	Among the top 22 finalists out of 850+ teams for proposal on contact-less delivery of essential goods	
2020	<b>M B Scholarship</b>	<i>IIT Kharagpur</i>
	Awarded with the prestigious scholarship for being institute's best all rounder among 1400 students	
2019	<b>Inter-IIT Tech Meet 8.0</b>	<i>IIT Roorkee</i>
	First Runners up (developed a UAV swarm solution for the given problem statement on search mission)	
2019	<b>27th Intelligent Ground Vehicle Competition(IGVC)</b>	<i>Michigan, USA</i>
	Secured the second position in the AutoNav Challenge among 40+ participating international teams	
2019	<b>Hardware Modelling General Championship</b>	<i>IIT Kharagpur</i>
	Captained a team of 10 students to build a semi-autonomous fire fighting robot (stood 5th in the event)	
2018	<b>Inter-IIT Tech Meet 7.0</b>	<i>IIT Bombay</i>
	Second Runners up (developed a prototype autonomous agricultural robot for respective event)	

## LEADERSHIP

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2019 - 2020	<b>Head, Technology Robotix Society</b>	<i>IIT Kharagpur</i>
	Led a 3-tier team of 42 people for organising Robotix'20, India's biggest college robotics fest	
2017 - 2018	<b>Volunteer, National Service Scheme (NSS)</b>	<i>Kharagpur</i>
	Awarded with silver medal for impeccable social service in the direction of rural empowerment	

## TECHNICAL SKILLS

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