

AYUSH GUPTA

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EDUCATION

- 2017–present **Bachelor of Technology**, *Indian Institute of Technology*, Kanpur, *CGPA- 9.0*/10*
Major in Mechanical Engineering with Minor in Industrial & Management Engineering
- 2017 **Grade XII**, *City Montessori School*, Lucknow, *Result: 95.5%*
- 2015 **Grade X**, *St. Francis College*, Lucknow, *Result: 95%*

RESEARCH EXPERIENCE

- Aug '19–present **Orbital Debris Mitigation through guided solar sails**
Intelligent Guidance & Control Laboratory, Supervisor: Prof. Mangal Kothari
 - Simulated a model of the atmosphere using N-body particle simulator, **Rebound**
 - Used probabilistic debris data from European Space Agency's MASTER, analysed the decay of particle orbits in presence of guiding satellites considering solar radiation effects and gravity
- May '18–present **Autonomous Underwater Vehicle (AUV)**
IIT Kanpur, Mentor: Prof. Mangal Kothari
 - Brainstormed a **hierarchical state machine** for robust autonomous behavior of the vehicle
 - Solved the localization problem using modified **landmark-based FastSLAM** implementation
 - Setup robust **underwater computer vision pipeline** using Deep Learning & traditional IP
 - Created **multi-class dataset** of labeled underwater photos, trained and evaluated custom & YOLO object detection models, setup realtime inference on Jetson TX2
 - Implemented a image preprocessing algorithm based on of **pixel-based fusion** technique
 - Simulated the model of vehicle in a custom-designed **hydrodynamically realistic** environment programmed on Gazebo, with underwater currents and fluid drag
 - Created an acoustic localization system capable of estimating the Direction of Arrival of ultrasonic signals from pinger using signal processing operations, STFT & Cross-Correlation
- May '19–Oct '19 **Realtime Onboard Dense RGB-D Mapping on Unmanned Aerial Vehicles**
Intelligent Guidance & Control Laboratory, Supervisor: Prof. Mangal Kothari
 - Benchmarked** various approaches such as REMODE & RTAB-Map against their computational and energy requirements, and modified publically available codes to process RGB pointclouds
 - Performed a literature review of different approaches related to **3D mapping** of the environment, in particular, using monocular and stereo cameras on a Jetson TX2 onboard
- Dec '17–Apr '18 **Design & development of bipedal prototype of kid-sized humanoid**
IIT Kanpur, Supervisor: Prof. Ashish Dutta
 - Worked on the walking mechanism of humanoid, capable of performing statically stable walking
 - Implemented the MATLAB simulated **inverse kinematics** walking algorithm based on zero moment point (ZMP) criteria on the actual robot using ROS
 - Developed a web-enabled graphical user interface for debugging and **monitoring diagnostics** along with realtime status of the robot using ROS web-bridge server, JavaScript and CSS

SELECTED PROJECTS

- June '19 **Identifying Parking Spaces for smart cities using Computer Vision**
Submission for TechGig Artificial Intelligence Challenge 2019, Online round
 - Preprocessed the robust **PKLot dataset** for Parking Lot Classification comprising of over **600k+ segmented images**, from 12k+ images of parking lots in varied conditions
 - Used a regular CNN-model for **binary classification** of vacancy of parking space, and **saliency maps** for finding parking spaces in the image of a parking lot
- Apr–Jul '19 **Mohammad Bin Zayed International Robotics Challenge 2020**
Intelligent Systems Lab, Supervisor: Prof. Laxmidhar Behera
 - Actualized simulation setup using MoveIt & Gazebo for UR5 manipulator on Guardian Robot
 - Implemented localization using occupancy maps, along with **RRT-based** motion planning
 - Final objective to create collaborative autonomous robots capable of building walls, extinguishing fires in unknown environments for **MBZIRC Challenge 2020**, in Abu Dhabi

May–Jul '18 **New York Office, IIT Kanpur**

[website](#)

Backend Intern, Supervisor: Prof. Manendra Agarwal

- Worked on **Scala & Akka** for a scalable concurrent multi-threading website backend
- Documented the entire collection of Application Programming Interfaces using PostMan
- Fixed bugs present in large codebase while developing an upcoming social platform, **gmantra**

Jan–Apr '18 **Development of a secure web-based chat client**

[github](#)

[report](#)

Course Project for Fundamentals of Computing (ESC101A), Prof. Puroshottam Kar

- Designed and developed a **chat application** on NodeJS, Express, Socket-IO, and MongoDB
- Implemented realtime chat using Socket-IO with PassportJS for extensively implemented **authentication & cookie handling** for secure **session management**
- Database management implemented using MongoDB, and application deployed on Heroku

ACADEMIC ACHIEVEMENTS

- 2019 Participated in AUV competition, **RoboSub** by AUVSI Foundation in San Diego
- 2019 **2nd place** in **Student Underwater Vehicle (SAVe)** competition by NIOT, Chennai
- 2017 **All India Rank 1075** in JEE Advanced among 200,000 students
- 2017 **Top 0.01% in country**, in JEE Mains among 1.6 million students
- 2015 & 16 **Top 1% in country**, National Standard Examination in Astronomy, India
- 2016 **Top 1% in state**, National Standard Examination in Physics, India
- 2016 **Top 1% in country**, National Standard Examination in Chemistry, India

TECHNICAL SKILLS

Software: Gazebo, Unity3D, SolidWorks, MATLAB, Octave, LabView

Languages: Python, C++, CUDA, C, Shell (bash), JavaScript, Java, Scala, C#, Lua

Frameworks: ROS, OpenCV, Tensorflow, Pytorch

Development: SocketIO, NodeJS, Express, Flask, CSS, HTML

Platforms: NVidia Jetson TX2, Raspberry Pi, Arduino, Odroid, NI Data Acquisition Board

Other: Git, GNU Octave, L^AT_EX

RELEVANT COURSEWORK

Robotics: Introduction to Robotics (*i*), CNNs for Visual Recognition (Stanford University, online)

Mathematics: Probability and Statistics, Ordinary/Partial Differential Equations, Complex Analysis

Algorithms: Data Structures and Algorithms (*i*), Fundamentals of Programming (*)

Mechanics: Mechanics Of Solids, Dynamics, Fluid Mechanics, Introduction to Machine Design (*)

(i) to be completed in Fall 2019, (): exceptional performance in course*

POSITIONS OF RESPONSIBILITY

April **Software Team Lead, AUV Team**, IIT Kanpur

'19–present

- Maintaining entire stack of an Autonomous Vehicle, deployed on Git, implemented using ROS, OpenCV and simulation integrated using Gazebo, while leading a group of 10 members
- Participating in international robotics competitions, RoboSub 2020 & Virtual RobotX 2019

Apr '18–Mar '19 **Secretary, Robotics Club**, IIT Kanpur

- Managed club website, prepared lectures on robotics, & organized competitions for community

Apr '18–Mar '19 **Student Guide & Academic Mentor, Counseling Service**, IIT Kanpur

- Assisted six freshmen students in adjusting to the college environment, providing guidance
- Provided personal tutoring to academically weak students for their courses in Mathematics

Apr '18–Mar '19 **Secretary, Consulting Club**, IIT Kanpur

- Successfully prepared and delivered lecture to the campus community on introductory Machine Learning and Data Science
- Founding member of the Hobby Group, aiming to work on outsourced consulting projects, with emphasis on insights from collected data

MISCELLANEOUS

Aug '19 Currently involved in preliminary phases of startup in **Orbital Debris Mitigation**

Oct '18 Conducted a lecture on '**Introduction to Machine Learning**' for campus community

Sep '18 Secured 2nd place at intra-college robotics tournament held in IIT Kanpur

Mar '18 Demonstrated application generated summaries of the latest news based on the **current trending hashtags** on Twitter using Natural Language Processing [[github](#)]

Jan '15 Developed basic side-scrolling platform game while in high school on **Unity3D** [[github](#)]