Ayush **Gupta**

Junior Undergraduate · Robotics Enthusiast

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Education

Indian Institute of Technology Kanpur — *Kanpur, India*

Bachelor Of Technology in Mechanical Engineering and Minor in Industrial Management and Engineering — *July 2017 - Present*

- Cumulative Point Index: **9.2*/10.0**

City Montessori School — *Lucknow, India*

Indian School Certificate Examination (Intermediate) — *March 2017*

- Overall Percentage: 95.5%

St. Francis' College — *Lucknow, India*

Indian Certificate Of Secondary Education (High School) — *March 2015*

- Overall Percentage: 95%

Research Experience

Team AUV-IITK — *Software Team Member*

Faculty Advisor: Prof. Mangal Kothari — *May 2018 - Present*

- Fused sensor readings from Doppler Velocity Log (DVL) and IMU using an Extended Kalman Filter to generate odometry message for the vehicle
- Implemented a novel image preprocessing algorithm based on Fusion Framework to formulate a robust underwater computer vision pipeline
- Created multi-class dataset of labeled underwater photos, trained YOLO object detection model and setup real-time inference on Jetson TX2
- Developed and tested acoustic localization system capable of estimating the Direction of Arrival of ultrasonic underwater signals from pinger
- Used signal processing operations such as Short Time Fourier Transform and Cross-Correlation to find time delay of arrival between signals
- Managed a multi-layered software stack for an autonomous underwater vehicle, Anahita developed on ROS and simulated using Gazebo
- Tuned and tested Cascaded PID Controller on the vehicle, enabling it to perform waypoint navigation and visual servoing
- Designed a hierarichal state machine for more robust autonomous behavior of the vehicle, with failsafes and proper decision flow
- Made extensive use of physics engine Gazebo to simulate model of vehicle in a custom hydrodynamically realistic environment
- Created setups for disparity map generation using a pair of cameras and implemented a modified Fast-SLAM for underwater localization

Team Humanoid, IITK — *Software Team Member*

Robotics Club, IIT Kanpur — *Dec. 2017 - April 2018*

- Worked on a Bipedal Prototype of the humanoid bot, capable of performing statically stable walking
- Implemented the MATLAB simulated **inverse kinematics walking algorithm** based on ZMP criteria on the actual robot using ROS
- Developed a Web Graphical User Interface for debugging and monitoring using ROS Web Bridge Server and JavaScript

Work Experience

Intelligent Systems Lab — *Robotics Intern*

Supervisor: Mr. Ravi Prakash, Doctoral Student — *April 2019 - Present*

- Ported outdated available ROS code to operate on current development platform using ROS Kinetic on Ubuntu 14.04
- Actualized setup for simulation using **Rviz and Gazebo** for Universal Robots manipulator on a Guardian Robot
- Tweaked the hardware drivers and changed odometry publishers to fix position drift estimated by motor encoders
- Assisted in final aim to create **collaborative autonomous robots** capable of building walls, extinguishing fires

New York Office, IIT Kanpur — *Backend Software Intern*

Supervisor: Prof. Manindra Agrawal — *May 2018 - July 2018*

- Worked on **Scala with Akka-HTTP** for scalable and concurrent multi threading using functional programming
- Documented and compiled the entire collection of backend Application Programming Interfaces using **PostMan**
- Fixed bugs in the Scala backend, and collaborated using Phabricator, while developing an upcoming social platform

Skills

Robotics	ROS, OpenCV, Arduino, Gazebo, CUDA, Gym
Data Science	Tensorflow, Keras, Scikit, MATLAB
Web Development	Node.js, MongoDB, Flask, Express, Socket-IO, Bootstrap, HTML5, Jekyll, Travis CI
Programming Languages	C++, Python, Scala, Javascript
Utilities	LabView, LaTeX, Git, SVN, Bash, Unity, Postman

Selected Projects

Realtime Onboard Dense RGB-D Mapping on UAVs

Summer Project

Mentor: Prof. Mangal Kothari — *May 2019 - Present*

- Studied and experimented various techniques related to 3D mapping of environment using monocular and stereo cameras on Jetson TX2
- Evaluated approaches for shortcomings and computational requirements considering its onboard realtime implementation on UAV

Chat-IITK

Course Project - ESC101

Mentor: Prof. Puroshottam Kar — *Spring 2018*

- Designed and developed a chat application on NodeJS, Express, Socket-IO, and MongoDB
- Implemented real-time chat using Socket-IO with PassportJS for extensively implemented **authentication** and **cookie handling**
- **Database management** implemented using MongoDB, and application deployed on Heroku's server

Mechanical Quadruped

Course Project - TA202

Mentor: Prof. Shantanu Bhattacharya — *Spring 2019*

- Designed and simulated a four-legged assembly that uses Jansen's linkage mechanism to walk using Solidworks
- Made a working model of the same under constraints of size and materials using manufacturing processes such as lathing, milling and drilling

Honors & Achievements

2019	**First Runner Up,** Student Autonomous Underwater Vehicle Competition (SAVe), organised by **National Insitute Of Ocean Technology, Chennai**	*Chennai*
2017	**Top 0.7% in country,** Joint Entrance Examination Advanced, **160,000 candidates**	*India*
2017	**Top 0.001% in country,** Joint Entrance Examination Mains, **1.3 million candidates**	*India*
2016	**Top 1% in state,** National Standard Examination in **Physics**	*India*
2016	**Top 1% in country,** National Standard Examination in **Chemistry**	*India*

Positions Of Responsibility

Team Autonomous Underwater Vehicle, IITK

Science and Technology Council

Software Team Lead — *April 2019 - Present*

- Leading a group of 8 people working on the software of Anahita, while managing funding, sponsorships, and technical progress
- Maintaining entire stack of an Autonomous Vehicle, deployed on Git, implemented using ROS, OpenCV and simulation integrated using Gazebo
- Working to participate in the international underwater robotics competition, **AUVSI RoboSub 2019**, and **SAUVC 2020**

IITK Consulting Group

Students' Gymkhana

Secretary — *July 2018 - April 2019*

- 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

Robotics Club

Students' Gymkhana

Secretary — *April 2018 - April 2019*

- Volunteered in organizing introductory workshops for interested freshman students across the year
- Managed the club website, prepared content for lectures and helped organising competitions for campus community

Counselling Service

IIT Kanpur

Academic Mentor and Student Guide — *April 2018 - April 2019*

- Assisted five freshmen students in adjusting to the college environment, providing guidance and emotional support
- Took campus level remedial classes for freshman year Mathematics, provided personal tutoring to academically weak students for their courses

Coursework

*: Exceptional Performance, **A**: Grade **o**: Ongoing, **!**: Next Semester,**#**: Online Audit

- Multi-Variable Calculus
- Linear Algebra and Differential Equations
- Fundamentals Of Computing **(*)**
- Introduction to Machine Design **(*)**
- Partial Differential Equations
- Probability and Statistics
- Mechanics of Solids (A)
- Dynamics (A)
- Fluid Mechanics (A)
- Energy Systems (o)

Extra Curriculars

Takneek 2018	Runners Up in robotic soccer event Wild Soccer, and an image processing competition, Visualise, organised by Robotics Club
code.fun.do	The application generated summaries of the latest news based on the current trending hashtags on Twitter using NLP
The Ball Game	Developed basic platform game while in high school, on Javascript & C#, updated on Github with Android & Windows builds