

Harsh Sinha

• SENIOR UNDERGRADUATE STUDENT • INDIAN INSTITUTE OF TECHNOLOGY, KANPUR •

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Education

Indian Institute of Technology, Kanpur (IIT Kanpur)

July 2014—Present

B.TECH IN AEROSPACE ENGINEERING, WITH A SECOND MAJOR IN ELECTRICAL ENGINEERING

GRSS Vidya Mandir, Bhagalpur, Bihar

April 2007—July 2013

CENTRAL BOARD OF SECONDARY EDUCATION

Publications

PUBLISHED

Convolutional Neural Network based Sensors for Mobile Robot Relocalization | [📄 PDF] [📄 IEEE]

ACCEPTED AT IEEE MMAR 2018, MIĘDZYDROJE, POLAND

Harsh Sinha, Jay Patrikar, Eeshan Dhekane, Gaurav Pandey, Mangal Kothari

Autonomous Detection & Tracking of High-Speed Ground Vehicle using a Quadrotor | [📄 PDF] [📄 IEEE]

ACCEPTED AT AIAA SciTech Forum and Exposition 2019

Animesh Kumar Shastry, Harsh Sinha, Mangal Kothari

SUBMITTED

Vision based Autonomous Tracking and Landing of a Fully Actuated Rotorcraft | [📄 PDF] [📄 VIDEO]

SUBMITTED TO CONTROL ENGINEERING PRACTICE, AN ELSEVIER JOURNAL

Mahathi T Bhargavapuri, Animesh Kumar Shastry, Harsh Sinha, Soumya Ranjan Sahoo, Mangal Kothari

Experience & Relevant Projects

Drone Swarm Development for Humanitarian Assistance and Disaster Relief

Oct 2018—Present

WITH DR. M. KOTHARI, DR. ABHISHEK, DR. V. P. NAMBOODIRI, DR. K. RAJAWAT, DR. S. R. SAHOO, AND DR. S. GOEL

IIT Kanpur

- Working on development of a **drone swarm** as the first response for **Humanitarian Assistance and Disaster Relief operations**.
- The primary objective is to showcase a VTOL swarm of **50 UAVs** that can travel **50 km** and collaboratively scan a 1 km by 1 km region.

Intelligent Ground Vehicle | [📄 REPORT] | [📄 CODE] | [📄 WEBSITE]

Nov 2016—Present

TEAM LEADER UNDER MENTORSHIP OF PROF. GAURAV PANDEY AND PROF. MANGAL KOTHARI

AUVSI IGVC, IIT Kanpur

COURSE PROJECT PROBABILISTIC MOBILE ROBOTICS | [📄 REPORT]

- Developed a **fully autonomous vehicle** for **waypoint navigaiton, obstacle avoidance and lane driving** on challenging terrain.
- Created the stack for **Computer Vision, Sensor Fusion, SLAM, Motion Planning and Control** and now mentor a team of 20 students.

Deep Reinforcement Learning for Optimal Navigation of a Visually Guided UAV

May 2018—Present

ONGOING PROJECT WITH PROF. FARSHAD KHORRAMI, DR. PRASHANT KRISHNAMURTHY AND NAMAN PATEL

CRR Lab, NYU Tandon

- Developed a modular framework for Deep RL for UAVs using **ROS, Gazebo Sim, Visual SLAM** and a custom RL training module.

CNN-based Sensors for Mobile Robot Relocalization | [📄 REPORT] | [📄 SLIDES]

May 2017—Sep 2017

WITH PROF. GAURAV PANDEY, PROF. MANGAL KOTHARI, JAY PATRIKAR AND EESHAN DHEKANE

IIT Kanpur

- Proposed a novel, robust and real-time **Convolutional Neural Network** based algorithm for **Mobile Robot Relocalization**.
- Integrated **Pose Estimation from RGB Images** with **Extended Kalman Filter** using the **ROS-Caffe** Platform.

Vision based Autonomous Tracking and Landing on Moving Platforms | [📄 PAPER]

March 2018—Sep 2018

WITH PROF. MANGAL KOTHARI, PROF. SOUMYA RANJAN SAHOO, MAHATHI T.B. AND ANIMESH K. SHASTRY

IIT Kanpur

- Developed a novel method to tracking of and landing on vehicles moving at high speeds using only vision based relative positioning.
- Proposed a novel high performance **Adaptive Controller** for motion estimation and showed performance in real-world upto 20 kmph.

Human Tracking and Following Quadrotor | [REPORT] | [CODE]

Jan 2018—April 2018

COURSE PROJECT WITH PROF. MANGAL KOTHARI AND SHUBH GUPTA

IIT Kanpur

- Developed a pipeline for Human Tracking and Following Quadrotor using **Tensorflow API's implementation of SSD Mobilenet**.
- Used **Kernelized Correlation Filter**, **Stereo Image Disparity maps** and **Extended Kalman Filter** for better tracking performance.

Low cost Tracking and Landing system for Quads | [REPORT] | [SLIDES] | [CODE]

Aug 2017—Nov 2017

UNDERGRADUATE PROJECT UNDER PROF. MANGAL KOTHARI

IIT Kanpur

- Developed a solution for tracking a ball of known size on a **low-cost low-power processor (Odroid XU4)** for light quadrotors.
- Implemented a **velocity field-based method** for landing and created a custom low-cost Gimbal using Arduino Nano.

Single Image Super Resolution through Sparse Representation | [REPORT]

Jan 2018—April 2018

COURSE PROJECT UNDER PROF. TANAYA GUHA

IIT Kanpur

- Implemented and Compared various papers for Single Image Super Resolution with **Dictionary Learning in Wavelet domain**.
- Proposed a simple Convolutional Neural Network based method for Single Image Super Resolution in Wavelet Domain.

Warehouse Inventory Check using Quadrotors | [SLIDES] | [CODE]

Oct 2017—Dec 2017

WITH PROF. MANGAL KOTHARI, KRISHNARAJ GAUR AND JAY PATRIKAR

IIT Kanpur

- Developed a solution for tracking a ball of known size on a **low-cost low-power processor (Odroid XU4)** for light quadrotors.
- Implemented a **velocity field-based method** for landing and created a custom low-cost Gimbal using Arduino Nano.

Quazar Oscillation Control Card for Scanning Tunnelling and Atomic Force Microscopy

May 2016—July 2016

SUMMER INTERNSHIP AT QUAZAR TECHNOLOGIES, UNDER JOSHUA MATTHEWS, UNIT HEAD, PROBE MICROSCOPY

Quazar, Delhi

- Designed oscillation control electronics, **Hardware PID Controller and Phase Locked Loop** system for scanning probe of an AFM.
- Designed the PCB, Implemented the drivers and tested the functioning with an AFM on Carbon Nano Tubes and Gold deposit.

Wind Propelled Navigation and Pole-climbing Robots | [POSTER] | [WEB] | [VIDEO]

Sep 2015—March 2016

PROJECT UNDER PROF. BHASKAR DAS GUPTA AND DR. ANJALI KULKARNI

ABU Robocon'16, IIT Kanpur

- Developed the Electronics for a pair of **Semi-Autonomous Robots for Collaborative Line, Wall-following and Pole Climbing**.
- Designed and Coded systems for Wall-following, Propeller Speed Control and implemented a Kalman Filter for Odometry estimation.

Artificial Intelligence for Factories of Future | [SLIDES] | [VIDEO]

Aug 2017—Jan 2018

WITH ANIMESH SHASTRY AND EESHAN DHEKANE

IIT Kanpur

- Proposed Solutions for Challenges proposed by HUL, with focus on **Human/Vehicle Tracking and Warehouse Management**.
- Winner of IIT Kanpur round with a **funding of INR 50,000** for deployment of proposed solutions in HUL factories.

Satellite Image Segmentation using Deep Learning | [SLIDES]

Dec 2018

WITH APURV GUPTA AND HARISH RAJAGOPAL

IIT Kanpur

- Developed a **per-class UNet** based solution for multi-class segmentation of Satellite Images and achieved accuracy around 90%.

Autonomous Underwater Vehicle | [WEBSITE]

Dec 2014—Aug 2015

PROJECT UNDER PROF. K S VENKATESH

IIT Kanpur

- Developed **Motherboard and Drive-system PCB** design and Localization using Inertial Measurement Unit (IMU).

Technical Skills

Programming	C/C++ • Python • Bash • Matlab / GNU Octave • \LaTeX
Computer Vision	OpenCV • Pillow • Pytorch • Sklearn
Electronics	gEDA • pcb • Altium • Eagle • Arduino • PixHawk • SPICE Simulator • MicroCap
Software Packages	ROS • Gazebo • Microsoft AirSim • Solidworks • AutoCAD
Manufacturing	Welding • Brazing • Casting • Water Jet Cutting • Laser Cutting • Lathe • Milling

Achievements & Honors

2018	Silver Medal, National , Satellite Image Segmentation, InterIIT TechMeet	IIT Bombay, India
2018	5th, International , Robot Design Competition, Intelligent Ground Vehicle Challenge	Michigan, U.S.A
2018	12th, International , Overall, Intelligent Ground Vehicle Challenge	Michigan, U.S.A
2018	2nd, National , Hindustan Unilever Limited, TechSpark Competition	Mumbai, India
2017	Bronze Medal, National , Warehouse Inventory Check, InterIIT TechMeet	IIT Madras, India
2016	3rd, National , Asia Broadcasting Union, Robocon 2016	Pune, India