

# Sachin Bhadang

4<sup>th</sup> YEAR UNDERGRADUATE  
MAJORS IN MECHANICAL ENGINEERING AND ELECTRICAL ENGINEERING

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## Education

### Indian Institute of Technology Kanpur

B.TECH. IN ME AND SECOND MAJOR IN EE - 8.5/10

Kanpur, Uttar Pradesh

Present

### P.B. Jog Junior College

CLASS XII MAHARASHTRA STATE BOARD - 91.85%

Pune, Maharashtra

2020

### The Bishop's School

CLASS X ICSE BOARD - 96.66%

Pune, Maharashtra

2018

## Publications

### Learning 6DoF Grasp-poses in Occluded Scenes Using RGB and 3D Point Cloud Modalities

AD Mathur, S Bhadang, P Raj, L Behera, T Sandhan  
IEEE National Conference on Communications 2023

### Bin-picking novel objects through category-agnostic-segmentation: RGB matters

P Raj, S Bhadang, G Chaudhary, T Sandhan, L Behera  
To be submitted

### Intelligent Tagging Assistant reinforced Brainwave Controlled Wheelchair

J Meenakshinathan, T Sandhan, V Gupta, S Bhadang, L Behera  
Patent under review

### Design of AI Ground Robots for Intelligent Combat in a Dynamic Arena

Poster accepted at IEEE, ICRA'22

## Research Experience

### Out-Of-Distribution Detection in Automotive Perception

MITACS GRI | ROBOTICS, NAVIGATION, AND CONTROL SYSTEMS LABORATORY | PROF. HASHIM MOHAMED

May 2023 - Present

- Developed a methodology to detect **Out-Of-Distribution (OOD)** samples for automotive perception using **outlier exposure**
- Proposed a **novel approach** that combines a **learned confidence score** with a **GAN-generated outlier samples** to accurately identify OOD samples
- Conducted a thorough **literature review** and **implemented** various SOTA OOD Detection approaches
- Currently engaged in the composition of a research paper with the aim of presenting and highlighting the obtained findings

### Bin Picking Novel Objects in Cluttered Environments

RESEARCH ASSISTANT, INTELLIGENT SYSTEMS LAB | PROF. LAXMIDHAR BEHERA | PROF. TUSHAR SANDHAN

Dec 2022 - Present

- Conducted a literature survey of existing **category-agnostic-segmentation** frameworks for bin-picking in cluttered environments, conducting experiments with different **sensor-modalities**
- Contributed to generate a simulated as well as a real **dataset and benchmark** for category-agnostic instance segmentation
- Developed an integrated **bin-picking framework** that can also grasp transparent and semi-transparent objects effectively combining the instance-segmentation method and an analytical grasp evaluation method

### Fruit Plucking using 9 DOF manipulator

RESEARCH ASSISTANT, INTELLIGENT SYSTEMS LAB | PROF. LAXMIDHAR BEHERA | PROF. TUSHAR SANDHAN

July 2022 - Nov 2022

- Developed a deep learning based framework for learning **6DoF apple fruit grasp-poses** for the application of robotic fruit harvesting & developed a **3D data augmentation** method for 6DoF grasp-pose labels in point cloud data
- Designed the framework using an **instance segmentation network** followed by a **grasp-pose estimation network** tested on **MobileNet & PointNet** backbone variations respectively
- Implemented a control algorithm enabling the **simultaneous control** of all degrees of freedom for a **UR5** robotic arm integrated with a **Clearpath Husky** base.
- Integrated a **force sensor** with the gripper to regulate the amount of pressure when grasping the fruit

### Autonomous Navigation System for a Brainwave-controlled Wheelchair

Report

RESEARCH ASSISTANT, INTELLIGENT SYSTEMS LAB | PROF. LAXMIDHAR BEHERA | PROF. TUSHAR SANDHAN

May 2022 - August 2022

- Tested and implemented algorithms for localization, mapping and path planning using **ROS navigation stack** integrating LiDAR, Depth Cameras, IMU and Rotary Encoders for Autonomous Navigation
- Used **RTAB\_MAP** to create a 3D map the environment using LiDAR and depth cameras | Real-time path-planning achieved using **Dijkstra's** and **Dynamic Window Approach (DWA)** path planners using cost maps and point clouds of obstacles
- Successfully integrated the Autonomous Navigation Pipeline with a **Brain Computer Interface**
- Designed and developed the **Printed Circuit Boards** and **3D printed mounts** for Embedded Systems and sensors

## Projects

### Development of AI Combat Robots

[Github](#) | [Report](#)

ROBOMASTER AI CHALLENGE | PROF LAXMIDHAR BEHERA | ERA-IITK

Dec 2021 - April 2022

- Designed an algorithm for **intelligent shooting** in a dynamic environment deploying developed algorithms on embedded **NVIDIA GPU's** using **cuDNN** for high perception and SLAM rates
- Trained **YOLO-v5** using darknet framework to recognize and classify patterns on the armor plate into 8 classes and detection of enemy robots by the **sentry cameras** in a global frame
- Achieved **mAP** of 85 percent on enemy recognition at **60 fps** and, **shooting accuracy** of 90 percent up to **8 meters**
- Developed intelligent Solution for Robot localization by using a fusion of multi Lidar system and visual odometry under high-speed motion pose using **Kalman filter** in a dynamic environment

### Floor Cleaning Robot

[Github](#) | [Report](#)

ALL INDIA IIT'S ROBOTICS ASSOCIATION | ROBOTICS CLUB, IIT KANPUR

Sept 2021 - Nov 2021

- Deployed an Area coverage algorithm based on **Ant Colony Optimization heuristic** for Optimal Spatial Coverage of an Unknown Region to maximize search area for clean in minimum time using a set of intelligent agents
- Employed a combination of a **greedy technique** based on the concept of rejection vector and a probabilistic technique for selecting the agent's rotating angles for exploring the unknown areas
- Planned local communication between a **swarm of robots** in order to keep track of decisions and the area covered by the robots
- Designed a robot in Fusion360 with an **advanced floor cleaning mechanism** for wet and dry waste using drippers, pneumatic, vacuum systems and Set up the **simulation environment** along with assembly of various components in Gazebo

### DEXTER Project

TEAM PROJECT ERA IITK | SCIENCE & TECHNOLOGY COUNCIL

April 2021 - present

- Developed a **customizable robot**, designing a power distribution system, manufactured a PCB Design for the electronic subsystem connecting the sensors, micro-controllers, motor drivers, and the computing devices
- Deployed LIDAR and GPS based Mapping and localization to make it **autonomous** and enhanced the moving capability of the robot by the **Holonomic drive** mechanism to make it move and rotate independently
- Implemented a modular distribution of different circuits and parts in order to allow the users to work on creating higher applications on top of the base chassis by providing **multiple slots** for different computing devices and other equipment

### Programobot Challenge

[Github](#)

ROBOTICS CHALLENGE, IIT PALLAKAD

April 2021 - May 2021

- Developed a **Vision-Based Obstacle Avoidance** System for Navigation in a complex environment
- Tuned **PID controller** to modulate the speed of a reaction wheel in order to control the two-wheeler motorbike and estimated angle using **Kalman filter fusion** on accelerometer and gyroscope measurements from an IMU

## Relevant Courses

Introduction to Reinforcement Learning  
Robot Motion Planning  
Ordinary and Partial Differential Equations  
Engineering Design and Graphics  
Introduction to Machine Learning

Statistical Natural Language Processing  
Introduction to Robotics  
Fundamentals of Computing  
Introduction to Electrical Engineering  
Manufacturing Processes

Probability and Statistics  
Control System Analysis  
Linear Algebra  
Introduction to Electronics  
Power Systems

## Skills

**Programming Skills** C, C++, Python, Bash, MATLAB,  $\LaTeX$

**Libraries** Pytorch, OpenCV, Pandas, Numpy, Matplotlib

**Robotics** AutoDesk Fusion 360, AutoDesk Eagle, EasyEDA, ROS, Gazebo, RViz, Arduino, PyBullet

**Languages** English, Hindi, Marathi

## Achievements

- Secured an **All-India Rank-2028** in Joint Entrance Examination (Advanced) 2020, among 1.5 lakh screened candidates
- Bagged the overall **Third Position** [🏆](#) in IEEE ICRA DJI RoboMaster AI challenge among the 40 international team, represented India as the only Indian team in the competition
- Cleared the first round and received a **Special Mention** [🏆](#) in the final round for the AIITRA Challenge (Team Wall-E)
- Selected as a **MITACS Globalink** Research Intern for conducting fully-funded research in Canada