# Gokul M K

**IDDD** in Robotics

🤳 +91-9489360360 🛛 🖬 ed21b026@smail.iitm.ac.in 🔚 linkedin.com/in/gokul-m-k-886a93263 🎧 

### **EDUCATION**

### Indian Institute of Technology, Madras (CGPA 8.79)

Bachelor of Technology in Engineering Design, IDDD in Robotics (Interdisciplinary Dual Degree) Chennai, Tamil Nadu

#### GRD Public School (Grade 12 CBSE (97.2 %), Grade 10 CBSE (93.8 %)) Primary, Seconday and Higher Secondary

# **RELEVANT COURSEWORK**

Control Systems     (ED2040)	<ul> <li>Optimization: Theory</li></ul>	<ul> <li>Optimal Control</li></ul>	• Deep Learning for
	and Algorithms	(EE6415)	Imaging (EE5179)
<ul> <li>Reinforcement</li></ul>	<ul> <li>Introduction to Motion</li></ul>	<ul> <li>Non-Linear System</li></ul>	<ul> <li>Introduction to Field</li></ul>
Learning (CS6700) <li>Recent Advances in RL</li>	Planning (ED5215) <li>Introduction to</li>	Analysis (EE6412) <li>Large Language</li>	and Service Robots
(DA7400)	Robotics (ID6040)	Models*	(ED5315)

# **RESEARCH EXPERIENCE, PROJECTS AND COMPETITIONS**

### Robert Bosch Centre for Cyber-Physical Systems (RBCCPS) - IISc Bangalore

Robotic Summer Intern, HiRo Lab, Dr.Ravi Prakash

- Developing a Learning-Based Approach for Bimanual Robotic Manipulation to Toss Objects Efficiently.
- Implemented key research works from LASA Lab, EPFL on Bimanual Manipulation which includes Dual Arm Coordinated Fast Grabbing, and from Google AI's TossingBot, a deep learning-based system for grasping and throwing objects.

#### Team Anveshak, Mars Rover Team, IIT Madras

Embedded System Lead, Electronics and Software Engineer

- Worked on embedded systems of the rover's manipulator, gaining experience in control systems and CAN integration. Worked with various Visual SLAM algorithms to address visual odometry and mapping.
- Coded the rover's manipulator in simulation to evaluate its functionality using the Moveit Framework for tasks such as obstacle avoidance with **OctoMap** and grasp planning.
- Finished 6th Globally in the Anatolian Rover Challenge, Turkey 2023 and 2nd in the International Rover Challenge, 2024.

# Eyantra Robotics Competition 2023-24, IIT Bombay

*Geo Guide Theme Participant* 

- Developed an Autonomous differential drive robot to navigate through an arena utilizing an overhead camera for guidance.
- The arena features war events detected by an overhead camera using CNN. The sequence of these events is communicated to the robot through a web server, initiating its mission. The positions of the events are indicated on the arena map using ArUco markers, which serve as GPS coordinates for navigation.
- The bot determines its path by georeferencing its location and selecting the closest ArUco marker to the event position. The objective is to visit the events in the most efficient order, prioritizing the shortest path and minimizing the time taken.

# Eyantra Summer Intern, IIT Bombay

Exploring Various Algorithms for Grasping Unknown Objects using a two finger gripper

• Conducted research on the **Point Cloud Library**, harnessing its robust features to devise a lightweight grasp detection method. This approach estimates grasp poses based on Euclidean Clustering and K-D Trees.

#### June 2022 – Present

May 2024 - Present

Bangalore, Karnataka

Nov. 2021 – Present

April 2007 – April 2021

Coimbatore, Tamil Nadu

Chennai. Tamil Nadu

Sep. 2023 – Jan. 2024

Mumbai, Maharashtra

May 2023 - July 2023

Mumbai, Maharashtra

- Integrated various grasping algorithms, including Graspnet, HAF, and GPD, with the Industrial UR5 arm and 2-finger gripper using **ROS**. Implemented these algorithms in both simulation and in hardware setups.
- Performed a comprehensive evaluation of the aforementioned algorithms through a series of experiments. Key evaluation parameters included accuracy, precision, estimation time, grasp success rate.

#### Eyantra Robotics Competition 2022-23, IIT Bombay

```
Sep. 2022 – Mar. 2023
Mumbai, Maharashtra
```

AIR-4 Krishibot Theme

- Programmed an **Autonomous Mobile Manipulator** for navigating a Greenhouse environment. The primary objective was to locate colored fruits, autonomously plan and pluck the fruits using the onboard UR5 Arm.
- Successfully implemented a **PD control** system on LiDAR LaserScan data, both in the simulation and on hardware, to ensure precise lane keeping and trajectory correction during turns.
- Worked in **Image Processing**, enabling accurate estimation of the fruit's position. Used the **Moveit** planning framework to autonomously control the onboard UR5 manipulator, orchestrating the plucking process.

# PROJECTS

Data-Driven Control of Nonlinear Systems using Koopman Operators | Prof. Anuj Tiwari July. 2024 - Present

- This project focuses on data-driven control for highly non-linear systems, such as Quadcopters and Legged Robots, where traditional linearization methods may not achieve global linearization.
- Koopman Operators offers an alternative by lifting the system dynamics to a linear infinite-dimensional space using a dictionary of observables. The aim is to solve robotic skills using a data-driven Koopman approach.

#### Implicit Reinforcement without Interaction at Scale (IRIS) | Prof. Balaraman Ravindran July. 2024 - Present

- The project deals with addressing sub-optimality and diversity challenges in large datasets for long-horizon manipulation tasks using **Offline Reinforcement Learning**.
- The project involves the basic implementation of IRIS in a few toy environments with dataset, and fine-tuning the architecture to process image-based datasets (like DREAMER) for running IRIS in latent space.

#### Trajectory Continous Optimal Planning using a Mobile Manipulator | Prof. Nirav Patel Jan. 2024 - May. 2024

- The project seeks to use the expanded workspace provided by a mobile manipulator system, with experimental testing conducted using the **KUKA Youbot**.
- The concept involves continuously tracing a trajectory using **RRT**\* while minimizing deviation in the end-effector pose through an **optimal control** formulation. This project shares similarities with 3D printing tasks performed by mobile manipulators.

# **SCHOLASTIC ACHIEVEMENTS**

- Achieved an **All India Rank of 6253** in the **JEE Advanced 2021** examination, surpassing a competitive pool of 1.5 lakh students nationwide.
- Attained the highest ranking within my school in the Grade 12 CBSE examination.

# **TECHNICAL SKILLS**

Languages: Python, C, C++, MATLAB, AVR Assembly Language

**Software Tools**: ROS/ROS2 (Robot Operationg System), Simulink, Git, Docker, Fusion360, Abaqus, Ansys Fluent, Gazebo, Arduino IDE, Altium

Libraries: Pytorch, Tensorflow, Scikit-learn, Google JAX, Gymnasium, Numpy, Pandas