Arjun Sadananda

Systems and Control Engineer | Robotics & Drone Developer

With a passion for robotics, I have spent the last few years learning, building, and programming a wide variety of robots. It has become my personal mission to connect the theory from the classrooms & research papers to practice in real-world projects because I believe this is true mastery of the subject. (plus it's a lot of fun!).

At the same time, I try to make myself useful to society with the valuable soft skills I have developed, through intrapreneurship and teaching. As an upbeat, self-motivated team player, I envision an exciting future filled with challenging projects and collaborative endeavors.

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M.TECH PROJECT

Stabilization of Quadcopter UAV under harsh initialization (using nonlinear geometric control) implemented on firmware developed from scratch on Teensy 4.1 development board *June 2024*

SysCon, IIT Bombay | Guided by Prof. Ravi N Banavar

The controller implemented is from the paper titled: *Control of Complex Maneuvers for a Quadrotor UAV using Geometric Methods on SE(3)* by Taeyoung Lee et al. The control objective is similar to the Throw Mode in ArduCopter Firmware, which is to stabilise a Quadcopter UAV thrown into the air (or dropped from a height). This work has also led to the development of a **flight controller firmware** from scratch for the Teensy 4/4.1 board called the **TeensyPilot** (public on GitHub).

Designed and Implemented a variant of Robust Attitude Estimator using 9-axis IMU by fusing ideas of TRIAD with MEKF (Manifold/Multiplicative EKF). *Jan - Oct 2024*

The estimator described in "Kalman Filtering for Attitude Estimation with Quaternions and Concepts from Manifold Theory" by Pablo Bernal-Polo et al. was extended to include two vectors, the accelerometer and the magnetormeter. But the performance of this extended estimator was not very reliable in practice due to the inconsistency in the magnetometer readings. Therefore introducing the idea of pre-processing the magnetometer vector to be the 3rd column of the rotation matrix generated by TRIAD. This improves the performance drastically. A paper describing this work in detail has been submitted to ECC 2025.

PROFESSIONAL EXPERIENCE

Senior Project Technical Assistant *June 2019 - present*

e-Yantra IIT Bombay - Robot enhanced teaching in engineering colleges and schools
Principal Investigator: Prof. Kavi Arya

Developer, e-Yantra Robotics Competition (e-YRC)

Conceptualised technical challenges or **Gamified Real World Problems** to facilitate *comprehension and application* of *technologies and concepts* from **multiple disciplines**.
Provided mentorship to **1000s of engineering students nationwide** in tackling a variety of problem statements listed below.

Holo-glyph Bots Theme *(e-YRC 2023-24)*

Build and program a **trio of holonomic drive robots** to plot images and functions on an 8ft x 8ft arena using ArUco markers and an overhead camera for localization.
Tech Stack: ROS2, Gazebo, OpenCV, micro-controller programming, μROS.

Holonomic Art Bot Theme *(e-YRC 2022-23)*

Single bot variant of the above with emphasis on kinematics of a holonomic drive robot.

Intrepid Explorer and Game Inventor *(School e-YSRC 2021-22)*

To explore the sense-think-act of robotics in the Webots simulator, and
To build games using the turtle library in python.

Patrol Fish Theme *(e-YRC 2019-20)*

Design (mechanical and electrical parts), build and program an underwater robot with fish like motion to complete an obstacle course.

Led Embedded Systems Faculty Training Workshops

*in **Indore** Institute of Science & Technology (IIST), IIT **Tirupati**, NITK **Surathkal** and IIT **Bombay**.*
The workshops were designed to equip faculty members from the vicinity of these cities with a comprehensive understanding of **embedded C programming**, on the **ATMEGA2560-based robotic platform Firebird V**.

Mentor, e-Yantra Summer Internship Program (e-YSIP)

Worked with summer interns on a range of projects like Design and fabrication of a Robotic Gripper for UR5 arm, CAD modelling of Arrestor and Battery Swapping Mechanism for UAVs, Design and simulation of Autonomous Underwater Vehicle, ...

Mechanical designer for a variety of platforms/projects @ e-Yantra

Chassis for the Collaborative Robot (to marry a UR5 robotic arm to a UGV)
Components mounts for 7kg payload drone platform, etc.

EDUCATION

Master of Technology; Systems and Control Engineering *2021 - 2024*
Indian Institute of Technology (IIT) Bombay

Bachelor of Technology; Mechanical Engineering *2015 - 2019*
National Institute of Technology (NIT) Karnataka

CBSE Senior Secondary Curriculum (XI-XII); *2013 - 2015*
Indian Educational School (Bharatiya Vidya Bhavan) Kuwait

MAJOR PROJECTS & ACCOMPLISHMENTS

CSD Robocon NITK *June 2017 - May 2019*
Center for System Design | Faculty Advisors: ***Prof. Pruthviraj U*** *and* ***Prof. K.V.Gangadharan***

Founder and Team Leader of the *first team from NITK Surathkal to take part* in the prestigious ABU Robocon. Lead role in Control Systems, MATLAB simulations, and Mechanical Design of the Robots for Robocon 2018 & 2019. Designed, built, and programmed four robots tailored to meet the specific task requirements outlined in the competition rule books.

Winners of First Time Best Use of MATLAB 2018
Recognized for adeptly modelling the forward and inverse kinematics of a holonomic drive robot and line tracking controller on MATLAB Simulink.

Runner Up e-Yantra Robotics Competition 2016 (Launch a Module Theme)

Implemented Image Processing using OpenCV for Localisation, Dijkstra's algorithm for Path Planning and PID + behaviour based controller to control the Differential Drive Robot.

e-Yantra Summer Intern 2017 *May 2017 - June 2017*

Designed and fabricated a 6 DOF Robotic Arm taking inspiration from the mechanics of the human arm Implemented object detection on point cloud data stream from a Kinect sensor using Point Cloud Library.

Country Topper (Kuwait 2015) in Computer Science in CBSE Senior Secondary Curriculum

PAPERS PUBLISHED

Robust Orientation Estimation with TRIAD-aided Manifold EKF (in review)
Arjun Sadananda, Ravi Banavar, Kavi Arya
Submitted to ECC 2025

Learn, Build and Compete: An Aquatic Robot-Fish Challenge
Saail Narvekar, Rucmenya Bessariya, Arjun Sadananda, Kavi Arya
2020 3rd International Conference on Education Technology Management (pp. 60-65).
Part of eYRC Patrol Fish Theme Development at e-Yantra

Learning Efficacy and Effect of Scaffolding in Online Engineering Education during COVID-19 Pandemic.
Narvekar, S., Gupta, V., Atar, S., Sadananda, A., Singh, S., Arya, K.
Proceedings of the 16th International Conference of the Learning Sciences - ICLS 2022

Geometrical Mapping of an Initially Unknown Region by a Mobile Robot
Shashank Rao Marpally, M S Nagarakshith, Arjun Sadananda, K. R. Guruprasad
2019 IEEE International Conference on Distributed Computing, VLSI, Electrical Circuits and Robotics
Part of BTech Major Project at NITK Surathkal (2015-2019)

SKILLS & LANGUAGES

Tools and Libraries Explored: ROS, Matlab Simulink, SolidWorks, Fusion 360, Autodesk Eagle, OpenCV, PCL, Atmel Studio, Android Studio...

Soft Skills: Problem Solving, Design Thinking, Team Work, Teaching, Leadership, Product Development and Prototyping, ...

Languages: Python, C++, English, Hindi, Tulu, Kannada

CO-CURRICULAR ACTIVITIES

Club Manager and **Spirit Captain** of the **IITB Ultimate Frisbee Club** *June'22-Dec'22*
Piloting FPV Acrobatic Drones, Racquet Sports (Badminton, Table Tennis, ...), Dancing, Long Distance cycling, running and swimming, Guitar (beginner), Bouldering (beginner) ...