Tarun S | **183079008**
Electrical Engineering | **M.Tech.**
Indian Institute of Technology, Bombay | **Gender: Male**
Specialization: Control and Computing | **DOB: 24-07-1994**

Examination	University	Institute	Year	CPI / %
Post Graduation	IIT Bombay	IIT Bombay	2021	9.3
Graduation	Kerala University	College of Engineering, Trivandrum	2016	9.13
Graduation Specialization: Electrical and Electronics Engineering				
Intermediate	CBSE	Arya Central School, Pattom	2012	93.40%
Matriculation	CBSE	St.Mary's Central School, Poojappura	2010	93.10%

AREAS OF INTEREST

• Control Systems • Embedded Systems • Robotics • Machine Learning • Deep Learning

MAJOR PROJECTS

- **Control law and path following algorithms for snake robots in space applications** [*June'20-present*]
  Guide: Prof. Harish Pillai [*Dept. of Electrical Engineering (EE), IIT Bombay*] M.Tech Project
  - Analysed different **modelling** techniques used for snake robots in **land** and **underwater** applications.
  - Studied their existing **construction** methods and path following algorithms (**pfa**).
  - Developing the **control law** and **pfa** for inter-planetary **cargo** of **docked payloads** forming a snake-like structure.
  - Devising the **controller** and **algorithms** for snake robots to **explore** congested areas in **heavenly bodies**.
- **Localisation of Autonomous Underwater Vehicle (AUV) using LSTM** [*Oct'19-present*]
  Guides: Prof. Leena Vachhani [*Dept. of Syscon Engineering, IIT Bombay*] and Institute Project
  Prof. Hemendra Arya [*Dept. of Aerospace Engineering, IIT Bombay*]
  - Objective is to localise an AUV without using a **DVL** sensor and thereby saving **$50,000** on the budget.
  - Simulated the AUV motion in **Gazebo** using **ROS** interface and the localisation dataset was generated.
  - Developed a **multi-LSTM** neural network for predicting the **vehicle's location** with an accuracy of $\pm$**1** metre.
  - Implementing the LSTM network in the **physical AUV** system for localising it by the desired precision.
  - Developing and tuning a nested **extended Kalman filter** along with the LSTM network to **boost** the **accuracy**.
- **AUV motion control in the presence of static and dynamic obstacles** [*June'19-Nov'19*]
  Guide: Prof. Dwaipayan Mukherjee [*Dept. of EE, IIT Bombay*] M.Tech Seminar
  - Conducted literature survey on AUV modelling, path planning and trajectory tracking.
  - Studied the application of **Model Predictive Control** (**MPC**) on path following control of AUVs.
- **Autonomous Aerial Vehicle** [*June'15-May'16*]
  Guide: Prof. Jisha V.R. [*Dept. of EE, College of Engineering, Trivandrum*] B.Tech Project
  - Simulated the possible trajectories for the **quadrotor** traversal in **Simulink** by varying the inputs.
  - Analysed the quadrotor **dynamics** and devised the **PID control law** for traversing between desired co-ordinates.
  - Implemented the controller in a **physical quadrotor** and the system was localised using **GPS**.

COURSE PROJECTS

- **Attitude estimation using extended Kalman filter** [*Estimation and Identification*] [*July'19-Nov'19*]
  Instructor: Prof. Debraj Chakraborty [*Dept. of EE, IIT Bombay*]
  - Designed an **extended Kalman filter** in **Matlab** for accurate estimation of the **attitude** of down-hole equipment.
- **Feedback linearisation controller for rotary drilling equipment** [*Nonlinear Dynamical Systems*] [*Jan'19-May'19*]
  Instructor: Prof. Debraj Chakraborty [*Dept. of EE, IIT Bombay*]
  - Designed a **nonlinear feedback linearisation controller** in **Matlab** to control the angular velocity of the drill-bit.
  - The nonlinear controller **dampens** the oscillations of the drill-bit thereby ensuring smooth operation.
- **Employee attrition (Kaggle)** [*Introduction to Machine Learning*] [*Jan'20-May'20*]
  Instructor: Prof. Amit Sethi [*Dept. of EE, IIT Bombay*]
  - Implemented a **Support Vector Machine** (**SVM**) for predicting employee attrition using given dataset features.
  - Attained a Kaggle score of **0.909** and **rank 4** on the private leaderboard.
- **Analog active noise-cancelling headphones** [*Control and Computational Laboratory*] [*July'18-Nov'18*]
  Instructor: Prof. Debraj Chakraborty [*Dept. of EE, IIT Bombay*]
  - Performed **system identification** on the headphone system using frequency analysis.
  - Designed a **lag compensator** circuit for attenuating the noise over the **100 - 1000** Hz frequency band.

- **Balancing an inverted pendulum** [*Control and Computational Laboratory*] [*July'18-Nov'18*]
  Instructor: Prof. Debraj Chakraborty [*Dept. of EE, IIT Bombay*]
  - Designed a **Linear Quadratic Regulator (LQR) controller** in Arduino to balance an inverted pendulum.
  - Tuned the weighing matrix **Q** in Matlab while simultaneously analysing the state variable plots.
  - Balanced the pendulum within the constraints of **3**° and **30**° for the pendulum and motor angle respectively.
- **Control of a line following robot: Spark-V** [*Control and Computational Laboratory*] [*July'18-Nov'18*]
  Instructor: Prof. Debraj Chakraborty [*Dept. of EE, IIT Bombay*]
  - Implemented a **PID controller** in ATmega16 for aiding the traversal of a Spark-V robot along the given track.
  - Traversed the track within the specified time constraint of **30** seconds without slippage.
- **DC motor position control** [*Control and Computational Laboratory*] [*July'18-Nov'18*]
  Instructor: Prof. Debraj Chakraborty [*Dept. of EE, IIT Bombay*]
  - Implemented **position control** of a DC motor using position feedback and **PID** control in Arduino.
  - Attained the desired position within the specified rise time and settling time of **0.5** s and **1** s respectively.

RELEVANT COURSES

- Applied Linear Algebra
- Multivariable Control Systems
- Matrix Computations
- Estimation and Identification
- Nonlinear Dynamical Systems
- Statistical Signal Analysis
- Introduction to Machine Learning
- Optimal Control Systems
- Embedded Systems Design

TECHNICAL SKILLS

Languages: C, C++, Python **Libraries:** NumPy, Pandas, scikit-learn, Keras

Softwares/Tools: MATLAB, Simulink, ROS, Gazebo, Arduino IDE, LaTex, Code Composer Studio, Git

Hardware Platforms: ATmega16, 8051, Arduino, TIVA development boards : TM4C123, MSP430

POSITIONS OF RESPONSIBILITY & LEADERSHIP

- **Chairman** of IEEE RAS Chapter, *College of Engineering, Trivandrum* (**CET**) [*July'15-Mar'16*]
  - Conducted a **state-wide** workshop on ROS and quadrotors which was attended by over **150** students.
  - Organised and led a team of more than **50** student members from various departments.
  - Conducted sessions for acquainting students with micro-controllers, sensors and automation.
  - Volunteered for IEEE student activities conducted by the college student chapter.
- **Research Assistant**, *Control and Computational Laboratory* [*July'18-present*]
  - Guided **20** PGs and **145** UGs in their Control systems lab course in the odd and even semesters respectively.
  - Trained the TAs to acquaint them with the softwares required for performing the lab experiments.
  - Modified the noise-cancellation headphone experiment by making it **noise-proof** and **compact**.
- **Student Companion**, *Institute Student Companion Program* (**ISCP**) [*Apr'19-Mar'20*]
  - Mentored **4** MTech students from the Electrical Engineering Department in academic and non-academic fronts.
  - Assisted in organising Institute orientation for **1867** students and parent orientation for **600** parents.
  - Received **mentorship training** from the student wellness centre, gender cell and professionals from TISS.
  - Organised sessions and conducted tutorials on Linear Algebra and Control Systems for the PG entrants.
- **Interview Coordinator**, *PG Admissions* [*Jul'20*]
  - Coordinated **online** PhD and M.Tech RA admissions for the Department of Electrical engineering, IIT Bombay.

ACHIEVEMENTS AND EXTRA CURRICULAR ACTIVITIES

- Awarded as the **Best student volunteer** on behalf of services done for the IEEE CET student chapter.
- Received **grant** from IEEE RAS Member Activities Board (USA) for my proposal on conducting state-wide events.
- Received **funding** for B.Tech project from the Centre of Engineering Research and Development (**CERD**).
- Awarded for **outstanding academic performance** in the B.Tech fifth semester University examination.
- Participated in state level exhibitions for presenting **embedded systems** and **robotics** projects.
- Worked with the robotics club of CET for **designing** projects and **mentoring** junior colleagues.
- Hobbies include spin bowling, playing badminton, participating in plays, video editing and playing the keyboard.