SIVA VIGNESH KRISHNAN CHIDAMBARAM

Fourth-year Undergraduate Student, Indian Institute of Technology Kharagpur

@ sivavigneshk@gmail.com +91 8754804466 in sivavigneshk csvk20

EDUCATION

2017 - 2021	B.Tech. Major: **Mechanical Engineering**, Minor: **Mathematics & Computing** Indian Institute of Technology (IIT) Kharagpur, India	CGPA: 9.02 / 10
March 2017	All India Senior Secondary Certification Examination (CBSE) Vishwa Sishya Vidyodaya, Pollachi, India	Percent: 96.4%

AREAS OF INTEREST

Robotics | Optimal Control | Optimization | Path Planning | Reinforcement Learning | Biomimetics | Machine Design

PUBLICATIONS

- Amit Kumar Das, Ankit Kumar Nikum, **Siva Vignesh Krishnan**, Dilip Kumar Pratihar, "*Multi-objective Bonobo Optimizer (MOBO): an intelligent heuristic for multi-criteria optimization*", Knowl Inf Syst (2020) (Published)
- **Siva Vignesh Krishnan**, Vimlendu Singh, Poojan Shah, et al, "*Development of an RFID-Based Semi-Autonomous Robotic Library Management System*" in 4th IEEE ICACR 2020, Rome, Italy (Published)
- C.D'Ettore, N.N.Dei, **S.V.Krishnan**, S.Zirino, G.Chalvatzaki, A.Stilli, D.Stoyanov, "*Flexible Framework for Reinforcement Learning in Surgical Robotics*" in 10th CRAS 2020, Barcelona, Spain (Accepted Preprint)

INTERNSHIPS

Reinforcement Learning Framework for Tele-Surgical Robotics *Apr 2020-Jul 2020*
Mentor: Dr. A Stilli, WEISS, University College London Certificate

- Modularised the simulation environment (dVRL) of the daVinci surgical robot by building a model in PyRep
- Built a ROS Node for recording demonstrations from the dVRK master console to overcome explorations in RL
- Recorded demonstrations from CoppeliaSim to learn a policy using Deep Deterministic Policy Gradient (DDPG)
- Employed the learned policy to pick the Pneumatically Attachable Flexible Rail and place it on the target organ

Multi-Objective Bonobo Optimizer (MOBO) - a Heuristic for Multi criterion Optimization *May 2019-Jul 2019*
Mentor: Prof. D K Pratihar, Soft Computing Laboratory, IIT Kharagpur Codes | Certificate

- Developed 3 algorithms, inspired from social behaviour of Bonobos, to solve multi-objective problems in MATLAB
- Employed techniques-non dominated sorting & grid indexing; ranking scheme crowding distance; decomposition
- Analyzed the results of the algorithms obtained when tested on 30 benchmark problems using standard metrics

RESEARCH EXPERIENCE/PROJECTS

Vector-Field Based Waypoint Following in 2D *Jul 2020-Present*
Bachelor's Thesis Project | Mentor: Dr. Sikha Hota, IIT Kharagpur

- Implemented a Lyapunov Guided Vector Field based algorithm for waypoint following ensuring C1 continuity
- Compared the proposed algorithm with quintic Bezier curves and G2CBS algorithm from the literature
- Currently, designing a model predictive controller to track the generated path, ensuring smooth maneuver

Autonomous Vision Based Pipe Climbing Robot *Sep 2019-Present*
Undergraduate Researcher | Mentor: Dr. D K Pratihar, IIT Kharagpur

- Developing a mobile robot to inspect and paint pipes in industries which are difficult for manual operations
- Designed a 5 DOF manipulator with two grippers which are connected by four links and five revolute joints
- Solved the kinematics and inverse kinematics problem by fixing one gripper in MATLAB

Kharagpur Hyperloop Research Group *Mar 2019-Present*
Team Manager & Co-Founder | Mentor: Dr. Aditya Bandopadhyay, IIT Kharagpur Brochure

- Designing and fabricating a Hyperloop pod with an aim to compete in the SpaceX Hyperloop Pod Competition
- Mustered financial (USD 7000) and workspace suport from MN Faruqui Innovation Centre, IIT Kharagpur [Video]
- Modelled the relationship between BLDC motor RPM and desired levitation height in EDW mechanism
- Designed a controller for synchronising the speed of two BLDC motors used while carrying out experiments

Intelligent Picking Robot *Jul 2020-Present*
National Finalist | Flipkart's Grid 2.0 - Robotics Challenge

- Proposed a 6-DOF gripper and developed an algorithm based on Becchi's criteria for form closure to pick objects
- Tested the algorithm for grasping on preprocessed point cloud data of different household objects
- Established the D-H parameters & generated end-effector trajectories for 6-DOF manipulator with a reach of 2 m

Terrace Farming Robot for Hilly Areas (Bagged First Place) *Oct 2019-Dec 2019*
8th Inter IIT Tech Meet, Roorkee | Mentor: Dr. Aditya Bandopadhyay, IIT Kharagpur Video

- Designed an autonomous robot with integrated mechanism for ploughing, seeding and rolling operations in series
- Developed a two cross scissor-lift mechanism for climbing and a novel module for harvesting and irrigation
- Optimized the linear actuator force to obtain the desired vertical stroke length (40 cm) of the bot

Semi-Autonomous Book Organizing Robot in a Library *Jan 2019-Apr 2019*
Hardware Modelling, Intra-Collegiate General Championship - 2019, IIT Kharagpur

- Designed the CAD model of scissor-lift riser subsystem and book holder & separator subsystem in SolidWorks
- Devised a four wheel skid steer driving mechanism and performed necessary calculations for the bot's locomotion
- Implemented PID control loop on magnetostators and Encoder Motors for motion using Raspberry Pi & Arduino

Vrishabh - a Robotic Solution for Agricultural Warehouse Management *Sep 2020-Oct 2020*
Tata Innoverse

- Proposed an RFID-based guided path planning and navigation scheme for the robot to move in the warehouse
- Designed the pedestal to serve as a housing for various components and as a mount for the 8 DOF manipulator

Tarang - a new Electrolyte Based Long Range Battery System *Jan 2019-Feb 2019*
Product Design, Intra-Collegiate General Championship - 2019, IIT Kharagpur

- Proposed a hybrid battery system - Vanadium Redox Flow Battery (Primary) and Aluminium-air battery (Secondary)
- Designed a polygon shaped battery pack for aluminium air battery with 30% increase in packing efficiency
- Performed the necessary calculations for battery efficiency- 95% and battery recharging time- 5 mins for 100 km

TECHNICAL SKILLS

Languages	C++, Python (stable_baselines, TensorFlow, sklearn, OpenCV, numpy, pandas), LaTeX
Robotics	ROS, CoppeliaSim (V-Rep), Gazebo
Softwares & Tools	MATLAB, Simulink, SolidWorks, Fusion 360, Ansys, Ultimaker Cura, COMSOL, EES
Hardware Programming	Arduino and AT-Mega microcontrollers, Raspberry Pi

ACHIEVEMENTS

2020 Qualified for National Finals in Flipkart's Grid 2.0 by markedly being in top 9 among 1500 teams
2019 Won first place, representing IIT Kharagpur, in the robotics event against 23 IITs at the Inter-IIT Tech Meet 8.0
2018 Secured a Department Change to Mechanical Engineering from Aerospace Engineering with CGPA 9.56/10 by being among top 0.5% of the freshmen batch of 2017-18
2017 Ranked in National Top 0.4% (amongst 1,200,000 candidates) in JEE Mains, 2017 Examination
2017 Awarded a certificate of merit from CBSE for outstanding performance and being among the National top 0.1% of successful candidates in AISSCE - 2017 in the subjects Computer Science and Chemistry

RELEVANT COURSEWORK

Control Courses	**Robotics Courses**	**Mathematics Courses**	**Computer Science Courses**
Automatic Control	Robotics (NPTEL) *	Probability & Statistics	Image Processing
Systems & Control	AI for Robotics *	Linear Algebra	Basic Electronics
Transform Calculus	Reinforcement Learning *	Computer Networks	Data Structures
Control of Mobile Robots *	Deep Learning *	Real Analysis	Machine Learning *

Core Courses - Design Optimization | Kinematics & Dynamics of Machines * - online courses

EXTRA-CURRICULAR ACTIVITIES

- **Leadership** - Lead the Hardware Modelling team of Patel Hall, IIT Kharagapur as vice-captain - 2019 & 2020
- **Management** - Managed a budget of INR 89000 as Technology Events Secretary of Patel Hall, IIT Kharagpur
- **Student Mentor** - responsible to assist 6 freshmen from this year under the Dean of Student Affairs, IIT Kharagpur
- **Volunteer** - National Service Scheme, Kharagpur - 170+ hours of social work - Increased awareness about education in Kharagpur region; Facilitated Blood Donation Camp at Patel Hall for the years 2018 and 2019
- **Cultural** - Participated in Ek Bharat Shreshta Bharat-2018, IIT Kharagpur, an initiative Government of India