

Keshav Bagri

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EDUCATION

Indian Institute of Technology, Kharagpur

B.Tech (Hons.) in Mechanical Engineering [CGPA: 9.21/10 (upto 6 semesters)]

Micro Specialization in Embedded Control, Software, Modelling and Design [CGPA: 9.64/10]

July'18 – May'22

Kharagpur, India

Aditya Academy Secondary

AISSCE (Grade: 93.6%) | CBSE Class X (CGPA: 9.21/10)

2016 – 2018

Kolkata, India

RESEARCH INTERESTS

ADAS | Localization & Mapping | Motion/path Planning | Autonomous Vehicles | Automotive Engineering | Controls

RESEARCH EXPERIENCE

Performance assessment of Driver-in-Loop Simulators

Supervisor: *Dr. Jeffrey P. Chrstos* | *CAR*

The Ohio State University

Feb'20 – Present

- ◇ Reviewed literature for absolute and relative validity of medium fidelity D-i-L simulators for physical validation
- ◇ Proposed the testing methodology for the simulator's platform's motion and analysed the results in essence of the OMCT

Memory footprint and inference time reduction for DL models

Summer Intern

KPIT Technologies Ltd, Pune

May'21 – Present

- ◇ Currently working on the hardware implementation and testing of these executables for performance on Arduino's ML kit
- ◇ Generated deployable executables using AI compilers like TVM leading to a substantial reduction in memory & inference time

SLAM for autonomous cargo delivery vehicles

Winter Intern | *[Description]*

Ati Motors, Bengaluru

Nov'20 – Jan'21

- ◇ Studied the **OctoMap** mapping and implemented open-source datasets to facilitate better visualization of 3D maps
- ◇ Explored multiple **SLAM algorithms** like IMLS, EKF, Gmapping, etc. to select an efficient method for implementation
- ◇ Implemented the **Particle Filter** SLAM algorithm to build maps on a 2D grid using lidar and wheel odometry in Python
- ◇ Analysed the effects of multiple **resampling algorithms** and variation in hyperparameters on the map's quality

Applications of ML methods in motion planning of autonomous vehicles

Supervisors: *Prof. Leena Vachhani* and *Prof. Arpita Sinha* | *ARMS Lab* | *[Description]*

IIT Bombay

July'20 – Oct'20

- ◇ Formulated the **Markov Decision Process** representation of the scenarios considering different state and action spaces
- ◇ Coded an **automatic controller** in Python to collect real-time client data & images from the CARLA Simulator
- ◇ Generated training datasets for a **RL model** for the safe traversal of an autonomous vehicle in a **campus-like environment**
- ◇ Developed a **Finite State Machine** for lane following & 2-way lane intersection (without traffic signals) management

Autonomous Drone & Rover Prototype development, & automated agriculture

Research & Development Intern | *[Description]*

Kanan Park, Pune

June'20 – Aug'20

- ◇ Developed the code for ArUco marker based **autonomous landing of a drone** using image processing in Raspberry Pi
- ◇ Formulated the conceptual model with update algorithm & reward function for the **RL based landing** sequence of the drone
- ◇ Devised the code & components of a GSM-based remotely controlled **motorised water flow system** for use in farms

PROJECTS

TeamKART, Formula SAE | *[Description]* | *[Website]*

Supervisor: *Dr. Dhananjay Kumar Srivastava* | *Mechanical Engineering Department*

IIT Kharagpur

June'19 – Present

- ◇ Worked on the designing of a **reactive muffler** for noise reduction from a combustion vehicle, with an insertion loss of **25 dB**
- ◇ Designed the **fuel tank** and the mounting arrangement for the vehicle considering the optimal capacity requirement
- ◇ Designed and analyzed the components of the **transmission** and **cooling system** for a standard FSAE electric vehicle
- ◇ Engineered the **intake manifold** & **downflow radiator** for a single cylinder engine, producing a power output of **35 HP**

Mathematical modelling of Li-ion batteries focusing on Si anode particles

Supervisor: *Dr. Jeevanjyoti Chakraborty* | *Mechanical Engineering Department* | *[Description]*

IIT Kharagpur

Feb'20 – Jan'21

- ◇ Studied the mechanics behind **crack development** and formation of amorphous lithiated Si with time around the Si anode
- ◇ Solved Ordinary and Partial differential equations, using **Finite Difference & Liebmans methods**, in Python
- ◇ Established a **two-way coupling** between diffusion & stress, to understand the effect of one parameter on the other

Fault Tolerant Controller for Electric Vehicles

Supervisor: *Dr. Somnath Sengupta* | *Advanced Technology Development Center*

IIT Kharagpur

Feb'21 – Present

- ◇ Currently working on the modelling of integrated ABS & regenerative braking for efficient braking & max energy recuperation
- ◇ Prepared the complete vehicle dynamics model for a RWD EV for analysing the effect of faults & the control strategy
- ◇ Studied various EV and HEV architectures along with powertrain and vehicle dynamics control systems required for modelling

Self-driving Cars Specialization, Coursera

University of Toronto

Supervisors: *Prof. Steven Waslander and Prof Jonathan Kelly* | [\[Description\]](#) | [GitHub](#)

Apr'20 – June'20

- ◊ Implemented & tested control algorithms like **LQR**, **PID**, **Stanley**, **Pure Pursuit** & **MPC** for autonomous vehicle control
- ◊ Designed an **EKF** for state estimation & localization of an autonomous vehicle using **IMU**, **GPS** & **LIDAR** sensor data
- ◊ Estimated the **drivable space**, **lane** and **distance to obstacles** using the segmented image from a **CNN model**
- ◊ Developed the **behavioral & local planners** to generate a collision-free path, using **conformal lattice planning**

Traffic Sign Classification using CNN

[Self Project]

[\[Description\]](#) | [GitHub](#)

July'20

- ◊ Deployed a CNN model with layers including a dropout rate of **40%** for identifying **43** different classes of **traffic signs**
- ◊ Trained the model for **100 epochs** on a dataset of **32x32 RGB** images with a testing accuracy of **94%** on **12000** images

Deep Reinforcement Learning for Autonomous vehicles

[Self Project]

[\[Description\]](#) | [GitHub](#)

Aug'20 – Sep'20

- ◊ Deployed a **Dueling DNN** to predict discrete action values & mapped them to continuous signals for vehicle control
- ◊ Used **84x84 RGB** images for the environment perception as the state information collected from the camera sensor
- ◊ Accommodated the wheel odometry, collision & lane invasion sensor data to compute real-time reward for the agent

TECHNICAL SKILLS

Programming: C/C++, Git, Python, MATLAB, LaTeX, Arduino, ROS, Atmel Studio

Softwares: SOLIDWORKS, Ansys, MATLAB/Simulink, CARLA Simulator, Autodesk Fusion 360, COMSOL, Ricardo WAVE

Libraries: NumPy, SciPy, Pillow, SymPy, Matplotlib, OpenCV, TensorFlow, Keras, CARLA

COMPETITIONS

Inter IIT Tech Meet 9.0

Virtual Event hosted by IIT Guwahati

[\[Problem Statement\]](#) | [\[Design Presentation\]](#)

Mar'21

- ◊ Secured the **Gold** medal in the event, "**Bosch's Electric Vehicle Simulation**" for the proposed solution
- ◊ Proposed the **powertrain architecture** comprising a PMSM motor (self-designed), ABS, VSC, etc.
- ◊ Determined the motor's requirements & battery pack's capacity based on target performance parameters using **Simulink**

4th Annual FSEV Concept Challenge 2020

Virtual Event hosted by Curiosum Tech

[\[Link\]](#)

July'20

- ◊ Secured an overall **5th place** among **37** teams
- ◊ Received a Notable mention: **Fresher Team Effort - Engineering Design**
- ◊ Stood **2nd** in **EV Presentation** & **4th** in **Powertrain package design** among **37** participant teams internationally

Formula Bharat 2020

Coimbatore, India

Kari Motor Speedway | [\[Link\]](#)

Jan'20

- ◊ Secured an **overall 10th Place** in **Combustion Category**, among **50** teams
- ◊ Secured **6th place** in **Engineering Design Event** & **15th place** in **Cost and Manufacturing Event**
- ◊ 1 of the 3 teams to clear the stringent Technical Inspection including mechanical scrutiny and tilt test on **Day 1**

RELEVANT COURSEWORK

University: Mechanics, Dynamics, Transform Calculus, Probability & Statistics, Embedded Control Systems, Programming & Data Structures, Embedded Sensing, Actuation & Interfacing System, Principles of Automotive Dynamics & Controls

MOOC: Algorithms for Battery Management Systems Spl., Data Structures*, Reinforcement Learning Spl., Self-Driving Cars Spl., Convolutional Neural Networks, Neural Networks and Deep Learning, Machine Learning

POSITIONS OF RESPONSIBILITY

Deputy Team Leader

IIT Kharagpur

TeamKART, Formula SAE

July'20 – Present

- ◊ Leading a dedicated team of **47** students towards the research & development of Formula Student prototype vehicle
- ◊ Responsible for the project management & sponsorship initiatives to ensure the timely completion of the team's preset targets
- ◊ Prepared the design & manufacturing timeline and procurement plan to ensure a smooth & efficient workflow for project **K6**

Powertrain & Corporate Relations Team Member

IIT Kharagpur

TeamKART, Formula SAE

July'19 – July'20

- ◊ Responsible for the design, analysis, and testing of the powertrain components in the FSAE prototype vehicle
- ◊ Involved in the training of **30** freshers in basic automotive engineering, powertrain technology, and aspects of manufacturing
- ◊ Acquired monetary as well as technical sponsorships worth **INR 1,10,000** for the season 2019-20