Siddharth S. Jha

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Education

- **Indian Institute of Technology (IIT), Kharagpur, India** **Current CGPA: 8.14/10.0**
  B.Tech in Electrical Engineering + M.Tech in Control System Engineering, *2014-2019 (expected)*

Publications

- **Modeling and Control of an Autonomous Three Wheeled Mobile Robot with Front Steer**
  IEEE International Conference on Robotic Computing, Taiwan - 2017

- **Low Cost Autonomous Navigation and Control of a Mechanically Balanced Bicycle with Dual Locomotion Mode [15ITEC-0224]**
  IEEE International Transportation Electrification Conference, Chennai - 2015.

Research Experience/Projects

- **Autonomous Ground Vehicle (AGV) Research Group** **IIT Kharagpur**
  Control Systems and Computer Vision Researcher *Feb 2015–Present*
  Guide: *Prof. Debashish Chakravarty, Dept. of Mining Engineering.*

  • Planned and implemented a robust control system and developed the vision based obstacle detection pipeline for Eklavya 5.0, a ROS based front-driven and front-steering autonomous electric vehicle built entirely in IIT Kharagpur.

  • Also worked on vision based traffic sign recognition, Stereo SLAM, real-time vision based road bumper detection, odometry/localization using a custom built velocity sensor data and communication networks.

  • Selected as an undergraduate representative for the university for Intelligent Ground Vehicle Competition 2016.

  • Also building a self-driving car for Mahindra Rise Driverless Car Challenge, where the group was selected among top 13 teams in the final round, out of the 600+ that applied for the same.

- **SKALA: A stair climbing mobile robot** **IIT Kharagpur**
  Embedded Systems and Computer Vision Team Captain *Jan 2017–April 2017*

  • Led the development of a large robot to carry people up and down stairs while also being able to move on floors.

  • Worked on an autonomous vision-based control system using real time object tracking, brain signal based control, voice control, touch interface development, mechanical design and overall embedded design.

  • Recipient of the Gold medal in the inter-hall hardware exhibition 2017 at IIT Kharagpur.

- **THAWR (Teachable Human Augmentation Workstation Robot)** **IIT Kharagpur**
  Embedded Systems and Computer Vision Team Member *Jan 2016–April 2016*

  • Developed a large scale industrial mobile robot with 4-DOF arms capable of storing and replicating human actions.

  • Worked on control of high torque actuators, computer vision for object recognition on a Raspberry Pi 2, multi-sensor interfacing and voice recognition.

  • Recipient of the Silver medal in the inter-hall hardware exhibition 2016 at IIT Kharagpur.

- **i-Bike : Low-Cost Autonomous Bicycle with Dual Locomotion Mode** **IIT Kharagpur**
  Embedded Systems and Control Team Member *Jan 2015–April 2015*

  • Built a low cost, modular and user friendly three-way hybrid bicycle [Manual, Electric, Autonomous] for the visually impaired and partially disabled people by modifying an ordinary bicycle.

  • Worked on sensor interfacing, motor control and implementation of motion planning on a network of Arduinos.

  • Recipient of the Gold medal in the inter-hall hardware exhibition 2015 at IIT Kharagpur.

- **3D Homing for quadcopters using visual servoing** **IIT Bombay**
  Project Intern *Dec 2016–Jan 2017*
  Guide: *Prof. Leena Vachhani, Systems & Control Engineering*

  • Implemented a bearing-only homing method under a visual servoing implementation on Parrot AR Drone v2.

  • Extracted image features, simulated the convergence of the algorithm, programmed the motion planner and developed the ROS architecture as a part of a month-long internship. Github Repository Link.

- **Retina^2 : Navigation and Tracking System for Visually Impaired** **IIT Kharagpur**
  Team Leader and Developer *Aug 2016–Apr 2017*
  - Finalist of the fully funded Analog Devices Inc.'s Anveshan 2016 Internet-of-things student developer challenge.
  - Developing a geo-navigation and tracking system for the visually impaired using computer vision for obstacle avoidance, Kalman filters for sensor fusion, haptic touch control and actual human gait analysis.

Course Projects

- **Soft Computing Tools in Engineering:** Developed a fuzzy joint obstacle avoidance and path planning algorithm for mobile robots, and demonstrated it on a real differential driven robot.
- **Computational Neuroscience:** Simulated neuron level learning on MATLAB by using generated spiking data from 4 neurons. Used analysis of Spike triggered averages, evaluated nonlinearities and performed pruning on trained models. Github Repository Link.
- **Embedded Systems Laboratory:** Developed a human follower autonomous mobile robot.

Research Interests

- Autonomous Robots, Computer Vision, Control Systems, Embedded Systems

Technical Skills

The number in brackets: (1) = Proficient (2) = Competent (3) = Beginner

- **Programming Languages:** C (1), Python (1), C++ (1), MATLAB (1), Lua (3), Java (3), LaTeX(3)
- **Hardware Programming:** Arduino and ATMega microcontrollers (1), Raspberry Pi & BeagleBone (1), Xilinx FPGAs using Verilog (2), ARM Cortex M4 (STM32 Discovery) (3)
- **Specialized Libraries & Environments:** ROS (1), OpenCV (1), Torch (2), Git (2), PCL (3), Gazebo (3)
- **Robotics Specializations:** Control Systems (1), Computer Vision (1), Localization (2), Motion Planning (3)

Relevant Coursework

- **University:** Control Systems Engineering, Programming & Data Structures, Embedded Systems, Signals & Networks, Computer Architecture & Operating Systems, Soft Computing Tools in Engineering, Data Communication, Analog Electronic Circuits, Power Electronics, Computational Neuroscience, Measurements & Electronic Instruments, Digital Electronic Circuits.
- **Online:** Algorithms-1, Control of Mobile Robots, Machine Learning, Artificial Intelligence for Robotics

Academic Achievements

- **2010:** Awarded National Talent Search Examination Scholarship by Government of India (99.96 percentile)
- **2013:** Awarded KVPY Fellowship by Dept. of Science & Technology, Government of India (99.67 percentile)
- **2014:** Qualified JEE Main and Advanced for science & engineering education entrance in India with percentiles of 99.98 (score 313/360) and 99.2 (All India Rank 1178) respectively.
- **2013:** Finished in top 1% in National Standard Examination(s) in Physics and Astronomy (NSEP and NSEA) in state of Delhi and qualified for Indian National Chemistry Olympiad (INChO).

Other Activities

- **Technology Robotix Society** **IIT Kharagpur**
  Head (Since Feb '16) *Aug 2014–Jul 2016*
  - As part of the university's official robotics and hobby maker group, conducted the largest robotics related events in India, namely Robotix 2015 and 2016 and mentored several workshops on Autonomous robotics.
- **Azad Hall of Residence Hardware Exhibition team** **IIT Kharagpur**
  Captain *Jul 2016–Apr 2017*
  - Led a team of 40+ for over 9 months to a gold medal in the inter hall hardware exhibition 2017. See SKALA project.
- **Personal Hardware Projects**
  Hardware Hacker/Hobby Roboticist
  - Built more than 10 hardware projects for learning the concepts of robotics and programming.
  - Bronze medal recipient at IEEE IIT Kharagpur Hardware Hackathon 2015.
  - Built a 3D printed ROS-compatible rangefinder using a Raspberry Pi 2 on my own and presented it at IBM Day 2016.