# SIDDHARTH SAHA

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## Education

| Examination | University | Institute | Year | GPA |
|---|---|---|---|---|
| Graduation | IIT Bombay | Indian Institute of Technology Bombay | 2017 - 2021 | 9.43/10.00 |

Undergraduate Degrees: B.Tech. with Honors in Mechanical Engineering, IIT Bombay
Minor in Computer Science and Engineering, IIT Bombay

## Bachelor's Thesis

**Mapping Regions of Dynamic Activity & Building Dynamic-free 3D Occupancy Maps** | Demo
*Guides: Prof. Leena Vacchani, Prof. Abhishek Gupta* Jun 2020 - Jul 2021

- Proved the occupancy & dynamic activity probabilities in an octree map to **form a field** in the range (0,1)
- Designed & implemented novel clustering algorithm in **ROS OctoMap** to reject nodes with high dynamic activity

## Scholastic Achievements

- Bagged the **Technical Citation**, $2^{nd}$ highest award for excellence in technical activities at IIT Bombay ['21]
- Ranked **top 5** among 150+ students on merit of GPA | Secured **perfect 10.0** GPA in $7^{th}$ & $8^{th}$ semesters ['21]
- Conferred **AP grade** (3/188 students) in Statistical Machine Learning course for exceptional performance ['20]
- Endowed with the **Economic Times Campus Star Award** from over 49,000 candidates across India ['20]
- Awarded the SSP scholarship (among 15 students from India) by **Japan Science & Technology** Agency ['19]

## Professional Experience & International Exchange

**Goldman Sachs**, Structuring Analyst | Bengaluru Jul 2021 - Present

- Deriving critical insights for the upsides & downsides of structuring ideas vis-a-vis Rating Agency methodologies

**Google Summer of Code – JdeRobot**, Student Developer | Final Report Jun 2021 - Aug 2021

*JdeRobot develops framework based on Django, Docker & ROS to simplify learning robotics & computer vision*

- Built the RADI-4.0 (Robotics Academy Docker Image) for **ROS2 Foxy**, and VNC-based RViz2 web template
- Implemented BT (**Behavior Tree**) Navigator | Extended pick-and-delivery exercise to ROS2 web-based template

**Goldman Sachs**, Quantitative Summer Analyst | Bengaluru May 2020 - Jun 2020

- Innovated and implemented **payment structuring** ideas for mortgage-backed securities to **maximize arbitrage**
- Achieved **sharp improvement** of 1.62% profits by optimizing cash-flows through different derivative instruments

**Hiroshima University**, Special Auditing Student | Japan Jun 2019

- Assimilated ongoing research in the **Cybernetics Laboratory** under the *Sakura Research Exchange Programme*

## Competitions

**Winner | International Micromouse Challenge** | Source & Demo Dec 2020

*Team Leader in Maze-solving challenge to program an autonomous bot simulated in ROS/Gazebo*

- Implemented *online breadth-first planner* for optimal path & **omni-wheel** based drive to reduce steering latency

**Winner | Off-Track Bot** | Innerve '20, Delhi Nov 2020

*Autonomous bot simulated in Webots to produce given pattern on ground, minimizing number of blocks kept as cues*

- Innovated vision-based **object detection in C** to sharply prune number of cues required by navigation algorithm

**Winner | Operations GC** | General Championship '21, IIT Bombay Feb 2021

- Devised optimization solutions in MathProg using the **GLPK Optimizer** | Solved machine learning problems

**Vision Based Obstacle Avoidance Drone** | $9^{th}$ Inter IIT Tech Meet, Source Mar 2021

*Team Leader of IIT Bombay in Autonomous Navigation challenge across complex static environments in ROS/Gazebo*

- **Ranked $6^{th}$** across India | Designed & implemented navigation pipeline with three-layered intelligence algorithms

**RoboCon, Team IIT Bombay** | ABU RoboCon '19 Ulaanbaatar, Mongolia Jan 2019 - Apr 2019

*Competition to construct a manual bot with throwing capability & an autonomous walking bot*

- Bagged **$9^{th}$ position** among 50+ national teams in stage-1 | Designed Solidworks model of **robotic gripper arm**

## Key Projects

**Quadruped Robot** | RoboCup Rescue League Challenge Dec 2019 - May 2021

*Team Leader of two-tiered team with 15 members, overseeing a technical budget of over 10 lakhs INR (~14K USD)*

- Explored **impedance control** to create virtual leg compliance & tested *gait trajectories* in Gazebo environment
- Implemented fusion of *MPU6050* sensor data with *Intel RealSense D435* **PointCloud2** data to achieve SLAM

**F1/10$^{th}$ — Autonomous Grand Prix** | IROS '20, Las Vegas Oct 2020

*International autonomous racing contest with standardized hardware simulated in ROS/Gazebo*

- Used *Bernstein polynomial* based local trajectory planner and MPC for Ackermann steering in 4-membered team
- Attained global optimal path using **OSQP solver** | Implemented obstacle detection | Composed Docker submission

**Two-wheeled Self-Balancing Bot** | Documentation & Demo Aug 2020 - Nov 2020

- Stabilized Arduino bot using PD control and applied **complementary filter** on gyroscope & accelerometer input

**Automated Graph Reader** | Source & Demo Aug 2020 - Nov 2020

*Deployed live on Heroku server, the web-app accepts queries for y-values in simple input graphs*

- Implemented image processing & OCR using **Tesseract** to automatically extract values & line plot in input graph

**Ricart-Agrawala Algorithm** | Source Aug 2019 - Nov 2019

- Built Java implementation of **mutual exclusion** among nodes in distributed environment with no shared memory

**Wifi De-auth Attacker** Mar 2019

- Programmed *ESP8266* (Wi-Fi chip) to send de-authentication frames, **exploiting vulnerability** in IEEE 802.11

**Sudoku Solver Using Block Printing** | Source & Demo Apr 2018 - May 2018

- Implemented a **Raspbian** based machine to **physically imprint digits** into any given unsolved sudoku grid
- Leveraged **scikit-learn** & invoked **support vector machines** for recognition of handwritten digits in the sudoku

**Gyro Brick Breaker** Jul 2018

- **Led 5-membered** team to develop a **hand-gesture controlled** brick-breaking game coded in Processing IDE

More projects

## Positions Of Responsibility

**Teaching Assistant** | Student Mentorship Program, IIT Bombay Apr-May 2018 / Jan-Apr 2019

- *Physical Chemistry*: **Only student from freshmen year** appointed to guide class of **15 students** in tutorials
- *Electricity & Magnetism*: Conducted tutorial sessions for **52 students** focusing on the academically weak students

**Summer of Science Mentor** | Maths and Physics Club, IIT Bombay Apr 2020 - Jun 2020

- Guided **4 mentees** to proficiency in *Data Structures & Algorithms* with **conceptual aid** and meticulous roadmap

**Convener** | Electronics and Robotics Club, IIT Bombay Apr 2018 - Mar 2019

*Part of a two-tiered team of 70 members constituting the Institute Technical Council of IIT Bombay*

- Organized bootcamps and **delivered talks** on Arduino and Image Processing, attended by **200+ enthusiasts**

## Technical Skills

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|---|---|
| **Programming & Scripting** | Python, C, C++, Java, R, Javascript, x10, Bash, Sed, Awk, Perl, RegEx |
| **Frameworks** | Git, Vim, Docker, OpenCV, PyTorch, TensorFlow, Tesseract-OCR, LaTeX |
| **Optimization** | GNU MathProg, GLPK, Gurobi, PuLP, Ipopt, OSQP |
| **Robotics tools** | ROS1, ROS2, Gazebo, Webots, MRPT, Pinochhio, TSID, Crocoddyl |
| **Controllers & Modules** | Arduino, Raspberry Pi, Tiva C, NodeMCU, MPU6050, Intel RealSense D435 |

## Key Courses

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|---|---|
| **Computer Science** | Computer Vision, Reinforcement Learning, Data Structures and Algorithms, Design and Analysis of Algorithms, Digital Image Processing |
| **Robotics** | Advanced Topics in Mobile Robotics, Design of Mechatronic Systems, Microprocessors & Automatic Control, Kinematics & Dynamics of Machines, Machine Design, Robotics |
| **Optimization** | Optimization from Fundamentals, Optimization for Engineering Design, Industrial Engineering & Operations Research |
| **Certifications** | Advanced Methods for Planning & Control of Legged Robots, ROS for Beginners II: Localization, Navigation & SLAM, Using GPUs to Scale & Speed-up Deep Learning |

## Extra Curricular Activities

| | | |
|---|---|---|
| **Competitions** | • First runners-up in Aerial Path Planning GC, IIT Bombay (Source) | ['21] |
| **Public Speaking** | • Participated in **Model United Nations** by WeSpeak, IIT Bombay | ['17] |
| | • Received **Special Mention** among **35 participants** in English Debate, IIT Bombay | ['17] |
| **Journalism** | • **Curated article** in Mechanical Media Newsletter with a **reach of 700+** students | ['17] |
| **Social Service** | • Volunteered at **Abhyasika** to tutor school children from underprivileged background | ['18] |
| **Sports** | • Completed inter-hostel **Crossy** General Championship & the Cyclothon by TechFest | ['17] |
| **Leadership** | • Headed **150+ students** as **House Captain** in $10^{th}$ & Vice-Captain in $9^{th}$ grade | ['14,'15] |