SIDDHARTH SAHA

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Education

Examination	University	Institute	Year	CPI/%
Graduation	IIT Bombay	IIT Bombay	2021	9.32/10.00
Intermediate/+2	HSC	Pace Junior Science College	2017	89.54 %
Matriculation	ICSE	Lilavatibai Podar High School	2015	97.40 %

Major Degree: B.Tech. with Honors in Mechanical Engineering, IIT Bombay
Additional Degree: Minor in Computer Science and Engineering, IIT Bombay

Bachelor's Thesis

Handling Dynamic Activity using Octree based mapping Jun 2020 - Present

Guide: Prof. Leena Vacchani | Co-guide: Prof. Abhishek Gupta

- Proved the occupancy and dynamicity probabilities in an octree map to be a field in the range (0,1)
- Implemented thermal map in ROS **OctoMap** library to monitor real-time irradiance distribution due to an emitter

Scholastic Achievements

- Awarded **SSP scholarship** (among 15 students across India) by **Japan Science & Technology** Agency ['19]
- Conferred the **AP grade** (3/188 students) for exceptional performance in *Engineering Data Mining* course ['20]
- Endowed with the **Economic Times Campus Star Award** from over 49,000 candidates across India ['20]
- Achieved **national top 1%** of 41K+ students to qualify for **InChO** (Indian National Chemistry Olympiad) ['17]

Professional Experience & International Exchange

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

Mortgage Structuring Strategies, Securities Division

- Innovated and implemented **payment structuring** ideas for mortgage-backed securities to **maximize arbitrage**
- Achieved **sharp improvement** of [redacted] profits by optimizing cash-flows through different derivative instruments
- Formulated a **stochastic model** capable of generating mock pool of mortgages with adjustable parameters

Special Auditing Student | Hiroshima University, 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

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

- Implemented maze representation & ideated **omni-wheel** based drive to significantly reduce steering latency
- Guaranteed **minimal exploratory time** to discover optimal path by implementing an *online breadth-first planner*

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

Autonomous bot simulated in Webots to trace given pattern minimizing number of blocks kept as cues

- Innovated vision-based **object detection in C** to sharply prune required number of blocks

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

Key Projects

Quadruped Robot | RoboCupRescue League Challenge Dec 2019 - Present

Team Leader of two-tiered team with 15 members, overseeing a technical budget of over 10 lakhs INR

- 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

F1/10th — 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 a team of 4
- Derived global optimal path using **OSQP solver** | Implemented obstacle detection | Compiled **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 — 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

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

Programming & Scripting	Python, C, C++, Java, R, Javascript, x10, Bash, Sed, Awk, Perl
Frameworks	RegEx, Git, Vim, Docker, OpenCV, TensorFlow, Tesseract-OCR, LaTeX
Optimization	GNU MathProg, Gurobi, PuLP, Ipopt, OSQP
Robotics tools	ROS1, Gazebo, Webots, MRPT, Pinochhio, TSID, Crocoddyl
Controllers & Modules	Arduino, Raspberry Pi, Tiva C, NodeMCU, MPU6050, Intel RealSense D435
Software	Matlab, Fusion360, AutoCAD, Solidworks, Octave

Key Courses

Computer Science	Computer Vision[§], Data Structures & Algorithms, Design & Analysis of Algorithms, Foundations of Intelligent & Learning Agents, Digital Image Processing, Introduction to ML
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	ROS for Beginners II: Localization, Navigation & SLAM, Using GPUs to Scale & Speed-up Deep Learning, Advanced Methods for Planning & Control of Legged Robots

§: To be completed in Spring 2021

Extra Curricular Activities

Competitions	• **1st** in Operations General Championship(GC) | **2nd** in Aerial Path-planning GC	['21]
	• Led Inter IIT Team in DRDO's Vision-based Drone Exploration challenge (Source)	['21]
Public Speaking	• Participated in **Model United Nations** by WeSpeak, IIT Bombay	['17]
	• Received **Special Mention among 35 participants** in English Debate, Freshiezza	['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]