Mohil Patel | Electrical Engineering

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Research Interests: Computer Architecture, High Performance Computing, VLSI design

EDUCATION

Indian Institute of Technology Bombay *July 2016 - April 2020*
B.Tech (with Honors), Electrical Engineering
- Major GPA: 9.5/10
- Minor degree in Computer Science & Engineering

PROJECTS AND WORK EXPERIENCE

Real-Time Server Based Communication with Hardware Encryption *July '19-Present*
Guide: Prof. Madhav Desai | Electrical Engineering, IIT Bombay

- Designed **microphone & speaker circuits** with proper filtering to reduce external noise and **digitized** the audio signal using **ADC** & captured it via a microcontroller **(TIVA-tm4c123g)**
- Transmitted the data from microcontroller to an **FPGA Board (Artix-7)** using **UART**, and encrypted the data using the **hardware encryption engine** (AES-128) written in **VHDL**
- Transferred the data to the PC, using **PL2303 USB-UART Module**, further, the data is transmitted to the client via an **MQTT based server** written in **python**. Received data is re-transmitted to FPGA and microcontroller where it is **decrypted** and **reconstructed** before sending to the speaker circuit.
- Established a **full duplex** communication link with **8kHz** sampling rate & **hardware encryption**

Inter-FPGA Data Transmission using LVDS *May '18-July '18*
Guide: Prof. Sachin Patkar | Electrical Engineering, IIT Bombay

- Established a **high-speed bidirectional communication link** between 2 **Cyclone IV E FPGA Boards** using Altera's **LVDS**(Low-voltage differential signaling) **SerDes IP** and **Quartus Prime**
- Formulated a FSM and control logic, in **Verilog HDL**, to use standard **FIFO** interface with **32-bit I/O**, to feed data to **LVDS SerDes IP** on transmitting side according to required data width and extract data from the IP at receiving side and store it in receiver FIFO
- Achieved **reliable, high-speed** inter-FPGA data transmission with the **data rate** of **400 Mbps**

Smart Devices' Data Summarization for Behavioral Insights *May '19-July '19*
Internship - Samsung RnD Institute, Bangalore

- Studied & understood multiple **clustering techniques** like K-Means, Kernel Density Estimation, etc
- Surveyed multiple **research papers**, like "**learning the k in k-means**", "**k-means lite**", to further **improve & adapt the available techniques** according to the project need
- Implemented the adapted & improved technique, using **python** model, on **smart devices' data** to understand user behaviour, and later use the insights to **predict the user behaviour**

Multiple Drone Tracking & Localization *December '17*
Guide: Prof. Siddharth Tallur & Drona Aviation | Electrical Engineering, IIT Bombay

- Localized the pluto drones position extracting its 3D coordinates and locating multiple drones simultaneously using **Whycon package** over **ROS** and got an **accuracy up to 3cm**
- Introduced additional functionality for drone flight control in a **10,000+ line code** base written in **C++** by tweaking the automated trajectory part and varying the **PID controller** & **trimming parameters**, thereby refining the drone's trajectory guided by **Whycon ROS package**

SELECT COURSE PROJECTS

Microprocessor Architecture: Superscalar *Spring 2019*
Guide: Prof. Virendra Singh | Course: Processor Design

- Designed and Implemented a **16-Bit Superscalar Architecture** based on a Turing-Complete ISA in **VHDL** having **fetch width of 2 instructions** and **4 different pipelines**
- Optimized the performance by **removing intra-fetch dependency** at decode stage and verified its logical correctness by simulating its code using **Modelsim**

Microprocessor Architecture: Pipelined RISC *Autumn 2018*
Guide: Prof. Virendra Singh | Course: Microprocessors

- Designed and Implemented a **16-Bit, 6-Stage Pipelined RISC** processor based on Turing-Complete ISA in **VHDL** and successfully tested the implementation on **Cyclone IV E FPGA**
- Included **data & control hazard mitigation** and **result forwarding** to improve the performance.

Data Transmission through Polymer Optical Fiber link *Spring 2019*
Guide: Prof. Joseph John & Prof. Kumar Appaiah | Course: Electronic Design Lab

- Designed a **PRBS(Pseudo Random Bit Sequence) Generator** at transmittor side using shifter IC capable of transmitting data upto the speed of **50 Mbps**
- Received the signal using high-speed Photodiode and converted the signal from light energy to **digitally readable** electrical signal of **voltage level 0-5V**, using **Transimpedance Amplifier** & **Comparator**
- Achieved speeds upto **35 Mbps** over a **10m long Polymer Optical Fiber Link** using LED

Texture Synthesis using Non-Parametric Sampling *Autumn 2018*
Guide: Prof. Suyash Awate & Prof. Ajit Rajwade | Course: Digital Image Processing

- Studied & understood the mathematical model discussed in the **research paper** on "Texture Synthesis through Non-Parametric Sampling" based on the assumption of spatial locality
- Successfully implemented the technique discussed in the research paper using **MATLAB**

Color Sensor using Phase Sensitive Detection *Spring 2018*
Guide: Prof. Siddharth Tallur | Course: Analog Lab

- Designed a color sensor using **3 different colored leds** in which the light from the leds are reflected through the colored surface and the response is seen using **photodiodes and transimpedance amplifiers**, the output of whom is properly scaled and mapped to different colors
- Refined the output using **Phase Sensitive Detection** circuit to remove ambient noise effects
- Among the **top 6 projects** in the batch which were awarded prizes by instructors for **best projects**

SCHOLASTIC ACHIEVEMENTS

- Secured **All India Rank 197** in JEE-Advanced among 2,00,000 applicants *'16*
- Secured **All India Rank 2167** in JEE-Main among 13,00,000 aspirants **(99.83 percentile)** *'16*
- Shortlisted for admission to B.Stat program in **Indian Statistical Institute**, Kolkata *'16*
- Among **Top 1%** at state level in **National Standard Examination in Physics**(NSEP), conducted by Indian Association of Physics Teachers(**IAPT**) *'15*
- Within **Top 1%** at state level in **National Standard Examination in Chemistry**(NSEC), conducted by Indian Association of Chemistry Teachers(**IACT**) *'15*
- Qualified for Indian National Chemistry Olympiad(**INChO**) and Physics Olympiad(**INPhO**) *'15*
- Achieved **All India Rank 87** & **Zone Rank 1** in Gujarat zone, in Unified International English Olympiad(**UIEO**), conducted by Unified Council *'13*

POSITION OF RESPONSIBILITY

Department Academic Mentor *April '18-Present*
EE Depatment

- Part of 22 member team which guides academically under performing students in the department
- Mentored 16 students helping them to overcame their academic and personal difficulties
- Provided sophomore course reviews to be displayed on the DAMP website to help the students

Technical Councillor *July '18-April '18*
Hostel 9, IIT Bombay

- Lead **Hostel 9** to secure **First Position** in **Institute Technical General Championship**, and was awarded **Technical Hostel Commendation Award** by **Institute Technical Council** for active efforts to improve Hostel Tech Culture
- Represented Hostel 9 in Institute Tech Committee meet and ensured proper maintenance of the Hostel Tech Room & regular participation in Technical General Championships (GCs)

RELEVANT COURSES & TECHNICAL SKILLS

Electrical Engineering	Mathematics & Statistics	Computer Science
Adv. Topics in Comp. Arch.	Probability & Random Processes	Data Structures & Algorithms
Algorithmic Digital Design	Data Analysis & Interpretation	Introduction to Machine Learning
Processor Design	Multivariate calculus	Digital Image Processing
Microprocessors	Linear Algebra	Operating Systems
Foundations of VLSI CAD	Real & Complex Analysis	Computer Networks

Computer Languages Verilog, VHDL, C/C++, Python, HTML, CSS, LaTeX
Software & Tools Quartus, MATLAB/Octave, Arduino, NGSPICE

EXTRA-CIRRUCULAR

- Completed a year-long certified course in **Hockey** under **National Sports Organization(NSO)**
- Won **Gold medal** in **Hockey GC** & **Silver** in **Institue Hockey League** (IHL), 2018
- Stood **1st** in **Glider making GC**, 2019 held by Aeromodelling Club, IIT Bombay
- Secured **1st** position in **Hostel Hack GC**, 2018 held by Electronics and Robotics Club, IIT Bombay
- Won **1st prize** in **Biotech General Championship (GC)**, 2017 held by Biotech Club, IIT Bombay
- Stood **1st** in **Electric Jhatka GC**, 2017 and earned special mention for being in **top 5 teams**
- Completed the Cult School for **Film & Media Editing** classes and acquired skills in **Adobe Premiere Pro**

REFERENCES

Prof. Virendra Singh
Electrical Engineering
IIT Bombay
website

Prof. Madhav Desai
Electrical Engineering
IIT Bombay
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Prof. Sachin Patkar
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