Thariq Shanavas

Indian Institute of Technology - Bombay

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Research Interests: Experimental Particle Physics, Trigger systems, ASIC, Computational Electromagnetics, RF Circuit design, Accelerator Physics

Education

2015 – Present Undergraduate, **Indian Institute of Technology – Bombay**, *Mumbai*
Major in Electrical Engineering, Minor in Physics
CPI – 9.02/10.0

2013 – 2015 **Intermediate/+2,** S N Trusts Central School, Kerala, Percentage – 97.8

2012 – 2013 **Matriculation,** S N Trusts Central School, Kerala, CGPA – 10.00

Research Internships

- **ASIC and FPGA controller for self-triggered hybrid pixel detector** *Nov 2017 – present*
  Dr Tetsuichi Kishishita and Dr M. Tanaka, KEK High Energy Accelerator Research Organisation, Japan
  - Developing the controller for a self triggered Pixel ASIC using an FPGA
  - Working on noise optimisation of charge sensitive amplifier for future iterations of the ASIC chip.
- **Computational Electromagnetics |Modelling of Photonic nanostructures** *May 2017 – July 2017*
  Dr Karthik Shankar, University of Alberta, Canada
  - Analytically modelled and numerically simulated the optical properties of titanium dioxide nanostructures using electromagnetic theory.
  - **Theoretically modelled** the observed surface plasmon resonances when the Titanium Dioxide nanotubes were coated with Titanium Nitride, using effective medium theories and the exact Gans theory. Calculations led to excellent agreement with experimental data.
  - Performed FEM simulations in the supercomputing cluster at the University of Alberta.
  - Findings submitted to a reputed journal; currently under peer review.

Major Projects

- **Muon Tracker | Prof. Mandakini Patil** *Aug 2017 – present*
  CMS collaboration | Tata Institute of Fundamental Research, Mumbai
  - Worked on developing an FPGA based algorithm for tracing the path of a muon from the readings of multiple detectors.
  - Tested out efficient algorithms to find a scalable method for tracing the particle from a detector matrix.
- **Silicon detector Calibrator | Prof. Pradeep Sarin** *Jan 2017 – Apr 2017*
  Department of Physics, IIT Bombay
  - Designed a high precision **nanosecond pulse generator** for the purpose of calibrating the electronic readout of Silicon and Diamond particle detectors.
  - Implemented a low noise transconductance amplifier circuit followed by an attenuator block to convert a voltage pulse into a micro ampere current pulse.
- **Design of multicycle RISC Processor – Course Project, EE309: Microprocessors** *Oct 2017*
  Dr. Virendra Singh, Department of Electrical Engineering, IIT Bombay
  - Designed and simulated a multicycle RISC processor optimised for performance.
  - Implemented a Von Neumann architecture, used a shared data and instruction memory.
  - Implemented and verified the design on an FPGA.

- **Image forgery Detection – Course Project, EE325: Probability and Random Processes** *Nov 2017*
  Prof. Gaurav Kasbekar, Department of Electrical Engineering, IIT Bombay
    - Used statistical analysis to detect copy-move forgery in digital images.
    - Images segmented to subcells, statistical moments extracted in the Fourier doamin.
    - Implemented an intelligent sorting algorithm that analyses suspicious images in *O(n)* complexity.
- **Matsya, Autonomous Underwater Vehicle | AUV-IITB** *Oct 2015-Oct 2016*
  International RoboSub, AUVSI & US Office of Naval Research
  Part of a 30 member team aimed at developing unmanned AUVs. The team came second in the world at the international Robosub competition 2016, San Diego, California.
    - Developed a **DC – DC Boost Converter** for boosting the battery voltage, enabling the use of more powerful actuators.
    - Designed a **motor driver module** which **is 80% cheaper and 200% as powerful** as the commercially available ones.
    - Implemented **hot-swapping** of batteries. Provided an additional layer of protection for the onboard computer in case of primary battery failure.

- **Simulation of Spiral RF inductors | Prof. Dipankar Saha** *Apr2016 - June 2016*
  Department of Electrical Engineering, IIT Bombay
    - Studied and simulated **Spiral RF inductors** in the micron scale using **MATLAB** and **Comsol Multiphysics**.
    - Achieved a **95% agreement between simulation and experiment.**
    - **Isolated** the chief cause of deviation from ideal behaviour by analysing the Smith chart.
    - Explored new models which were found have better characteristics than conventional ones by simulation.
    - Worked on the extraction of **S parameter** of **RF waveguides**, as a function of the frequency of operation.
- **Coverage Control of multi-agent robotic systems | Prof. Sukumar Srikant** *Nov 2016 – Feb 2017*
  Systems and Control Engineering, IIT Bombay
    - Worked on the control of decentralised autonomous mobile robots.
    - Suitable for decentralised sensing and action, for example, cleaning up oil spills.
    - Proposed a Lyapunov-type proof for the stability and convergence of the system.
    - Numerical simulations carried out for the proposed controller. Results found to agree very well with coverage objective.

Scholarships and Achievements

- Secured **All India Rank 69** in IIT JEE 2015 among 1.35 million candidates for admission to IIT Bombay.
- Kishore Vygyanik Protsahan Yojana (**KVPY**) awarded by Department of Science and Technology for promotion of basic Sciences among high school students to ~250 students in the country - 2015
- National Talent Search Examination (**NTSE**) awarded by the National Council for Educational Research and Training to ~1000 students in the country – 2013

Positions of Responsibility

- **Manager**, **Maths and Physics Club**, IIT Bombay. *2015 - present*
  - Leading a team of six conveners to foster enthusiasm in mathematics and physics, tending to a community of 400 – 500 and an outreach of over 6000 online.
  - Over **five times increase in participation** in the Summer of Science initiative, a one to one mentoring program between enthusiasts and experienced senior students.
  - Organised several institute-wide quizzes and events to promote interest in the fundamental sciences.
  - Provided funding and mentorship to over 100 freshmen to pursue technical projects as part of Institute Technical Summer Projects – 2017

Technical Skills

Programming Languages	: C++, MATLAB
CAD Software	: Eagle, Altium, SolidWorks, AutoCAD, Cadence
Simulation Software	: Comsol Multiphysics
Other software	: Atmel studio, Arduino IDE, HTML, CSS, Latex, gnuradio

Extracurricular Activities

- Completed a year-long course on playing the Keyboard.
- Built a line follower using an AVR microcontroller, implemented the **PID control loop**.
- Gave a talk on **Control loops** and the **PID algorithm** for the Robotics club, IIT Bombay.
- Successfully completed the Summer of Science initiative under an experienced senior mentor, on Cosmology under the Maths and Physics Club. Report
- Secured first prize in Electric Jhatka General Championship by the Electronics club, an institute-wide circuit design competition.