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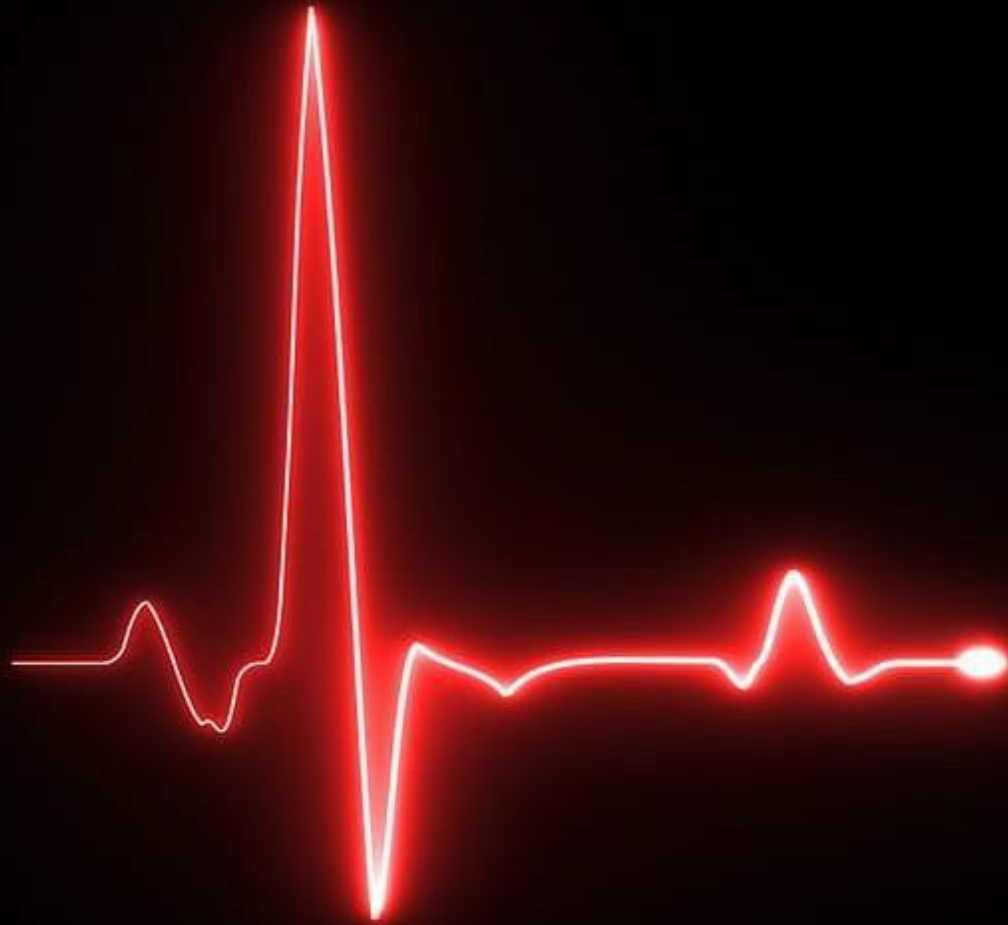(DEEMED TO BE UNIVERSITY)
BANGALORE · INDIA

THE PULSE

NEWSLETTER
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Vision

To emerge as a centre of academic excellence in the field of Electronics & Communication Engineering to address the dynamic needs of the industry upholding moral values.

Mission

- Impart in-depth knowledge in Electronics & Communication Engineering to achieve academic excellence.
- Develop an environment of research to meet the demands of evolving technology.
- Inculcate ethical values to promote team work and leadership qualities befitting societal requirements
- Provide adaptability skills for sustaining in the dynamic environment

FACULTY CONNECT

Lab on Chip – Silicon Optical Biosensor

Worldwide, the recent COVID-19 pandemic resulted in more than 5.8 million diagnosed cases and more than 360,000 fatalities. The pandemic had a huge social and economic impact on every country in addition to the immediate effects on health, partly due to the social isolation policies and global lockdowns put in place. Lifting these lockdowns was dependent on the evaluation of the risk involved with restarting businesses, educational facilities, and other social and cultural entities that required rapid diagnostic tests. An analytical device that detects the presence of a specific biological substance is known as a biosensor. Biosensors can be effective platforms for quickly quantifying biological analytes of interest when linked with sample collection and processing. The use of biosensors in numerous applications, including drug discovery, toxin detection, industrial process control, food quality and monitoring, environmental monitoring, memory design, medical diagnosis, and defense and maritime applications, has resulted from a remarkable development in biosensor technology over the past few decades. Fast detection response, simplicity, reliability, high sensitivity and specificity, cheap cost, and compactness are the key benefits of biosensors. Optical biosensors are based on several approaches, including absorption, bioluminescence, calorimetry, and fluorescence, and they are utilized in a wide range of industries. Over the past several decades, silicon photonics technology has advanced quickly, and the combination of silicon photonics technology and biosensors has greatly increased the range and applications of optical biosensors. Numerous clinical research labs have made use of small-scale, lab-on-chip, or sample-to-answer diagnostics. Because of their ability to consolidate several laboratory activities onto a single chip and automate laboratory tasks, these lab-on-chip platforms have attracted research attention. These devices provide improvements in sensitivity, total analysis time, portability, and convenience of use thanks to advancements in micro- and nanoscale technology. In the realm of point-of-care diagnostics, a variety of silicon photonic-based biosensing devices have recently been developed. These devices often include interferometer or resonator sensing elements that are fully integrated into the silicon-based Photonic Integrated Circuit system. Photonic-integrated sensors are frequently used in biological and chemical applications. Silicon-based optical biosensing systems have made significant advances in chip-scale integration and downsizing enabling hand-held, label-free bio-diagnosis with high-volume production at low cost by using the established CMOS manufacturing technology. Target molecules that alter the refractive index near the sensor are sensed in real-time by

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monitoring disturbances of the guided light in the waveguide, demonstrating a strong sensing capacity down to sub-femtomolar levels. By including optical gratings, microplates, and microresonators into the sensing platform, companies like Corning Inc., Axela Inc., and Genalyte Inc. have even commercialized some of the silicon-based biosensing designs for label-free detection. Researchers are working on overcoming the challenge of monolithic integration on the silicon substrate to realize a portable chip-scale biosensor for point-of-care diagnosis. In future, Lab-on-chip silicon optical biosensors will reduce the entire analytical time from hours or days to seconds due to the

possibility of quick, point-of-care results. This will enable patients to receive therapy more quickly, lessen the risk of unintentional transmission to others, and ease the demand for overworked clinical labs. With the globally extensive research effort, it is anticipated that lab-on-a-chip, portable biosensing devices would revolutionize global healthcare.

the silicon-based bio sensing designs for label-free

- **Dr Jesuwanth Sugesh,
ECE department**
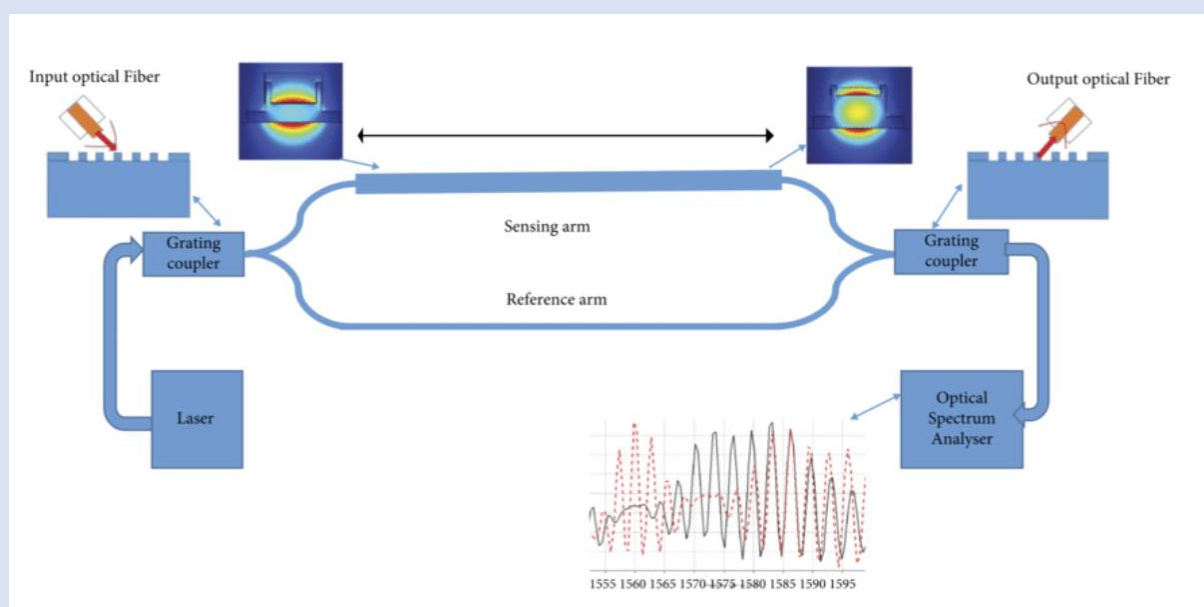
EVENTS

Highlights of the Month:

- Organized Departmental level Bootcamp for the event of cricket, Football, Volleyball, Basketball, Tug of War, held on 12.11.2022.

- Organized a Tech Talk on "SoC Design" handled by Dr. K. Padmanabhan, Intel Technologies held on 18.11.2022.

- Organized Departmental level Training Session on "RF and Microwave Research 2Lab", held during 18.11.2022 to 19.11.2022.

- Prof. Shashikumar attended a Training Programme on "Advances in Wireless and Antenna Technology" at KLE University held on 07.11.2022.

- Dr. Praghash.K attended a Training Programme on "Electric Vehicle Charging Station and Retro Fitting Business" at National Power Training Institute NPTI – PSTI, held on 12.11.2022.

- Col. Jai Govind.P, Dr. Chidambaram.S and Dr. Jesuwanth Sugesh. R. G. have attended the inaugural event of Regional Technology Node Bengaluru(RTN-B) organized by Army Service Corps(ASC) Centre, and College, Bangalore on 14.11.2022.

- Department Faculty meeting with the primary agenda on academic related matters held on 14.11.2022.

- Dr. Sujatha.S and Prof. Shashikumar.D has visited Government School, Nagdevanahalli for creating awareness among the students on "Mobile Usage and Effects of Electromagnetic Radiation" held on 16.11.2022.

- Col. Jai Govind.P has been invited as Resource Person for the event of Continuing Education Programme on "Artificial Intelligence/Machine Learning for Airborne Systems" organized by CABS-DRDO, Bangalore held during 16.11.2022 to 18.11.2022.

- Dr. Iven Jose and Prof. Delson T R published an article entitled as "Analysis and Optimization of Uplink Spectral Efficiency in Massive Multiple-Input and Multiple-Output" in Indonesian Journal of Electrical Engineering and Computer Science, Nov 2022.

- Dr. Hari Murthy has been granted with a copyright for his work entitled as "Energy-efficient Portable Dual-Powered Immersion Rod with Temperature Sensor and Automatic Shutdown" on 15.11.2022 by Copyright Office, Government of India.

- Dr. Naveen Kumar et al. authored an article entitled as "Next-Generation Connectivity in a Heterogenous Railway World", accepted in IEEE Communication Magazine(SCIE IF : 9.03)
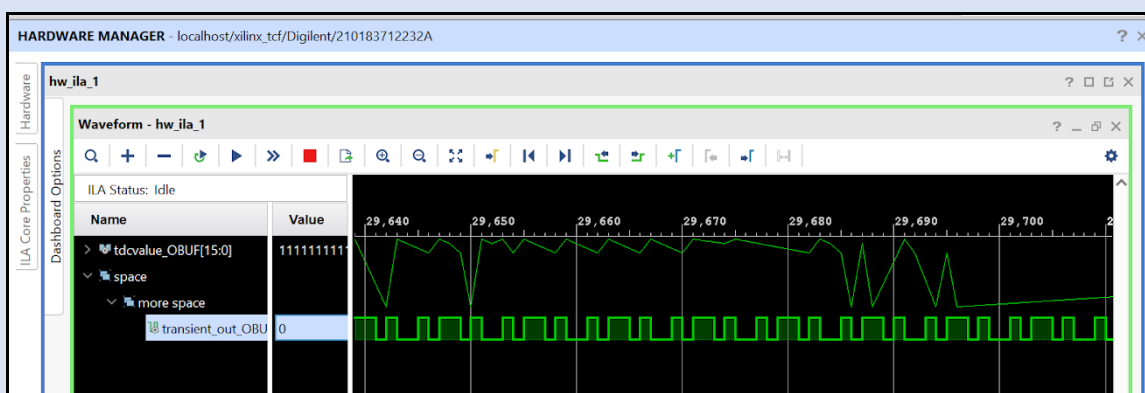
STUDENT CONNECT

Intel Unnati Rapid Challenge (IURC) 2022

Hi, I'm Prem Kumar R an 8th semester undergraduate Electronics and Communication Engineering student, sharing my account of competing, winning and eventually landing an Internship at Intel through the Intel Unnati Rapid Challenge 2022.

To set the premise, IURC happened during the semester break after 6th semester for us and spanned about 6 weeks from the last week of May till the first week of July. The format of the competition was simple; you're presented with some relevant industry specific problem statements to choose from. Teams pick a problem statement, submit a proposal on the chosen problem and if selected (Top 7) get to implement their proposal on hardware for the next 4 weeks and present their findings to a jury made up of domain experts from Intel. Winners are awarded a cash prize along with an opportunity to interview for internships at Intel India. The problem statements were highly specialized and it took us days and weeks to just comprehend them. This precisely, is why IURC 22 was so invaluable to all its participants - the students. By not holding back, they revealed the gaping divide between industry and academia, specifically in the VLSI domain. While it helped to have just learned FPGA design and implementation in sixth semester from Dr Sudhi, also the faculty guide for our team, there simply is no substitute for the "engineering process" that we learned and used by competing in the challenge.

The domain we chose was *security implications of hosting multiple tenants in FPGA [Field Programmable Gate Arrays]*. In simpler terms, the dangers of sharing a single FPGA fabric among untrusted users in a cloud environment. Our team focused on finding out possible attack vectors and after weeks of reading research on the subject , we designed and implemented a side channel attack using basic primitives available inside an Artix 7 FPGA and presented a hardware demo to the Jury on 5th July 2022.

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We learned relevant and important concepts in timing closure, Verilog, time to digital converters, voltage switching transient networks, sensor calibration and iterative design that we couldn't have stumbled on or learned if not for this initiative from Intel.

As winners of the competition, we interviewed for Internships at Intel and got assigned to PSG - Intel's FPGA group. I learned so much about the role of FPGAs in datacenters as accelerator and infrastructure processing units, and was able to interact with a great set of professionals on a daily basis. It was enlightening to learn about the great work that most of us outside the industry isn't aware of, but which is crucial to all the services we use daily.

Incredibly grateful to the University for the support during and after the competition and lastly to the folks at Intel behind the Unnati Rapid Challenge

-**Prem Kumar R**
ECE 2019-23 Batch

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Kindly share your thoughts and research experiences via e-mail to our team, and be featured in next month's issue!