

Real-Time Communication Interpreter System for Deaf and Dumb people using a Machine Learning Approach

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Project Overview:

The communication interpreter system is proposed to facilitate deaf and dumb person's life style. Dumb and deaf people communicate with common people throughout the world using hand gestures. However, common people face difficulty in understanding the gesture language. In order to overcome these real time issues, the proposed system is developed. This user friendly, cost effective system reduces communication gap between dumb and deaf with ordinary people. The main aim of the proposed project is to develop a cost effective system that can give voice to voiceless people with the help of smart gloves. In addition, the system will integrate a speech-to-video feature that determines the video of the speech and displays it for the wearer of the smart glasses.

Eligible Departments:

Electronics	X
Communications	X
Networking	X

Software/Hardware:

- Embedded C
- Java

Efficient Wireless Charging of Electric Vehicles

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Project Overview:

Consider a future in which a driverless ridesharing electric vehicle (EV) pulls over as you exit a building, takes you to your destination, and proceeds to drive passenger after passenger without ever needing to stop to recharge its battery. Instead, power generated by nearby wind and solar resources is delivered wirelessly to the vehicle.

Eligible Departments:

Electronics	X
Communications	X
Networking	

Software/Hardware:

- Electronics design tools
- Embedded C
- Java

Adaptive Hardware security for IoT Devices

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Project Overview:

Internet of Things (IoT) is a promising technology that is continuously spreading around the world leading to many challenges facing cryptographic designers who are trying to fulfill the security standards of IoT constrained devices. In this work, a new design is proposed that adds a new dimension of security by using the concept of frequency hopping to generate a pseudo-random pattern for switching between 5 lightweight cryptographic ciphers that are participating in the Competition for Authenticated Encryption, Security, Applicability, and Robustness (CAESAR). The proposed design exploits the advantages of Dynamic Partial Reconfiguration (DPR) technology in Field Programmable Gate Arrays (FPGAs) to switch between the 5 ciphers using Internal Configuration Access Port controller (AXI-HWICAP).

Eligible Departments:

Electronics	X
Communications	X
Networking	

Software/Hardware:

- VHDL
- Embedded C

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Traffic flow Prediction for Intelligent Transport Systems using online Machine Learning Algorithms

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Project Overview:

Traffic flow prediction is an important component of the autonomous driving system and used for traffic management and public safety. The **traffic flow prediction** is affected by many complex factors, such as inter-region traffic, events, and weather.

Online machine learning is a method of machine learning in which data becomes available in a sequential order and used to update our best predictor for future data at each step. The fact that the dataset is always varying in size within time arise to the need of online machine learning. Online Machine-learning algorithms adapt to train models continuously as soon as new data is available.

The main aim of the proposed project is to apply online machine learning algorithms to predict traffic flow.

Eligible Departments:

Electronics	X
Communications	X
Networking	X

Software/Hardware:

- Python

Hardware optimization for Travel Time Estimation Using Online Deep Neural Network

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Project Overview:

Vehicle travel time estimation or estimated time of arrival (ETA) is one of the most important location-based services (LBS). It is becoming increasingly important and has been widely used as a basic service in navigation systems and intelligent transportation systems.

Online machine learning is a method of machine learning in which data becomes available in a sequential order and used to update our best predictor for future data at each step. The fact that the dataset is always varying in size within time arise to the need of online machine learning. Online Machine-learning algorithms adapt to train models continuously as soon as new data is available.

The main aim of the proposed project is to design an accelerator using online machine learning algorithms to predict the vehicle travel time. The student will optimize the application on FPGA.

Eligible Departments:

Electronics	X
Communications	X
Networking	X

Software/Hardware:

- C or VHDL

Recent Attacks and Defenses on FPGA-based Systems using Dynamic Partial Reconfiguration

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Project Overview:

Field-programmable gate array (FPGA) is a kind of programmable chip that is widely used in many areas, including automotive electronics, medical devices, military and consumer electronics, and is gaining more popularity. Unlike the application specific integrated circuits (ASIC) design, an FPGA-based system has its own supply-chain model and design flow, which brings interesting security and trust challenges. In this project, we review the security and trust issues related to FPGA-based systems from the market perspective, where we model the market with the following parties: FPGA vendors, foundries, IP vendors, EDA tool vendors, FPGA-based system developers, and end-users. For each party, we show the security and trust problems they need to be aware of and the associated solutions that are available. Dynamic Partial Reconfiguration will be proposed to protect the hardware design in the FPGA.

Eligible Departments:

Electronics	X
Communications	
Networking	

Software/Hardware:

- VHDL
- Embedded C

Wireless Distribution for Satellite Signal using Directive Antennas

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Project Overview:

The satellite dish capture the signals from the satellites. The parabola shape of the satellite dish reflects the radio signal inward onto a dish's feed horn. The central element in the feed horn is the LNB. The LNB amplifies the radio signal bouncing off the dish and filters out the noise. In the market product, The LNB passes the amplified, filtered signal to the satellite receivers using wires. Transmitter and receiver systems will be proposed to send the output of the LNB to the satellite receiver wirelessly using Directive antennas.

Eligible Departments:

Electronics	
Communications	X
Networking	

Software/Hardware:

- CST

Deep Learning Utilization in Ultrasound Beamforming Application

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Project Overview:

Ultrasound medical imaging has become one of the most regular and usual procedures for the diagnosis of diseases and helps in surgery guidance. Its popularity arises as it provides high resolution images without ionizing radiation. Yet, ultrasound imaging still has a lot of drawbacks that hinders its use in many applications such as early breast cancer detection. Most of ultrasound medical imaging systems currently on the market implement standard Delay and Sum (DAS) beamforming to form B-mode images. However, image resolution and contrast achievable with DAS are limited by the aperture size and by the operating frequency. Moreover, ultrasound images are usually corrupted with speckle noise which can complicate the detection of small and low contrast lesions. Therefore, it is essential and valuable to reduce speckle noise for better analysis and diagnosis. In this work, the enhancement of DAS beamforming is explored using various deep learning approaches (CAE, ResNets, etc..). Moreover, speckle noise reduction is also tackled aiming for image resolution improvement.

Eligible Departments:

Electronics	X
Communications	X
Networking	X

Software/Hardware:

- Python
- Matlab

Modelling NoC data sub-router with QDI Asynchronous Design

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Project Overview:

The target of this project is to learn the basics of asynchronous design and to understand different design techniques. One of those techniques is the Quasi-Delay Insensitive (QDI), where the data transfer is independent on the delay of the wires and interconnect. The benefit of the QDI is achieving high robustness against process variation especially with the minimizing transistor sizing. QDI usually consumes large area and power so the sense amplifier QDI is proposed to perform the same function with less power consumption. After this project, the student should have full understanding of the asynchronous design techniques and the ability to employ them. Tools to be used are the Cadence and Synopsys software.

Eligible Departments:

Electronics	X
Communications	
Networking	

Software/Hardware:

- Cadence
- Synopsys

Hardware and Software Architectures for the 3D Computing Era

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Project Overview:

The proposed research aims to address fundamental gaps in current and future 3D-stacked memory architectures. This proposal focuses on exploring new PIM hardware architectures and their required software interfaces, designed specifically to achieve high performance for memory-intensive operations. Technical challenges for designing the hardware and software architectures will be identified and addressed. Examples of such challenges are: designing the PIM programming model, achieving coherence between the main CPUs and the PIM logic, deciding on PIM granularity, and achieving efficient data mapping.

Eligible Departments:

Electronics	X
Communications	X
Networking	X

Software/Hardware:

- gem5 Simulator

Low Power High Accuracy Weather Station for Agriculture using LoRaWAN End Devices on The Things Network

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Project Overview:

The goal of the project is to create a system that can be deployed anywhere (even in the more remote orchards and fields) that regularly monitors weather conditions and notifies the farmer when immediate action is required to prevent crop loss.

The LoRaWAN (Long Range Wide Area Network) is a Low Power Wide Area Network (LPWAN) made for the Internet of Things (IoT). It is designed for long-range, low-power operation with sensors and controls that work off of batteries or energy-harvesting devices.

Eligible Departments:

Electronics	X
Communications	X
Networking	X

Prediction of seizure likelihood for patients with drug-resistant epilepsy.

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Project Overview:

Epilepsy is a central nervous system disorder in which brain activity becomes abnormal, causing seizures or periods of unusual behavior, sensations, and sometimes loss of awareness. Epileptic seizures affect patients lives due to the uncertainty of when the seizure will occur, which impairs the quality of life for these individuals. The main part of epilepsy treatment lies in prediction of when the seizure occurs and hence prevent it or take cautious measures. Brain implants, electrodes can be used for prediction of seizures. However, this harms brain tissues and the damage cannot be reversed. The goal of this work is to predict epileptic seizures by classification of seizures using Machine learning approaches to help produce a solution for epilepsy treatment. The result should be either "high" or "low" risk of seizures according to patient data.

Eligible Departments:

Networks	X
Communications	X
Electronics	x