Rayen SELMI

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Electrical Engineer and PhD Student

PhD student in Electrical Engineering specializing in power electronics, embedded systems, and high-efficiency DC–DC converter design.

Education

National Engineering School of Tunis, Master's Degree in Signal and Systems Techniques. 2024 - 2025

National Engineering School of Tunis, Electrical Engineering Degree. 2022 - 2025

Coursework in power electronics, embedded systems, PCB design, IoT, Edge AI, operating systems, robotics, microcontroller programming, VLSI technology, processor architectures, FPGA programming and simulation, automation, and supervision.

Preparatory Institute for Engineering Studies of El Manar, Physics and Technology Preparatory Studies. 2020 - 2022

Experience

End of study project Internship: **Hexa5** 02/2025 - 06/2025

- Designed and implemented an AI-based dynamic target tracking system for a PX4-controlled drone, integrating ROS2 for control and communication, YOLOv8 for real-time object detection, and SORT (Simple Online and Real-Time Tracking) for tracking. The system was tested in a Hardware-in-the-Loop (HIL) setup using a server for processing.

Master's Thesis Internship: **Hexa5** 04/2025 - 07/2025

- Researched AI techniques to improve drone tracking and object recognition, developed and tested advanced tracking algorithms using deep learning, studied sensor fusion methods to enhance target detection accuracy.

Engineering Internship: **Valeo** 06/2024 - 08/2024

- Studied and improved an assembly machine: component analysis, GRAFCET simulation with FluidSim, programming with TIA Portal, HMI development, and data supervision. Validated system reliability through PLCSim simulation.

Internship: **Amorim Cork** 06/2023 - 07/2023

- Gained knowledge of automated machines and their programs, identified defects, and discovered various laboratory machines as well as the factory's electrical installations.

Projects

Design and Implementation of an FM Radio Using STM32F4 and the RDA5807 Circuit 10/2023 - 05/2024

- Developed an STM32 driver for the RDA5807 with I2C communication, using Keil uVision and STM32Cube. Created the project prototype, incorporating PCB design in Eagle and a graphical interface developed in C++ with Qt. The interface communicates with the board through a USB port configured as a Virtual COM Port (VCP).

Real-Time DC Motor Control via Web Server on BeagleBone Black 09/2024 - 10/2024

- Built a real-time Node.js web server with Socket.IO on the BeagleBone Black, allowing users to select the PWM duty cycle for precise DC motor speed control, developed a C program executed by the web server, which dynamically adjusts the motor's speed through PWM output, showcasing real-time system integration and hardware control.

FreeRTOS Project: Smart Home Real-Time Monitoring and Control System 10/2024 - 11/2024

- Constructed a smart home system using an STM32F4 with FreeRTOS to manage real-time tasks for communication with sensors and actuators via I2C, UART, and SPI. The system uses an ESP8266 for Wi-Fi connectivity to exchange data with the VS Code application to control the home, monitor energy consumption, and display database data.

PCB Design and Implementation 01/2022 - 03/2022

- Designed and implemented a PCB for a light game with sound control. Conducted theoretical studies, simulated the project using PSPICE, and designed and routed the PCB with EAGLE.

Soc Project: Implementation of a RISC-V Processor 10/2023 - 11/2024

- Created VHDL code for a RISC-V processor, performed simulations using ModelSim, and validated the processor with assembly code. The design was then integrated into an SoC and implemented on a Xilinx FPGA using Vivado.

Development of a Dashboard for Monitoring Temperature and Humidity with ESP32 12/2023 - 01/2024

- Generated a code for ESP32 discovery that retrieves data from a humidity-temperature sensor, creates and publishes MQTT topics, developed a dashboard with Node-RED using the topics. Finally, stored the data using SQLite.

Autonomous Robot with ROS2 and Raspberry Pi 10/2024 - 11/2024

- Development and implementation of algorithms for autonomous robots using ROS2, enabling efficient navigation while avoiding obstacles. Integration of a Raspberry Pi for real-time processing and simulation, along with an Arduino for sensor management and communication.

Public Lighting System Management Application 08/2022 - 10/2022

- Implementation of a C++ Qt application enabling the manipulation of city lighting, calculation, display, and storage of energy consumption data in a database using SQLite.

Motion Detection with STM32L4 IoT 10/2024 - 11/2024

- Implementation of an AI model via STM32Cube.AI for motion detection using data from integrated sensors (accelerometer and gyroscope), communicating through the I2C interface to retrieve real-time data. The USART interface was used to display motion detection results on a serial terminal.

Calculating the phase difference between two signals using STM32F4 discovery 10/2023 - 12/2023

- Using an STM32, to generate two sinusoidal signals with a phase difference via the DAC and fed into the ADC to calculate the phase difference. A potentiometer, connected via the ADC, is used to vary the phase difference.

Skills

Languages : Arabic (native) | French (DELF : B2) | English (TOEIC : B2) | German
Programming languages: C/C++/C#, Python, Rust, VHDL, Assembly, JavaScript, HTML, SystemC.
Microcontrollers: STM32F4 discovery, STM32L4 discovery, Arduino, ESP32, ESP8266.
Microprocessors: Raspberry Pi, BeagleBone Black, Nvidia Jetson Nano, FPGA.
Software: Keil uVision, STM32CubeMx, STM32CubeIDE, IAR, Matlab, VIVADO, ModelSim, MySQL, Visual Studio, TIA Portal, PLCSIM, WinCC, STEP7, Eagle, Pspice, LTspice, KiCad, Psim, Gazebo, QT Creato.
Operating Systems: Windows, Linux, RTOS(FreeRTOS), ROS.

Extracurricular Activities

Robotics club ENIT : Project Manager and Head of Research and Development
INJAZ Tunisia : Head of the production department in a student-based start-up called "PLIVET"