Rithic C H Chellaram Hariharan

A masters student at TU Eindhoven with a genuine interest in research

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Education

Eindhoven University of Technology	**Sep 2024 - Present**
Masters of Science in Embedded Systems	*Eindhoven, Netherlands*
Government College of Technology, Coimbatore India	**Jul. 2019 – May 2023**
Bachelor of Electrical Engineering	*Coimbatore, India*

Relevant Coursework

- Real-time embedded systems
- Wireless sensor networks
- Control systems
- Internet of Things
- Analog and Digital
- Electronics
- Signals and Systems
- Data Structures and
- Algorithms

Experience

Indian Institute of Technology, Madras	**May 2023 – Present**
IoT Hardware Firmware Researcher (Prof. Raghunathan Rengaswamy)	*Chennai, India*

- Developing the **Firmware** for collecting data from the embedded device.
- Integrated seamless communication between 2 different micro controllers for increasing the ability to **parallel process** the information.
- Developed Firmware for **Firmware Over The Air Firmware updates(FOTA)** using various cloud platforms like Firebase, Azure, Google Cloud Platforms, and GitHub. For increased accessibility and scaling of the device.
- **Researching** on wireless sensor network and wireless sensor control algorithms.
- Wrote back end code to download IoT device's data from **MongoDB**, allowing users to set filtering criteria.

Madras Institute of Technology, Chennai	**Jun. 2022 – August 2022**
Summer Student Research Internship (DR. C. Shanthi)	*Chennai, India*

- Worked with Cypress Development Board **PSOC 6**.
- Worked on numerous network protocols available inbuilt such as **WIFI and BLE - Beacon** for sending data to a centralised server and creating a sensor network in a mesh topology.
- Created a **Full Duplex communication** between the two PSOC 6 development boards using WIFI.
- Optimized performance of the system using the **Free RTOS library** for real time scheduling and task communication .

NALVision India Ltd, Coimbatore	**Sep. 2021 – Dec. 2021**
Electronics Engineering Intern	*Coimbatore, India*

- Have scrutinized the utility of various development micro controller boards **Raspberry Pi, Jetson nano, Heltec LoRa ESP32, TTGo, Espressif ESP32, Espressif ESP8266 Node MCU** in various industrial applications.
- Worked on numerous network protocols such as **LoRa, ESPnow, BLE - Beacon, WiFi etc.**
- Exploring Industry 4.0 automation such as **AWS - Greengrass, AWS-IoT Core**
- Worked on dashboard creation using Grafana.
- Real time task optimization using Real time systems **RTOS - FreeRTOS**

AIDATADRIVEN	**Jul. 2021 – Sep. 2021**
IoT security, development, and Data Science Intern	*Remote - Amsterdam, Netherlands*

- Provided safety reports and data analysis to building managers for information security processes.
- The optimized algorithm for the OTA was developed and the update was based on a timed cycle and availability cycle.
- Worked On FOTA updates for Embedded Systems from the Cloud Storage platforms like **Firebase, Azure, Google Cloud Platforms, GitHub**, etc.
- Worked with a Data Science team worked closely with the sales.
- Developed an automatic website that would sort out the sensor data using a Machine learning algorithm and give insightful data to the end user

Suzlon Wind Energy Corporation (SWECO)	**Apr. 2021 – May 2021**
Internship Trainee	*Tirunelveli, India*

- Learned about the basic working principles of wind power generation.
- Learned about **PLC** ladder logic concepts and **SCADA** based monitoring
- Learned about the **Wireless Sensor Networks** and how it works and remote monitoring and remote control of the sensors and actuators of the wind turbines

Projects

SURAKSA - Safety for Underground miners and Risk Avoidance system.
- **Concepts used**: Remote Sensor data collection, Miner's Health Safety, LORAWAN, Mining Environment Monitoring
- Created a **Mesh topology based communication** for the underground mine worker for a **reliable data transmission** and no data loss.
- Localization of the mine worker using efficient localization algorithms **1.RFID** and **2.LoRa based Localization algorithms**.
- Analysing the miner's working environment and analysing the exposure to pollutants on a **individual, spatio-temporal and hyperlocal levels**.
- Creating a **Flexible PCB** for embedding the device on the miner's jacket for not hindering the working efficiency of the miner.
- Created back end API for the **custom made LoRa gateway** for sending the data to the cloud.
- Managing the **data serves** and **SQL databases** for data storage and data analysis.

Guidance and navigation control of a missile using MATLAB
- **Concepts used**: MATLAB Simulation, PID Tuning, Kalman Filter, Linear Quadratic Regulator (LQR) Algorithm .
- Controlling variables to guide and control the path of the missile to hit the appropriate location.
- Used control algorithms like **LQR and PID** algorithm for controlling the missile to hit the location.
- Used **Kalman Filters** to estimate the missile's location and give corrective actions to the missile
- Both of the control scheme was integrated together using **Matlab Simulink**, created a model using flight gear software for simulating the situation under various test conditions.

Over The Air Firmware Update for ESP32-based Home Security Systems for Zero Downtime
- **Concepts used**: FOTA (Firmware Over the Air updates), RTOS (Real Time Operating Systems), Home Security System.
- Developed a **home security system** to address increased theft in an area. Used various types of **vibration, Passive infra Red, Temperature and Gas sensors for detecting intruders** and home environment for **timely notification** of any abnormality.
- Enabled microcontrollers to automatically update over the air to the latest firmware without user intervention to reduce the downtime in the system.
- Used Real-Time Operating Systems (RTOS) to optimize CPU workload based on **Earliest Deadline First (EDF) scheduling and Priority based scheduling.**
- Compared various types of **scheduling algorithms** in RTOS and finding the best fit for the application.

Remote Health Monitoring Device
- **Concepts used**: Embedded Systems, Sensors, Internet of Things, Data acquisition, and Live monitoring.
- Engineered **cost-effective Arduino-based system** for remote health monitoring.
- Monitored critical parameters: **Heart Rate, ECG, SpO2, and Body Temperature.**
- Achieved **97 percent success rate** in data transmission without latency.
- **Developed dynamic web app** for direct data reporting and abnormal pattern prediction
- Significantly advances embedded systems in healthcare for **early diagnosis and remote monitoring.**

Automatic Drone Marker Detection
- **Concepts used**: Python, ROS (Robotics Operating System), Jetson Nano, Raspberry Pi, Ubuntu, Linux
- Constructed a drone using the Robotics Operating System (ROS) for **precise package delivery**.
- Learned various control algorithms like **PID controller and fuzzy logic controller**
- Engaged in the Eyantra robotics competition organized by **IIT Bombay**, involving 12 challenges.
- Specialized in drone marker detection and navigation towards the designated marker in the competition.
- Used **localizaation algorithms** to predict the actual location of the drone without GPS.

Automatic Dustbin
- **Concepts used**: Embedded Systems, ESP32, WIFI, Blynk IoT App.
- Engineered an automated dustbin designed for collaboration with the municipality of Coimbatore.
- Integrated a full-level sensor, activating when the dustbin is full, and notifying the municipality for timely clearance.
- Features automatic open and close functions to prevent mosquito and parasite breeding.
- A smart solution aimed at optimizing logistics and enhancing sanitation practices.

Pymewc (Python Microcontroller Interface)
- **Concepts used**: Python, UART, Embedded Systems, Data acquisition.
- Pymewc is a python library that can be used for connecting python with the micro controller.
- Pymewc is a lightweight package that aims for simplicity yet performs complex tasks with ease.
- **Features:**
- Read data from each pin of the microcontroller.
- Scoping Using Analog Pin 0 with an accuracy of up to 100 Hz

Conference and journal research paper published

I proposed solutions, led the study design, data collection, and analysis, creating a proof of concept for the proposed model.

- **C. H. Rithic** and N. Arulmozhi, "Real-Time Implementation of RF-based Mobile Fleet Localization and Collision Avoidance System in Wireless Sensor Network for Drones and Gliders," 2023 7th International Conference on Intelligent Computing and Control Systems (ICICCS), Madurai, India, 2023, pp. 1459-1465, doi: 10.1109/ICICCS56967.2023.10142713.
- **R. C. H**, N. Srinivasan and A. S, "Design and Development of Temperature Controlled Intelligent Portable Reefer Container for Delivery Optimisation in Logistics and Supply Chain Management," 2022 3rd International Conference on Electronics and Sustainable Communication Systems (ICESC), Coimbatore, India, 2022, pp. 58-63, doi: 10.1109/ICESC54411.2022.9885337.
- **Ch, R.**, Narendran, S., Marimuthu, C. (2021). ECG AND PULSE OXYGEN LEVEL MONITORING AND ARRHYTHMIA CLASSIFICATION USING CNN. International Journal of Engineering Applied Sciences and Technology, 6(8), 171–176. https://doi.org/10.33564/ijeast.2021.v06i08.028.
- Chinnamamudi, Marimuthu. et al(2022). Performance Analysis of Three Phase Boost Cascaded Multi Level Inverter in Hybrid Microgrid System Using Ann Controller. International Journal of Innovative Science Technology. 9. 48-68.

Involvement in Collegiate teams

University Racing Eindhoven - Formula Student Team of TU/E   **2024 - Present**
Electronics and Software team member - Working on ECU(Electronic Control Unit) assignment   *TUE, Eindhoven*

- **Learning Outcomes:** NXP IMXRT controller, NXP MBDT, Stateflow, , MATLAB, Automotive Ethernet, CAN bus, Embedded Python, Embedded C, Teamwork.
- **Fabricated the ECU of a forumula student car** and playing a key role in getting the car running with the new lighter ECU from NXP (NXP IMXRT1176).
- Developed custom CAN bus firmware for seamless communication with all I/O modules, motor drives, inverters, Battery Management Systems (BMS), and integrated safety features of the car
- Currently developing a custom implementation for automotive grade T1 Ethernet to ensure reliable high-speed communication with the autonomous system controller of the car.

Team Screwtenizers - Society of Automobile Engineers (SAE) Baja Team   **2020 - 2023**
Vice Captain (2023), Lead of Electrical and Data Acquisition Team (2021-2023)   *GCT, Coimbatore*

- **Learning Outcomes:** National Instruments Data Acquisition System, MATLAB, Xbee Technology, Solidworks, Ansys , Embedded Python and wireless telemetry optimisation, Teamwork, Team management, and Leadership.
- **Fabricated a All Terrain Vehicle**(ATV) and played a key role gathering essential sensor data for **material selection and optimisation of design**. and giving the data insights using MATLAB.
- Implemented a **National Instruments Data Acquisition System**, coupled with **Xbee technology** and a microcontroller, to enable **real-time data telemetry** and analysis during actual operation.
- **Collected data**: **Brake Disc Temperature** for brake failure analysis, Primary and Secondary Pulley **RPM** for Continuous Variable Transmission (CVT) tuning, **Strain data** from the Roll cage for structural analysis, and **damper travel data** for suspension tuning.
- Designed the ATV's Steering Wheel and collaborated on the water jet cutting of this component. Additionally, conducted analysis of the vehicle's steering using Ansys software.

Institute of Electrical and Electronics Engineers (IEEE) Student Branch   **2021 - 2022**
IoT Society Co-Lead, Programming Committee   *GCT, Coimbatore*

- **Learning Outcomes:** IoT Application , Embedded C/C++, Chip Designing, PCB Designing, Firmware Design, Research methodology, Mentoring.
- Contributed to the development of IoT solutions to address contemporary societal challenges, such as crowd management, smart farming, and Industry 4.0 solutions.
- Participated in the development of an embedded microcontroller from the ground up to achieve optimized Application-Specific Integrated Circuit (ASIC) performance.
- Assisted students within the student branch in fabricating their projects for participation in Hackathons held at various institutions in and around Tamilnadu.
- Worked closely with the programming team to coordinate various programming-related tasks, including website design, server setup for data collection, and the development of custom APIs to facilitate event registrations

Technical Skills

Embedded Devices: Cypress PSOC 6, STM 32, ESP32, NodeMCU ESP8266, Arduino, MSP430, Raspberry pi, Jetson Nano, Raspberry pi Pico.
Softwares: Python, C/C++, Postgres SQL, R, MySQL, MATLAB, LABVIEW, HTML-CSS
Developer Tools: VS Code, Eclipse, Google Cloud Platform, Android Studio , AWS
PCB Design Software: KiCad, EasyEDA, Eagle, and Altium (Minimum working Experience).

Extracurricular

- Smart India Hackathon 2022 finalist Hardware Edition at KIET Group of Institution, Ghaziabad, Uttar Pradesh. Problem Statement provided by Coal India Limited

- Student member of SAEINDIA and SAE International club and Student member at IEEE GCT Student Branch

- Cofounder of Electrocuit, a platform for Electronics enthusiasts

- Solopreneur - I had taken up whose motive is to help people with the technology I know, the telegram bot and automated dustbin is the outcome of this project

- Open Source contributor and Hacktoberfest participant in 2021 and 2022
- Member of Ys Men International and TedX GCT

- Google Hash Code Ranker – Participated in a C Hash Code competition conducted by Google at the National Institute of Technology, Tiruchirappalli. Rank within the top 5 percentage.

- Did research in Photovoltaic Thermal Systems installed at college hostel premises to improve the efficiency of the solar panel as well as the water heating system

Certifications Done

- Digitalization in Aeronautics by Technische Universität München (TUM), Coursera

- Development of Real-Time Systems by EIT Digital, Coursera

- Embedded Hardware and Operating Systems by EIT Digital, Coursera

- MBSE: Model-Based Systems Engineering by University at Buffalo, Coursera
- The Raspberry Pi Platform and Python Programming for the Raspberry Pi by the University of California,Irvine, Coursera

- Crash Course on Python by Google, Coursera

- Python Data Structures by University of Michigan, Coursera

- Blockchain: Foundations and Use Cases by ConsenSys Academy, Coursera

- SQL for Data Science by University of California, Davis, Coursera

- Programming Foundations with JavaScript, HTML, and CSS by Duke University, Coursera