GOUTHAM VISHNUVARDHANAN

CSIR-CENTRAL ELECTROCHEMICAL RESEARCH INSTITUTE, KARAIKUDI

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RESEARCH INTEREST

I am deeply interested in the intersection of electrochemistry, computational modeling, and artificial intelligence. My work involves computational electrochemistry, utilizing simulation tools in COMSOL Multiphysics to developing data-driven models for battery state-of-health prediction. This has strengthened my passion for applying AI and mathematical modeling to electrochemical systems. I am particularly keen on exploring how machine learning and numerical methods can enhance the design, optimization, and performance prediction of energy storage devices.

EDUCATION

2022 – 2026 **Bachelor of Technology in Chemical and Electrochemical Engineering**
(CGPA: **8.3/10.0**)
CSIR - Central Electrochemical Research Institute

2022 **All India Senior School Certificate Examination (AISSCE)**
Percentage: **97%**
Central Board of Secondary Education, Thiruthangal Nadar Vidhyalaya

RESEARCH EXPERIENCE

Lithium-Ion Batteries: [Sep 2025–Current]

Title: "Machine Learning–Driven Health Prognosis of Lithium-ion Batteries using Electrochemical Impedance Spectroscopy"

Guide: Dr. Sindhuja R (Senior Scientist)
Central electrochemical Research institute, Karaikudi, India
*Objective: To develop an **accurate and data-driven approach** for predicting the **state of health** of lithium-ion batteries by integrating **electrochemical impedance spectroscopy (EIS) with machine learning algorithms**, enabling real-time diagnostics and improved battery management systems.*

Lithium-Sulfur Batteries: [Jan 2025 – June 2025]

Title: "Propyl Viologen-Based Catalysis for Enhanced Performance in Anode-Free Lithium–Sulfur Batteries"

Guide: Dr. Arul Manuel Stephan (Senior Principal Scientist),
Central electrochemical Research institute, Karaikudi, India
*Objective: Enhancing the performance of anode-less lithium–sulfur (Li–S) batteries by increasing **capacity** and **mitigating the shuttling effect** of lithium polysulfides (Li_2S_x) using propyl viologen as a catalytic additive in electrolyte*

Title: "Nickel–Cobalt Nanocage-Based Metal–Organic Frameworks (MOFs) Enhanced Lithium-Sulfur batteries for High-Capacity and Extended Cycle Life"

Guide: Dr. Arul Manuel Stephan (Senior Principal Scientist),
Central electrochemical Research institute, Karaikudi, India
*Objective: Developing **nickel–cobalt nanocage** MOF structures as catalyst for advanced cathode materials to enhance the electrochemical performance of lithium–sulfur (Li–S) batteries, focusing on improved **capacity**, **conductivity**, and **extended cycle life** by reduction in polysulfides dissolution into electrolyte*

RESEARCH INTERNSHIPS

Title: Developing Hybrid Electrochemical Battery Modelling Using Pybamm for Li-ion Batteries
***Guide*: Dr. Atriya Biswas, Assistant Professor,** [Jul 2025 – Aug 2025]
Indian Institute of Technology Madras (IITM), Chennai, India
*Objective: Developing robust hybrid electrochemical model using prebuilt electrochemical models in **Pybamm** and coupling them with **Machine learning methods** to predict **SoH** along with degradation parameters*

Title: Collection & Review of data on Data driven methods for Lithium-Ion Battery Health Assessment Using Electrochemical Impedance Spectroscopy (EIS) [Jul 2024 – Aug 2024]
***Guide*: Dr. Sindhuja R (Senior Scientist),**
Central electrochemical Research institute, Karaikudi, India
Objective: This project aims to provide an overall review of battery health assessment using EIS, specially using data driven models

RESEARCH ACTIVITIES UNDERTAKEN

- Synthesized materials through hydrothermal and solvothermal methods *(MoFs)* as well as quaternization reactions *(propyl viologen)*
- Assembled coin cells in an inert **glove box** environment for **electrochemical testing**.
- Performed electrochemical analyses including **Cyclic Voltammetry** (CV), **Electrochemical Impedance Spectroscopy** (EIS), and **Galvanostatic Charge-Discharge**.
- Conducted battery performance testing on commercial lithium-ion cells using **Biologic** and **OrigaLys** systems; processed and analyzed data using **Python** and **OriginPro**
- Characterized materials using a range of techniques including **FTIR**, **SEM**, **TEM**, **Raman spectroscopy**, and **X-ray diffraction** (XRD)

SKILLS AND EXPERTISE

- Certified **Python** developer and **data analyst**. (pandas, NumPy, Matplotlib, seaborn).
- Certified in **Machine learning techniques** (Udemy).
- Certified **in SQL and MATLAB & Simulink** (Udemy).
- Professional Certification in **AI & Data Science from DRISHTI CPS, IIT Indore & Microsoft** [Ongoing].
- Intermediate knowledge of **COMSOL** & firm knowledge in **Application building through COMSOL.**
- Hands-on experience with **Electrochemical techniques** (electrochemical impedance spectroscopy, cyclic voltammetry, chronoamperometry) and firm knowledge in **PS-Trace software**

EXTRACURRICULAR ACTIVITIES & ACHIEMENTS

- Acting **president** for **Intersect (National level technical symposium) @ CSIR - CECRI**
- Involved in various **NGO Activities (Leo club)** and a founding member of the **science club** at CSIR-CECRI.
- Active member of **Vetrivel Foundation**, a non-profit dedicated to empowering underprivileged children.
- Recognized as the **best junior KHO KHO player** and two-time **Sportperson of the year** (College)**.**
- **State-level table tennis player** in singles & doubles

REFERENCES

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