Naughton Internships for students from the University of Notre Dame

Dr. Dominic O' Sullivan

The Intelligent Efficiency Research Group www.ucc.ie/ierg is an award winning team of PhD and Masters Researchers specialising in the advancement of the next generation of energy efficiency technologies.

The research focus of the group centers on four core areas:

- The development of intelligent analytics systems to support industrial energy management.
- The incorporation of fault detection and diagnostics to industrial energy systems.
- Building energy performance simulation.
- The application of next generation renewable and sustainable energy systems to industry.

Project 1.   Application of Analytics Software for Building System Optimisation and Fault Detection

This project will involve extracting data from various existing systems, developing visualisation front ends for data presentation and developing rules for detection of faults in monitored systems.

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Dr. Alan Morrison

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Project 2 Title:	**An integrated solar resource monitoring station**
Supervisor(s):	Dr Alan P. Morrison
Contact Details	a.morrison@ucc.ie
Project Location:	EEE Building
Project Description:	For the efficient and effective design of PV systems knowledge of the available local solar resource is imperative. Instruments exist for the measurement of global, direct and diffuse solar radiation. The purpose of this project will be the development of an integrated instrument capable of measuring all three parameters with a data logging capability in real time. The system should compare favourably with reference instruments and be capable of long-term deployment in the field. Data captured from the instrument cluster should be displayed in real-time on a webpage, where daily, weekly, monthly and annual statistics should be visualised. A back-end database of captured data should be automatically maintained.
Special Requirements:	Interest and ability in instrumentation, experimental measurement, electronic and software design, microcontrollers.

Project 3 Title:	**A battery test-bench and charging system**
Supervisor(s):	Dr Alan P. Morrison
Contact Details	a.morrison@ucc.ie
Project Location:	EEE Building
Project Description:	Modern energy storage in PV systems is based on either Lead acid or Li-ion battery technology. The purpose of this project is to assemble a test-bench capable of measuring key battery parameters (e.g. Equivalent Series Resistance (ESR), state of charge, open circuit voltage, capacity etc…) for a variety of battery technologies. The system should be intelligent enough to recognise the attached battery technology and it should have the capacity to make the fundamental measurements with minimum user intervention. A further desirable outcome of the project is to provide a charging station for different battery types and sizes. The overall system should be standalone with a computer interface for data visualisation.
Special Requirements:	Interest and ability in instrumentation, experimental measurement, electronic and software design, microcontrollers.

Project 4 Title:	**Use and evaluation of open-source software for modelling PV systems**
Supervisor(s):	Dr Alan P. Morrison
Contact Details	a.morrison@ucc.ie
Project Location:	EEE Building
Project Description:	A variety of simulation and modelling tools exist for the simulation and design of everything from PV cells through to modules and ultimately complete systems. Many of these simulation environments are commercial systems and are expensive/prohibitive for academic purposes. This project will initially investigate and evaluate the variety of free and open source software available for academic use. The software will be categorised according to the types of modelling problems it is best suited. The second half of this project will involve customising some of the open-source software variants to suit the Irish environment. Simulations will be developed to evaluate the suitability of various locations around Ireland for PV deployment.
Special Requirements:	Interest in PV system design and software development, particularly in Python.

Dr. Zili Li

Website: https://www.ucc.ie/en/civileng/people/drzilili/

Project 5 description:

Geothermal energy is a promising renewable energy technology to reduce energy dependencies in Ireland and secure its energy future. Typical shallow geothermal foundation is a recyclable system of extracting heat from the ground to house in cold season and remove surplus heat from house to the ground in hot days.

The warm moist soils and climate in Ireland is ideally suited for harnessing shallow geothermal throughout the year, and there is an increasing number of domestic ground source heat pump (GSHP) installed in Ireland and across the world. However, limited geothermal research and application has been applied to large-scale infrastructure, for example, metro tunnels.

Dublin tunnel project provides an opportunity to investigate and harness geothermal tunnel system. It is aimed to conduct soil-thermal-fluid coupled finite element analysis of soil-tunnel interaction to offer some guidance on the design of geothermal metro tunnel in Dublin and Ireland.

Statement of expectations:

1. Good command of finite element software packages for geotechnical engineering (e.g. Plaxis finite element software)
2. Understand the soil-thermal-fluid coupled field surrounding the geothermal tunnel
3. Evaluate energy efficiency of the proposed geothermal tunnel in Dublin metro