FindAPhD Project Template

Electrical Engineering and Electronics

Department Name:

Supervisor(s) and their email address (2 max):

Dr Saqib Khursheed, s.khursheed@liverpool.ac.uk
Prof Alan Marshall

Funding Status (select from below drop down menu):

Directly Funded Project (Students Worldwide)

Application Deadline:

No deadline, candidate will start as soon as possible. This position will remain open until a suitable candidate is found.

Project Title:

Investigation into hardware security of low-power embedded systems
Summary:

There is global consensus on the importance of embedded systems in a number of application domains including autonomous mobile systems, internet of things, medical monitoring, robotics, autonomous avionics etc. However, full utilisation of embedded systems is currently threatened by challenges posed by security of the underlying hardware that realise such systems. A recently published report estimated that the loss to US economy is $7.5 billion per year from counterfeit semiconductors alone [1]. In the UK, a recent study concluded that a cyber-attack on a carefully selected target, for example electric company that supplies electric power to domestic and industrial users, can cause serious damage to the British economy. It estimated the immediate direct and indirect impact to be about £12.9 billion and also estimated that it will take up to 2 years to fully recover with total loss of £49 billion to the GDP [2]. This case study analysed the potential mayhem caused by Trojan deployed in an embedded system in an electric company. Trojan is a rogue piece of hardware that is secretly deployed through deception for a number of reasons, including information gathering, false signalling and control etc. This project will address challenges that facilitate counterfeit semiconductors and hardware Trojans.

The issue of counterfeit semiconductors will be addressed by developing smart counter measures to minimise un-authorised access of hardware logic, which is the primary mechanism that reverse engineers use to understand and replicate logic. Proposed methods will camouflage logic cells and also devise a protection mechanism for embedded systems that will be triggered upon observing a number of events. The challenges posed by hardware Trojan will be addressed by detecting and alienating embedded systems that are affected by Trojans. This will be achieved by designing a low-cost digital logic. Particular emphasis will be on rigorous validation of proposed approach and its impact on performance, power and area overhead.

Candidate specification: They should have a strong background in digital system design, micro-electronics and embedded systems with a degree in Electronics Engineering (or related disciplines) with excellent hardware and software programming skills, for example: C/C++, Verilog/VHDL, SPICE, Python and EDA design tools (Cadence, Mentor Graphics, Synopsys). Preference will be given to candidates with prior research experience as demonstrated by publication(s) in well-reputed conferences/journals.

Start date of PhD programme: Immediate

For more information, please contact Dr Saqib Khursheed at s.khursheed@liverpool.ac.uk
References (optional):


Funding Notes (max 100 words):

**UK/EU students:** This is a fully funded position for UK/EU students and covers their tuition fee and living expenses.

**Non UK/EU students:** Only tuition fee will be covered for non EU/UK students. They will have to find additional funding to support their living expenses.

Dr Saqib Khursheed, s.khursheed@liverpool.ac.uk

https://www.liverpool.ac.uk/electrical-engineering-and-electronics/staff/saqib-khursheed/

Name and email address to direct enquiries to:
List of subject areas (please select the appropriate subject areas the project applies to):

**Engineering**
- [ ] Acoustics
- [ ] Aeronautical Engineering
- [ ] Biomedical Engineering
- [ ] Chemical Engineering
- [ ] Civil & Structural Engineering
- [x] Electrical & Electronic
- [ ] Energy
- [ ] Manufacturing
- [ ] Materials Science
- [ ] Mechanical Engineering
- [ ] Nanotechnology
- [ ] Nuclear Engineering
- [ ] Semiconductors
- [ ] Software Engineering
- [ ] Telecommunications

**Maths & Computing**
- [ ] Applied Mathematics
- [ ] Bioinformatics
- [ ] Computational Chemistry
- [ ] Computer Science & IT
- [ ] Data Analysis
- [ ] Information Science
- [ ] Mathematics
Operational Research
Software Engineering
Statistics

**Humanities**
- American Studies
- Anthropology
- Archaeology
- Architecture & the Built Environment
- Asian Studies
- Classics & Ancient History
- Communication, Cultural & Media Studies
- European Studies
- Geography
- History
- Middle East & African Studies
- Modern Languages & Linguistics
- Philosophy
- Theology & Religious Studies

**Social Science & Health**
- American Studies
- Anthropology
- Architecture & the Built Environment
- Asian Studies
- Development Studies
- Economics
- Education
- European Studies
- Gender & Sexuality
- Geography
- Health Sciences
- History
- Middle East & African Studies
- Modern Languages & Linguistics
- Nursing, Midwifery & Allied Health Professions
- Philosophy
- Political Science & International Studies
- Psychology
Public Health & Epidemiology
Social Work, Social Policy & Administration
Sociology
Sports, Recreation & Leisure Studies
Town & Country Planning

Business & Finance
Accounting & Finance
Business & Management
Economics
Tourism & Hospitality

Law
- Law

Arts
- Architecture & the Built Environment
- Art & Design
- Classics & Ancient History
- Drama, Dance & Performing Arts
- English
- History
- Music

Chemical Sciences
- Agricultural Chemistry
Analytical Chemistry
Biochemistry
Chemical Engineering
Chemical Toxicology
Computational Chemistry
Electrochemistry
Environmental Chemistry
Food Chemistry
Geochemistry
Inorganic Chemistry
Macromolecular Chemistry
Materials Science
Organic Chemistry
Pharmaceutical Chemistry
Physical Chemistry
Synthetic Chemistry

Physical Sciences
Applied Physics
Astrophysics
Atmospheric Physics
Atomic Physics
Biophysics
Condensed Matter Physics
Fluid Dynamics
Geophysics
Low-temperature Physics
Materials Science
Medical / Biomedical Physics
Metrology
Nuclear Physics
Optical Physics
Particle Physics
Plasma Physics
Radiation
Semiconductors
Theoretical Physics
Earth Sciences
- Agronomy & Soil Science
- Atmospheric Physics
- Climatology & Climate Change
- Ecology & Conservation
- Ecotoxicology & Pollution
- Environmental Chemistry
- Environmental Science
- Geochemistry
- Geography
- Geology
- Geophysics
- Hydrology
- Meteorology
- Oceanography