

# MSc Project Proposals

Programme Leader: Ali Al-Bayati

4th March 2018

# PROJECT 01: SECURITY MANAGEMENT FRAMEWORKS

## E.G. INFORMATION GOVERNANCE (IG), SECURITY ASSURANCE (SA) Introduction

Information Governance is to ensure appropriate use of personal information. It is a set of policies, procedures, and controls implemented to manage information. It includes both technical assurance and non-technical assurance. Security Assurance is to ensure that system is protected at a level that the security objectives are satisfied. Assurance can also be viewed as the confidence that the security control will function as expected.

Key areas are IG/SA for banking and healthcare industries. These frameworks can be used to inform the updates of policies/standards and support an organisation's legal, risk, and operational requirements. We have a group of PhD students, who are security professionals/consultants, working in these areas. Students selecting this project will join this group for active discussion and knowledge exchange.

### Projects Objectives

Review and have a thorough understanding of IG/SA.

Model and validate IG/SA Framework in a practical environment.

### Prerequisite

Basic skills of case studies and business modelling.

Work experience in industry (banks, healthcare) is desirable.

A Cyber Security or Information Systems background is desirable

### Expected Deliverables

Your Final Report can be either of the following,

- A Survey of IG/SA in a specific area (e.g. healthcare)
- Case Studies & IG/SA framework modelling
- IG/ SA framework modelling & validation (e.g. through industrial business cases)

### Supervisor - Dr Ying He

Lecturer

GH 5.61 - The Gateway De Montfort University LE1 9BH

T: +44 (0) 116 207 7614 E: ying.he@dmu.ac.uk

# PROJECT 02: INFORMATION DRIVEN CYBER SECURITY INTELLIGENCE

## E.G. SOCIAL MEDIAL INTELLIGENCE, CYBER SECURITY INTELLIGENCE AND RISK MANAGEMENT

### Introduction

With the information explosion of cyber threat data from different sources such as social media, security forum, incident management systems, system log files, etc, responders can gather and share real-time, dynamic information to improve situational awareness and assist in decision-making. The ability to identify, verify, coordinate, aggregate, and contextualise is very important to re-use this information.

Cyber threat intelligence aims to visualise and predict the next state of threat landscape/status and suggest security solutions to counteract threats. The cyber threat intelligence generated can be used to inform risk management (e.g. asset management) and security decision-making (e.g. solution prioritisation). Key areas are CTI for banking, healthcare and other security critical industries.

This project is based on a current DMU funded project, in collaboration with Rensselaer Polytechnic Institute and Georgia Institute of Technology. MSc Topics can be aligned to our on-going project.

### Projects Objectives

Generate threat intelligence from different data sources.  
Analyse, visualise and represent data in to support threat prediction. Produce security knowledge to inform effective security decision-making.

### Prerequisite

Basic knowledge of security risk management and decision-making.  
Work experience in industry (banks, healthcare) is desirable.  
Basic skills of business analytics, data visualisation, and programming are desirable. A Cyber Security or Information Systems background is desirable.

### Expected Deliverables

Your Final Report can be either of the following

1. A survey of cyber security intelligence
2. The design of an approach to analyse data for a particular security decision-making scenario.

## Supervisor - Dr Ying He

Lecturer

GH 5.61 - The Gateway De Montfort University LE1 9BH

T: +44 (0) 116 207 7614 E: ying.he@dmu.ac.uk

# PROJECT 03: IT/ICS SECURITY INCIDENT RESPONSE FRAMEWORKS & AGILE MANIFESTO

## **E.G. DYNAMIC INCIDENT RESPONSE AND SECURITY FORENSICS Introduction**

IT/ICS security incident response requires efficient change management (e.g. patch update), data integration, reporting, adaptability and collaboration of different stakeholders. However, current incident response practices follow a linear plan-driven approach, not reflecting the real-world incident handling procedures. This has limited the benefits of incident response capabilities. There is a need of an iterative and incremental incident handling approach.

Agile principal values collaboration, communication and flexible response to changes. IT/ICS security incident response would potentially benefit from the integration of Agile Principal. The proposed Agile Incident Response/Security Forensic Frameworks will be tested and validated in our Cyber Range Events.

### **Projects Objectives**

Model and validate an Agile Incident Response Framework. Model and validate an Agile Security Forensic Framework.

### **Prerequisite**

Basic knowledge of security incident response and forensics. Work experience in industry (banks, healthcare) is desirable.

A Cyber Security or Information Systems background is desirable.

### **Expected Deliverables**

Your Final Report can be either of the following,

- Agile Incident Response Framework modelling and validation
- Agile Security Forensic Framework modelling and validation

### **Supervisor - Dr Ying He**

Lecturer

GH 5.61 - The Gateway De Montfort University LE1 9BH

T: +44 (0) 116 207 7614 E: ying.he@dmu.ac.uk

# PROJECT 04: USABLE SECURITY

## E.G. HUMAN FACTORS IN SECURITY. INTERACTIVE SECURITY EVALUATIONS

### Introduction

In many systems, human users play an important role. They are also known as the “weakest link” in the security process. This has become the target of social engineering. They develop secure systems, encrypt data and share information that can secure or destroy a system. However, many secure systems are designed with little or no consideration of people's cognitive abilities. As a result, people make mistakes and get “security obstacles”. It is important for security experts to understand how people will interact with the systems they develop. We need to design security into products from inception.

### Projects Objectives

Design and build secure systems with a human-centric focus. Evaluate the usability of secure systems through user studies.

### Prerequisite

Basic skills of programming,

The skills of HCI experimental design, and user studies are desirable.

A Cyber Security or Human Computer Interaction background is desirable.

### Expected Deliverables

Your Final Report can be either of the following,

- The design of a secure system with a human-centric focus
- The evaluation of a security interactive system

### Supervisor - Dr Ying He

Lecturer

GH 5.61 - The Gateway De Montfort University LE1 9BH

T: +44 (0) 116 207 7614 E: ying.he@dmu.ac.uk

# PROJECT 05: E-LEARNING ENVIRONMENT THAT PROVIDES PERSONALISED LEARNING PATH ACCORDING TO LEARNING STYLES

## Project Outline

Learning difficulties is not related to the subject material, but in fact to the way we perceive information. The recent eLearning industry is concerned to improve on-line courses through the computer assistance in order to reach a higher degree of learning monitoring. To improve a learning course, the system must be capable of monitoring the user behaviour to decide his learning style, and then decide the course content or the presentation into adaptive learning path according to his learning style. However, current learning systems are very limited. There is a need for refined adaptive learning approach. C programming course was built on MOODLE platform. The course was embedded with eye tracker to track the eye gaze for behaviour monitoring. The system annotates the images, texts, and videos in the screen. Then it collects and gives a data of the time percentage that the user spent on (texts) or (images and videos). In a later phase the user model of learning style is determined and stored. Also, ontology was built for modelling the course content and learning style.

This course could be expanded to have more features of providing the best recommendations for the most suitable learning path according to the learner learning style (whether it is visual or verbal). The ontology model is to be embedded in the system to determine learning style. And based on that learning style , using the mechanism of inferencing to determine the best content to deliver to the user. Also, we need the use to make a run-time event inferencing to continuously adjust the user model and the recommended path.

## Project Objectives

The objectives are to extend the existing C programming course capabilities which involve:

- Using the Ontology, the prototype gives a recommendation of content items like texts, or images.
- When there is equality in usage percentage, a prompt message should appear asking the user what is preferable to watch.
- Delivering the recommended content type to the user.
- Storing, and updating and data.

## Prerequisite

Basic programming skills in Java/C.  
Awareness of modifying a course with MOODLE.

## Expected Deliverables

A system prototype with documentations and dissertation report covering following aspects:

- Giving a recommendation of the best material items, according to stored learning style whether it was verbal or visual. This must be using the mechanism of semantic inferring.
- When there is equality in usage percentage, a prompt message should appear asking the user what is preferable to watch.
- Filtration of the material items into two parts which are suitable, and not suitable.
- Delivering the recommended material items for the learner.
- Storing interactions and recommendations in user profile.

### Supervisor – Prof Liming Chen

Professor of Computer Science GH 5.34 - The Gateway  
De Montfort University  
LE1 9BH  
T: +44 (0) 116 207 8490  
E: liming.chen@dmu.ac.uk  
W: [www.tech.dmu.ac.uk/~limingchen/](http://www.tech.dmu.ac.uk/~limingchen/)

### Khawlah Alhasan (PhD Student)

GH 6.19 - Gateway House  
De Montfort University  
LE1 9BH  
E: p14188496@my365.dmu.ac.uk



# PROJECT 06: SMART ENVIRONMENTS: THE PAST, PRESENT AND FUTURE

## Project Outline

Pervasive computing aims to enable a new paradigm of human-centric computer interaction – one person versus many computers, by embedding increasingly ubiquitous connected computing devices in an environment to allow the thorough integration of everyday objects and activities. Built upon this, ambient intelligence tries to make the environment sensitive and responsive to the presence of people by providing technologies and systems that support context awareness, personalisation, adaptability and anticipation. In parallel, several threads of enabling technologies have also made significant advance, including sensing technologies – the prevalence of miniaturised low-power low-cost high-capacity sensors and actuator, mobile computing – the large scale uptake and increasingly powerful mobile devices, WIFI, NFC, internet of Things and cloud computing, to name but a few. In combination this has created intelligent environments where miniature computing devices / objects work in concert to support people in carrying out their daily working and living life activities in an easy, natural and personalised way. A typical real-world example of such an intelligent environment is a “Smart Home” within which the daily activities of its inhabitants, usually the elderly or disabled, are monitored and analysed so that personalised context-aware assistance can be provided.

## Problem description

This dissertation aims to carry out a thorough examination on the state of the art of the research and development of smart environments, in particular, their applications, implementations, case studies and demonstrations. It is expected that the student should develop meaningful structures to organise (classify or categorise) existing work based on one or the other criteria. This will be one major contribution to knowledge. The student should be able to carry out extensive in-depth analysis on related work, e.g. comparison in terms of various dimensions such as the application domains, or the underlying technologies or the user cohorts or the types of environments. Based on the analysis the student should draw conclusions of the strengths and weaknesses of existing research and development of smart environments, identify open research problems and derive insights and visions into future research, development, and applications. This will be the second major contribution to knowledge. In addition, built upon the previous review and analysis, the student should speculate, conceive and design novel smart environment applications, in particular, based on real world use scenarios including daily life, working, doing business and entertainment. This will be the third contribution to knowledge of this dissertation.

## Deliverables

In addition to the three aforementioned contributions to knowledge, the dissertation should be able to be readily published as a survey or review paper after the completion of the dissertation.

The following is an indicative structure with a number of pullet points that this dissertation should cover. Nevertheless, the student should not be limited to this. It is expected that emphases of the dissertation should be placed on the review and analysis of reference implementations, application case studies and speculation of innovative use and application scenarios of smart environments. We would particularly like to see the critical review, comparison and analysis of reference implementations, application case studies and speculation of novel use scenarios of smart homes and semantic smart homes.

### **Suggested Key Points to be Covered by the Dissertation (it is the student's responsibility to organise the dissertation in a logical, coherent way)**

- General introduction / overview to smart environment
- High level description of smart environments
  - The requirements from user' perspectives and from application perspectives, its anatomy and physiology
  - in terms of architecture, constituent components and underlying technologies, e.g. sensors, actuators, middleware platforms,
  - In terms of functional features, e.g. adaptability, learning, cognitive capabilities, interoperability, openness, etc.
- The categorisation of smart environments, e.g.
  - closed world application scenarios - including smart homes, smart conferencing centres, meeting rooms, hospital, smart research environments
  - open world application scenarios – including airport, context aware commercial environments, i.e. service robot enabled shopping mall, smart cities, etc.
- For each category of smart environment,
  - review the state of the art of application, potential use scenarios include health (smart homes, assistive living), energy, mobility and commercial services (smart cyber-physical systems), etc.
  - review the state of the art of reference implementation including proof-of-concept, large-scale

demonstrations and validation driven by innovative use scenarios

- analyse the strengths and weaknesses in particular existing problems

- Speculate future R&D directions
- Speculation, conception and specification and/or design of novel smart environment application scenarios, potential implementations, etc.

### **Supervisor - Prof Liming Chen (Luke)**

Professor of Computer Science GH 5.34 - The Gateway  
De Montfort University  
LE1 9BH

T: +44 (0) 116 207 8490

E: [liming.chen@dmu.ac.uk](mailto:liming.chen@dmu.ac.uk)

W: [www.tech.dmu.ac.uk/~limingchen/](http://www.tech.dmu.ac.uk/~limingchen/)

# PROJECT 07: EXTENDING EYE TRACKING MOODLE SYSTEM TO MOTIVATIONAL PERSONALISED LEARNING SYSTEM

## Project Outline

Students' high level of motivation to learn is associated with their learning success. User motivation is a response to the interaction process and is fundamental for the success of the interaction process. Recognition of the role of identified motivational factors can contribute to an assessment of the interface and can be an indicator of how well design has addressed user needs. That's why we need to recognise and use techniques to enhance user motivation in the interaction process, in order to attract and sustain the interest of the target audience. Specifically, students with various kinds of learning difficulties such as dyslexia can cause young people not to engage fully with the education system or drop out. Thanks to the advancement of assistive learning system and user modelling techniques for personalised learning, the different individual learning needs and preferences can be taken into account and met by personalising the learning environment based on user models.

One of our DMU students has already developed an eye tracking learning system with course materials based on Moodle learning platform. View a quick demonstration video here: <http://xxxxxxxxxx>. The system can continually monitor learners' eye movements when they are using the system along with the percentage of eye gaze time spent on text, images and out of the screen and monitor learner behaviour such as clicking history and navigation behaviour as well as record learning task performance including test score, learning completion time, etc.

However, the motivational factors that are essential to learning success are not included in the system yet. By incorporating motivational factors into student modelling in the system, personalisation can be further applied based on student motivation model. We already have a motivation model and the corresponding motivation questionnaire and the inference rules as well, and we will need the system to collect the user behaviour data combined with the motivation model and inference rules, to output the learning content based on the inferred results. The initial personalisation of learning content will be performed based on the motivation questionnaire and the rules, and then the real-time user behaviour data will be recorded and used to update user's motivation, according to the real-time motivation, adaptive feedback will be output to user to sustain and enhance their motivation. The basic system architecture and its working principles is shown here:

The motivation plays a role in the teaching process primarily in the quantity of course materials presented to the student. For example, high motivated students tend to learn faster and to accept learning content in bigger quantities, while low motivators must be presented with smaller knowledge chunks with appropriate feedback, trying to increase their motivation. Another interesting perspective on motivation includes the idea of

positive feedback as a kind of retribution or praise with a series of studies showing the effects of feedback interventions as altering user's motivational state. Therefore, based on the data collection combined with the motivation model and inference rules, the output will be different quantities of course materials with feedback to user.

## Project Objectives

The objectives are to extend the current eye tracking Moodle system that involves:

- Identifying user's motivation at the beginning and in real-time.
- Recording and storing user's real-time data including eye movement and learning task performance (i.e., time spent on a page, time spent on a test, test score, etc.).
- Updating the motivational state with the aforementioned real-time data.
- Providing learning content (i.e., feedback and course quantity) for user based on the real-time motivational state.

## Prerequisite

Basic programming skills in C++/Java/Python.

Some experience of developing e-learning system will be beneficial. Technical

Requirements: YELLOW (Traffic light indicator)

## Expected Deliverables

A system prototype with documentations and dissertation report covering following aspects:

- Incorporating a motivation questionnaire (developed already) in the registration form.
- Recognising user attention by collecting eye-tracking data using given analysis method.
- Updating the motivational state with eye-tracking data and other recorded indicators such as browsing time using pre-defined rules.
- Allowing the motivation model and inference rules to be entered in the system
- Outputting the course content (with feedback and course quantity) based on the inference results.

**Supervisor – Prof Liming Chen Professor of Computer Science**

GH 5.34 - The Gateway De Montfort University LE1 9BH

T: +44 (0) 116 207 8490 E: liming.chen@dmu.ac.uk

**Ruijie Wang (PhD Student at CIIRG)**

GH 6.19 - Gateway House

De Montfort University

LE1 9BH

E: p1523357x@my365.dmu.ac.uk

**Ruijie will provide:**

1. The motivation model and questionnaire along with the pre-define weight of motivational factors in the motivation model/questionnaire; 2. Which user behaviour data serves as the indicators of which motivational factors to be collected; 3. Inference rules (input: motivation; output: Levels of course quantity; Feedback expressions and messages); 4. Levels of course quantities and Feedback expressions and messages.

# PROJECT 08: SMARTLAB PROJECT 2- IMPROVING USER INTERACTION METHODS FOR NON-TECHNICAL USERS FOR ASSISTIVE SYSTEM

## Project Outline

As the aging population rising, it can be seen as a human evaluation advancement. However, along with positive effects, there are also some side effects that it brings in for the elderly to even perform their Activities of Daily Living (ADLs). Therefore, Ambient Assisted Living (AAL) systems are being developed for the elderly, professional health services and even for their family members and relatives to monitor, provide efficient care and support for the elderly when required non-intrusively. Most of the AAL systems focus on trying to collecting appropriate sensing data and recognising the ADLs performed by the inhabitant in a given smart environment. However, little has been done for the elderly or the users who are have very limited knowledge of using ever-growing technologies. Therefore, many systems proposed fail in providing Human-computer interaction (HCI) capabilities for non-technical users and natural interaction methods. With the recent advancements of smart home technologies and evolution of HCI methods, it is now possible to provide natural HCI to non- technical expert users. For instance, conversational methods of voice-based devices such as Amazon Echo and Google Home, touch and gesture based method using Smartphone and Smart TV devices are now being integrated within AAL systems. A typical use case scenario could be to remind the elderly to take their afternoon medicines using voice-based device or prompting while entertaining themselves on Smart TV.

The smart system developed by Context, Interaction and Interaction Research Group (CIIRG) at DMU has already developed an Android mobile application and a website that is able to receive real- time sensing data and recognition of simple and composite user activities; view a quick demonstration video here: <https://1drv.ms/v/s!AgEZTTI9Fd75mXH9Lmnp7XHsXm-c>. This system can be expanded with some of the devices that we already available (Amazon Echo, Smartwatches, and SmartThings), being considered/ordered (i.e. Smart TV and Google Home) and the new devices can also be acquired.

## Project Objectives

To extend current CIIRG smart lab system with natural HCI by doing the follow:

- Integrating voice based services such as Amazon Echo/Google to inform inhabitant/user with a bespoke assistance instruction (i.e. suggesting to take medicine, reminding for doctor appointments)
- Extend Android mobile application to support Smart TV/Tablet application.

- Improve current graphical user interface (GUI) design of the Android application and create maintainable code.
- Create 2D/3D model of the smart environment and show where real-time events are occurring.
- Evaluate with the system with non-technical users.

### **Prerequisite**

Basic programming skills in Java/C.

Some exposure of developing Web Service/Website, Mobile application (Android) and programming to display graphical model of the room within the application would be beneficial.

Technical Requirements: YELLOW (Traffic light indicator)

### **Expected Deliverables**

A system prototype with documentations and dissertation report covering following aspects:

- Improving HCI by integrating voice based services and gesture/touch methods on Android application that supports Smart TV/Tablet.
- Improve GUI design with 2D/3D model simulating sensor events and create maintainable code.
- Evaluation of the system by non-technical expert users.

### **Supervisor – Prof Liming Chen**

Professor of Computer Science GH 5.34 - The Gateway

De Montfort University

LE1 9BH

T: +44 (0) 116 207 8490

E: [liming.chen@dmu.ac.uk](mailto:liming.chen@dmu.ac.uk)

W: [www.tech.dmu.ac.uk/~limingchen/](http://www.tech.dmu.ac.uk/~limingchen/)

### **Darpan Triboan (PhD Student at CIIRG)**

GH 6.19 - Gateway House

De Montfort University

LE1 9BH

E: [darpan.triboan@my365.dmu.ac.uk](mailto:darpan.triboan@my365.dmu.ac.uk)

W: <https://uk.linkedin.com/in/dtriboan>, <http://darpantriboan.wixsite.com/dtriboan>



# PROJECT 09: SMARTLAB PROJECT 2 - EXTENDING SENSING CAPABILITIES TO ENABLE EFFICIENT ASSISTANCE PROVISIONING

## Project Outline

Ambient Assisted Living (AAL) systems are being developed to support aging population to perform their Activities of Daily Living (ADL). The system not only provides a great tool for health services to provide efficient care to the patients but also enable one to live independently and potentially improve the quality of their life. Collecting contextual, behavioural, object interactions within the smart environment is critical in performing activity recognition (AR) and on demand assisting inhabitants. Thanks to the advancement of sensing capabilities and the notion of Internet-of-Things (IoT), the sensing can be carried out in three manners; environmental (ambient), object interaction based (dense) and physiological (wearables).

One of the challenge in collecting data is to not only deploy large varieties of sensors in non-intrusive manner but also efficiently communicating the data generated from the sensors to one hub/smart system. Although, there are many off-the-self sensors available in the market today, the sensing parameters are limited and the communication protocols may also vary.

The smart lab developed by Context, Interaction and Interaction Research Group (CIIRG) at DMU has already developed the smart system to collect data from off-the-self and custom devices in real- time; view a quick demonstration video here: <https://1drv.ms/v/s!AgEZTTI9Fd75mXH9Lmnp7XHsXm-c>. The system is continually evolving and it can currently collect ambient data using sensors supported by and Securifi Almond router(off-the-self) and dense sensing using Arduino boards (wired and wirelessly). However, number of sensors are also available. For example, UHF RFID readers, NFC tags, Estimotes beacons, and SmartThings starter kit for Ambient sensing; Mini-/Arduino boards based sensors using XBee/Bluetooth/WiFi/RF shields for Dense sensing; and Smart watches, SensorTag, and Shimmer platform for Wearable sensing.

## Project Objectives

- The objectives are to extend the CIIRG smart lab system's current sensing capabilities which involves:  
Integrating some of the off-the-self/custom sensors described above (i.e., SensorTag, Shimmer, SmartThings, Estimotes and Smartwatch).
- Store, query and update and delete sensor data into the database via web service.
- Viewing sensing data in real-time on a mobile application and web browser.
- Improving methods to add new sensors with minimal setup efforts.
- Evaluating the quality of the data generated by the sensors.

## Prerequisite

Basic programming skills in Java/C.

Some exposure of developing Web Service/Website, Mobile application (Android) and working with Arduino board would be beneficial.

Technical Requirements: **YELLOW** (Traffic light indicator)

## Expected Deliverables

A system prototype with documentations and dissertation report covering following aspects:

- Extending data collection capabilities from varieties of off-the-self/custom ambient sensors,
- wearable sensors and dense sensors wired/wirelessly to efficiently capture relevant inhabitant data.
- Each collection method must be described and documented.
- Storing and manipulating sensor events into the database via web service.
- Enable data to be viewed in real-time on a mobile application and web browser via web service.

## Supervisor – Prof Liming Chen

Professor of Computer Science GH 5.34 - The Gateway  
De Montfort University  
LE1 9BH  
T: +44 (0) 116 207 8490  
E: liming.chen@dmu.ac.uk  
W: [www.tech.dmu.ac.uk/~limingchen/](http://www.tech.dmu.ac.uk/~limingchen/)

## Darpan Triboan (PhD Student at CIIRG)

GH 6.19 - Gateway House  
De Montfort University  
LE1 9BH  
E: [darpan.triboan@my365.dmu.ac.uk](mailto:darpan.triboan@my365.dmu.ac.uk)  
W: <https://uk.linkedin.com/in/dtriboan>, <http://darpantriboan.wixsite.com/dtriboan>

# PROJECT 10: SELECTING PORTFOLIO OF SECURITY COUNTERMEASURES

## Objective

The final goal is to develop a tool for selecting portfolio of security countermeasures.

## Project Description

Choosing an optimal investment in security is an issue most companies facing these days. Which security countermeasures/controls to buy to protect their IT system in a best way? Selecting subset of security countermeasures among many available ones can be formulated as a resource allocation problem. To solve it usually several conflicting objectives should be optimised simultaneously. In particular, security of system should be improved without hindering productivity. Moreover, company might have limited budget for buying controls, which should be taken into account in the optimisation problem. In this project, the problem will be formulated and solved using existing optimisation frameworks, e.g. JMetal.

## Project Outline

- Study security budget allocation problem and existing approaches to solve it.
- Formulate budget allocation as an optimisation problem.
- Solve the problem using existing optimisation frameworks.
- Analyse results (e.g. compare performance for several algorithms) and draw conclusions.

## Prerequisite

- Programming skills, e.g. Java
- Problem structuring and modelling using existing mathematical formulations.

## Expected Deliverables

- Short literature review of security budget allocation problem and existing approaches to solve it.
- Solution of the existing benchmark problems using existing optimisation frameworks.
- Report on the analysis of results.

## Supervisor - Dr Iryna Yevseyeva,

Lecturer in Computer Science

School of Computer Science and Informatics Faculty of Technology

5.33 Gateway House, The Gateway

De Montfort University, LE1 9BH, Leicester, UK E: iryna.yevseyeva@dmu.ac.uk

W: TBC

# PROJECT 11: DECISION AIDING FOR SELECTING A PRIVACY NON-INVASIVE APPLICATION FROM PLAY STORE

## Objective

To develop a mobile application for ranking Mobile Applications according to their permission requirements.

## Project Description

Nowadays when searching for a Mobile App, e.g. in Play store, people are mainly considering how many downloads were made for an App. However, this criterion does not consider how privacy invasive each application is, which becomes of importance for modern privacy aware society. In this project the available Apps will be ranked based on how many and which permissions it requires for being installed. Scoring will be done based on Mobile App privacy invasion assessment and developed as an App, e.g. to be used as an alternative to popularity ranking in Play Store.

## Project Outline

- Study literature on existing privacy permissions and privacy assessment.
- Design evaluation function for scoring privacy of an App in Play Store.
- Implement and test the scoring App.

## Prerequisite

- Programming skills for mobile phones, e.g. Java for Android
- Problem structuring and modelling using existing mathematical formulations.

## Expected Deliverables

- Short literature review privacy permissions and privacy assessment.
- Decision aiding model for scoring privacy invasion assessment of an App.
- Scoring App.

## Supervisor - Dr Iryna Yevseyeva,

Lecturer in Computer Science

School of Computer Science and Informatics Faculty of Technology

5.33 Gateway House, The Gateway

De Montfort University, LE1 9BH, Leicester, UK E: [iryna.yevseyeva@dmu.ac.uk](mailto:iryna.yevseyeva@dmu.ac.uk)

W: TBC

# PROJECT 12: TRUST AND SECURITY IN EVERYDAY DECISIONS

## Objective

The final goal is to develop security scenarios and their trust models for helping in everyday decision making.

## Project Description

Nowadays making security decisions is a common everyday task that most of working or studying with computers people facing. For instance, answering the following questions becomes common: Shall I plug this USB stick into my computer? Shall I connect to this public Wi-Fi? Trust plays significant role in all these scenarios. In this project, the ways to model trust and assist in such decisions are explored by combining existing decision analysis models with developed in this project trust models. The developed decision aiding system is supposed to analyse all available information and suggest the decision maker a solution optimal from security and trust points of view. For instance trust can be studied in the context of phishing: why some people trust phishing emails and fall victims of social engineering.

## Project Outline

Study everyday decision scenarios and existing trust models.  
Develop trust models for selected scenario(s).  
Design decision aiding system for advising on security choices.  
Implement and test the system.

## Prerequisite

- Programming skills, e.g. Java
- Problem structuring and modelling using existing mathematical formulations

## Expected Deliverables

- Short literature review of existing trust models.
- Implementation of the decision aiding system for selected scenario(s).
- Report on the analysis of system performance.

## Supervisor - Dr Iryna Yevseyeva

Lecturer in Computer Science  
School of Computer Science and Informatics Faculty of Technology  
5.33 Gateway House, The Gateway  
De Montfort University, LE1 9BH, Leicester, UK E: iryna.yevseyeva@dmu.ac.uk  
W: TBC

# PROJECT 13: RISK ATTITUDES AND BEHAVIOURS IN SECURITY DECISIONS

## Objective

The final goal is to gain better understanding in risk attitudes in security decision making.

## Project Description

Understanding how people perceive risks and how they make decisions about risks associated with the business processes they perform within an organisation is a key to understand the overall risk exposure of an organisation to cyber security and other related risks. In this project risky decision making will be investigated in context of different business scenarios. In particular the hypothesis about correlation between type of business activity and risky behaviour will be investigated. Moreover it will be studied whether relaxing strict security policies improves security behaviours.

## Project Outline

- Literature review on risk profiles and behaviours in security decision making.
- Surveys and questionnaires about risk security behaviours related to different business scenarios and security policies.
- Statistical analysis of the results.
- Reporting conclusions from the study.

## Prerequisite

- Good skills on reviewing literature and performing questionnaires.
- Knowledge or willingness to learn usage of statistical analysis tools for the questionnaires results analysis.

## Expected Deliverables

- Literature review of existing risk behaviour models and their usage in security decision making.
- Designing questionnaires about risk security behaviours and testing a group of participants.
- Analysis of results using statistical tools.
- Report on the analysis of results.

## Supervisor - Dr Iryna Yevseyeva,

Lecturer in Computer Science

School of Computer Science and Informatics Faculty of Technology

5.33 Gateway House, The Gateway, De Montfort University, LE1 9BH, Leicester, UK

E: iryna.yevseyeva@dmu.ac.uk

W: TBC

# PROJECT 14: PROTECTING CRITICAL WATER INFRASTRUCTURE

## Objective

Design sensors layout for threats detection in critical infrastructure: Water supply scenario.

## Project Description

In this project a critical water infrastructure will be protected by designing a sensors layout to perform early warnings of threats. This is an important topic with high impact due to potential attacks, e.g. via pollution of water, affecting safety of large populations. Currently existing solutions are limited to intuitive trial and error approaches. In this study it is proposed to explore systematic innovative approaches, borrowed from optimisation approaches like graph and network analysis, taking into account additional available information about water supply network structure. The idea is to maximise the number of detected critical events and minimise damage from potential attacks. For this critical points within infrastructure have to be located, identified and protected.

## Project Outline

- Study literature on water critical infrastructure protection.
- Identify common procedure for protecting critical water infrastructure.
- Design of warning system for critical water infrastructure.
- Implement and test the created procedure in combination with hydraulic simulator on existing benchmark.
- Compare created solution with existing ones.

## Prerequisite

- Knowledge or willingness to learn risk assessment of critical infrastructures
- Knowledge or willingness to explore optimisation approaches in graph or network analysis
- Programming skills, e.g. Python/Java/C/C++/C#/

## Expected Deliverables

- Short literature review for becoming familiar with optimisation approaches in graph and network analysis that could be applied for critical water infrastructure.
- Implementation of the designed warning system for critical water infrastructure.
- Analysis of the performance on the benchmark and comparison to existing approaches.



## **Supervisor - Dr Iryna Yevseyeva**

Lecturer in Computer Science

School of Computer Science and Informatics Faculty of Technology

5.33 Gateway House, The Gateway

De Montfort University, LE1 9BH, Leicester, UK E: [iryna.yevseyeva@dmu.ac.uk](mailto:iryna.yevseyeva@dmu.ac.uk)

W: TBC

## PROJECT 15: MOBILE APPLICATION DEVELOPMENT AND MIGRATION

Mobile phones make a lot of difference in our lives and there are many chances and challenges in this area. The skill learnt in this project will make you creative and success in your future career. Currently, the mobile phone development and simulation environments are available and free for software developers. This project can be done by the students who are interested in mobile phone software development and migration.

- You can design and develop a mobile application on a mobile platform. You need to provide all lifecycle documents in your final project and evaluate your developed system. It is better you use an existing framework to support your design and development.
- You can investigate some research topics. For example, you can propose how to migrate existing software into a mobile application. You can also design your own framework or approach for domain specific applications. All the test cases, evaluation framework and source code will be provided and documented in detail in the final technical report.

### Supervisor - Dr Feng Chen

Senior Lecturer, Deputy Faculty Head of Research Students Coordinator of Doctoral Training Programme in Cyber Technology Software Technology Research Laboratory, De Montfort University 5.32 Gateway House, Leicester, LE1 9BH, England

T: +44 (0) 116 257 7860 E: fengchen@dmu.ac.uk

## PROJECT 16: CLOUD COMPUTING SOFTWARE DEVELOPMENT AND MIGRATION

Cloud Computing can significantly reduce IT costs and complexities while improving workload optimisation and service delivery. There are many ongoing projects, especially for application. Researchers are investigating in different ways to enhance it.

In this research, open source cloud computing platform will be selected as environment for software development. This project can be done by the students who are interested in cloud computing software development and migration.

- You can design and develop a cloud application on a cloud platform. You need to provide all lifecycle documents in your final project and evaluate your developed system. It is better you use an existing framework to support your design and development.
- You can investigate some research topics, such as how to migrate existing software into a cloud application, inter cloud resource management. DAG algorithm for cloud scheduling.

All the test cases, evaluation framework and source code will be provided and documented in detail in the final technical report.

### **Supervisor - Dr Feng Chen**

Senior Lecturer, Deputy Faculty Head of Research Students Coordinator of Doctoral Training Programme in Cyber Technology Software Technology Research Laboratory, De Montfort University 5.32 Gateway House, Leicester, LE1 9BH, England

T: +44 (0) 116 257 7860 E: fengchen@dmu.ac.uk

## PROJECT 17: CLOUD COMPUTING AND MOBILE COMPUTING

This project can be done by several students, who are interested in both cloud computing and mobile computing. Each task can be assigned to at least one student.

- You can design and develop a mobile cloud application. You need to provide all lifecycle documents in your final project and evaluate your developed system. It is better you use an existing framework to support your design and development.
- You can investigate some research topics, such as task management or scheduling within mobile cloud environment.  
All the testing cases and source code will be provided and documented in detail.  
An evaluation framework for the future research will be provided in the final technical report.

### **Supervisor - Dr Feng Chen**

Senior Lecturer, Deputy Faculty Head of Research Students Coordinator of Doctoral Training Programme in Cyber Technology Software Technology Research Laboratory, De Montfort University 5.32 Gateway House, Leicester, LE1 9BH, England

T: +44 (0) 116 257 7860 E: fengchen@dmu.ac.uk

## PROJECT 18: INDUSTRY 4.0 SURVEY AND ANALYSIS

More and more companies recognise the importance of continuous innovations as a means to survive. Hundreds of billions of dollars are spent worldwide every year on R&D. The world is in the midst of a fourth wave of technological advancement: Industry 4.0. Industry 4.0 is a collective term for technologies and concepts of value chain organisation, driven by several foundational technology advances: Internet of Things, Mobile Computing, Cloud Computing, Big Data, Augmented (Virtual) Reality, Robots, Cyber Security, Artificial Intelligent etc.

Industry 4.0 is the future of productivity and growth in manufacturing industries. It originates from a project in the high-tech strategy of the German government, which promotes the computerisation of manufacturing. On 8 April 2013 at the Hanover Fair the final report of the Working Group Industry 4.0 was presented. Other countries, e.g. USA and China, are also looking towards the next generation of manufacturing processes. It is believed that Industry 4.0 is an opportunity for the UK to apply its many skills and technologies to build a manufacturing-driven economy. Much needs to happen before the Industry 4.0 can reach its true potential.

This project will carry out a survey on the following aspects of Industry 4.0.

1. Review and analysis on underlying technologies
2. Review and analysis on existing applications
3. Discussion on open issues and future research, technology and development directions

### **Supervisor - Dr Feng Chen**

Senior Lecturer, Deputy Faculty Head of Research Students Coordinator of Doctoral Training Programme in Cyber Technology Software Technology Research Laboratory, De Montfort University 5.32 Gateway House, Leicester, LE1 9BH, England

T: +44 (0) 116 257 7860 E: [fengchen@dmu.ac.uk](mailto:fengchen@dmu.ac.uk)

## PROJECT 19: REVERSE ENGINEERING FOR BINARY CODE ANALYSIS

This project will follow UK IT Security Evaluation and Certification Scheme. It will extend FermaT transformation engine with emphasis on Wintel platform binary code analysis. It can be used to analyse security and diagnose vulnerability of business critical and safety critical systems to enable the certification of such systems.

The potential market is world-wide and is very promising. According to a recent study by IDC, the market grew 17% in 2008 when compared with 2007. Revenue in the market was \$2.6 billion in 2008 compared with \$2.3 billion in 2007. By the end of the forecast period (2013), the market should exceed revenue of \$4.4 billion.

There are a variety of software security assessment products available today that provide code analysis to find flaws and malicious code. Two of them are the most related: Veracode has introduced the industry's first code review solution that uses static binary analysis. HBGary was founded in 2003 and its product, the Responder Platform, is the industry's first live memory and runtime analysis software suite.

This research will apply a unique, world-class transformation technology to Wintel-based (Windows on Intel platform, IA32 compatible processors) software for future mass marketing (Malicious Software, Cryptographic algorithms, Digital Rights, Software Quality).

There are two tasks for this project:

1. write an IA32 Assembly Translator for WSL
2. use the transformation system to help code analysis.

All the testing cases and source code will be provided and documented in detail. An evaluation framework for the future research will be provided in the final technical report.

### **Supervisor - Dr Feng Chen**

Senior Lecturer, Deputy Faculty Head of Research Students Coordinator of Doctoral Training Programme in Cyber Technology Software Technology Research Laboratory, De Montfort University 5.32 Gateway House, Leicester, LE1 9BH, England

T: +44 (0) 116 257 7860 E: fengchen@dmu.ac.uk

# PROJECT 24: MALICIOUS INSIDER THREAT KEY INDICATORS AND DATASET ANALYSIS

## Project Outline

Insider threat issue is complex area for researcher community to address, and to deal with this kind of security breaches we have to think differently, as most of previous approaches address this problem from one aspect usually technical solution which applied to particular application or systems.

## Project Objectives

The aim is to find out the main indicators that indicate the behaviours of any potential insider threat (Human Factor).

Objectives are:

- Review Insider threat incident cases
- Identify the behaviour of insider threat
- Validate your indicators by analyses datasets (Data mining) to identify any malicious user (Dataset will be provided)

## Prerequisite

Programming skills

Technical Requirements: **YELLOW**

## Expected Deliverables

- Literature review of Insider Threat
- Insider Indicators
- A report on the design of the approach with the analysis and validation your results

## Supervisor – Nebrase Elmrabit

PhD Student (Insider Threat Prediction) Loughborough University

E: n.elmrabit@lboro.ac.uk

# PROJECT 20: HOME NETWORK INTRUDER DETECTION ALERT USING MOBILE APPLICATION

## Project Outline

With the use of Internet of Things (IoT) nowadays, it is simple to connect any devices at home (e.g., mobile phone, tablet, gaming console, TV, network storage devices, printer, CCTV, sensor, and many more) to your Local Area Network. However, the need of developing an easy way for the home user to manage and monitor these connections is vital.

## Project Objectives

The aim of this project is to create a mobile app solution to scan the private network for any unauthorised connection.

Objectives are:

- Develop a new mobile app that gives alarms for any discovered unauthorised access to your Private network (LAN or WLAN).
- Easy user interface to manage a whitelist of trusted devices which allowed to connect to your network using the app.
- Sending SMS notification.

## Prerequisite

- Programming skills (Java)
- Android Studio
- Good knowledge of TCP/IP Technical Requirements: **YELLOW**

## Expected Deliverables

- Mobile app
- User manual

## Supervisor – Nebrase Elmrabbit

PhD Student (Insider Threat Prediction) Loughborough University  
E: n.elmrabit@lboro.ac.uk



# PROJECT 21: INSIDER THREAT - DATA LOSS PREVENTION SYSTEM

## Project Outline

The increasing number of data breach carried by authorised users “Insiders”. And the urgent need to mitigate from such a threat. We can develop a control system that monitor data communication flow and prevent data leakages.

## Project Objectives

The aim of this project is to mitigate the level of insider threats by:

- Develop DLP system using Squid proxy server “Linux”
- Content filtering based on criteria  
Writing java code and install it on the client computer that search on the bodies of website text (e.g., Hotmail) to compare it with the organisation’s intellectual property files. If similar text is found the proxy server will drop the packet and notify system administrator.

## Prerequisite

Programming skills

Linux

Technical Requirements: **YELLOW**

## Expected Deliverables

- Literature review of existing approaches
- Implementation of the DLP system for HTTP request and HTTPS is an advantage
- Report

## Supervisor – Nebrase Elmrabit

PhD Student (Insider Threat Prediction) Loughborough University  
E: n.elmrabit@lboro.ac.uk

## PROJECT 22: AN INTERACTIVE WEBSITE FOR THE CALCULUS OF CONTEXT-AWARE AMBIENTS

The Calculus of Context-aware Ambients (CCA) is a formal notation for modelling the behaviours of context-aware and pervasive computing systems. The main features of the calculus include mobility, context-awareness and concurrency. The interpreter of CCA called ccaPL is a java program that executes CCA processes.

The aim of this project is to develop a CCA website which enables ccaPL programs to be edited and executed online in a web browser.

**Proposer: Dr Francois Siewe ([fsiewe@dmu.ac.uk](mailto:fsiewe@dmu.ac.uk), GH5.31, DMU)**

# PROJECT 23: A BEHAVIOUR-BASED HAZARD DETECTION SYSTEM TO ENHANCE SITUATION- AWARENESS IN SMART VEHICLES

## Background

Driverless car technology is an emerging smart technology that will revolutionise road transport in the UK and around the world as it has the potential to fundamentally reduce road accidents, CO2 emission, energy consumption, and traffic congestion; while fostering social inclusion by increasing the potential for everyone to use a car regardless of age (e.g. the elderly people) and disability (e.g. visually impaired people).

According to the Department for Transport (DfT) report of February 2015 entitled “The Pathway to Driverless Cars”, more than 90% of road accidents are due to human errors. As a result, driverless car technology is welcome by the UK government for its tremendous potential benefits in improving road safety, reducing emission and easing congestion. In addition, such a technology will increase mobility and social inclusion; and enable a more independent living for the elderly people and the disabled people who may be unable to drive (e.g. blind people). The driverless car technology will produce a generation of smart cars that can drive autonomously (fully automatic) or with little human input (highly automatic). Prototypes of such cars (e.g. Google’s driverless car and driverless Nissan leaf), are already being tested in the USA and in many countries in Europe, including the UK. However, public safety is a critical requirement for the wide acceptance and adoption of driverless cars as a reliable means of transport.

## Main Aim and Objectives

This project proposal aims at developing a behaviour-based Hazard Detection System (HDS) that analyses live video footages of a car’s surrounding environment to detect patterns of dangerous driving behaviours (such as tailgating, speeding, swerving, and wrong signalling). The proposed HDS will enhance the situation-awareness of a driverless car and provide the on-board computer with crucial context information on the surrounding environment necessary for taking appropriate actions to avoid accidents.

The main objectives of this project are:

- To develop a fine-grained classification of hazards caused by dangerous driving behaviours.
- To develop machine vision algorithms that can identify dangerous driving behaviours in video footages of driving scenarios.
- To develop a prototype software tool that implements these algorithms in a friendly GUI for demonstration purposes.

## Main Tasks

The programme of work comprises the following activities:

**Task 1** will carry out a thorough literature review on hazard perception and pattern recognition using image processing, machine vision and machine learning techniques.

**Task 2** will develop algorithms to analyse and detect patterns of dangerous driving behaviours using a combination of techniques from image processing, object tracking and machine learning.

**Task 3** will implement the algorithms developed in Task 2 into a software product that will be used for demonstration and proof of concept.

**Proposer: Dr Francois Siewe (fsiewe@dmu.ac.uk, GH5.31, DMU)**

# PROJECT 24: EATSMART: A PERSONALISED SMART SYSTEM FOR SAFE AND HEALTHY EATING FOR THE ELDERLY

## Background

We are all living longer and need to eat safer and healthier as we grow older to compensate the changes in our body composition and functioning. In this respect, it is urgent to develop technologies to support and promote safe and healthy eating to the elderly, enabling them to sustain a healthier, happier and more independent living. Ultimately, this will lead to a more prosperous society where fewer people are ill, reducing significantly the overwhelming stress on the healthcare services, the carers and the families; and saving money that can be invested elsewhere to support the economy. EatSmart is one of these technologies.

EatSmart is a personalised smart application that will run on a smartphone to help the user choosing what to eat based on their personal circumstances (e.g. age, impairments, illness and food allergies) and preferences. The intelligent system will be able to learn from the user past usages and feedback and automatically adapt to changing situations so as to guarantee that the best (available) meal options (safe and healthy) are proposed to the user. E.g. based on the user location, the system can tell the user the nearby restaurant where she can have her favourite food.

## Main Objectives

Develop a deep understanding of the impact of a poor diet on the health and the quality of life of the elderly.

Analyse the requirements of the EatSmart system.

Design a prototype of the EatSmart system for experimentation and in-depth requirement engineering

## Main Tasks

**Task 1** will carry out a thorough literature review on nutrition and the impact of a poor diet on the wellbeing of the elderly.

**Task 2** will carry out a survey of smart apps development platforms.

**Task 3** will develop the architecture and algorithms for the EatSmart system.

**Task 4** will focus on the development of a prototype of the EatSmart system.

**Proposer: Dr Francois Siewe (fsiewe@dmu.ac.uk, GH5.31, DMU)**

# PROJECT 25: PROBABILISTIC CALCULUS OF CONTEXT- AWARE AMBIENTS (PCCA)

## Background

Ubiquitous computing (ubiquitous computing for short) is ultimately the paradigm for next generation distributed systems where wirelessly networked computers disappear in the fabric of the user environment and interact calmly to provide the user with relevant information and services anywhere and anytime. A typical ubiquitous computing system monitors the user context (e.g. location, available resources and user activity) using a variety of sensors and uses that context information to decide autonomously what adaptation action to perform when this context changes, so as to minimise explicit user interactions.

Unlike traditional distributed systems, the design of ubiquitous computing still faces a great deal of challenges due to user mobility, communication is wireless mainly and the network topology is constantly changing in an unpredictable manner as nodes dynamically join and leave the system. As a consequence, context information may be imprecise or incomplete at times. This is critical for the behaviour of an ubiquitous computing system as wrong adaptation decisions may be taken due to imprecision or incompleteness in context information. There is a crucial need for a suitable framework for modelling and reasoning about the behavioural properties of ubiquitous computing systems, prior to their actual implementation and deployment. To address this problem, the Calculus of Context-aware Ambients (CCA) was developed to model and reason about mobility, context-awareness and concurrency. However, CCA is limited when modelling and reasoning about imprecision, incompleteness and unpredictable behaviours; it lacks notations for quantifying these important features of ubiquitous computing systems.

## Aim and Objectives

This project aims at developing an extension of CCA that uses the notion of probability to model and reason about uncertainty in the behaviours of ubiquitous computing systems. The resulting process calculus is called *probabilistic CCA* (pCCA for short). The research will build upon our previous work on CCA and:

- propose a syntax and a formal semantics for pCCA, with explicit notations for representing imprecision, incompleteness and unpredictable behaviours;
- develop techniques for reasoning upon the behaviour of pCCA processes, e.g. specific observational equivalence or bisimulation relations.

## Main Tasks

**Task 1** will carry out a survey of probabilistic calculi.

**Task 2** will develop a syntax and operational semantics for pCCA.

**Task 3** will develop bisimulation relations.

**Proposer: Dr Francois Siewe** ([fsiewe@dmu.ac.uk](mailto:fsiewe@dmu.ac.uk), GH5.31, DMU)

# PROJECT 26: APPLICATION OF THE INTERNET OF THINGS IN PERFORMING ARTS

## Background

Performing arts are forms of creative activity that are performed by individuals in front of an audience, such as drama, music, and dance. One of the key challenges in this type of arts is to keep the audience entertained and engaged during live performances. In order to achieve this goal, the artists must be able to improvise and produce live from time to time creative emergent stories depending on the audience behaviour. Indeed, an effective feedback mechanism is crucial for timely improvisation and maintaining audience engagement in performing arts. In this respect, it is envisioned that the Internet of Things (IoT) technology can prove effective in providing performers with feedback and endless possibility of improvisation through smart interactions with the environment.

IoT is the technology of the future for creating smart space where objects (things) are augmented with tiny electronic components which enable them to sense, compute, and communicate seamlessly with other objects in their environment. This makes it possible to build a smart space in which things can interact intelligently to achieve application goals. IoT is advancing very fast, paving way to a huge surge of applications in the manufacturing industry (IIoT: Industrial Internet of Things), the health (smart healthcare), home automation (smart homes), and intelligent transportation systems (smart vehicles), to name but a few.

## Aims and objectives

This project aims at investigating how the IoT technology can best be used to support creativity and enhance the audience experience in performing arts. To achieve this aim, following objectives will be fulfilled:

- To critically review the state of the art on the use of ICT in performing arts.
- To critically analysis the advances in IoT technologies
- To develop a framework for the design of a smart stage where the performers can interact seamlessly with the environment using IoT technologies.
- To evaluate the proposed framework using a real-world case study.

## Deliverables

1. A survey paper on the use of ICT/IoT in performing arts
2. A framework for the design of a smart stage using IoT technologies.
3. A case study of the application of the proposed framework.



## References

- Y. Wei et al. (2014) Performance monitoring and evaluation in dance teaching with mobile sensing technology. *Pers Ubiquit Comput* (2014) 18:1929–1939
- M.A. Wyon et al. (2011) Time motion and video analysis of classical ballet and contemporary dance performance. *Int J Sports Med* 32(11):851
- Y. Chu et al. (2012) Validation of a video-based motion analysis technique in 3-D dynamic scapular kinematic measurements. *J Biomech* 45(14):p2462
- Birringer, J. (2007) 'Performance and science'. *PAJ: A Journal of Performance and Art*, 85: 29 (1). pp. 22 - 35. doi: [10.1162/pajj.2007.29.1.21](https://doi.org/10.1162/pajj.2007.29.1.21)
- Birringer, J. and Danjoux, M. (2009) 'Wearable performance'. *Digital Creativity*, 20 (1-2). pp. 95 - 113.
- F. Sparacino, C. Wren, G. Davenport, and A. Pentland (1999) "Augmented Performance in Dance and Theater," International Dance and Technology 99 (IDAT99), Arizona State University, Tempe, AZ (February 25–28, 1999).
- F. Sparacino, G. Davenport, and A. Pentland (2000) "Media in performance: Interactive spaces for dance, theater, circus, and museum exhibits," *IBM Systems Journal*, vol. 39, pp. 479– 510, March-April 2000.

**Proposer: Dr Francois Siewe ([fsiewe@dmu.ac.uk](mailto:fsiewe@dmu.ac.uk), GH5.31, DMU)**

## PROJECT 27: CYBER INCIDENT SHARING: THE ATTACK MODEL?

### Project Outline

Two bits of relatively new European legislation (the General Data Protection Regulation and the NIS Directive) call for cyber incident information sharing and notification of various kinds: with regulators, between regulators, and with affected parties. A requirement of such cyber incident information sharing is that it preserves privacy and confidentiality, and “anonymization” often gets mentioned. This project asks a question that should come before such measures, namely: what are the security and privacy risks in such scenarios? What potential attacks are we defending against?

### Project Objectives

To gain insight in what the risks are in cyber information incident sharing, and how we can defend against those risks.

### Prerequisites

A strong interest in information security management, ideally some risk assessment knowledge.

### Expected Deliverables

A detailed report representing an overview of risks and possible controls in this area, ideally also with an assessment of the extent to which existing technology can address all the risks.

### Project Supervisor

Eerke Boiten

Professor in Cyber Security [eerke.boiten@dmu.ac.uk](mailto:eerke.boiten@dmu.ac.uk)

## PROJECT 28: REASONING ABOUT SCRATCH CARDS

## Project Outline

Scratch cards can be used in security related applications. In particular, they can be used to replace cryptographic primitives in applications like electronic voting. Of course they are also used in lottery- like commercial games, with serious financial risks involved.

This project explores reasoning about scratch cards: what states can they be in, and what information is known about them by whom in those states? How can this basic knowledge about scratch cards and their states be translated into properties of scratch cards with multiple fields, and games or protocols based on such cards? What security properties would we like to hold for scratch cards, and what assumptions about the physical objects and their production process do we need to make?

## Project Objectives

To come up with a model of scratch cards which allows informal or possibly even formal reasoning about them.

## Prerequisites

A genuine interest in modelling systems and reasoning about them.

## Expected Deliverables

A literature survey including the (limited) literature on using scratch cards in security applications and (more extensive) literature on security of scratch cards themselves. A model of scratch cards which includes their production, what can be observed about them at any point in time, and the operations on scratch cards with their effects. This could be entirely in precise informal language or diagrams, or using logic or mathematical notations for extra precision and extra marks. Some examples of reasoning about scratch cards, e.g. that customers are unable to cheat with scratchcard games.

## Project Supervisor

Eerke Boiten

Professor in Cyber Security [eerke.boiten@dmu.ac.uk](mailto:eerke.boiten@dmu.ac.uk)

# PROJECT 29: FORMAL VERIFICATION OF INFORMATION FLOW SECURITY IN CLOUD COMPUTING SYSTEMS

## Project Description

The use of Cloud computing is rapidly increasing due to the demand for internet services and communications. The large number of services and data stored in the cloud creates security risks due to the dynamic movement of data, connected devices and users between various cloud environments. Therefore, it is necessary to build a model to track and analyze the information flow in the Cloud computing systems to keep the information and data traceable.

This project will develop a model to verify the information flow security in the Cloud computing systems. The Bell-Lapadula rules and Cloud security rules will be used to control the information flow in the Cloud computing systems. SPIN model checker and Promela modelling language will be used to build the model.

## Project Objectives

The goal is to using formal verification tool to verify the information flow in the Cloud computing systems.

## Prerequisites

- Basic knowledge in information flow security and access control
- Good skills on reviewing literature
- Knowledge or willingness to learn usage of model checking tools

## Expected Deliverables

- Literature review of existing work on Cloud computing security, information flow and access control
- Using SPIN model checker/Promela to build formal models
- Analysing information flow security using SPIN and Promela

## Project Supervisor

Lecturer in Cyber Security  
School of Computer Science and Informatics Faculty of Technology  
5.17 Gateway House, The Gateway, De Montfort University, LE1 9BH, Leicester, UK  
[wen.zeng@dmu.ac.uk](mailto:wen.zeng@dmu.ac.uk)

# PROJECT 30: NETWORK SELECTION ALGORITHMS IN HETEROGENEOUS WIRELESS NETWORKS

## Project Description

Future wireless network will provide users the possibility to be “always best connected” by using different radio access network technologies (RAT). This latter, opens path towards the development of Network Selection Algorithms able to evaluate and select the most proper and available network interface, satisfying the user requirements and keeping the connection “alive”.

Actually, these algorithms make use of several inputs coming from low (radio parameters, new wireless networks, etc.) and higher layers (application policies and requirements), and based on that information, they are able to evaluate which is the most proper available network interface to then finally execute a network switching if necessary.

## Project Objectives

The main goal of this thesis is to develop novel network selection algorithms able to select the most proper network interface based on different parameters, and meeting the user requirements.

The thesis work plan consists in two stages; first, the analysis of the State of The Art regarding Network selection algorithms will be performed. Second, main activities will take place and correspond to the design and implementation of novel algorithms and its performance evaluation.

## Required Skills

- Good knowledge of C/C++ programming languages
- Familiarity with wireless networking and NS2/OMNeT++/OPNeT

## Project Supervisor

Dr. Sarmadullah Khan  
Lecturer in Cyber Security  
GH 5.60, The Gateway House  
De Montfort University  
LE1 9BH  
E: [sarmadullah.khan@dmu.ac.uk](mailto:sarmadullah.khan@dmu.ac.uk)

# PROJECT 31: DESIGN OF COGNITIVE POSITIONING ALGORITHM BASED ON WIRELESS TECHNOLOGIES

## Project Description

Nowadays, various services in wireless communication networks depend on mobile positioning. In fact, the availability of positional information is of great importance for many commercial, public service and military applications including asset tracking, intruder detection, healthcare monitoring, emergency services and so forth.

Cognitive positioning approaches have recently received much attention from the research community. In particular, the cognitive positioning approach consists in becoming aware of users' requirements and environment characteristics and uses this knowledge into the positioning module in order to improve its final performance.

## Project Objectives

The main goal of this thesis is to develop novel cognitive positioning approaches that meet positioning requirements and minimize power consumption by adapting some position related parameters and PHY parameters such as transmission power.

The thesis activity comprises, firstly, a literature survey about cognitive positioning approaches, secondly, the design and implementation of novel algorithms and, finally, performance evaluation through computer simulation or measurement campaign.

## Required Skills

- Good knowledge of C/C++ programming languages
- Familiarity with wireless networking and NS2/OMNeT++/OPNeT

## Project Supervisor

Dr. Sarmadullah Khan  
Lecturer in Cyber Security  
GH 5.60, The Gateway House  
De Montfort University  
LE1 9BH  
E: [sarmadullah.khan@dmu.ac.uk](mailto:sarmadullah.khan@dmu.ac.uk)