Research Poster Conference 2015 Press Releases
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33. Abduljabbar Rasheed - Nanomaterial Sensing Integrating MEMs Technology and SAMs

This research collaborates between school of chemistry, chemical engineering and mechanical engineering at university of Birmingham. The chemical part will be done by Abduljabbar Rushdi, Parvez Iqpal, Jon A. Preece in school of chemistry and Paula M. Mendes in chemical engineering and mechanical part will be done by Nasim Mahmoodi and Carl Anthony in mechanical engineering. This research will be improve the MEMs devices to be used for highly specific detection and recognition of analytes such as proteins and harmful ions. Self-assembled monolayers (SAMs) open a new approach for applications in nanotechnology via the functionalisation of surfaces on resonating microelectromechanical systems (MEMs) for the detection of analytes. The sensing is by virtue of changes in resonance frequency upon absorption of an analyte to the chemically tuned MEMs surface through the SAM. So, this type of resonator needs SAMs, which have a high specificity for the analyte. The aim of this project is to determine the optimum binding between binary SAMs formed from a thiol-containing a biotin moiety (BUT), which has a high affinity for the protein NeutrAvidin, and a thiol diluent (TEG), using Surface Plasmon Resonance as the sensing method, prior to incorporation of SAM on to the MEMs device.

34. Abeer Khudhur Jameel - The aggregation of International Road Assessment Programme (iRAP) Star Ratings for Urban Area

Road safety has become a serious global problem because more than 3500 people are killed yearly by traffic accidents. To control this issue, many organisations are established and many programmes are designed. The International Road Assessment Programme (iRAP) is one of the agencies that have a significant role in providing support for controlling traffic safety issues in about 70 countries by developing the road star rating technique. By this technique, roads are analysed according to traffic safety measures and classified into five levels starting from (one star) which represents the worst road safety situation to five stars which represents the best situation. However, each road is represented by four star ratings; each of them refers to different road user type and crashes. There types are: car, motorcycles, bicycles, and pedestrian accidents. Because these four types represent the four main road users of urban road and the analysis of urban road requires the aggregation of the four
types, this research aims to the aggregation of the four star ratings into one rating by estimating and selecting the most suitable aggregation technique. These techniques include: statistical aggregation function, products star rating aggregation technique, and mathematical aggregation methods.

35. Aidan Jones - Open Learner Modelling with a Robotic Tutor

Our research aims to investigate the impact of personalised tutoring with a robotic tutor on effectiveness of a student’s learning. Our robotic tutor aims to support students between 11-13 years old in a geography activity. We specifically investigate how a robotic tutor can help students reflect on their knowledge and skills with the use of an Open Learner Model (OLM). An OLM is a visualisation of the state of the students' knowledge and skills that we infer from their interaction with the activity. This scenario enables the student to reflect and self-regulate their learning by correcting any errors and building upon their strengths as they progress through the activity. Previous research has shown that the ability to self-regulate is significantly correlated with measures of academic performance. There is also a growing amount of research to show the benefits of personalised tutoring with robotic tutors. Our results to date indicate that a robotic tutor can increase trust in explanations of an OLM over text based representations. The level of trust in the explanations provided by the robot is very encouraging as this means that the learner may pay attention and act based on the explanation.


The automotive industry has started a major transformation process where everything from car keys to the hand-break have become digital. Modern vehicles have several wireless interfaces and are connected with various devices and the Internet. This connectivity adds great functionality but it also introduces a number of security and privacy threats. Moreover, safety critical functionality of the vehicle is controlled by a multitude of computing units which are fully programmable. As vehicles become more programmable and interconnected, they also become more vulnerable to cyber-attacks. This research project will develop cryptographic protocols and primitives to secure critical functionality such as firmware upgrades and secure communication between the different computing units. We need to
reconcile the tension between safety, availability and security. Some of the challenges that we will address are key management, in a domain area with a multitude of stakeholders and where every garage has the right to repair. All this functionality should be implemented in the most stringent time and resource constrained environment where bandwidth and memory are limited and where a few microseconds can make a life-saving difference.

37. Ashley Hayden - Developing future transport planning strategies to reduce car use: a case study approach

Delivering sustainable development is a post-millennium goal. Increasing sustainable transport usage has been noted as a key tool to achieve sustainable transport goals, e.g. creating healthier and more sustainable communities and to decrease urban congestion and air pollution. Many metropolitan areas require urgent action to achieve these goals. Current and projected greenhouse gases (GHG) pose major global and UK climate change challenges fuelled by population increases, increased average incomes and material consumption, making decreasing national and global emissions a difficult task. Transportation accounts for 25% of the UK’s carbon dioxide emissions (CO2) with projected CO2 emissions from transport expected to double by 2050 (based on 2010 levels). But how to develop sustainable transport networks faces continual debate. This research attempts to determine how different urban demographics (i.e. age, gender and deprivation) manipulate and influence car use based upon a case study approach. The methodological approach is based upon questionnaires, travel diaries and interviews. The data will be used to inform and develop new sustainable transport planning strategies which aim to reduce car use and promote low carbon transport networks.

38. Bogdan M. Duma - Humans vs. Bacteria: Fighting Drug-Resistant Tuberculosis

With nine million new cases and approximately 1.8 million deaths each year, tuberculosis is the second major cause of death due to an infectious disease in adults worldwide. But more worrisome is the fast rise of multi-drug resistant tuberculosis. This cannot be treated using conventional methods. And extensively drug-resistant tuberculosis, for which no cure has been devised yet, is becoming more and more common. Although in Western countries tuberculosis is rarely mentioned in mainstream media, Europe alone has registered 360,000 new cases in 2013 and 38,000 deaths according to the latest statistics provided by the
European Centre for Disease Prevention and Control. Financed by the European Union and carried out as a collaboration between the University of Birmingham and GlaxoSmithKline, this project attempts to tackle the advance of resistant bacteria causing the disease by creating new drugs that block its ability to grow and develop in humans. Using state-of-the-art technology to analyse over 200000 molecules, a relevant structure has been identified as a potential candidate for this purpose. Currently our efforts are directed towards attempting small modifications that further increase its efficiency against the bacteria.

39. Daniel Murrant - The water-energy nexus: quantifying its impact on future UK thermal power generation

A secure supply of electricity is integral to everyday life and often taken for granted in the UK. Thermal generation (where water is heated to drive steam through a turbine) represents 85% of all generation. However generation of this type requires large amounts of water for cooling. This is a key example of the interdependence of water and energy; the water-energy nexus. Future water resources are predicted to decrease due to climate change, and an increasing population will result in increased competition for the remaining water. Subsequently this research, in collaboration with the Energy Technologies Institute (ETI), aims to understand how the water-energy nexus may limit future electricity generation. The first step is to quantify the future water demand of the UK energy sector, nationally and on a regional scale. This was done using a revised methodology to calculate water use for multiple future generation pathways including the ETI’s Energy Systems Modelling Environment (ESME) model. Initial results detailed in the poster indicate that nationally the volume of water required by 2050 may lead to environmental concerns. Regionally a lack of freshwater is most likely to be an issue in the West Midlands and South East.

40. Eleni Giannouli - Advanced Signal Processing for wayside condition monitoring of railway wheelsets

The reliability and safety of axle bearings in passenger and freight rolling stock has always been of concern to the rail industry. The existing wayside condition monitoring of in-service axle bearings can only detect problems once they have become critical and is prone to measurement errors. An on-line condition monitoring methodology, based on multi-sensor Acoustic Emission (AE) and vibration signals data fusion for detecting axle bearing failures, is
presented. The traditional signal fusion method such as the weighed averaging algorithm is applied in signals in order to compare the performance between the novel system and the single sensor alone system. The novel system is expected to improve the accuracy and the reliability of the system and reduce maintenance costs. Experimental work carried out under laboratory conditions at The University of Birmingham has proven that the developed system is able to detecting axle bearing failures at an early stage. The experiments indicate that the proposed system can significantly increase signal to noise ratio (SNR). Field experiments using in service axle bearings will be used to qualify the effectiveness of the aforementioned system in a representative environment.

41. Emily Summerton - More than just a bottle by your sink - Low temperature stability of surfactant systems

Surfactant systems are included in many household products, namely shampoos and dish liquid. These products are in demand all over the globe, inclusive of extreme weather such as cold climate regions. As such, it is necessary for such products to demonstrate a good level of stability at low and sub-zero temperatures with no appearance of crystals or biphasic systems. In collaboration with consumer goods company, Procter & Gamble, the aim of the research project is to understand and investigate the process of crystallisation of such systems, inclusive of whether the process has enough energy to take place and if the product is more stable than the reactant. An understanding of the transitional behaviour from liquid to crystal form is being conducted via a selection of scientific techniques, such as microscopy that allows for observation of the area of the crystal formation. Through broadening the understanding of such processes, the knowledge can subsequently be applied to test methods regarding product stability at Procter & Gamble so as to increase efficiency, decrease costs and improve shelf life of their brands.

42. Fadhil AlFarag - Quality Control Chart

To maintain the quality of a product or to improve the reliability of a process, all industries need to monitor several parameters about their production process. Control charts are some visualization tools for monitoring processes statistically. They have been in use in the manufacturing processes for a quite long time, but all of them were based on either a single characteristic of the process or they used several different charts for different characteristics.
ignoring the dependence between the characteristics. With the ease of computing power and advances in technology, it is now easier to monitor several characteristics at the same time and to include their interdependencies as well. In this project, we propose a few control charting schemes to monitor several characteristics of a process at the same time and to detect when it goes out of control. Our objective is to reduce the false alarms (the scheme detects a problem when actually there is none) as well as to quickly detect the correct out-of-control situation. The novelty of the proposed schemes are that they do not depend on commonly assumed Normal distribution of the process variables and is applicable for a much wider range of data distributions.

43. Greg O’Callaghan - Developing Conductive Organic Molecular Resists for Nanofabrication of Insulating Materials

Electron beam lithography can be used to pattern feature smaller than 10 nm. However, reaching this length scale has only been possible on conducting surfaces, e.g. silicon wafers. On insulating substrate such as glass charging limits the resolution of electron beam lithography. Whilst photolithography can be used in some applications it is not appropriate for low volume high value manufacture. Therefore in order to mitigate charging, and enable the use of electron beam lithography on such substrates it is necessary to use a discharge layer, such as thin film of metal underneath or on top of the resist. However, such measures limit resolution in themselves, and can also damage device performance. Sub 100 nm patterns have not been achieved for insulating materials such as glass using electron beam lithography. In this work we are developing resist materials that are inherently conductive. Here we describe the synthesis of triphenylene cored resist for use in EBL as candidates for nanostructuring insulating materials. The triphenylene’s liquid crystalline behaviour, delocalised electrons and excellent electron transport make them appealing candidates to be able to not only act as a resist, but also as a charge dissipater.

44. Hanna Burton - Look into your heart – 3D imaging of coronary arteries

The Biomedical Engineering research group at the University of Birmingham has been studying the microstructure of coronary arteries. The heart pumps blood around the body, and coronary arteries transport blood to the heart tissue. Coronary arteries can become blocked and necrosis (tissue death) can occur in areas of the heart. This in turn can impede
the effectiveness of the heart pumping blood to the rest of the body, and can result in a heart attack. Computer modelling of the blood flow through arteries is a useful tool for surgeons, and for designing medical devices for insertion, but a greater understanding of the surface of vessels is required to improve these computer simulations. To study the surface in close detail, Scanning Electron Microscopy can be used; however the tissue must undergo a series of chemical processes to prepare it which can damage and alter the surface. This study uses a 3D optical microscope to enable the changes caused by different stages in the tissue preparation to be quantified.

45. Hannah Middleton - Astrophysics of massive black-hole binaries using pulsar timing array searches for gravitational waves

Gravitational waves are tiny ripples in the fabric of space-time caused by accelerating massive objects. Predicted by Einstein’s theory of General Relativity a hundred years ago, they are yet to be directly observed. Massive black-hole binary systems at the centres of merging galaxies are amongst the most powerful gravitational wave sources. The mergers of many black-hole binaries throughout the Universe is expected to produce a background of gravitational waves from many overlapping signals. One way to detect this background is by using pulsars, rapidly rotating stars which give out pulses of radio-waves like a light house. Gravitational waves change the arrival time of these ultra-stable pulses in a characteristic way. Currently, pulsar timing experiments from around the world are continuously improving their sensitivity with the expectation that over the next few years they will be able to detect such a gravitational wave background. However, they already place constraints on the strength of the signal. We are researching what can be learnt about massive black-hole binaries throughout the cosmos, such as their masses and rate of mergers, and what we will be able to learn about these elusive sources once gravitational waves are detected.

46. Holly Roberts - Electrifying Modified DNA: Initial Progress in Disease Detection

Health is one of the biggest concerns for society. Often disease diagnosis comes far too late. For Alzheimer’s this affects the ability to ensure the patients quality of life for as long as possible. For cancer this can mean the difference between life and death. The lack of inexpensive and easy to use devices is a massive issue and can directly affect cancer patient mortality rates. Both of these diseases have been shown to have DNA strands where a
mistake in the sequence is indicative of the disease itself. This opens a possible route to fast
detection. Ferrocene, an iron based organic compound, is used regularly as an
electrochemical reporter within DNA. It is easily manufactured within the lab, stable, non-
toxic and has well defined behaviour to applied voltage. These qualities make it an excellent
candidate for DNA sensing. Ferrocene modified with a DNA base on each cyclopentadienyl
ring has been synthesised; replacing two of the sugar units in the DNA backbone. The DNA is
then modified to allow for attachment on a gold electrode. The voltage can be adjusted and
the resulting change in current monitored. The response would hopefully be different for
healthy and diseased DNA.

47. I Made Murwantara - Configuring Products for Software Product Line in Cloud
Computing with Concern to Energy Consumption

A large Information Technology (IT) infrastructure such as Cloud computing system provides
flexibility and range of price for small to large enterprises. Because of the economies of scale
that Cloud provides, there is a great interest in hosting the enterprise systems and services
on Cloud system. Most of the enterprise systems are created from components such as
Database Management Systems, HTTP and Transaction servers. There is a wide variety
of components that can be used to configure an enterprise system. The choice of components
influences the performance and energy consumption. Most current research in the software
engineering for large infrastructure focus on system performance, and only small number of
researchers give attention to energy consumption. In this research, we propose a method to
select the components of the enterprise system configuration to reduce energy
consumption. In our method, we manage component configuration and predict energy
consumption of enterprise system. To validate, we developed a technique to measure energy
consumption of several product configurations that running in a Virtualized system. Our
approach allows Cloud providers to help companies to choose the enterprise system that will
run in a Cloud system that consumes less energy.

48. Jack Bishop - Nuclear spinning tops – measuring resonances in oxygen-16

In nature, many excited systems exhibit resonant behaviour. Resonances occur where specific
properties are satisfied that cause large vibrations in a particular system - from running a
finger round the rim of a wine glass causing it to violently vibrate to a finely tuned musical
instrument and even inside stars which "ring" with a characteristic frequency dependent on their properties. With the right parameters, resonances appear inside nuclei which correspond to short lived states (around a hundred billionth billionth of a second) with very precise energies (much like finely tuning a note to smash a wine glass). Research performed by the Nuclear Physics Group at Birmingham focuses on analysing these shortly lived resonances in order to ascertain the properties of the nucleus. To better understand the nuclear force, responsible for the structure of the nucleus, we can study and measure the properties of a wide range of nuclei. My research focuses on examining the structure of oxygen-16 using high energy particle accelerators to study the properties of these resonances. Understanding how they relate to the internal structure of the nucleus allows for a remarkable insight into the nuclear realm.

49. Kholoud Faleh - Self-Reported nutritional practices of Health workers in Saudi Arabia compared to public.

The study will include 300 Saudi 150 will be from the public and the other half is nutritionists. Both genders will be included. Food frequency questionnaire is the method will be used for collecting the data, it contain relevant questions about the people's food habits and their lifestyle. Most studies have examined the health of the public, the specific range of age or risk group. However, there are no studies that have been made for the eating habits or diet of the nutritionists. Obesity has become a worldwide epidemic. Overweight and obesity are the fifth leading risk for global deaths. Approximately 58% of diabetes and 21% of ischaemic heart disease and 8–42% of certain cancers worldwide were attributable to a BMI over 21 (Ng et al., 2011). Globally, non-communicable diseases are the leading causes of death. It kills around 2.8 million people each year worldwide (WHO, 2012a). In Saudi Arabia particularly obesity is increasing significantly, the prevalence of obesity is 35.6% and females are considerably more obese than males with 44% of the prevalence. The questionnaire designed electronically using survey monkey, Facebook, linked in and Twitter are the tools to distribute the questionnaire to the participants.
50. Lamiya AlShanfari - Intelligent systems to help students overcome their misconceptions

One of the main aims of education is to facilitate critical thinking. Computers as intelligent systems can play an important role in helping learners to evaluate their understanding and skills. As a student interacts with an adaptive computer system to solve problems the system can update a model of the student's understanding, and provide personalised feedback based on this learner model. The system can therefore guide individuals, and fade its scaffolding to allow more independent learning as the learner becomes more confident. Thus, learners can take greater responsibility for their learning, while the system can offer prompts for reflection on their learning at appropriate moments. Of particular interest for this PhD is students' misconceptions. This research reveals these difficulties inferred from the learner modelling process, in a human-understandable form, as a starting point for prompting reflection. For example, comparing their misconceptions to the corresponding concept can help learners overcome these difficulties. The adaptive system will be deployed in multiple courses with log data to identify how the system is used in practice, and the extent to which learning improves compared to other approaches. Questionnaire data will help identify user perceptions of the development of their reflective and self-evaluation skills.

51. Lenka Mudrova - Towards robots' laziness: How to increase robots' time efficiency?

We – people – often seek ways in which we can perform our tasks efficiently. When we need to go to a shop to buy a sandwich and to a post office to send a parcel, we will merge the tasks in order to save walking time if the post office is close to the shop. Because of the time saved, we can perform more tasks in work or just relax and be a little bit lazy. How can mobile robots do the same? They will probably not become lazy, but instead they can perform more tasks for us. For example, one demanding area of application is taking care for elderly people. Nowadays, mobile robots are beginning to be used in assisting in a house for elderly people, but the price of these robots is too high. However, if the robot will be time efficient, it can perform more tasks each day and assist more people. Therefore, this research into automatic merging of robots' tasks, as part of the EU funded project STRANDS, has two
outcomes. First, it leads to money savings, as fewer robots will be needed, and second, it increases people's life comfort.

52. Luthfi Rais – Product development of activate carbon anti-pollution mask from palm shell impregnated with titanium dioxide.

The levels of air pollution in many big cities in Indonesia have exceeded safety limits. In order to eliminate air pollutants, many pedestrians need to wear Activated Carbon (AC) mask. However, AC in the mask is made from non-renewable materials and saturated easily. We have made a mask filter coated with AC derived from palm shell as a renewable material and mixed with Titanium Dioxide (TiO2) to prevent rapid saturation. The mask was tested by flowed carbon monoxide (CO) gas continuously with various conditions and TiO2 compositions. The mask filter worked better if it’s exposed to the UV light due to activation of TiO2 that oxidize CO gas on AC. The best result obtained was a mask with composition 5g AC-5% TiO2. This mask can eliminate CO gas from motorcycle exhaust gas with the average 33.87% of its concentration. We also ran tests based on the highest CO concentration that has ever been recorded in Indonesia. The result showed that the mask could eliminate CO until below the inhalation safety limit. For that, the mask can be used to overcome the air pollution. This research is funded by the Indonesia Government.

53. Marcelo Blumenfeld Mendonca - Designing the Metro systems of tomorrow

Historically, city size has walked hand in hand with our ability to move. The faster we could travel, the larger the city could grow. From walking villages, to railway suburbs, to automobile megacities, cities have grown too large in size for metro systems to operate efficiently and with good coverage. Put stations too far apart for higher speeds, you reduce accessibility. Put stations too close, and average speed is too low compared to the automobile. Users tend to choose the faster mode, and the consequential domination of the car threatens the future sustainability of cities. This research uses the systems engineering approach to develop a new system that can solve these problems and efficiently meet the future demands in growing urban areas. It proposes a new operations model that can solve the coverage-speed paradox, based on autonomous vehicles and the self-organising methods found in natural systems. Such model, even with half of the common distance between stations, can offer twice the average speed of a regular system, resulting in a
reduction of 50% in journey time. Additionally, when combined with emerging technologies, this model has the potential to make the metro systems of tomorrow more efficient, resilient, intelligent and sustainable.

54. Maria Bogarra Macias - Particulate matter: an invisible enemy

The increasing number of cars in our cities, as well as the hazardous pollutants emitted by internal combustion engines has raised concern about the quality of air. Researchers and vehicle manufacturers are combining their strengths to produce a step-by-step change towards cleaner and more efficient technologies. This is the case of the Gasoline Direct Injection Engine (GDI), which can reduce fuel consumption and CO2 emissions by around 20% when compared with previous gasoline engines. However, every new development has drawbacks associated to it. It has been reported that the GDI engines increase Particulate Matter (PM) levels. PM emissions are linked with DNA alteration, mutagenic behaviour, leading to higher rates of cancer, asthma and respiratory diseases, in addition to cardiovascular hazard and even premature death. Hence, legislation such as Euro6 had imposed a strict limit of 6x1011 particulates emitted per kilometre in order to fight against this invisible enemy. The aim of this research is to understand PM characteristics in order to find ways to effectively reduce PMs from their origin to their emission into the atmosphere. Advanced multidisciplinary techniques, such as Electronic Microscope and Thermogravimetric Analysis are investigated as they are useful tools to succeed in precise PM characterization.

55. Maria Salama - Stability of Self-adaptive Software Architectures

Autonomous Computing has been around for several years. Self-adaptive software has been driven by the desire to achieve or maintain the desirable Quality of Service during run-time in the presence of run-time changing requirements and emergent behaviours. As architecture has a profound effect on whether or not the system can meet the expected quality attributes, architecture stability is considered as a primary criterion for evaluating how well the software accommodates the evolution. Meanwhile, architectural stability was evaluated as a static attribute in the light of the requirements elucidated during design-time. Self-adaptive software continuously changes to adapt themselves with the changing requirements, and the stability state defined at design time would not be a suitable state for
the changing software. In an evolutionary context, there is a pressing need for maintaining the software architectures stable during run-time. The research investigates the notion of architecture stability at run-time in the context of self-adaptive software. We expect to characterise run-time stability, as well as identify trade-offs that needs to be dynamically managed and consequently adjust the run-time self-adaptation process.

56. Marianna Cavada - Smart cities: making cities smarter

Smart cities during the early 2010 decade have gained much recognition from cities, governments and corporations, who all give a different perspective on the challenges that smartness could address. Although sceptics argue that the smartness trend is a tool for city operations against personal freedoms, there have been many initiatives that have made cities Smart, with responses to climate change, resilience, mobility, business and others. This research explores the metrics for achieving smartness in cities and different contexts. From the research, we understand the collaborations between the initiatives and creation of systems that through collaborations can achieve innovation and subsequently new paths to make cities smarter. The aim of the new collaborations emphasize on the value of the citizen (or netizen), that is an active entity in a resilient and smart urban settlement.

57. Miguel Perez-Xochicale - Quantifying Dexterity in Dance

The use of wearable sensors has increased significantly in the last 20 years due to the relation between application-oriented scenarios (industrial sector, office scenarios, healthcare, sports and entertainment sector) and activities to recognise (ambulation, transportation, daily activities, exercise, military, upper body and recreation). Although, state-of-the-art systems for activity recognition present acceptable performance, advances in this area are mainly focused on identifying which activity is being performed. Thus, little work has been done on studying how well skilled or dextrous activity is performed. To this end, the study of human motion performance is not simply a matter of experts performing the actions in a more consistent manner than novices since the expert is able to produce different but contextually relevant actions in a manner that the novice is unable to perform.

For this this poster, I present a description of time-delay embedding and Principal Component Analysis to analyse data from body-worn inertial sensors mounted on dancers.
Preliminary results are presented from three male participants with different years of experiences in dancing salsa: expert (14yr of experience), intermediate (4yr of experience) and novice dancers. Additionally, areas of exploitation, conclusions and future work are presented.

58. Mohammadhossein Moghimi - Adaptive Virtual Environments: A Psychophysiological Feedback HCI System Concept

The recent “resurrection” of interest in Virtual Reality, courtesy of new interface and gaming technologies evolving from international crowd-funding communities has, once again, stimulated interest in the quest for true “immersion” or the generation of a believable sense of “presence” in computer-generated worlds. Some believe that true immersion may only ever be achieved through advanced brain-computer interfaces, but, until that day arrives, it is important to understand how it may be possible to measure and, indeed, influence human engagement and emotional connection with virtual worlds using psycho-physiological techniques. This project aims to design an adaptive dynamic virtual environment, capable of responding to human emotions. Based on the development of a pleasure/displeasure-arousal “Circumplex” model, a controllable affective virtual medium (in fact a computer game capable of evoking multiple emotions within the users) has been constructed. Multiple variations to the content and interface parameters of this game have been evaluated subjectively using over 68 participants with different gender and gaming experiences. From these tests, more objective, physiologically-based experiments have been executed, in which the EEG, GSR and heart rates of 30 male and female gamers have been recorded during exposure to the most powerful affective environments identified in the earlier study.

59. Mohammed Fayad - Influence of Alternative Fuels on Lubricant Properties in Diesel Engines

This research aims to study oil dilution and fuel compatibility in Compression Ignition (CI) diesel engines when alternative fuels, alcohol blends and diesel fuels are combusted. This is achieved by identifying which physical and chemical properties of the lubricant that are most indicative of the ageing process and rates at which properties degrade. The effect of soot loading is also examined with different size and number of particulate matter (PM) emitted from combustion of different fuels analysed and compared in order to identify the significant
effect of soot on lubricant properties. The results of this study will help to improve the understanding engine durability, tribology of engine component, and life of engine oils. The research will be focussed on oil property analysis with a focus on changes over long periods of usage. These changes will be examined using an accelerated lubricant aging system that can be connected to exhaust gas part of actual engine.

60. Omotayo Farai - Digital communication along buried pipes through the use of acoustic signal propagation

One of the main challenges for a wireless communication system implementation for buried pipeline monitoring is the harsh nature of the underground environment to radio frequency propagation (Sadeghioon et al. 2014). The Smart Pipes project deploys cost effective Micro sensing technology for the development of an integrated monitoring framework for buried water pipes (Metje et al. 2012). Acoustic wave communication for pipeline monitoring represents a form of wireless communication which has grown, in part, due to the search for alternative forms of communication in the area of structural asset management. Much promise is envisaged for this technology in overcoming some of the limitations encountered by radio communication in the area buried pipeline monitoring. This research investigates the use of acoustic wave propagation, with the aim of achieving practical wireless communication along a buried pipe. This research is focused on the adaptation of state of the art and cost effective wireless smart sensing technology to the development of a digital communication system useful for buried water pipeline monitoring. The proposed communication system is based on acoustic signal propagation along a buried pipe.

61. Pietro Cònsoli - Know your Routes: improving solution quality for the Capacitated Arc Routing Problem

The Capacitated Arc Routing Problems (CARP) is the problem of finding the optimal routing plan of a set of vehicles with limited capacity that need to serve specific streets in a map. This problem has close connections with real world applications such as Winter Gritting, Urban Waste Collection or Post Delivery. Evolutionary Algorithms (EAs) are used to find optimal or near-optimal solutions for this kind of problems. The aim of this study is that of developing new methodologies to improve the performance of the existing EAs approaches on CARP.
62. Raquel Fernández del Río - Volatile organic compounds in breath for diagnosis of liver disease

Alcohol and virus related liver diseases constitute the third commonest cause of premature death in the UK. Liver disease is often difficult to diagnose because its symptoms can be vague and once they are notable the liver has already suffered severe damage. Early diagnosis of the disease would improve the quality of life for the patient and contribute to efficiency savings for the NHS. Presented in this poster is breath gas analysis research in real-time. It is a non-invasive method for monitoring volatile organic compounds (VOCs). These VOCs are present in the exhaled breath of patients suffering with liver disease and have been measured using Proton Transfer Mass Spectrometry. This study showed that there are three volatile compounds which have elevated concentrations in the breath of patients suffering from liver disease and are indicative of liver dysfunction. This project is funded by PIMMS-ITN, European Commission's 7th Framework Program (GA 287382).

63. Rosalind Davies - A new, lighter, hydrogen storage material.

Vehicles powered by hydrogen release only water at point of use and are therefore preferable to petrol or diesel vehicles, as pollution levels are reduced. One of the main obstacles to using hydrogen to power a vehicle is the challenge of on-board storage. Combining lithium amide (LiNH2) with lithium hydride (LiH) is a promising system, releasing up to 6.5 weight percent of hydrogen. However, the system requires high temperatures to release the stored hydrogen. Addition of ions, such as chloride (Cl-), forms amide halides that show a reduction in the temperature of hydrogen release. However, this addition of halides also increases the weight of the system, which is not favourable for mobile or vehicular applications. The aim of this research was to lower the chloride level without increasing the desorption temperature. A new phase with half the amide : chloride ratio was synthesised and characterised using a range of techniques including X-ray diffraction. The lower chloride phase successfully maintained the improvement in hydrogen cycling properties when compared to the original amide chloride, and is equivalent to a 17 kg reduction in the weight of a system storing 5 kg hydrogen.
64. Sarah Lauren Newton - Improved Efficiency of Medical Imaging Probe

The Peacock Group, based at the University of Birmingham, has developed a new imaging probe with the potential to drastically improve the identification of disease compared to the current standard. The work is part of the Biomedical Imaging DTC. The new design uses a miniature protein which binds to an active metal. Magnetic Resonance Imaging (MRI) is a technique commonly used in hospitals to look inside the body without the need for invasive surgery. Contrast agents can be injected to allow for easier diagnosis of disease. There are many factors that affect the effectiveness of these imaging agents, the rate at which the molecule tumbles and its association with water are thought to be the most important, and there is a lot of room for improvement from the contrast agents currently used. A miniature protein had been previously designed by the group which showed an increase in efficiency compared to the current medical standard. The aim of this work is to enhance the original design. This has been achieved by using a larger protein so that it tumbles more slowly, and using a protein that has an increased association with water. By investigating these, an optimal design can be generated.


Over the years development in the field of pharmaceutics has yielded a very diverse variety of useful substances targeting numerous medical conditions. However the transition from laboratory practice to clinical use is often met with issues such as low solubility of the molecule, severe adverse reactions or decrease in efficiency due to instability of the drug in vivo. Drug loaded devices that can offer stable controlled release have been developed to deal with such issues. Polymer technology has made a significant contribution to this goal, offering protection of the drug and also improving patient compliance. In particular, biodegradable polymers, which degrade naturally in the body, have the additional advantage of eliminating the need for secondary removal surgery. Polyesters such as poly(lactic acid) and poly(glycolic acid) and their copolymers have been extensively used. Such polymers can be formulated into pellets, microparticles etc. and tailored for a variety of applications e.g. for delivering drugs such as bisphosphonates (BPs) to bone fractures. Local delivery of BPs
can offer an alternative to the existing orally administered drugs which are associated with administration difficulties and systemic side effects.

66. Sunan Deng - Laser Directed Writing of Flat Lenses on Buckypaper

Compared with traditional curved lens, flat lens focuses by changing the phase of light with surface structure in nano or micro scale. Flat lens takes at least two advantages over curved lens: 1, it can be made very thin, even thinner than the wavelength of light 2. Flat lens don’t have imaging distortions. So it’s very important to develop flat lenses as it provides the possibility to revolutionize the design of compact optical systems. Fresnel Zone Plate (FZP), which consists of a series of radially symmetric transparent and opaque rings, offers a suitable way for developing flat lens. Laser directed patterning of carbon nanotubes-based buckypaper for producing FZP lens is presented here. Computational modelling was performed which revealed excellent focusing performance of the lens for both visible and THz radiations. The focusing properties of the lens were characterized and a good agreement with the simulations was achieved. Hence, we exploited a new way to fabricate thin flat lens. The one-step fabrication process is economical, convenient and has great potential for industrial scale up.

67. Sunghee Cho - A study of smart grid for railways

A smart grid is a next-generation of the electrical power supply grid where information communication technologies are used to exchange information between suppliers and consumers in real time, and so optimise energy efficiency. It is an intelligent power system that supports the efficient management of consumption and the provision of power.

Previously smart grids have been focused on home and domestic sectors, so there has been a little progress in developing smart grids for the railways. This is because the electric railway traction system has different requirements compared to home systems. The electric railway traction system operate multiple electrical trains which present variable electrical loads depending on the combination, velocity and operation of the trains. The most important thing for railway systems is safety, if trains are not supplied with electricity, safety is at risk.

The product of this research, the distributed energy resource management system (DERMS) controls the integration of distributed power generation, including regenerative braking
energy saving. The smart power management system (SPMS) will control and monitor all of the components with communication lines.

68. Vikrant Venkataraman - Design & development of Fuel Cell heat driven refrigeration system

Refrigerated transportation plays a crucial role in transporting goods from manufacturing sites to primary storage centers and from primary storage centers to other places such as retail stores and secondary distribution centers. Current refrigerated trucks run on vapour compression systems which are either powered by an auxiliary diesel engine or the main diesel engine itself. Refrigerated trucks powered by internal combustion engines are noisy and emit considerable amount of Green House Gases (GHGs). Fuel Cell technology promises to solve both these problems, hence there is a need for applying fuel cells to power truck refrigeration systems. In this work, modelling and simulation studies have been carried out to couple a Solid Oxide Fuel Cell (SOFC) with a Vapour Absorption Refrigeration System (VARS) for a refrigerated truck. Besides providing high quality heat, which is used to drive the VARS, the electrical power available from the SOFC is used to run all the electrical loads (classified as Hotel Loads) on board the truck. The electrical power can also be employed for traction purposes that enables design of hybrid truck configurations. This novel strategy utilizes both heat and power from the SOFC, thereby leading to an overall increased system efficiency of around 70%.

69. Xianfang Yue - Is Human Cranial Cavity Deformed with the Changing ICP?

The most common cause of death in neurosurgical patients is raised intracranial pressure (ICP) and therefore it is essential that accurate monitoring of this pressure is undertaken clinically. ICP is the pressure inside the skull and therefore is the tissue of the brain and cerebrospinal fluid (CSF). Increased ICP can arise for a variety of reasons such as trauma to the head and brain tumours. Prolonged high pressure can lead to brain damage or death. The current state of the art techniques for measuring ICP are all invasive, which means that devices must be inserted into patients. Currently there are no non-invasive methods available. This proposal will use novel engineering techniques to develop an improved understanding of ICP measurement and develop a novel non-invasive technique for measuring the pressure. When the amount of CSF (CSF) and venous blood that can be
extruded from the skull has been exhausted, the ICP becomes unstable and waves of pressure develop. Dr. Upledger discovered that the inherent rhythmic motion of cranial bones was caused by the fluctuation of CSF. Accordingly, the cranium can move and be deformed as the ICP fluctuates. So the ICP can be monitored by measuring the deformation of skull bone.

70. Zarulazam Eusofe - The efficiency & effectiveness of road safety management system in Malaysia: the way forward

Malaysia recorded among the world’s highest death rate per 100,000 populations with 23 deaths. In terms of economic loss, it is estimated that RM 8.39 billion was lost in 2013 which represented about 0.8% of the country’s GDP. There is a need to identify action that may be able to address the problem comprehensively. This study was conducted to analyse the current road safety institutional arrangements in Malaysia with emphasis on funding mechanisms using the World Bank’s road safety management framework as a guideline. This research used semi-structured interviews targeting key stakeholders in road safety management including policy makers from various government agencies, private sector and academic, with the aim to identify and enhance the current institutional arrangements in the area of road safety management. The analysis revealed that road safety management in Malaysia may be improved to achieve the road safety targets set if the key stakeholders concerned could coordinate their activities under an improved approach of defining, agreeing and meeting objectives and using existing financial resources efficiently. In addition, this research has suggested a new mechanism for sufficient and sustainable funding of road safety in Malaysia based on the concept of the second generation road funds.

71. Zhongbei Tian - Energy evaluation of the power network of a DC railway with regenerating trains

With the continuing focus on environmental concerns and rising energy prices, energy-saving operation technology for railway systems has been paid more and more attention. Regenerating trains are now in common use on many DC fed railway systems to reduce energy consumption. The electrical losses in a DC system are significant, and a comprehensive understanding of how regeneration affects the overall system loss has not
been developed. This research presents a simulation method in which a multi-train analysis is used to determine the system losses with and without regeneration in operation. The Beijing Yizhuang Subway Line has been used as a case study for this work. The results are used to determine a full “energy audit” of the system. This includes the energy supplied by the substations, that used by the train in traction, that regenerated by the trains with regen, that used in the power network, and that used within the train itself. The initial results show that regenerating trains have a significant lower substation demand compared with non-regen trains. In addition, optimisation of timetable, which can achieve a better use of regenerative energy, has been illustrated in this study.