List of 3rd Year Projects for 2019/2020 - 09:24:39 am 09/12/2019

Got 98 projects.

ADH2-1 adh2 sjp1 : jb64 : na

Musical instrument development for iOS

This project would suit anyone who has access to a mac computer and an ipad or iphone and would like to learn how to develop interactive audio applications for that platform. The project would involve selecting and researching a topic in interactive audio agreed with the supervisor, designing, writing and testing Apps for the selected device, building on and beyond the iOS module in Autumn Term. The generic project title here will be modified as students develop their own research topic. This project must involve an engineering challenge and a mini research project, so it is much more than just an audio coding exercise. More information about the Apple iOs Developer Programme can be found here: http://developer.apple.com/devcenter/ios/index.action You can download and develop for free, using the University's Apple Developer registration, but to be able to release any of your Apps publicly you would need to pay the Apple registration fee of 99 dollars! More than one project could be run on this topic if people are interested, and we would form a Special Interest Group in the area in this case, providing a level of self-support independent of the supervisor. This would involve regular group supervisions, occasional individual sessions, and supporting material on a joint project website, small-group discussions and presentations.

Skills: A real commitment to learning about programming (as this is an exciting, but learning-intensive, environment). Access to a modern mac and to an iphone or ipad helps enormously. We have a Mac lab where macs and ipads are available. Much of the development can be done using Apple's iPad/iPhone Device Simulator in the XCode environment. Skill areas to be developed are programming in Swift, use of Apple's X-Code development environment, Apple's Device Simulator, the Apple CocoaTouch libraries, and a number of Frameworks such as Audio Kit and SpriteKit etc.

Programming; Music Technology.

ADH2-2 adh2 jb64 : edc1 : ap23

Sonification algorithms in PureData (PD)

Sonification is the art and science of mapping data to sound, such that it can be perceived and interpreted by humans for analysis. This project would suit anyone who would like to use their knowledge of PD to perform scientific analysis of data using sound. The specific application area represented by the data will be chosen by investigation and discussion with the supervisor. More information about Sonification can be found here: http://sonification.de/son, and links to past papers and current research on interactive sonification can be found here: http://www.interactive-sonification.org/ The generic project title here will be modified as students develop their own research topic. This project must involve an engineering challenge and a mini research project, so it is much more than just an audio coding exercise. More than one project can be run on this topic if people are interested. We would form a Special Interest Group in the area in this case, providing a level of self-support independent of the supervisor and a mix of Group meetings and Individual sessions to make this possible. We use Google Sites and Groups to coordinate the activity as a research group, which gives some sense of working in a team similar to industry.

Skills: Interesting in multi-disciplinary thinking. Being comfortable with an open-ended research specification. Willingness to design & program, in Pure Data (see http://puredata.info/ for more information if needed). Music Technology helpful, but not essential.

AEW6-1 aew6 na : na : na

Contactless PC interface

In this project contactless meaqns of interfacing to a computer will be explored, possible options include a Hall Effect sensor array and Theramin although other approaches can also be adopted. The project should explore how a user can interface to a PC, especially someone with disabilities, this will involve an exploration of medical conditions and the impact they have on hand movement ability. This project links into the active EU Lifelong Learning Programme "SALEIE" (Strategic ALignment of Electrical and Information Engineering in European Higher Education Institutions) and the work will be aligned to the area of assistive technologies to support students with disabilities.

Skills: Some hardware; Arduino programming None

AEW6-3 aew6 : :

Voice control of Electronic Lab Test Equipment

In this project, voice activation of items of electronic laboratory test equipment will be explored. The project is primarily aimed at items of test equipment that can be controlled by USB, Network or IEEE control bus instructions. The instruction command will be generated by a voice recognition system instead of the more conventional typed command. The project is primarily a software project and can be written as either a stand alone programme or as a web based tool. The chosen instrument(s) and range of commands should cover those normally used in undergraduate electronic experiments. This project links into the active EU Lifelong Learning Programme "SALEIE" (Strategic ALignment of Electrical and Information Engineering in European Higher Education Institutions) and the work will be aligned to the area of assistive technologies to support students with disabilities.

Skills: Software design and development

AEW6-4 aew6 : :

Text analysis tool for sentiment, mood and reflective writing ability

The objective of this project is to develop an application that will take as its input a piece of text and analyze it for sentiment, mood and personal reflection quality. The project is part of one of the threads of research within the Engineering Management Group exploring the effectiveness of students ability to reflect. Personal reflection is a key component of generic skills development but measuring reflection ability is challenging. One of the approaches taken to measuring it is to semantically analyze a reflective essay looking for key words that are indicative of reflective language. The techniques used to evaluate sentiment and mood in social media communications are a basis for this project and, to have sentiment and mood metrics in addition to reflective ability are also desirable. The deliverable for the project should be a program in the form of an app or website, that enables a piece of text (of any length) and which produces a range of measurement statistics

including a measure of sentiment, mood, personal reflection. All perhaps also moderated by number of words, etc. The project would involve a literature review of appropriate measures and result presentation methods. The project would suit a software programmer. The ideal language, for ongoing maintenance is Java.

Skills: Programming in Java

AEW6-5 aew6 sjb508 : :

Networked electrical laboratory experiments

The object of this project is to develop a flexible, internet accessible laboratory experiment workstation to help students learn electrical and machine control concepts. The hardware heart of the station will be a series of components or modules (examples include Pulse Width Modulation, Thyristor, MOSFET, etc.) used to control motors and actuators (for use in robotics, vehicle drives or industrial processing systems) that can be arbitrarily connected together and to real motors or actuators. Power supplies and monitoring instruments should also be able to be connected into the system so real experiments can be undertaken. A video camera will monitor the instruments and motor/actuator so the student can see in real time the results of their experiments. The objective of the station is that it can be accessible 24/7/365 to significantly increase the available student learning resources. A stretch goal of this project is to introduce intelligence into the electronic monitoring system to ensure the station can not be connected in such a way that damage to any component can result and/or to provide an AI or machine learning student support system.

Skills: Hardware for the development of the station although this can be by the purchase of commercially available compoents or modules, and Internet software

AGB1-1 agb1 yz1 : :

Mains signalling for energy efficient 'smart grid'

To improve the efficiency of the electricity distribution system, and hence reduce our national 'carbon footprint', it would be very helpful to provide communication between the customer's equipment and the electricity suppliers to help balance demand and supply, especially where customers are using micro-generation (e.g. solar photovoltaic or small wind turbines). This is an important application of the so-called 'smart grid'. A particularly appropriate communication medium for this purpose would be signalling on the mains electricity cables themselves. This project will investigate the feasibility of this, making use of coupling units to insert and receive signals on the mains while maintaining the isolation required for safety reasons. It will then measure the interference present on the mains in the signal frequency range, and also the attenuation of the signals, and hence develop signalling techniques which can provide reliable communication. Could accommodate 2 students

Skills: Hardware design and construction, measurement and signal processing Communications or Electronics stream preferred

AGB1-2 agb1 mpr2 : jfd1 : acm4

Measuring and predicting solar output

Increasingly solar cells are being mounted on the roofs of houses for domestic electricity generation as well as to feed back into the grid. It is important to estimate as accurately as possible what the output of the cells will be, and also to make sure the cells are placed in the best possible position on the roof, considering the effect of obstacles which may shade parts of the roof. The main idea of the project is to develop software to calculate the expected amount of solar energy collected, throughout the year, depending on where on a roof the cell is placed, and also to take in to account the likely effects of weather. A previous project has also developed equipment to measure the output from a solar cell, which can be used in the monitoring of weather effects. Could accommodate 2 students

Skills: Software skills, building and using measurement hardware None

AGB1-3 agb1 yz1 : :

Acoustic communication system demonstrator

A pair of lap-tops equipped with sound card, microphones and speaker, and running signal processing software provides an easy way to design and demonstrate a communication system which uses the same techniques as advanced wireless communication systems like 3G, 4G, WiFi, etc, but without the complicated RF and DSP technology required for wireless. The project will initially demonstrate a very simple communication system, but it is open-ended and could easily be used to demonstrate techniques like OFDM and MIMO which are central to current and future wireless broadband communications. Could accommodate 3 students

Skills: Knowledge of Matlab None

AH566-1 ah566 eaa2 : jke1 :

Magnetic braille

Ferrofluid, consisting of ferromagnetic nanoparticles and solvent, will be used to develop a magnetic braille. The size of the nanoparticles and the amplitude/separation of the meshed current leads to generate magnetic fields will be controlled to optimise the condition to form clear difference between the nanoparticle aggregate and the solvent matrix. In this project, the architecture of the control electrodes as well as the size and density of the nanoparticles will be optimised through experiment. Such architecture can offer a new type of magnetic braille.

Skills: General laboratory skills Nanotechnology modules preferred

AH566-2 ah566 jke1 : eaa2 :

Neuromorphic computation with a magnetic tunnel junction

The latest hard disk drives (HDD) utilise a ferromagnetic tunnel junction to read data due to their high signal-to-noise ratios. Such a junction, consisting of a ferromagnet/oxide tunnel barrier/ferromagnet structure, can exhibit quantum tunnelling phenomena even at room

temperature. In this study, a set of metal masks in a sputtering chamber will be used to fabricate a junction. By varying oxide barriers, a tunnelling feature will be investigated.

Skills: General laboratory skills Nanotechnology modules preferred

AH566-3 ah566 jke1 : eaa2 :

Magnetic sensors for brain imaging

Fe:MgO anti-granular films will be grown using an ultrahigh vacuum molecular beam epitaxy system. These films will then be characterised by four-terminal transport measurements. This system is expected to exhibit unique magnetoresistive behaviour due to magnetic domain wall pinning. Such a system can be used for precise magnetic field measurement probe. This study is based on our preliminary work [1] and can conclude the collective behaviour of quantum tunnelling. [1] M. Rummey et al., IEEE Transactions on Magnetics 48, 4010 (2012).

Skills: General laboratory skills Nanotechnology modules preferred

AH566-4 ah566 jke1 : eaa2 :

Remote sensing for an electrical wire

Currently the check of power cables has been carried out by eyes or drones, which requires intensive man power. In this project, we plan to develop a new remote sensing method using detecting an electromagnetic wave from the cable. This project involves some modelling and experiments.

Skills: General laboratory skills and modelling Nanotechnology modules preferred

AH566-5 ah566 eaa2 : jke1 :

Nano-spintronic devices for next-generation computation

Recent development in nanofabrication enables us to expand a vertical magnetoresistive device into a lateral device. In particular, a lateral spin-valve structure can offer both local and non-local measurement geometries. In this study, lateral device will be characterised by both (non-)local measurements and numerical simulations. For spin generation, this project will utilise not only electrical spin injection but also spin Hall and/or spin Seebeck effects to enhance the generation efficiency.

Skills: General laboratory skills Nanotechnology modules preferred

AH566-6 ah566 eaa2 : jke1 :

New ferromagnets with 100% spin polarisation

In magnetic memories and storage, it is crucial to develop a new ferromagnet with 100% spin polarisation, half-metallicity, to improve the efficiency of their operation. In this project, our recently developed setup [1] with infrared light will be used to determine the band structure of such ferromagnetic materials. Such a study is fundamental but highly useful for the development of a

robust half-metallic ferromagnet. [1] T. F. Alhuwaymel et al., IEEE Transactions on Magnetics 50, 2600504 (2014).

Skills: General laboratory skills Nanotechnology modules preferred

AJP109-1 ajp109 tc2 : jes1 :

Haptic feedback

Haptic (touch) feedback is used extensively in modern technology: the vibration of a mobile phone when the screen is tapped, the resistance of a BMW iDrive wheel, the force feedback in flight joysticks (both toy ones and real ones), and so on. The technology of touch may well have future applications in medical diagnosis too. In this project you will specifically investigate rotary force feedback, where the force that a user experiences when turning a wheel can be adjusted at will, as a function of the position and velocity of the wheel. You'll perform experiments to see whether it's possible to use a low-cost brushless DC motor as a haptic feedback actuator.

Skills: Independent research; software and hardware design; methodical approach to experimentation Year 2 Control Engineering

AJP109-2 ajp109 na : na : na

OpenTRV: Smart, open-source heating controls

An open-source heating project has recently been started called OpenTRV ("TRV" stands for "thermostatic radiator valve"). It ultimately aims to create an open-source hardware and software system that can control heating on a room-by-room basis in homes, saving energy, carbon and money. Commercial solutions do exist but they tend to be prohibitively expensive and/or use proprietary APIs and protocols (which means they can't be integrated into smart home systems). The aim of this project would be to contribute a useful "module" to the OpenTRV project. Exactly what you work on will be up to you. Possible projects include: - Devise a way to scavenge energy from a radiator to power the electronic TRV. - Develop novel, low-power sensors for occupancy detection. These could use microphones, CO2 detectors, anything you like! Whatever you choose will no doubt need some clever signal processing to avoid false positives and false negatives. - Intelligently limit the rate at which sensors send information, on the basis of how 'interesting' the information is. This has the potential to save a significant amount of power. - Write an app or web interface to control the heating system in a house. - Automatically learn the thermal properties of a building, and/or its occupancy patterns (the temperature data might have to be simulated given the times of year the project will be running!). - Research, design, implement and test algorithms to use the home's heat source as efficiently as possible. The heat source might be a modulating boiler, non-modulating boiler, heat pump, sunlight entering through south-facing windows etc. The "radiators" might be normal radiators or underfloor heating. Some of these things are covered by patents so a patent search may be necessary during the literature review.

Skills: Various

AJP109-3 ajp109 : :

Accurate and intelligent servo controller for mbed

The aim of this project is to develop a 'smart' servo controller for the mbed range of microcontroller development boards. The controller will integrate smoothly with the existing mbed libraries, and will allow the mbed to be connected to standard radio-control servos. It should ideally support: - Very large numbers of servos - Programmable pulse rates - 'Idle' settings to save power in uncommanded servos The pulses sent must have very accurate widths (within a microsecond or so), measured using an oscilloscope. This is basically a software project, and will require decent C programming skills as well as some knowledge of C++.

Skills: C

AP23-1 ap23 dh20 : mt540 : na

Motion capture suite for virtual reality applications in medicine

The Laboratory for Intelligent Virtual Environments (LIVE) is offering up to two projects in collaboration with the Department's spinout company, Asuuta Ltd., in human gait capture, display and skeletal movement analysis for medical applications. The work will involve the enhancement of a room-sized rig for capturing human movement, and particularly locomotion, in a virtual reality space. A 14-camera marker-based motion capture system would be integrated for the purpose of investigating human movement using multiple sensor sources, configured as a sensor-independent server, to establish calibrated accuracy and precision. A user interface will be created for visualising and comparing the outputs and associated metrics as the user engages with tasks in either reality, virtual reality or augmented/mixed reality.

Skills: Programming

BJB511-1 bjb511 jfd1 : jb64 :

Closing the skills gap between Engineering Industries and Higher Education

Today, the understanding of the skills expectation from graduates in the jobs market is getting complex due to changing scenarios and trends in the economic environment. The explicit skills, knowledge, experience and competences demanded by industries as part of their recruitment criteria tend to vary. In the field of engineering, emerging new technologies and innovation changes particularly tend to have significant influence on the skills expectations from engineering graduates in the jobs market. For instance, some jobs ask for specific IT and programming skills like SQL, JAVA, JAVASCRIPT, PHP and PYTHON while some ask for specific work experiences. Many universities are now devising curricula and modules in order to equip graduates with the employability skills sought in such sectors and make them ‘work-ready’. However, developing new programmes to meet these industrial expectations requires a well-developed understanding of the nature of the skills demand. This is where a gap exists between engineering industries and Universities and their understanding of the skills and competences of engineers. What specific skills and competencies do employers in the engineering sector seek in work-ready graduates? What criteria do UK universities apply in order to measure these skills trends and expectations of recruiters in the jobs market? What schemes do universities adopt for updating their teaching programmes? A reliable framework for understanding the nature of various employable skills in the engineering sector seems to be missing. This study will aim to bring clarity in the understanding of the skills gap between engineering industries and Higher

Education. This will involve a detailed literature review on the relevant topics followed by an analysis of a sample of online job advertisements from the engineering sector. It will require the use of NVivo software for coding and analyzing the contents of these job advertisements. This study will also require conducting some interviews with potential engineering recruiters/employers and academics in Higher Education to understand their perspectives of this skills gap. From the overall analysis, this study will aim to develop a skills-needs framework which can be used by students, education providers and industries as a common platform to articulate engineering skills understanding.

Skills:

BJB511-2 bjb511 nj578 : aew6 :

Integrating Leadership skills development in engineering curricula

Effective leadership involves creating an inspiring vision of the future, motivating and inspiring people to engage with that vision. A good and influential leader will always play a pivotal role in the delivery and achievement of this vision by building and managing a team. Today leadership is among one of the most highly sought after competences and skills among employees in various organizations. It has been deemed as a key criterion for career progression particularly in engineering professions. Leadership competency and development has become increasingly important in engineering education as different companies now look for engineers with leadership, communication and teamwork skills. Organizations, in order to attain a competitive edge, are encouraging Higher Education Institutes to produce engineers who are capable of leading multidisciplinary teams, combine business acumen and innovate effectively. Recent studies have suggested that exposure at the undergraduate and postgraduate level to different leadership skills building opportunities can help young budding engineers to gain the key foundation of a strong and successful career. Integration of leadership in engineering courses is therefore vital. So far, there is not much clarity on how this is done. Does Higher Education offer enough opportunities to develop leadership skills among undergraduates and postgraduates through their modules and curricula contents? How can Higher Education curricula especially in the field of Engineering increase the development of leadership skills among students? This project will investigate the different factors which can facilitate the development of leadership skills among engineering students. The aim is to construct a model to measure leadership readiness among budding engineers by reviewing the integration of leadership in engineering curricula. This will be a research led project potentially combining both qualitative and quantitative research. It will involve a detailed literature review followed by some in-depth interviews and surveys with students and academics from an engineering education sector. It might potentially require the use of Excel, Qualtrics or SPSS for analyzing survey data or NVivo for coding interviews.

Skills:

BJB511-3 bjb511 nj578 : :

Use of Business simulation and other innovative technologies for teaching entrepreneurship in Higher Education

Today entrepreneurship education plays an important role in facilitating the development of entrepreneurial aspirations among students in Higher Education. Over the past three decades,

entrepreneurship education has come a long way in terms of its validity and impact in society especially when the previously held classic notion was that ‘entrepreneurs are born, not made’. Many researchers now recognize the fact that entrepreneurship and its related attributes can be taught as part of a curriculum and there are several examples of successful practicing entrepreneurs as a result of entrepreneurial degrees. Some of the pioneering universities all over the world now offer dedicated courses on entrepreneurship. Entrepreneurship education primarily includes activities aimed at fostering entrepreneurial mind-set, skills and competences such as idea generation, innovation management and finance analysis. Some researchers argue that entrepreneurship education differentiates from a typical business education thereby emphasizing the use of a range of ‘experiential learning’ methods along with traditional lectures such as getting students to work in teams, reviewing market gaps, consulting with practising entrepreneurs and writing business reports. For some researchers, a good deal of fundamental business knowledge can be taught in a classroom but what about the uncertainties surrounding a new business? How can students be exposed to some of the risks attributed to an entrepreneurial venture? Some studies highlight the potential integration of technologies for delivering entrepreneurship education especially in interdisciplinary engineering curricula. This project will review some of the new innovative approaches to teaching entrepreneurship such as ‘immersive technology’ and ‘business simulation tools’. It will involve measuring the effectiveness of these technologies and the application of a controlled learning environment using some of these technologies to get students to work on their entrepreneurial ideas and experience the challenges that matches real-life scenarios in a business. How well do these technologies enhance the learning experience among students? How well do these technologies address the teaching and learning outcomes in entrepreneurship education? How can Higher Education Institutes measure the effectiveness of such innovative teaching approaches? This project will involve analyzing case studies of some of the UK universities where new innovative technologies are integrated to deliver entrepreneurship education. It will include conducting interviews with students and academics to understand their perspectives on the use of technologies in entrepreneurship education.

Skills:

BJB511-4 bjb511 : :

Analyzing the sustainability and drivers of renewable energy entrepreneurship

With rising global energy issues, environmental degradation and fossil fuel exhaustion, several countries are now focusing on finding alternative sustainable solutions. Currently, there are no clear alternatives other than renewable energy sources which have led to the increase of entrepreneurial businesses primarily dealing with the advancement and uptake of renewable energy technologies. This process is known as Renewable Energy Entrepreneurship (REE) and it involves the “starting up, running and potentially growth of a new business venture that focuses on the development, design, production and distribution of renewable energy as well as renewable energy systems and technologies including all aspects of the renewable energy value chain, comprising planning, consulting, financing, installation, maintenance and end of life management or disposal”. The EU has raised renewable energy targets to 32% by 2030 and there are now several measures being undertaken to address these targets. However, being an under-researched area, there is no clarity on the drivers and effective business models that can facilitate renewable energy entrepreneurs. There is still a lack of understanding of the skills desired in this sector and the market trends. The project involves reviewing the current market for renewable energy and the challenges that

entrepreneurs face in the renewable energy sector in the EU. What are the major drivers that can support and push the growth of entrepreneurs? What skills do entrepreneurs require in these areas? How can businesses build more resilience in order to survive and sustain in the renewable energy sector? It will involve analyzing some case studies of organizations in the renewable energy sector. It might also include potential interviews with businesses and academics. The overall objective of this project is to develop a resilience model for renewable energy businesses that can highlight the challenges, drivers and skills associated with renewable energy entrepreneurship.

Skills:

BJB511-5 bjb511 : :

Analysis of Product Manufacturability and Market Entry Model - A Case Study of York Instruments

This project will be in collaboration with York Instruments. York Instruments is a vibrant young company making a significant commercial impact in the north of England in advanced manufacturing, especially with regards to medical devices. Innovation is a core aspect in all of their products. Some of their applications are for treatment of epilepsy, concussion and oncology. One of the main products is MEGSCAN: a next-generation magnetoencephalography (MEG) brain scanner. It is commonly used for patients undergoing brain surgery due to epilepsy, trauma/stroke, or brain tumours. York Instruments is also focussed on emerging technologies using quantum sensors and a suite of other potential future products which are currently under development. As part of your final project, you will be focusing on the marketing entry model for York Instruments. You will need to review and analyze the product development stages including product features and product launches for some of their upcoming innovation. You will be looking at some of the challenges with localization and strategies for tackling competitors in potential markets and new territories. In this context, you will also look at the various aspects of manufacturability, how to choose technologies, components and materials to make bespoke products for potential clients? How can these be serviced? You will be using a combination of interviews and surveys as part of your research and data collection.

Skills:

DAJP1-1 dajp1 : :

An electronic pitchfork for choirs

This project aims to design a prototype for a tuning aid for choral singing. It's a common problem when singing in choirs: a part has to make an entrance on a note that is not simply related to any previous note. In these cases it can be difficult for everyone in the part to make a confident entry. Some singers keep tuning forks in their pockets to help with this sort of event (however this can look a little odd to the audience in a small choir). The proposal here is to design and build a small device, which can be clipped to a belt or kept in a pocket, with a simple user-interface which can be used without having to look at the device, and which can play into the singer's ear (either through a directly connected earphone or a Bluetooth ear-piece), the required note. The design should aim for low-power operation (the device will be battery powered), and low-cost components (it is thought there could be a market for this device if the prototype is successful). An advanced version could

attempt to keep track of the choir's tuning and compensate automatically (choirs singing unaccompanied frequently tend to stray off-pitch).

Skills: Some basic musical knowledge, microcontroller programming

DAJP1-2 dajp1 : :

Transmission line simulation in Javascript

I used to have a whole set of useful animation programs and simulations that ran in any web-browser. Unfortunately the technology I used (Silverlight) is now dead, and as a result these programs do not run in any modern browser. This project is to take one of the more useful programs, expand it, and convert it to JavaScript so it can run anywhere. The final app will ideally be able to simulate a range of common transmission line problems, including mismatched terminations, junctions and quarter-wave impedance matching transformers, showing the waveforms at all points in the circuit.

Skills: Programming, and a interest in (or willingness to learn) Javascript.

DAJP1-3 dajp1 : :

Audio kit for STM32F4 microcontrollers

The STM32F4 microcontroller (as used on the development board in the Design, Construction and Test module) has great potential for being used in stand-alone novel instruments and sound applications: it has an on-board stereo DAC, and an a plethora of peripherals and input possibilities. However, the development system we have in the labs is not ideal for this application: the in-house ARM Cortex-M4 Processor Board is bulky, and the LCD module cannot be used at the same time as the DAC. This project aims to design a development system (and associated software) so that prototypes of a variety of novel instruments can quickly be constructed, taking both analogue and digital inputs from a wide range of sensors. An audio amplifier could be included on the board. This will involve PCB design, as well as writing the software drivers required.

Skills: Microcontroller software, PCB design, some analogue and digital design

DAJP1-4 dajp1 : :

Rugged sound installation / novel electronic musical instrument

I'd like to create a number of rugged (e.g. can be taken to festivals and used outdoors) self-contained novel electronic musical instruments, which can be used to demonstrate that electronics can be fun to school-age children (and everyone else). The Theremin is one possible approach, but it's already been done (see the Theremin Bollard https://thereminbollards.com/). There are hundreds of other possibilities for instruments which can supply chords, melody lines, bass sequences, percussion, etc. This project aims to design and build one such instrument, preferably self-contained, possibility based on the use of the STM32F4 discovery board (which has an audio DAC built in).

Skills: Low-level audio programming, hardware design build, some knowledge of music

DH20-1 dh20 : :

Neural Networks, Brains and Neural Coding.

Description: The human brain is the most complex organ in the human body. It consists of billions of cells, or neurones, which communicate using electrical impulses, or spikes. Various ideas exist about how information is encoded by neurones. One theory is that it is the rate of discharge of impulses from a cell which is the principle carrier of "information", an alternative view is that it is the precise timing of input spikes which determines when a cell fires an output spike. In this project you will 1. Design and implement a representative phenomenological model of a cortical neurone. 2. Construct a neural network, either as a representation of a specific brain area, or using a generic architecture. 3. Use the network to investigate ideas about the representation and processing of information in the brain. This is a software project. An information sheet is available with further details.

Skills: Software, interest in biological and neural systems Neural Networks course (desirable)

DH20-2 dh20 : :

Spiking Cellular automaton

A cellular automaton is a discrete network of nodes or cells, which can assume two states (on or off). The state of each cell evolves according to a set of simple rules that are usually based on the states of neighbouring cells. Cellular automata are important in theoretical computer science, but can also be fun to play with. A well know example of a cellular automaton is “Conway’ s game of life”. There are strong parallels between the structure of a cellular automaton and that of a neural network, both consist of distinct units or nodes that interact locally. This project will explore the concept of a Spiking Cellular automaton, whereby the units are not on or off, but include temporal dynamics and generate distinct spikes that control local interactions. You will build a GUI to implement a standard Cellular automaton, such as Conway’ s game of life, then modify it to work with spiking units. In line with the simplicity of the operation of cellular automaton, the dynamical rules will need to be straightforward (no differential equations!). Since the nodes will then include temporal dynamics, it is anticipated that this will endow the automaton with a wider repertoire of interesting behaviours. The aim of the project is to investigate this suggestion.

Skills: Software, interest in biological and neural systems Neural Networks course (desirable)

EAA2-1 eaa2 na : na : na

User friendly, flexible front end for an optoelectronic device simulator

Numerical modelling of optoelectronic devices (lasers, amplifiers, photodetectors, integrated optical circuits) is a fast developing field (partly because with the collapse of the telecoms bubble, manufacturers can no more afford to optimise device constructions by costly trial and error). Several user-friendly commercial simulators of various degrees of sophistication have become available recently. Most of these are very useful for design and optimisation in industry, but neither flexible enough nor affordable enough for more adventurous research in academia. I have written a laser/amplifier simulator of my own which, being in-house, is more flexible than commercial packages, but at the moment lacks the user-friendly input/output facilities, and is written in a rather

old-fashioned (for engineers) language, Fortran, which is not known for the ease of user interface programming. The purpose of the project is, essentially, to equip the software by user friendly, graphic and ideally interactive input and output facilities. This could be done either by translating the entire code into C/C++, or (more likely) by writing separate input and output interfaces which should have the flexibility to accommodate possible future changes in the software (the interfaces can be written in C++ and interact with the solver via data files).

Skills: STREAM: Electronics, Comms and Nanotechnology

EAA2-2 eaa2 na : na : na

Teaching materials for Optical Communications and EM Waves

When teaching the 3rd year undergraduate and Taught MSc Optical Communications courses I find that for many students, some the key concepts of wave propagation such as travelling and standing waves, polarisation, total internal reflection, and particularly waveguide and resonator modes, are very difficult to understand and feel. It would be of enormous use if instructive simulation and visualisation software illustrating these concepts could be available to myself and the students studying the courses. This project will aim at developing such software tools. The choice of implementation language will be up to the student, and the project is quite open-ended, with the ultimate goal being interactive software. The student will have to be able to show initiative and work substantially unaided - I know about electromagnetic waves, but I am not an expert in visualisation!

Skills: STREAM: Electronics, Comms and Nanotechnology

FS598-1fs598 adh2 : dtm3 : dajp1

Demystifying FM Synthesis

FM Synthesis is a sound synthesis method making use of frequency modulation techniques. Following its development and commercialisation by John Chowning and Yamaha in the 1970s and 1980s, FM synthesis hit the mainstream with the release of the Yamaha DX7 in 1983. Despite this popularity, the programming of FM synthesisers remains a fairly arcane process. This project aims to generate an FM synthesis engine (perhaps in PD, or using some novel physical interface) and to develop a set of design tools and pedagogical material in order to demystify FM synthesis sound design.

Skills: DSP, Music Technology, PD None, although music technology experience would help.

FS598-2fs598 adh2 : dtm3 : dajp1

Intonarumori Reimagined

Luigi Russolo's 1913 futurist manifesto, The Art of Noises, explored his philosophy regarding the effect of industrial noise on music. In this manifesto, he identified six families of noises which he developed a series of experimental noise-maker instruments (intonarumori) in order to recreate. These intonarumori were completely acoustic and were used to create a variety of rumbles, whistles, screeches, beats, and screams. This project will involve the creation of one or more

updated/reimagined intonarumori, making use of hardware and software design, and a musically motivated approach, to explore the ongoing relationship between music and noise.

Skills: DSP, sound synthesis, hardware/software design Core MusTech modules

FS598-3fs598 dtm3 : gk588 : na

A listener-centric approach to long-term noise level measurement and audio recording

Extant noise level measurement techniques often make little to no use of actual audio recordings, limiting the usefulness of collected data. A soundscape informed approach focussed on the listener experience is therefore required. This project will make use of noise level measurement data and long-term audio recording in order to develop a series of tools (likely in MATLAB) to provide a best-practice for the gathering, handling, analysis, and presentation of such data.

Skills: Audio recording, MATLAB analysis, DSP Core MusTech modules

FS598-4fs598 adh2 : dtm3 : dajp1

Oramics Today

Daphne Oram is a hugely influential and important figure in the world of electronic music. She developed 'Oramics', a sound design technique making use of drawn shapes to determine the nature of the sound produced. Her original system involved several strips of clear 35mm film with shapes drawn on them to create a mask modulating the light received by photocells. In 2016 a PhD project at Goldsmiths resulted in the construction of a working Oramics machine. The aim of this project would be to develop a digital alternative to allow users to explore the Oramics technique (perhaps in the form of an app).

Skills: DSP, sound synthesis, possible iOS programming iOS programming

FS598-5fs598 adh2 : jb64 : mpr2

Stayin' Alive: Sonification and CPR Training

Administering CPR includes the delivery of chest compressions and rescue breaths. This project will focus on developing CPR training equipment that will teach a user the correct tempo and pressure to apply when giving CPR. When learning CPR, first aiders are often encouraged to match the tempo of 'Stayin Alive' (or, perhaps less appropriately 'Another One Bites The Dust...'). This project will make use of sonification techniques to give aural feedback on the quality of the CPR being delivered.

Skills: PD, sonification, some hardware design None, MusTech preferred

GK588-1 gk588 hd502 : jb64 : dtm3

Evaluating plausibility thresholds for reverberation in augmented reality

In Augemented Reality (AR) virtual characters and environments are overlaid onto real world environments typically through the use of AR glasses and headphones. Audio for AR is therefore

challenged with presenting realistic reverberation of virtual sources that matches well with both the real room acoustic and the AR visuals. This project will evaluate the perceptible thresholds for reverberation for plausible AR rendering. For example, if a long reverberation time is used in a living room AR scenario, does the plausiblity of rendering (spatial location, sense of externalisation, believablity) break down? This project is well suited to a Music Technology student with a strong interest in audio for virtual and augmented reality. The project will involve acoustic measurement, development of audio based AR environments and perceptual listening tests.

Skills: Matlab, Experience with digital recording, Acoustic measurement, listening tests. Music Technology stream

GK588-2 gk588 hd502 : dtm3 : jb64

Evaluation of immersive audio effects on gameplay for competitive E-Sports.

A natural application for virtual and augmented reality technologies is in gaming. Recently there has been a boom in competitive e-Sports, yielding a $1 billion dollar industry worldwide. E-Sports players are constantly looking at ways in which they can react faster and gain higher scores and immersive audio has the potential to deliver auditory cues for faster reaction times in games that could yield competitive advantage. This project seeks to assess whether there are significant benefits to using spatial audio in this regard. The project will look at evaluation of different surround sound rendering methods including loudspeaker and headphone based decoding algorithms tailored to the player.

Skills: The student should ideally have a background in audio and music technology and be familiar with Unity, Wwise and Unreal games development tools, digital audio workstations and Matlab.
Music Technology stream

GK588-3 gk588 dtm3 : hd502 : jb64

Spatial Audio Quality in Virtual and Augmented Reality applications for 5G

Next generation mobile devices will come with the capability of delivering immersive soundfields as standard. This technology will enable truly realistic conference calls where the user can hear people on the call around them as if they are in the same room as well as new ways of consuming content in virtual and augmented reality experiences. To this end, this project looks to determine optimal algorithms for rendering of surround sound over headphones and immersive loudspeaker arrays. The work will focus in particular on perceived differences in spatial audio between binaural headphone based listening and 9.1.4 surround sound. The student would evaluate the best candidate surround sound decoding algorithms for a variety of VR and AR use cases (Music, VR cinema, AR etc).

Skills: Matlab, Experience with digital recording, Acoustic measurement, listening tests. Music Technology stream

GT512-1 gt512 mt540 : ajp109 : amt2

Self-test and self-repair in reconfigurable processors

The next generation of VLSI technology is predicted to become increasingly prone to defects and run-time errors. As a consequence, there is a growing interest in the design of circuits (and particularly processors) able to detect the presence of faults and manage to achieve meaningful computation even in this case. Reconfiguration is a possible tool to achieve this kind of fault tolerance. This project will start from an existing processor design and investigate how to introduce fault detection and fault tolerance capabilities to its components.

Skills: Processor architecture, VHDL None

GT512-2 gt512 mt540 : amt2 : ajp109

Communication in Network-on-Chip systems

The increasing size of integrated circuits has led to the realization of entire networks of processors on a single chip. Limited to a few units in their current incarnations (e.g., IBM's Cell processor) these networks will reach considerable size in the next few years, introducing several issues related to their use to effectively handle computation. In particular, communication between processors is a highly sensitive component of these systems. This project will use an existing processor architecture designed specifically for this kind of system and develop a communication network able to implement data exchange within a massively multi-processor system.

Skills: VHDL None

GT512-3 gt512 mt540 : ajp109 : amt2

Partial reconfiguration for application-specific processors

Modern FPGAs have evolved into very large and fast programmable devices, to the extent that many researchers in academia and industry are advocating the introduction (or, to be more precise, the re-introduction) of application-specific processing, that is, the design and implementation of processors that can be customized to execute a particular application very quickly. In this context, a very interesting and powerful feature of modern FPGAs is partial reconfiguration, that is, the possibility to change the configuration of a section of the device while the rest continues to operate. Building on past results, this project will involve the design and implementation of a partial reconfiguration unit within a custom processor architecture.

Skills: VHDL None, but VHDL-based modules recommended

GT512-4 gt512 mt540 : amt2 : ajp109

Non-standard processor architectures for bio-inspired systems

Modern off-the-shelf processors are based on the "conventional" Von Neumann architecture. While optimized for performance, this architecture lacks versatility: it is very difficult to customize it for non-standard instructions (a vital requirement for any approach that draws inspiration from biological systems). Alternatives to the Von Neumann architecture, however, do exist. In this project, you will contribute to the development of such a non-standard architecture, based on the TTA (Transport-Triggered Architecture) paradigm. The specific topic of the project can be one of several

aspects of the development (to be decided together), ranging from compiler technology to the adaptation of standard processor mechanisms (e.g. memory subsystem, interrupts, etc.)

Skills: VHDL Core modules; Computer Architectures and Digital Engineering helpful but not necessary.

IGW1-1 igw1 mpr2 : jke1 : yx2

Title: Micro-contact used to attract functionalised nanoparticles/carbon nanotubes with the aim of developing a diagnostic tool used to concentrate biological test samples.

Supervisor: Dr I G Will Description: A un-doped silicon based micro-contact will be designed and fabricated. An electrostatic, or magnetic field will be applied across a small gap, attracting conductive nanoparticles to the site. This will bridge the gap, forming a new electrical connection. If the nanoparticles/carbon nanotubes are functionalised they can attach to biological molecules and concentrate them for analysis. This technology may also enable circuits to repair themselves, or form new connections in response to a change in device requirements if you wish to pursue this route.

Skills: None None

IGW1-2 igw1 mpr2 : yx2 : jke1

Development of a Novel Electromagnetic System for in situ targeted drug delivery systems

This work will concentrate on the design and fabrication of a novel magnetic drug delivery system and the associated electromagnetics, sensors and control systems that are required to facilitate its targeted delivery. Targeted drug delivery systems can eliminate, deleterious whole body dosage, when targeted administering is more appropriate. For example, in situ tissue engineering aims to harness the bodyÂ's own regeneration capacity to heal injury or reverse age-dependent degeneration using growth factors. This can, for example be achieved by delivering proliferation and differentiation promoting factors to stem cell pools in the injured or degenerating areas of the body such as the skeletal system. This is especially important with the increasingly aging population. You will develop the apparatus required to produce a focusable magnetic field in a three dimensional space. This will confine the treatment volume to a specified location and prevent collateral cell damage to healthy adjacent tissues. It will also sense the amount of MNPs, in order to quantify the drug dosage to the treatment volume. You will use treated, magnetic nanoparticles (MNPs), as delivery vehicles. These will potentially conceal the drug, during delivery, and allow their concerted release at the site of action. Release is achieved by thermal activation using magnetic fields. Therefore, only a small amount of the therapeutic drug has to be administered, and it will only be active at the desired site. In order for MNP based delivery and release to be successful, the particles have to be small (to migrate into tissues outside the circulation) and need to have a high magnetic moment (for efficient magnetic field based heating for factor release). Therefore, you will design and produce novel MNPs by controlled thermal decomposition of small molecule precursors. The MNPs delivery system contains the therapeutic drug, and will undergo a sharp phase transition at 40 to 45 ÂºC releasing the cargo.

Skills: No specialist skills needed. None

IGW1-3 igw1 mpr2 : yx2 : sdj507

Artificial cell membranes derived from electrostatically formed lipid-oil membranes on integrated gold tracks, used to form artificial neurons.

You will fabricate gold tracks grown atop of Si wafer and electrostatically coat these with lipid membranes derived from lipid-oil emulsions. In this way you will be able to form an insulating layer on the gold track which will act as a cell membrane analogue. The whole structure will sit in an aqueous emulsion bath. You will then electoporate the membrane using an electric field supplied to an electrode that lies in close proximity to the lipid coated gold track. The resulting hole in the membrane will allow the momentary flow of ionic current to the lipid gold track. This is rather like a voltage gated ion channel in the synapse between two neurons. You will thus have progressed towards making an artificial biological neuron.

Skills: No specialist skills needed. None

JB64-1 jb64 bjb511 : dajp1 : sdj507

Development of learning resources to engage school pupils with electronic engineering

This project asks you to develop and produce a learning and teaching resource on electronic engineering which will be useful for school-based learning. The age-group for which you develop your resource is not specified; but you will be expected to gain knowledge of the national school curriculum and to design your resource such that it fulfills some of the learning objectives in the science curriculum. You can decide whether your resource will be software or hardware based but you will have to justify your design decisions and be clear about the learning outcomes for students using your resources.

Skills: creative thinking, software and hardware skills, willingness to learn about the school curriculum; ability to write engaging materials for school use Core modules

JB64-2 jb64 fs598 : hd502 : adh2

Wearable Music technology

Can you create some wearable audio/ music ? the challenge is to design, create and make a piece of wearble e-textle technology with music /audio capability and to write an easy to follow tutorial for others to be able to make their own version of your creation. For example, the LilyPad Arduino can be incorporated into textiles, and by combining with sewing in conductive thread a great number of creative possibilities exist. What exactly it does and what it looks like is up to you - and you can draw on your own musical interests. The output should be audio related e.g. audio recording, music synthesizer, mp3 player - but all of this can be decided with your supervisor.

Skills: motivation towards interactive technology, electronic circuits, interest in audio/music technology - sewing skills not required (you can learn!) music technology stream

JB64-3 jb64 hd502 : gk588 : ajp109

Inclusive Music Technology

You will be aware that there is a gender imbalance in the fields of Music Technology and Audio Engineering both at school and university level. In this project you will investigate some of the reasons behind the present lack of gender diversity in this area, and come up with some ideas to help fix the problem. This might be teaching/learning resources, on-line resources to enthuse and encourage female students to study Music Technology, or something else....

Skills: creative thinking, interest in equality, diversity and inclusivity, ability to write engaging materials for public use

JFD1-1 jfd1 jke1 : rg515 : acm4

Switched-mode Audio amplifier

Class-D (switching) audio amplifiers are becoming widespread in consumer electronics (Brotton 2005). The aim of this project is to produce a switched-mode audio amplifier demonstrator. Ideally the work will include developing a simulation of the amplifier as well as working hardware and performance measurements. Reference Brotton, D., (2005). Sound advice for Class D amplifiers.. EDN, 50(9), 65 - 70 , Available from: http://search.ebscohost.com/login.aspx?direct=true&db=buh&AN=16953517&site=ehost-live&scope=site

Skills: Skills : Analogue and digital design, fabrication and testing, circuit simulation.

JFD1-2 jfd1 eaa2 : rg515 : ajp109

Solar powered sensor net

Sensor networks are of interest for all kinds of domestic and industrial applications [1]. Wirelessly monitoring temperature, pollution, machine operation etc. Low power radio solutions such as Zigbee [2] and LoRaWan, are available but still the sensors must find power. The aims of this project are to develop an efficient, low cost, solar charging system for re-chargeable batteries and use it to power a small wireless sensor network. It is likely the solar charger will be a switched mode power supply to extract maximum power from all light conditions. Wireless modules are available at low cost to fabricate the network. References [1] Wikipedia contributors. "Wireless sensor network." Wikipedia, The Free Encyclopedia. Wikipedia, The Free Encyclopedia, 25 Apr. 2014. Web. 25 Apr. 2014. [2] Wikipedia contributors. "ZigBee." Wikipedia, The Free Encyclopedia. Wikipedia, The Free Encyclopedia, 11 Apr. 2014. Web. 25 Apr. 2014. [3] A Closer Look at LoRaWAN and The Things Network, http://www.rs-online.com/designspark/electronics/eng/blog/a-closer-look-at-lorawan-and-the-things-network

Skills: Skills: Anlogue, and digital design, simulation construction and testing, some programming for sensor network.

JFD1-3 jfd1 map568 : gt512 : ait1

Roll your own

Some of the best projects I have supervised over the years have been based on students own ideas. I have a wide range of interests and would be happy to discuss any ideas. Ultimately if you want to do your own project you will need to generate a short description like you can see on this database, and show that we have the resources in the department to complete it within the limited funds available.

Skills:

JFD1-4 jfd1 mpr2 : rg515 : sjp1

Crosstalk, singal and power integrity demonstrator

The aim of this project is to produce a simple PCB which can be used to demonstrate: cross-talk in digital circuits; power supply noise in digital circuits; along with simulations of the effects seen, and the effects of mitigation.

Skills: Digital design, Ansys simulation, PCB design, FPGAs; SPICE simulation.

KC935-1 kc935 : :

Achievable secrecy rate optimizations for two-user relay channel

Relay networks have been identified as the potential candidate to enhance the spectral and resource efficiency in future wireless networks due to low computational complexity, low processing time and viable practical implementation. In addition, the relay nodes can be exploited to establish secure communication links against passive eavesdroppers, where the relays will forward the received signals based on amplify and forward relay protocols. In general, the performances of the relay assisted secrecy communications will be evaluated by the achievable secrecy rates, which could be achieved by optimally allocating transmit power at different nodes. This project aims to solve different power allocation problems with different constraints in a two-user relay channel. The student will start this project with a literature survey on relay assisted physical layer security networks. Then, it is expected to develop optimal power allocation strategies for a) power minimization problem b) secrecy rate maximization problem based on convex optimization techniques. The proposed schemes will be evaluated through MATLAB simulations and the optimality of the results will be validated through exhaustive search algorithms. In addition, the proposed schemes will be compared with the existing schemes in terms of achievable secrecy rates. Having experience in MATLAB simulations and fundamental knowledge of wireless communications will be advantageous for this project.

Skills:

KC935-2 kc935 na : na : na

Cooperative jamming schemes for secure communications

Secrecy communication based on physical layer dynamics of the wireless channels has been recently proposed to enhance the security of wireless data transmissions, which would also complement the conventional cryptographic methods. However, this security scheme cannot be implemented all the

time in practice due to unfavourable channel conditions. Cooperative jamming is a well-known approach to improve the quality of the secured links in physical layer security, where the jamming signals will be introduced to the eavesdroppers to degrade their decoding capability. This project will aim to develop optimal cooperative jamming scheme to improve the achievable secrecy rates in the presence of multiple eavesdroppers. The original secrecy rate function with cooperative jamming is non-convex in nature and therefore, different approximation methods will be explored to convert the original secrecy rate function into a convex one. Based on the suitable approximation, different cooperative jamming schemes will be developed. The performance of the proposed jamming schemes will be evaluated through MATLAB simulations and will be compared with the existing schemes in the literature. Therefore, having experience in MATLAB simulations would be desirable for this project.

Skills: Good programming skills; Knowledge of MATLAB Basic knowledge of wireless communications would be useful

KC935-3 kc935 : :

Simultaneous wireless information and power transfer

Since signals that carry energy can transport information at the same time, simultaneous wireless information and power transfer (SWIPT) has become an interesting new area of research and has drawn an upsurge of interests. Through SWIPT, mobile users are provided with access to both energy and data at the same time which brings enormous prospects in future wireless networks. In this project, different SWIPT schemes will be developed to satisfy different quality of services at the users. In particular, secrecy rate and energy harvesting optimization problems will be investigated to design optimal transmission strategies which will satisfy the secrecy rate constraints at the legitimate users, while providing required energy at the wireless energy harvesting nodes. The proposed scheme will be evaluated through obtaining the secrecy rate – harvested energy curves with different conditions on the network. The corresponding simulations will be performed through MATLAB. Hence, having experience with MATLAB simulations will be desirable for this project. The performance of the developed transmission strategies will be compared with the existing schemes to demonstrate the advantages of the proposed schemes.

Skills: Good programming skills; Knowledge of MATLAB Basic knowledge of wireless communications would be useful

KC935-4 kc935 : :

Cooperative jamming schemes for secure communications

Secrecy communication based on physical layer dynamics of the wireless channels has been recently proposed to enhance the security of wireless data transmissions, which would also complement the conventional cryptographic methods. However, this security scheme cannot be implemented all the time in practice due to unfavourable channel conditions. Cooperative jamming is a well-known approach to improve the quality of the secured links in physical layer security, where the jamming signals will be introduced to the eavesdroppers to degrade their decoding capability. This project will aim to develop optimal cooperative jamming scheme to improve the achievable secrecy rates in the presence of multiple eavesdroppers. The original secrecy rate function with cooperative jamming is

non-convex in nature and therefore, different approximation methods will be explored to convert the original secrecy rate function into a convex one. Based on the suitable approximation, different cooperative jamming schemes will be developed. The performance of the proposed jamming schemes will be evaluated through MATLAB simulations and will be compared with the existing schemes in the literature. Therefore, having experience in MATLAB simulations would be desirable for this project.

Skills: Matlab, Monte Carlo simulations Linear algebra, fundamentals of communication theory

KC935-5 kc935 : :

Simultaneous wireless information and power transfer

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Skills: Matlab, Monte Carlo simulations Linear algebra, fundamentals of communications theory

MAP568-1 map568 na : na : na

Self-organizing controller networks for distributed robotics and sensing

Robots are undergoing a continuous and visible trend towards decentralization. Now that we have ubiquitous, low-cost and powerful microcontrollers that can execute complex programs in every single component, we need to consider more scaleable, more efficient, and more responsive communications between these components. Moreover, these networks are dynamic and must both maintain an internal "self-awareness" in each component and also be able to cope with new configurations and tasks at the system level. In this project, students will program networks of microcontrollers to autonomously assemble, organize, and manage themselves for different tasks by changing the functions they execute and the information they use and produce as part of a larger decemtralized network.

Skills: C/C++/Python programming; network protocols and communication; operating systems

MAP568-2 map568 na : na : na

Associating meaning with information related to robot sensing and control

Modern robots have achieved great feats of autonomy by using dedicated programs and control systems for each task. However, nearly all autonomous machines are missing one key component of intelligence - that is "Knowledge". Knowledge is represented by the association of abstract concepts with each other, and provides a valuable way for autonomous systems to make decisions without having to be programmed for every eventuality. In this project, students will give "knowledge" to a robot control system to associate data and functions with a semantic ontology using OWL conventions, and then make the system autonomous using reasoning on this ontology to perform simple tasks.

Skills: Semantic Web; communications; autonomous robotics; logical computation

MAP568-3 map568 na : na : na

Control methods for flexible and bio-inspired superlight and tensegrity robots

Tensegrity "tensional-integrity" structures use flexible wire or spring connections between compression components to make structures self-supporting and rigid without using rigid joints, much like our own bone and tendon structures. This allows robots to be very light, flexible, and adaptive while still being strong and controllable. In this project, students will build small robotic structures that can bend and flex using actuators, and program microcontrollers so that precise and repeatable movements of the structure for locomotion, etc. are possible.

Skills: mechanical design and mechatronic actuator control

MAP568-4 map568 na : na : na

Accelerating embedded robot sensor processing and control using high-level synthesis

The new generation of hybrid FPGA "System-on-a-Chip" microcontrollers make it possible to accelerate and harden algorithms for robot sensors, communications, and actuator controllers by using High-Level Synthesis (HLS) to convert C and C++ code directly into Hardware Description Languages. However, the fusion of hardware and software comes with a new set of challenges. In this project, students will design sensor fusion and actuator control functions normally run on a microcontroller and move them into FPGA fabric on Xilinx Zynq using automated HLS conversion of C code.

Skills: C/C++ programming; knowledge of FPGA concepts; understanding of robot sensing and control

MAP568-5 map568 na : na : na

A modular actuator to drive small bio-inspired autonomous underwater vehicles

In this project, the student will design the a fin-like dielectric elastomer actuator that can drive a small AUV. The actuator is modular and independent of the body. The 3D printed body will hold all of the electronics to run the actuator. The thrust force will be tuned by stacking multiple actuation layers and modifying the Young's modulus of the elastomers. The small AUV is reconfigurable by a

shift of its center of mass. The project will demonstrate the autonomous swimming and the actuator will power the AUV to swim at sufficient speed to overcome a drift of 0.5m/s if possible.

Skills: Electronic design, 3D printing, hardware in the loop experiments and testing, an interest in fluid dynamics is helpful

MPR2-1mpr2 ap23 : jb64 :

Switches 4 Kidz: toys for children with disabilities

The idea of this project is to create a toy that can be enjoyed by children with disabilities such as cerebral palsy, by using specially adapted switches. We will be working with the William Merritt Disabled Living Centre in Leeds (see https://www.wmdlc.org/), a charity that keeps a 'library' of adapted toys that children can borrow. The first stage of the project will be to discuss with an occupational therapist at the Centre what toy to make. Then to design, build and test it, and finally get some user feedback from the Centre. You can either adapt something that is commercially available or start from scratch. Previous project students have worked on a Whac-a-Mole game, Scalextric car racing and various musical toys.

Skills: general analogue and digital electronics; design and construction none

MPR2-2mpr2 igw1 : rg515 : jfd1

Dielectric replica measurement: 3D printing for object identification in archaeology

We have recently developed a new method of measuring dielectric properties (permittivity and conductivity) of a solid object. The application is non-destructive testing of fragile objects, particularly archaeological artefacts, where we need to identify what material the object is composed of. A replica of the object is made with a 3D printer, and the responses of this replica and the original are compared in a specially built sensor. The project work will include improving both the hardware and software of the system, as well as scanning and producing 3D models of real artefacts provided by the Department of Archaeology.

Skills: ability to make things and do practical work; interest in RF measurements would be useful but not essential none

MPR2-3mpr2 igw1 : jfd1 : rg515

Liquid dielectric measurements for green chemistry

In collaboration with the Green Chemistry Centre of Excellence, we have developed a microwave sensor that can measure the dielectric properties (permittivity and conductivity) of liquids in a non-contact process. These properties are useful in the processing of waste cellulose with microwaves, into fuels and chemical reagents. We now want to develop a system for continuous measurements of liquids in pipelines, to be used in applications such as environmental monitoring. Your role will be to design and test a control system to deliver samples of liquids to the sensor, and synchronise this with RF measurements made with a network analyser.

Skills: ability to make things and do practical work; interest in RF measurements would be useful but not essential none

MPR2-4mpr2 jes1 : jc12 :

Chaotic Audio

Audio signals can be synthesised from mathematical functions, but simple sine waves sound monotonic and uninteresting, while random numbers produce unvarying white noise. Chaotic functions are a fascinating field of mathematics; they produce outputs which, when converted to audio signals, have a wide range of interesting and peculiar sounds. Your project is to explore their application in creating sound effects and music.

Skills: Programming (e.g. Matlab), mathematics, interest in music and sound none

MPR2-5mpr2 : :

Microwave Theremin

In my EM lectures I use an Electromagnetic Waves Demonstrator where the strength of a microwave beam between a pair of antennas controls the pitch of a tone. How could you adapt this equipment to make a non-contact electronic instrument that sounds better and is more versatile? One thing needed is a second channel to control the volume, but how you implement it is up to you.

Skills: Interest in electronics and music, willingness to experiment and build things none

MT540-1 mt540 sjb508 : gt512 :

Fault-tolerance Through Dynamic Reconfiguration

FPGA vendors are aiming to enable partial dynamic reconfiguration of their devices for a number of years now, however, with only limited success. While it is, in principle, possible to partially reconfigure an FPGA, it is not yet possible to do so without interrupting operation of the device. Moreover, in the case of more complex systems, design tools still lack the ability to efficiently and automatically partition a logic design. In previous research projects within the Intelligent Systems Group custom FPGA systems have been created, which allow dynamic partial reconfiguration: the Reconfigurable Integrated System Array (RISA), the Logic Evolver Substrate and the Programmable Analogue and Digital Array (PAnDA). In this project, you will work with one of these unique, partially dynamic (at run-time) reconfigurable FPGA architectures. The main aims are to investigate some mechanisms and aspects of partial dynamic reconfiguration and their use in enabling fault-tolerance and self-healing in FPGA systems.

Skills: digital circuits, FPGAs, C

MT540-2 mt540 gt512 : amt2 :

Bio-Inspired Image Processing with Many-Core Systems

One of the most fascinating properties of biological development is the fact that large, complex organisms are created using the relatively small amount of information that is encoded in the deoxyribonucleic acid (DNA) of a single cell. Once development is initiated, a complex process of gene activity and regulation takes place that triggers a series of cell actions, which, over time, create complex, multicellular organisms. During the organism's lifetime, the developmental process constantly adapts to changing environments and maintains it in the case of damage. The crucial factor that allows developmental processes to unfold their power is time. From an engineering and computer science point of view, this means that information is encoded in the time steps of the developmental process. Hence, DNA represents compressed information, which is expanded during the developmental process and is expressed through the various states of the organism. This project will investigate whether bio-inspired computational models of DNA and development can be used to compress images and/or perform image-processing tasks, such as de-noising or 'healing brush'. The overall goal of the project is to encode/decode images using a gene regulatory network model for artificial development on a many-core processing array on a Xilinx Virtex 7 FPGA.

Skills: basic image processing, C/C++.

MT540-3 mt540 sjb508 : :

Logic Lego Blocks for Modular Dynamic FPGA Design

Logic design is performed at different levels of abstraction, the gate level, the block level and the system level. At the gate level the designer has fine-grained control over a circuit, allowing precise optimisation for a specific application. At the medium-grained block level, the use and re-use of readily available and tested (!) blocks allows to quickly realise designs with more complex functionality. Finally, at the coarse-grained system level, assembling high-level functional blocks (e.g. an ALU, a memory, a pipeline and a network module) provides a robust methodology to realise customised solutions (e.g. an application-specific processor). This kind of hierarchical design principle is common practice in systems design and a variety of electronic design automation (EDA) tools exist to support it. However, although EDA tools are capable of implementing complex designs based on high-level descriptions (e.g. a device netlists or a hardware design language), the resulting system is generally fixed and not supposed to change later on, let alone at runtime! Whilst this approach yields performance-optimised implementations, their rigidity does not allow for runtime adaptation in the case of faults or in case the application requirements change. As a result, on-line fault recovery is limited and opportunities for dynamically saving resources is missed. The aims of this project are to create a library of logic Lego blocks implementing atomic functions that can be assembled in different ways, at runtime using partial dynamic reconfiguration, to realise larger functions. You will work with a custom FPGA that has been developed previously in the Intelligent Systems Group (ISG), the Programmable Analogue and Digital Array (PAnDA), which provides a simple interface for partial dynamic reconfiguration. This project builds on successful work from the previous year where a framework for dynamic reconfiguration and basic "Lego" blocks were developed.

Skills: digital circuits, FPGAs, C

MT540-4 mt540 dh20 : map568 :

Evolution of an Electronic Neuron

Artificial neural networks (ANNs) are currently in the focus of interest of international research due to their potential for low-power non-standard computation. A variety of applications exist, ranging from face/text recognition over classifiers to data mining. For maximum performance of an ANN, it would be beneficial to implement it on the transistor level, and there are a number of research projects that are working on exactly that. However, one of the greatest challenges of transistor-level design is to come up with suitable circuit topologies that meet desired specifications and implement, for instance, an operational amplifier, an analogue filter or an ADC, let alone a circuit that behaves like a neuron! There are large libraries of predefined, parametrisable topologies (standard cells) from which designers usually pick the one most suited to their needs and make minor adaptations. However, restricting themselves to a pool of predefined structures might in some respects prevent designers from discovering new interesting and useful structures. This project will take inspiration from how biology "designs" its systems in nature. An evolutionary algorithm (EA) will be used, which can design and optimise circuits directly on a reconfigurable hardware prototyping system, the field-programmable transistor array (FPTA), which is essentially representing a transistor breadboard on chip. Hence, you will specify the behaviour of a Neuron and use an EA as an automatic design tool. You will be able to work with an existing hardware-in-the-loop evolution system.

Skills: A programming language (Java or C++), basic knowledge of CMOS transistors

NJ578-1 nj578 : :

Skills Development and Retention in Undergraduates

An investigation of the development of skills in undergraduates across the wide range of modules both core and optional delivered in the School of Electronics courses. The project will consider the variety of methods employed to develop required skills and the respective ability of each of those methods to embed the skill/s such that the student could use the skill/s whenever called upon to do so - here whilst in full time education or later in their careers. There will be a need to carry out desk and field based research, construction of questionnaires and/or interview guides, compilation and analysis of collected data and construction of a research report detailing methodology, findings, conclusions and recommendations in a format suitable for publication in a respected journal.

Skills: Research, Analysis, Computing (use of SPSS), Presentation - written and oral. None but it would be useful to have some business knowledge.

NJ578-2 nj578 : :

Acoustic modelling of adjustable sound boxes for stringed instruments

This project will look at the behaviour of sound waves in a variety of acoustic box configurations from a theoretical and a practical perspective. The first part of the project will be to determine the theoretical effects of changing the internal structure of an acoustic sound box, starting with a standard guitar style sound box as a baseline and looking at what can be done within the sound box to alter the reproduced sound. The second part will be to construct a suitable model to carry out measurements that may demonstrate the extent to which the theory is accurate - some practical help may be available for this stage if required.

Skills: Research, Recording of results, Analysis, Theoretical Modelling, Practical Modelling, Reporting
Sound generation and recording knowledge.

NJ578-3 nj578 : :

Assessment of Learning in Engineering Modules

The project will look at how modules are assessed, whether any one method appears to be more effective than any other, what range of assessment options might be suitable within modules, the impact the assessment method has on students and staff, feedback mechanisms. There will be a mix of desk and field based research carried out to identify assessment methods available, those used in the department, the impact of their use and possible options for future assessment.

Skills: Research, Analysis, Computing (use of SPSS), Presentation - written and oral. None but a background in business modules may be useful.

NJ578-4 nj578 : :

Mobile Phone App for Scheduling

Take all the major effort out of taking/writing notes or remembering to do something and get reminded in a timely fashion of a required activity. You can argue that use of existing calendar functions could do this now if you set them up correctly. The project explores the requirements for and opportunity to develop an application for mobiles (iPhone, Android) that reminds people to do things on a one off or regular basis and then provides the vehicle to make that much more convenient, easier to do and improves your efficiency giving you more time to do other things. For example, if linked to exam or assignment schedules it could be used to prompt students to write down what they have learned (for reflective logs), carry out revision or complete chapters for an assignment. If linked to electronic diaries or calendars it could also prompt for important dates, events, meetings etc. Uses: Maybe if after you are prompted and you activate the application it could automatically invoke a voice recorder function for example to make short vocal reflective notes that would transfer to your PC as a text file when appropriate – i.e. the App could remind you when it gets a sync to your PC and you press to transfer. Then, when deadlines loom you have already got much of the info you need to complete certain types of assignment. Why not also link related images (pictures, videos) taken on your mobile to your appropriate assignment folder and have those auto-downloaded too? I' m sure there are many other uses that you could think of.

Skills: This project would best suit a student interested in mobile apps development with skills in programming in an Apple or Android operating environment. There would also be a need to research exact Application requirements amongst fellow students, analyse and utilise that data and plan the project to deliver a meaningful product. Programming

PDM106-1 pdm106 edc1 : jfd1 :

Perpetual wireless sensor network operation

Wireless sensor networks represent a promising technology for large scale automated monitoring of environments. One of the primary challenges associated with their use is longevity of operation, notably for deployments in remote and/or inaccessible locations where it is not feasible to manually replace/recharge batteries. Perpetual operation of wireless sensing nodes is the ideal solution to this problem, which may be achieved through the use of appropriate energy-harvesting technology,

capable of replenishing depleted batteries or other electrical charge storage devices. The amount of energy that can be harvested with existing technology is a major constraint and the time-varying nature of energy availability is a challenge in the design of such systems. For perpetual operation to be achieved, communication overheads (required transmit power, signalling etc) must be kept to a minimum. Further to this, the more efficient the communication protocols are, the higher the data throughput capability. The aim of this project is to explore the technologies that can be used for energy harvesting on typical wireless sensor nodes and to understand the constraints imposed by the vision of perpetual operation. The implications on the communications protocols can then be determined and the feasibility of achieving perpetual operation can be considered. The project can be divided into three key stages:- 1. Review of existing energy-harvesting and wireless sensor network technologies, leading to an understanding of potential energy-harvesting rates and communication/processing overheads. 2. Investigation into the feasibility of perpetual operation and the implications on the communication protocols that can be used through simulation. 3. Estimates of the data throughput capability of the envisaged devices/protocols To get the most out of this project, an interest in wireless communications, energy harvesting technology and simulation is important. This project will give you the opportunity to develop your research skills. If you are interested in this project, you are advised to come and see me about it to discuss it further.

Skills: Good programming skills; Knowledge of C/C# or MATLAB useful Communication and computing courses useful

PDM106-2 pdm106 tc2 : :

Can an underwater wireless sensor network be polite?

A wireless sensor network consists of a number of small electronic devices, which combine micro-electro-mechanical sensors with micro controller and a low power transceiver for the purpose of environmental monitoring. These devices will often be required to operate for long periods of time in challenging environments, such as that found underwater. The multiple access protocol has a major impact on achievable throughput rates and the long propagation delays and low data rates characteristic of underwater acoustic communication make the development of a suitable scheme particularly challenging. Carrier Sense Multiple Access (CSMA) is a commonly used scheme in wireless networks (notably wireless local areas networks) as an efficient means of allowing many communications nodes to share the same radio channel. Communication underwater is often achieved through the transmission of acoustic waves since radio wave experience significant attenuation. The low propagation speed of acoustic waves is expected to have an impact on the performance and effectiveness of CSMA. The aim of this project is to investigate whether CSMA schemes can be used in an underwater wireless sensor network, identifying performance limits and implementation requirements. The project can be divided into three key stages: General study on underwater wireless sensor networks and medium access control, leading to a complete scenario specification Development of a simulation model of CSMA in a suitable software package Detailed evaluation of the benefits and limitations on the use of CSMA in an underwater wireless sensor network To get the most out of this project, an interest in communications is important. This project will give you the opportunity to develop skills in software simulation and enhance your knowledge of communication protocols. If you are interested in this project, you are advised to come and see me about it to discuss it further.

Skills: Knowledge of C/C# or MATLAB Communications courses useful

RG515-1 rg515 na : na : na

A real-time spectrum analyser in audio frequency range

Xilinx All Programmable System on Chip (AP SoC) combines a dual-core ARM Cortex-A9 processor with traditional Field Programmable Gate Array (FPGA) logic fabric - see Zynq AP SoC. This combination allows to rapidly prototype products that require sequential, dynamic, unpredictable processing (using the processor) as well as high-speed, parallel deterministic processing (using the programmable logic). This year I am offering a number of projects based on AP SoC (or you could do the same on Atlys Spartan 6 boards that supports a soft-core processor called MicroBlaze). All projects involve development of required hardware and software components for the project. Here you can find a short description of the project idea, so it would be good to contact me if you want to discuss the project idea with more detail or if you have your own project idea(s) that may fit onto the above platform. The aim of this project is to capture audio frequency range (could go bit higher than that with the hardware available) and provide standard analysis tools available in a spectrum analyser (real-time frequency composition and possibly the spectrogram of an input signal). This type of unit will be useful in analysing voice or any audio frequency signals.

Skills: willing to learn new software tools, VHDL, C

RG515-2 rg515 : :

An FPGA based adaptive echo canceler

You must have experienced hooting in public address (PA) systems due to echo. The echo (a positive feedback loop formed by a microphone and the speakers) usually depends on the locality the PA system works. Therefore, a solution based on fixed filter(s) may not work for different locations. In this project you are required to design, construct and test an FPGA base adaptive echo canceler. The project requires you to first identify characteristics of echo that may be able to use in an adaptive echo canceler and device an FPGA based echo canceler that may work in any locality!

Skills: willing to learn new software tools, VHDL, C

RG515-3 rg515 eaa2 : :

A low cost automated spectrometer for mineral and gem identification

Visible light spectroscopy is one of the methods to identify gems and minerals. This is done by shining white light to a piece of material under test and observing the absorption (or reflection) pattern in the visible light spectrum that characterises the material. With the advent of LED (light emitting diode), LED controller and light sensor technologies it may be possible to develop a low cost automated system to identify gems and minerals. In this project you are required: to understand what visible light spectrometry is and how that can be used for material identification; do a detailed study on different LED, LED driver and sensor technologies that can be used to provide a solution to the problem; design, implement and test a low cost automated spectrometer providing suitable solutions to limitations in chosen technologies. You should be willing to learn the concepts behind this project idea. Please have a look at the links provided to get a general understanding of the project. https://www.cigem.ca/research/GLGemSpecPP.pdf

http://www2.chemistry.msu.edu/faculty/reusch/virttxtjml/spectrpy/UV-Vis/spectrum.htm#uv1
http://physicsbuzz.physicscentral.com/2013/02/turn-your-phone-into-spectrometer-for.html
https://en.wikipedia.org/wiki/Ultraviolet%E2%80%93visible_spectroscopy
http://chemwiki.ucdavis.edu/Core/Physical_Chemistry/Spectroscopy/Electronic_Spectroscopy/Electronic_Spectroscopy%3A_Application

Skills: Analogue and microcontroller based hardware design and C

SDJ507-1 sdj507 edc1 : :

Inexpensive, portable potentiostat

Almost all uses of electrochemistry, from glucose monitoring and DNA profiling to battery testing and environmental monitoring rely on an electronic device known as a potentiostat. Research grade potentiostats of the type used in the Biomolecular Electronics Laboratory are capable of performing a remarkable array of high sensitivity, high-resolution electrochemical measurements. But this functionality comes at a cost, that cost being upwards of £8,000! For many applications, such as on site pollution monitoring and home glucose testing for example, the range and quality of measurements are relaxed and a basic, inexpensive instrument is required. The aim of this project is to design, build and test an inexpensive and portable potentiostat that is capable of performing a range of electrochemical measurements with a particular focus on environmental monitoring and point-of-care/ home based diagnostics.

Skills: Basic electronic circuits. Basic construction skills.

SDJ507-2 sdj507 amt2 : mt540 : na

Peptides for molecular computation

One of the most promising developments within nanoscience and nanotechnology has been the emergence of molecular computing machines built entirely from biological molecules. For example, simple boolean logic gates and finite state machines have been demonstrated that are constructed from and actuated entirely by DNA. While the critical factors that regulate DNA machines are becoming well understood, the control and activation of molecular machines based on peptides remains relatively unexplored. The aim of this project is to study experimentally the dynamics, specificity/selectivity and stability of molecular machines based on the coiled-coil peptide.

Skills: Good experimental skills: N.B. Prior knowledge of biology/ chemistry is NOT essential but you should have an interest in inter-disciplinary research

SDJ507-3 sdj507 amt2 : mt540 : na

Silicon biosensors

A comprehensive understanding of protein pathways in cellular processes and in disease states, as well as the identification of novel disease biomarkers, will require the ability to monitor tens or even hundreds of thousands of protein species in parallel. This represents a significant technological challenge that will involve the fabrication of functional, high-density micrometer- or submicrometer-

scale biosensor arrays. Recently a number of silicon-based electronic and photonic biosensor technologies have emerged that have the potential to meet this challenge. In order to translate these technologies into clinical practice, it will first be necessary to develop generic, reliable and robust approaches for integrating functional biological molecules, such as antibodies and aptamers, with the underlying silicon biosensor. This project will investigate and optimize a range of silicon surface chemistries and assess them for selective binding of functional biological molecules.

Skills: Good experimental skills. Prior experience of cleanroom work useful: N.B. Prior knowledge of biology/ chemistry is NOT essential but you should have an interest in inter-disciplinary research

SDJ507-4 sdj507 edc1 : dajp1 :

Cardiac monitor for shellfish

Shellfish cardiac activity monitoring and analysis can be used as an indirect measure of water pollution. For example, previous studies have shown a significant response of the crayfish cardiac system upon exposure to selected chemical agents in water, e.g., potassium nitrate and ammonium phosphate. The aim of this project it to develop a noninvasive cardiac activity monitoring system for long-term, continuous and noninvasive monitoring of cardiac activity of shellfish.

Skills: Good circuit design and construction skills.

SJP1-1 sjp1 na : na : na

Evolutionary Optimisation of Antenna Design for 5G Systems

Modern antenna design requires complex optimisation of electromagnetic and geometric parameters to satisfy the requirements for, e.g. communication systems. Evolutionary algorithms allow the optimisation of challenging problems with such complex requirements. This project will investigate the use of evolutionary algorithms to optimise the performance of 5G antenna systems. This is generally a software based process, but there may be opportunity to construct and measure the physical antennas.

Skills: Programming

SJP1-2 sjp1 acm4 : jfd1 : jt517

Are You Uncertain or Just Not Sure? Can an Evolutionary Algorithm Tell You?

Evolutionary algorithms and particularly genetic algorithms have been used successfully for several decades to optimise real world problems. Given a complex problem they give an estimate of the best solution. However, it would be very useful to know how "uncertain" the solution is - what is the likely error. This project will use genetic algorithms to optimise problems but also incorporating error/uncertainty calculations along the way. The specific problems could be in many fields, e.g. circuit simulation, antenna design - I am open to any field that the student might be interested in.

Skills: Programming.

SJP1-3 sjp1 dh20 : sls5 : ajp109

Fake News

This project will consider whether it is possible to use automated algorithms to classify undesirable forms of posts on social media. Such posts may be advertising, spurious, etc. A previous project that used social media to predict stock prices did make some early, successful classification of advertising.

Skills: Software Engineering

SLS5-1 sls5 dh20 : hd502 : na

Analysis of speech deficits in Parkinson' s disease using evolutionary algorithms

Parkinson' s disease is a common debilitating condition that affects over 12000 people in the UK alone. This project, undertaken in conjunction with the National Hospital for Neurology and Neurosurgery, will look to analyse the speech recordings of patients before and after deep brain stimulation – a treatment for the symptoms of Parkinson' s disease. MATLAB is used to extract features from the raw speech data, which are then used to train an evolutionary algorithm – CGP, as a classifier.

Skills: MATLAB and C programming

SLS5-2 sls5 dh20 : pdm106 :

Automated analysis of clinical drawing tests using evolutionary algorithms

The Department is collaborating with a multinational research orgnisation to analyse data from standard clinical drawing tests used to diagnose a range of neurological conditions. The motion of the pen is captured in real time using a digitzing tablet. MATLAB is then used to extract features from the raw data, which is then used in turn to train an evolutionary algorithm – CGP, as a classifier.

Skills: MATLAB and C programming

SLS5-3 sls5 sdj507 : sjp1 : ajp109

Analysis of drosophila movement using high frame rate videos and evolutionary algorithms

Collaboration with the Department of Biology is concerned with assessing the movement of fruit flies (drosophila) using high frame rate videos from which features are extracted and analysed using evolutionary algorithms. This work has important significance in the treatment of Parkinson' s disease.

Skills: MATLAB and C programming

SLS5-4 sls5 mpr2 : jc12 :

Automated detection of breast cancer from mammograms using evolutionary algorithms

Breast cancer is one of the highest causes of death in women. This project will use MATLAB and evolutionary algorithms to analyse mammograms (high resolution X-rays of the breast) to detect regions that may indicate the presence of cancerous structures known as speculated masses.

Skills: Biologically Inspired Computation and Electronics for Medicine useful but not essential
Biologically Inspired Computation and Electronics for Medicine useful but not essential

YX2-1 yx2 : :

Magnetic RAM (MRAM) – a new universal memory device

This project is to develop materials for MRAM, a new universal memory device, which may combine the functions of hard disk. For decades, the IT industry has followed Moore's Law, that the number of transistors on a chip doubles about every 2 years, but conventional solid state electronics may soon reach a limit due to the increasing heat dissipation challenges of charge current and quantum size effects in small devices. Spintronics technology, such as MRAM, is expected to ensure continued adherence to Moore's law in the future. Within the context of spintronics, the electrons' spins, not just their electrical charge, are manipulated within electronic circuits. They already play an increasingly significant role in high density data storage, microelectronics, magnetic sensors, quantum computing and bio-medical applications etc. This project will use the state-of-the-art facilities in the department clean room and the university NanoCentre.

Skills: no no

YX2-2 yx2 : :

High frequency electronic materials for 5G communications

This project is to design and fabricate a new generation of PCB materials for the coming 5G communication. 5G is on the way to be used for smart cities, driverless cars, ultrafast communications etc. The PCB is the basic block for all the electronics, and the high frequency PCB is a key element for the future electronics. This project is to develop PTFE and ceramic based PCB, which will have excellent properties for 5G applications. The project student will have the opportunity to make these materials and devices using the state-of-the-art facilities in the departmental clean room and the University NanoCenter.

Skills: no no

YX2-3 yx2 : :

Sun simulator and the solar energy

This project is to design and set up a "Sun Simulator" with a group of light sources to simulate the light from the sun. This sun simulator is expected to have the similar energy band as the light from the sun. This sun simulator will then be used to measure the efficiency of the solar cells. With the shortage of the oil and the risk of the nuclear power, the solar energy is one of the most effective and green technology for the energy needs of the human being. The project will also have the

opportunity to make solar cells using the state-of-the-art facilities in the departmental clean room and the University NanoCenter.

Skills: no no

YX2-4 yx2 : :

GMR and TMR sensors for ABS system and automobile industry

This project is to design and build up an “Anti-lock Brake System (ABS)” for automobile industry. A skidding wheel is one of the most serious reasons to cause accident. By keeping the wheels from skidding, the anti-lock brakes will enable the drive to steer while trying to stopping. There are four main components to an ABS system, speed sensors, pump, valves and controller. In this project, we are expected to develop the new speed sensors using the GMR and TMR effect (2007 Nobel Prize). The new GMR and TMR sensors will response much quicker than the current Hall sensors, which will make the car much safer when needing to stop in emergency. The project will also have the excellent opportunity to make these GMR and TMR sensors using the state-of-the-art facilities in the York Spintronics Laboratory led by Professor Yongbing Xu and the University NanoCenter.

Skills: no no

YX2-5 yx2 : :

Magnetic Liquid

The magnetic materials are usually in the form of solids and the liquids are not magnets, as we know. This project is to design and prepare the magnetic liquid, also called ferrofliuds, which is magnetic and can flow at the same time. These magnetic liquids or ferrofluids will be made from a suspension of tiny magnetic particles in a liquid such as water or oil. Such a mixture creates a liquid that can be attracted by a magnetic field. NASA discovered Ferrofluids at one of their research centres in the earlier years while they were looking for different methods of controlling liquids in space. The most common form of ferrofluid is made using particles of a type of iron oxide known as magnetite (Fe_3O_4), which is environmentally friendly and safe for the human beings. These magnetic liquids have some unique applications in automobile industries and vacuum sealing etc. The project will have the excellent opportunity to make these magnetic liquids in the departmental clean room and spintronics laboratory led by Professor Yongbing Xu and see them using the state-of-the-art facilities in the University NanoCenter.

Skills: no no