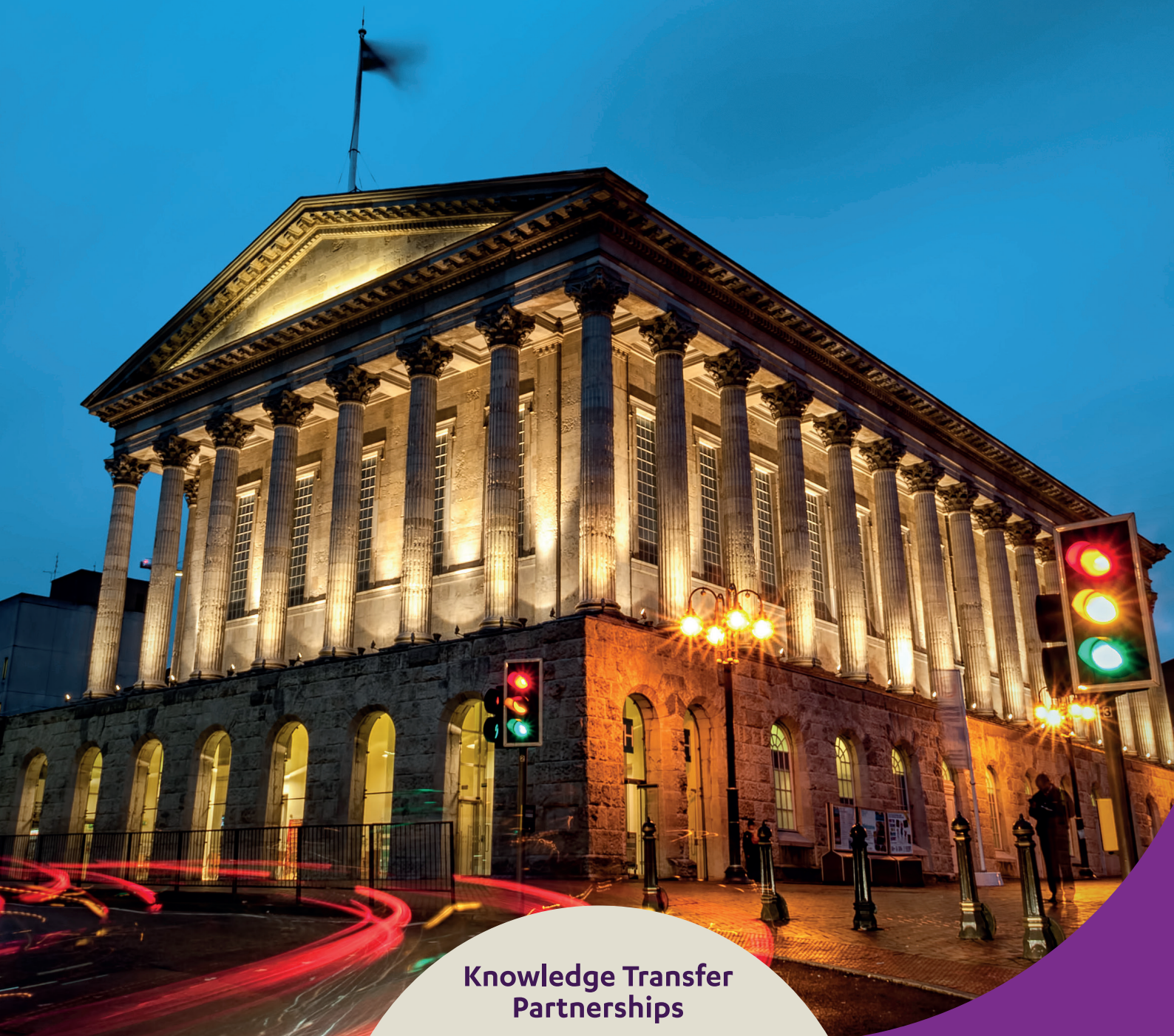# Innovate UK

KTP Associates Conference 2017
Birmingham

Abstracts

Knowledge Transfer Partnerships

UNIVERSITY OF BIRMINGHAM

BIRMINGHAM CITY University

Aston University

Presentation abstracts

Towards a hybrid smart door phone system

Femi Adeyemi-Ejeye
Kingston University
The Entryphone Company Ltd

Aligned with: Emerging and Enabling Technologies
Stage of project: Early

Door phone systems that allow people inside a building to communicate with visitors at the door, while also controlling access. This system has developed over the years with current solutions enabling remote communication and control over the internet. However, to adopt newer internet-based solutions, current analogue systems would have to be replaced, which can be costly and cumbersome to deploy, especially in a multi-tenanted building.

This presentation discusses an ongoing KTP project, which provides an interface that enables the continuous use of analogue door entry phone systems, whilst enabling remote communication and control using a range of devices such as smartphones and tablets.

Improving protection against rockfall accidents on the railway networks

Hassan Al-Budairi
University of Glasgow
QTS Group Ltd

Aligned with: Infrastructure Systems
Stage of project: Established

Low-energy rockfall catch fence is a mechanical structure that is used along the tracksides in the mountain regions to stop destabilised rocks and debris, which are located on side slopes, from reaching and damaging the train track. In contrast to other means of rockfall protection systems that use bespoke components and require heavy machinery for installation, low-energy catch fence uses readily available components and requires only manpower for installation. This makes it a cheaper and a practical solution for railway safety projects. However, these fences were developed primarily by engineering, experience that cannot ensure effective protection over the wide range of loading conditions. Thus, an effective design approach is needed to ensure the fence can provide the required level of protection.

As one of the largest railway infrastructure services contractors in the UK, QTS Ltd engaged with the University of Glasgow in this KTP project to develop the design of low-energy rockfall catch fences in order to enhance safety on the railways. The project aims to develop an efficient and a cost-effective design of low-energy rockfall catch fences by using advanced numerical modelling techniques and full-scale field tests.

Integrated sludge recovery and deployment system for nuclear decommissioning

Shuai Wang
The University of Manchester
Barrnon Ltd

Aligned with: Emerging and Enabling Technologies
Stage of project: Early

In nuclear facilities, the recovery of sludge at the bottom of ponds and the deployment of varied decommissioning tools remain to be major problems without effective solutions. This KTP project aims at delivering an integrated system as a turnkey solution of the above problems. This system includes Bladecutter, Rotocutter and Hydrospyder.

Bladecutter was originally developed as a horizontal dredge system for the Hunterston A nuclear facility. Its patented design allows it to cut through and collect stratified nuclear sludge, fluidising the material as part of the process. This allows the highly dangerous contaminated material to be collected from radioactive sludge ponds and gathered for more effective storage. It has been deployed at Hunterston. It is now currently under consideration for use in the ponds at Sellafield and Fukushima (Japan). Experimental data has been collected and analysed to reduce water consumption during sludge removal. This will lead to academic contributions.

Rotocutter has been developed to break down and recover hard heel and bitumen encased radioactive waste. This type of waste exists in areas where water cannot be used because of the risk of leaching into the watercourse. It's a particularly challenging environment and no other recovery system has been deployed effectively to date. Rotocutter, however, with its extremely tough and hard wearing blades can break down the contaminated dry material and recover it efficiently. The tool is now being put through a range of tests and is under consideration for deployment at the Hanford (USA).

Hydrospyder is a floating deployment tool. Inspired by the insect the water boatman, which uses surface tension to walk on water, our Hydrospyder can float to any point and deploy a wide range of different tools. It can be operated with precision from a remote location. Hydrospyder is a remarkably useful device. Its buoyancy can be varied and, using its hydraulic legs, it can alter its size to manoeuvre into restrictive areas. The passive form has already been demonstrated to the National Nuclear Laboratory deploying Bladecutters. It has been shown as a pipe management system for sludge pipes, hydraulics and feed pipes.

Analysis of crowdsourced data to empower our cities

Michael Taylor
Queen's University Belfast
See.Sense

Aligned with: Emerging and Enabling Technologies
Stage of project: Early

As cities across the globe experience ever-increasing rates of urbanisation the transport infrastructure of many of these cities is being put under immense strain. To withstand this surge in urban population, many cities are attempting to create integrated multi-modal transport systems through the promotion of cycling. Such a system will help to deal with increased commuter demand whilst also exploiting the well-documented benefits cycling brings to both the cyclist and the environment. The safety of these cyclists is a fundamental concern not only to the cyclists themselves but also to city planners whose job it is to incorporate cycling-specific infrastructure into often well-established

transport systems. Lack of up-to-date information regarding the most popular cycle routes can often be a stumbling block for effective city planning leading to misspent funds and ultimately increased danger for the cyclist.

We at See.Sense have developed intelligent technology, which not only ensures the cyclist is highly visible to other road users by constantly reacting to the cyclist's environment but can also be configured to collect data during every second of the ride. Our cycle lights use advanced sensor technology to monitor road surface quality, brightness levels of surrounding light, bike orientation, cyclist speed and altitude, all of which can be utilised to provide detailed analysis on many different aspects of the journey. These lights are currently deployed in a number of cities across the UK and Ireland in conjunction with local councils to provide the information currently eluding city planners.

This presentation will detail preliminary results from these city trails using data collected by our intelligent and connected devices. Cycling trends of both commuters and casual cyclists will be analysed in order to deduce city-wide cycle trends. Road quality measurements will explore the smoothness of certain cycle routes and also possibility of pothole detection. This information can have an impact in a number of ways, most importantly by reducing future incidents by for example alerting cyclists of dangerous routes and informing councils and municipalities on their priority areas for cycling infrastructure provision.

The realities for grid integration of electric vehicles

Anthony Simpson
University of Reading
Drive Electric

Aligned with: Emerging and Enabling Technologies
Stage of project: Early

Electric vehicles (EVs) and plug-in hybrids are connecting to the grid in steadily increasing numbers, and with substantial growth anticipated as battery prices fall and vehicle

range improves, this presents new challenges to the management of the UK electricity system.

The University of Reading is working in partnership with electric vehicle managed charging provider and leading Electric Vehicle leasing specialist Drive Electric, to trial and analyse the impacts of unmanaged and managed EV charging on domestic (low voltage) electricity grids, and to devise a viable business model for delivering remotely managed EV charging services.

To help enable a commercial managed EV charging services, the KTP project has three streams of activity:
- Research of the landscape for the growth of EVs and the potential service opportunities for cooperative EV charging;
- Technical assessment of the capability of various EVs to support different types of services;
- Commercial modelling of the potential organisations to work with, and value potential – with the development of a business around the most accessible and viable services.

The presentation will share early research findings around the nature of EV charging patterns, and the capability to respond to remote signals to modify charging to achieve different objectives. It will demonstrate the potential for cars to reduce system carbon emissions by smoothing demand during the night away from the early evening peak.

In terms of the power of charging during a charge cycle, initial findings show variations dependent on the model of car – with some vehicles hitting full power very quickly and dropping rapidly at the end – compared to other vehicles that power up and down more gradually. This is important information to understand when forecasting for aggregated vehicles the amount of power demand over time. Finally, early data suggests well over half of EV charging is currently conducted in just 25% of the day – between 3.00–9.00pm. This highlights that the growth in EVs without technology to manage charging will cause the electricity grid at peak times to be under considerably more pressure.

Developing a reliable and cost-effective tuberculosis detection kit

Dr Josep Canyelles-Pericas
Northumbria University
Epigem Ltd

Aligned with: Emerging and Enabling Technologies
Stage of project: Early

Based in the micro-engineering company Epigem Ltd, this KTP aims to develop a usable, accurate, fast and low-cost tuberculosis (TB) detection kit. With wide benefits in emerging economies and developing regions, this venture has the potential of saving thousands of lives while helping to eradicate TB. Using state-of-the-art microfluidics research to manipulate blood sample droplets into an electronically automated process, the project integrates cross-disciplinary academic research into a commercially viable product prototype. Restricted by the remote on-field operation; energy efficiency, robustness, straightforward operation and reliability are all critical factors. The technology identified in the KTP incorporates a set of innovative and emerging technologies requiring leading-edge product design solutions. This framework is ideal in the KTP context, with a challenging manufacture, testing and calibration process. The development of this system using bio-microfluidics, molecular diagnostics, microelectronics, computing software and secure telemedicine, mixed with product design and instrumentation, is highly benefited from KTP collaborative networks.

For this, the expertise of the academic team is key, including lab-on-chip device, advanced and smart thin film materials, biomedical microdevices, micromechanics, sensors, microfluidics, nanotechnology, electronics integration and industrial design. Of particular relevance is the pioneering microfluidic and sensing work using ZnO/Al film based surface acoustic waves (SAWs) and the theoretical analysis of fluid dynamics in liquid droplets interacting with acoustic waves. Epigem's strategic vision is in providing high-tech solutions to healthcare practitioners globally. Existing projects include microfluidic, microelectrode and micro-optic components for water, blood and milk research, including

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quality, safety control and infectious disease diagnostics. Epigem's success is based on R&D-led innovation and the ability to manufacture meeting specialist technical requirements and solving problems in a wide range of applications. The company has an extensive track record in University collaboration. Now, with the first KTP project, the company is moving to design and build their own instrumentation range, implementing a robust process of design-led innovation via academic knowledge exchange. The KTP associate is contributing to create Epigem's own brand products for the first time and delivering these to healthcare diagnostic markets around the world.

Level 3 Building Information Modelling in offsite construction

Hadeel Safaa Saadoon
Queen's University Belfast
McAvoy Group LTD

Aligned with: Emerging and Enabling Technologies
Stage of project: Established

Level 3 Building Information Modelling (BIM) and Modular Manufacturing Offsite Modular construction is a crucial to improving the construction sector in terms of efficiency, cost, quality and sustainability. Modular buildings are built to the same standards as traditionally constructed buildings but they offer fast bespoke solutions. BIM's natural strengths run towards upfront planning and coordination, and that fits in perfectly with what off-site construction is all about.

Queen's University of Belfast are working in collaboration with the McAvoy group Offsite Construction Company in a knowledge transfer partnership in the aim of mastering off-site construction management's involvement with BIM projects.

The KTP research associate is investigating the use of BIM in offsite construction and the knowledge transfer gives feedback to academia on the use of BIM in practice with teaching material for the MSc course of BIM and project management at Queen's University of Belfast.

The research focuses on the following:
- BIM inspired engineering effect on the modular construction competitive costs and time savings as BIM in offsite is a whole new paradigm of benefits.
- Offsite 'modules' are designed using BIM to produce As-Built Building Information Models. These can integrate directly with existing Facility Management Systems (FM); ideal for not only buildings but also for civil/infrastructure assets and plant/facility assets.
- The use of BIM in offsite construction reduces the costs and downtime associated with construction rework, site revisits and field changes.
- Highly detailed data improves decision-making and engineering designs.
- Offsite Factory-Controlled Environment assures best production of the building modules ensuring outstanding design outcome.

The Level 3 BIM vision as part of a wider digital strategy. The vision for Digital Built Britain is to provide a seamless transition from the achievements of Level 2 BIM and the UK government strategy aims to provide an environment where technology and working with technology is second nature in construction. BIM for Offsite will lead to automated factory innovation and 3D prototyping from BIM models into manufacturing. The transition into full rapid prototyping is in the near future and it is a clear opportunity for development and innovation in offsite construction.

Synthesis of inorganic materials with near infrared absorbing properties

Elena Perez-Barrado
Keele University
Keeling & Walker Ltd

Aligned with: Manufacturing Materials
Stage of project: Early

This KTP project is developed between Keeling & Walker Limited and Keele University, located in the area of Stoke-on-Trent. The aim of the project is to

commercialise materials that absorb in the near infrared. This has many energetic applications, such as smart windows, insulation in buildings, car windows, laser marking and security inks.

The nature of the project involves working in R&D facilities in both locations. However, the cost of laboratory and analysis equipment cannot be afforded by most small and medium size-companies. Innovation and research is necessary for companies like Keeling & Walker to keep up in the very competitive business environment. It is in this context that the KTP programme provides a great link between university infrastructure and the business world. Thanks to the KTP structure, research and characterisation on interesting materials can be done at the university facilities, where a wide range of equipment, technicians and reagents are available. Also, from the university it is possible to access scientific databases that allow researchers to be informed on the latest trends in research and access to databases of chemical knowledge.

The input of the University lecturers and researchers involved in this project is greatly appreciated. For example, the knowledge on analytical techniques is much bigger now than at the start of the project. The experience of the company when scaling up materials has been of great help. Knowledge is transferred constantly from the university and from the company. From a managing point of view, as the project is managed directly by the KTP Associate it personally helps me to develop organisational skills regarding daily work, finances, scheduling meetings, etc.

At the same time, the KTP programme allows financial resources for the KTP Associate's personal development: attendance to courses and conferences that are connected with (Materials Chemistry) and access to CMI qualifications that are useful for this project regarding production and management.

In conclusion, the KTP structure enables the development of an industrial project that will finally be commercialised, with the help of the university, and ensures the KTP Associate grows his/her curriculum thanks to the personal development plan.

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The path to human behaviour analysis: minus the sci-fi

Louis Clift
University of Essex
Leonardo MW Ltd.

Aligned with: Emerging and Enabling Technologies
Stage of project: Early

CCTV systems can be seen almost anywhere in the world, especially here in the UK. CCTV systems simply capture the live environment and offer playback, more advanced systems provide features such as event detection, motion alarms or vehicle number plate recognition (ANPR). Surveillance systems are also commonly used to identify and monitor human behaviours, however the identification, monitoring and alerting is performed by humans and not machines. Monitoring surveillance systems is a complex task, involving an operator watching multiple live feeds.

Through this KTP project we are exploring the use of cutting-edge, research-driven machine learning and computer vision techniques to try to autonomously identify humans within the environment and their respective behaviour to assist the control operators and provide real-time alerts such as those requiring medical or security responses. The KTP structure creates a partnership combining industrial research and development with key academics to enable the exploration into the variety of avenues in which could enable the surveillance field to push forward and support the ever-growing demand for surveillance for the purposes of safety and risk control.

KTP confidence – projecting KTP in the company

Robert Stewart
University of the West of Scotland
Paisley Housing Association

Aligned with: Open/Other
Stage of project: Established

It's great to have confidence in your project; you have support from your company, the milestones are being met, people know who you are, and you're building experience as the project rolls forward. But, it's not unknown for KTP Associates to experience detachment from their projects. Factors such as; sponsors losing interest, lack of progress and loss of focus on the end product can knock the confidence of any Associates.

So what can you do to avert this? Below, are listed nine suggestions to promote project visibility and build confidence in the project method and outcomes:

1. Stop the project for one month while you review/redraft the project plan. You now have a business plan whose aims are realistic, manageable and achievable.
2. Buy a large whiteboard. Put it on a wall visible to senior managers. Use it as a calendar with major issues/tasks. Project sponsors become familiar with resource demands.
3. Buy another large whiteboard. Put it on a wall visible to general staff. Outline the project goals and anticipated gains. Working colleagues become familiar with project aims.
4. Use Cloud-hosted project management software, eg, Atlassian: include key staff as users. Stakeholders can keep up to date with project progress at a finer detail.
5. Update the calendar board on a daily basis and the other board on a weekly basis. Your project is seen as dynamic and mobile. You can track your own progress.
6. Request to produce a lecture or short set of lectures using your project as subject matter. Try to do this each year. You have now become a 'Guest Lecturer', and can talk comfortably about your project.
7. Attend as many KTP seminars as reasonable. Learn from other Associates' experiences; discover their achievements and strategies for success.
8. Book yourself onto a conference. Some conferences have Dev Paper sessions where you can submit papers for the purpose of discussion.
9. Take your scheduled holidays! Book that plane, lie on that beach and order that mojito. No-one deserves it more than you!

Chancellor's Court, University of Birmingham

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Novel polymer rolling elements bearings for the automotive industry

Karolis Vilcinskas
University of Bradford
BNL Bearings

Aligned with: Manufacturing Materials
Stage of project: Early

BNL Bearings is the world leader in integrated plastic bearing solutions for variety of industries, most notably the automotive sector. Bespoke BNL bearings have been successfully utilised in the commercial vehicle steering columns, where they are positioned in the lower and middle sections of the steering column assembly to ensure a smooth and robust rotation. The company aims to strengthen its position in the automotive market by expanding its product portfolio to the upper and firewall bearing positions in the steering column assemblies. However, the harsh operating environment of the upper and firewall bearings calls for the polymeric materials with the excellent thermal and mechanical properties. In addition, the viscolelastic nature of polymers and the complex tribological behaviour of polymer bearings render the product performance and lifetime prediction difficult. Therefore, in-depth knowledge and technological support from an academic partner is vital to the success of the company.

In order to address these issues and to achieve its strategic goal, BNL Bearings, aided by Innovate UK, has formed a partnership with the University of Bradford. The alliance with the outstanding academic partner has allowed the company to undertake the research and development programme into polymeric materials that are suitable for the rolling element bearings operating in the extreme environment. Having gained access to the world class research facilities available at the university, the pre- and post-life properties of existing as well as new polymer rolling element bearings have been currently investigated. The obtained data together with expertise of the academic staff involved in this partnership will be used to design a model to validate bearing performance and lifetime. Finally, the bearing prototype will be built, tested and introduced to customers.

In this poster, I give a brief introduction to the project, offer a short overview of the polymer bearings in the light vehicle steering column assemblies, outline challenges of the project and benefits to the each party involved, and define the anticipated outcomes.

Novel conductive polymer-based composites with tuneable pyro-resistive properties for use in specialist industrial heating applications

Dr Harshit Porwal
Queen Mary, University of London
LMK Thermosafe Limited

Aligned with: Emerging and Enabling Technologies
Stage of project: Established

One of the major challenges with industrial heating devices remains with temperature control using thermostats which limits its application in hazardous areas. Currently a better control in temperature for industrial heating applications is provided by rigid trace heating cables that are expensive to install and maintain. In the present work we demonstrate the compound optimisation, fabrication, characterisation and working of SMART heating devices especially for hazardous areas applications. The produced intelligent devices are shown to self-regulate at a specific temperature while changing the power output automatically depending on the operating temperature. The devices are also independent of external temperature change with their operating temperature ranging from -25 to 120°C. The smart heating devices produced are more energy efficient, significantly less expensive to install, flexible, and easy to adapt to different sizes, shapes and applications. The patent is pending for the smart heating devices developed.

Applying psychology and human factors to improve and understand accident risk in a large safety critical organisation

Rajkiran Kandola, MBPsS
Leeds Beckett University
Amey Plc.

Aligned with: Health and Life Sciences
Stage of project: Early

The overall objective of this 36-month KTP is to develop, implement and embed a structured safety behaviour framework with the aim of reducing safety incidents, leading to improved wealth creation through cost reduction. The partner organisation, Amey Plc. is a leading supplier of consulting and infrastructure support services in the UK and internationally. This KTP is based within its Consulting and Rail business unit, where its employees operate within safety critical environments on a regular basis. Although Amey Plc. has an excellent safety record, accident rates have now reached a plateau above zero. Amey Plc. recognises that a further understanding of accident risk and human performance in its safety critical operations is required in order to achieve their target zero objective.

The poster aims to cover the benefits of a KTP derived from social science and applied psychology, how this is beneficial for a particularly large organisation, the associate and academia despite being in its early stages.

Development of bespoke commercial render repair products

Callum Robinson
Queens University Belfast
Kilwaughter Minerals Company

Aligned with: Manufacturing Materials
Stage of project: Established

The remit of my KTP project was the development of external render repair products. This included both a masonry

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coating and a repair filler. My poster aims to offer an insight into the types of remedial damage that are encountered on external render and how both products have been formulated to ensure a compatible and permanent solution. The poster also provides an overview of the R&D process from a lab based formulation into a commercial product ready for launch.

Siemens Test Automation Process Management System (STA-PMS): KTP creating a step change in gas turbine acceptance testing

Jombo Gbanaibolo
University of Lincoln
Siemens Industrial Turbomachinery Ltd

Aligned with: Emerging and Enabling Technologies
Stage of project: Early

Industry specification and customer demands dictate that all gas turbines, new and overhauled are tested and certified prior to shipment. The conventional approach for gas turbine acceptance testing proceeds in a sequential manner, relying heavily on manual interventions. In the event of a test failure, the conventional approach falls short of diagnosing the cause of the fail without incurring huge test cost due to increased testing times, logistics and personnel cost and increased fuel usage. Siemens Industrial Turbomachinery Ltd (SITL) with an operational fleet of over 1,700 gas turbines returning for overhaul and testing every three to four years and together with the demand for new engines, a step change in how SITL test and certify her engines is critical for business growth. This KTP project develops a bespoke test automation process management system that integrates test documentation management, test data acquisition, automated diagnostics, test data analysis, fault and management reporting to create a streamlined platform for testing gas turbines. For the company (SITL), the project will cause an increase to its testing capacity by +25% due to reduced testing time as compared to status quo, reduce fuel burn, increase test productivity and provide bespoke test

automation software. For the university (University of Lincoln), the project benefits are enhance its profile with regards to collaboration with industry, showcase the industry-relevance of its research, publication of high-quality journal and conference papers and provide a suitable case study for submission to the university's Research Excellence Framework (REF) ranking. For the associate, the project benefits are an opportunity to take ownership of a project which will be a step change in test automation in Siemens, acquire an invaluable commercial experience and also training and professional development.

BCMY Stock Management System, a Business Decision Support System

Ajibola Emmanuel Obayemi
University of Brighton
BCMY Ltd

Aligned with: Emerging and Enabling Technologies
Stage of project: Established

This poster will illustrate the techniques and methodologies applied to solving a pertinent business problem in the sale of recycled printer cartridges. Specifically, in negotiating sales of products with several attributes and functions.

Currently, sales negotiations are solely based on tacit knowledge and as such all sales go through one channel making it difficult for the company to scale or grow as desired.

There are several considerations that determine whether each line of an order is good or bad for the seller, and then a second layer of reasoning that determines whether the good outweighs the bad in a particular order. The BCMY Stock Management System is a business decision support system which utilizes algorithmic modelling, Artificial Intelligence/ Machine Learning techniques and Predictive Analytics to suggest base pricing, optimal pricing and highlight the goodness factor of a sales deal by spotting the performing and non-performing product lines. The business insight also facilitates on-demand stock levels reporting and visualisation of KPIs.

The technology used is heavily based on analysis of past data. The demand for products can change rapidly if new printers are released; old cartridges are declared obsolete by the original manufacturer, making second-hand cartridges more valuable; or proprietary cartridges are re-manufactured in breach of copyright. The system dynamically derives a suggested price for a cartridge from past sale prices, past demand, and past prices proposed but rejected in the course of negotiation.

A benefit to the business is the enablement of multi-channel sales and optimised sales workflow allowing market expansion and business growth. Additionally, it is envisaged that the system will facilitate demand forecasting by predicting cartridge performance over a period allowing the application of the right pricing strategy.

It is estimated that the system will significantly increase the business partner's turnover by £1.4million in three years, creating additional jobs and funding for the printer cartridge recycling programmes. Benefits to the Associate and knowledge base will be highlighted in the poster.

Bibliography: *Ferreira, K.J., Lee, B.H.A. and Simchi-Levi, D., 2015. Analytics for an online retailer: Demand forecasting and price optimization. Manufacturing & Service Operations Management, 18(1), pp.69-88.*

Sandoh, H. and Larke, R., 2002. A theoretical model for testing new product sales velocity at small format retail stores. RAIRO-Operations Research, 36(2), pp.157-172.

Improving security of digital financial solutions through machine learning

Gavin Fenton
Queen's University Belfast
Intelligent Environments

Aligned with: Emerging and Enabling Technologies
Stage of project: Early

Intelligent Environments is an international provider of innovative mobile and online solutions for financial services providers.

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For many years they have been the digital heart of a diverse range of financial services providers including HSBC, Bank of Ireland, Atom Bank, Lloyds Banking Group and many more.

A key problem they and their competitors face is the increasing threat of cyber security breaches and the impact they can have on both their clients, and their end users, i.e. every day bank and financial service users like you and I. With billions being lost every year and thousands of customers being affected by bank & credit fraud each year, it is key that financial service providers and their suppliers stay on top of the mounting threats faced in an increasingly online world. Intelligent Environments aim to do this by preventing over reliance on hard coded security rules – which hackers can often circumvent – by employing the latest technologies in machine learning. Using machine learning, behavioural analysis can be performed to determine the difference between everyday users and those who are using the systems with malicious intent in real time.

With the success of this project, not only will Intelligent Environments further differentiate themselves as a market leader when it comes to the security of their financial software, they will also prevent the stress and financial loss caused to their clients' customers every time there is a security breach, potentially saving millions per client through prevention.

Dynamic optimisation for intelligent manufacturing systems

Ayush Joshi
Aston University
Zenzero Software

Aligned with: Emerging and Enabling Technologies
Stage of project: Early

The objective of this KTP project is to develop automated solution generation capabilities for one, two and three-dimensional stock cutting using mixed integer linear programming and evolutionary algorithms, in an existing Zenzero application for the metal cutting industry. The software 'metal-al' will be enhanced with prediction and learning capabilities using machine learning, specifically deep learning with the goal to improve yield, reduce waste and reduce costs for the metal company. The benefits for the three parties involved are envisioned to be as follows – development of an innovative product whilst embedding knowledge of optimisation and machine learning within the Zenzero software team enabling them to grow software development activities; application of research interests in a commercial environment and high quality publications along with potential final year projects/research-led modules, which benefits the university; and finally, the associate benefits through the experience of managing complex projects as well application of theoretical concepts to commercial scenarios, algorithmic development, improve communication at technical and end user level as well as experience of road-mapping of future product plans.

The world's largest underground indoor skatepark

Carlotta Giussani
University of Brighton
The Source BMX

Aligned with: Open/Other
Stage of project: Early

The Source BMX Ltd was initially founded in 2003 as a retailer store for BMX. Today, the Source BMX is an award-winning business recognised as the leading retailer in the BMX and skateboarding markets. In February 2016, the Source BMX launched the Source Park in an historic Victorian building beneath Hastings seafront. The Source Park is the largest underground indoor skatepark in the world and it has become a catalyst for major BMX Freestyle and Skateboarding events. Accordingly, this Knowledge Transfer Partnership (KTP) project aspires to embed sports coaching expertise to create the first formalised coaching pathway for BMX freestyle and skateboarding. Indeed, this project aspires to propose marketable coaching offer and leverage value to further drive the business to the Source Park and to its Source BMX retail store. Besides, this project aims to capitalise on the Source BMX and the increasingly attractiveness of BMX freestyle and skateboarding to increase grassroots participation and expand potential opportunities rising from the recent inclusion of BMX freestyle and skateboarding in the 2020 Summer Olympic Games in Tokyo.

Majestic Analytics: Big Data Analysis

Dr Vasiliki Chatzikonstanti
Aston University
Majestic 12

Aligned with: Open/Other
Stage of project: Established

This is a project between Majestic 12 Ltd and Aston University, Aston Business School that aims to extract information from large data sets in ways that bring new meaning and insight to the data and to develop a suite of configurable tools to enhance interpretation. By using leading edge statistical and computational techniques we created new tools to analyse the emerged patterns and relationships within big data. Specifically, we identified an inherent issue within the data collection process and proposed a procedure that generates not only Big Data, but Better Data which are suitable for statistical analysis.

Design and performance of flexible composite materials for space

Alex Brinkmeyer
University of Bristol
Oxford Space Systems

Aligned with: Open/Other
Stage of project: Established

This KTP project aims to characterise and predict the performance of deployable, flexible composite materials for space applications. Flexible composites are one of the core technologies employed by Oxford Space Systems (OSS) to develop and fly deployable structures that are lighter, simpler, and more cost effective than current products in commercial demand. Deployable structures are used for an array of satellite applications, such as solar panels, telescopic booms, and large unfurlable antennas. The first objective

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of the KTP is to gain a thorough understanding of materials and processes compatible with the space environment, such that a range of flexible composite materials can be competently and confidently produced in a repeatable manner. Essentially, the activity goal is to produce a detailed portfolio of foundations, through knowledge transfer from the University of Bristol, from which Oxford Space Systems can select to design and construct hardware for commercial exploitation. The second objective takes the form of developing a software 'toolkit' that can be demonstrated to have a robust and reliable correlation with practical sample materials. The toolkit's end users are OSS mechanical designers – with this new software OSS aims to acquire a unique 'design-to-build' capability with significantly lower lead times than competitors. This set of models, underpinned by practical work, is also intended for use by OSS to reassure commercial customers that the novel materials the OSS intends to commercialise are suitable for space flight. The poster describes the main elements of this 'toolkit', with the main performance indicators it provides. The poster also shows the applications that have directly benefited from using the software, including the recent AstroTube boom launched in space in September 2016, the multifunctional embedded boom developed under the NEOSAT project, and an antenna-boom system currently under development by OSS.

SignSense: a dynamic signature verification platform for authentication on mobile devices

Sandipan Pal
The University of Buckingham
Deepnet Security

Aligned with: Emerging and Enabling Technologies
Stage of project: Early

The aim of this project is to research and develop a sophisticated, convenient and reliable authentication tool based on dynamic signatures on mobile platforms. With the growing virtual presence of individuals/organisations on the World Wide Web, verifying authentic users is of paramount importance. Secured PIN services and passwords are definitely robust solutions but the ever increasing threats to these authentication modalities make them more vulnerable with the passing day. SignSense is a novel platform that would help an individual or an organization to authenticate a user based on their signatures. The user would be able to authenticate themselves by providing their signature on mobile phones or tablets. SignSense uses state of the art signal processing and machine learning techniques to authenticate pre-enrolled users. SignSense is a browser-based platform which can work on different touch-screen devices (mobiles, tablets, laptops etc.). The data used to authenticate an individual is completely anonymized and encrypted in such a fashion that it would be practically impossible to reconstruct the signature of an enrolled user in an event of a security attack.

This two-year project combines the academic expertise of the knowledge base partner on biometrics-based authentication and the industry position of the company as a leading provider of multi-factor authentication to offer the next generation solution of authenticating a user using a mobile device. SignSense as a prototype platform has been demonstrated at an international event (Biometrics 2016, London, UK). The poster will outline the aim and objectives of the project along with the milestones achieved over the past 1 year. The poster will also detail a brief overview of the prototype system that has been developed and also focus on the collaboration outcomes of the project till now along with the tangible benefits of this partnership.

Trust and user privacy are the two pillars on which SignSense is envisioned. SignSense offers a combination of the security of using one's biometric imprints as well gives the flexibility of personalizing the imprint. SignSense would pave the way in which individuals and organizations would carry out virtual transactions in the coming decades.

Reliable service delivery over challenging communication networks

Ognen Ognenoski
Kingston University
Vocality

Aligned with: Emerging and Enabling Technologies
Stage of project: Early

Solutions enabling reliable delivery of voice, video and data communication services are relevant to several key markets, including government, military, transport and the private sector. Design and implementation of these solutions is a challenging project that requires expertise and experience in different areas, making the KTP partnership model suitable for undertaking such project. The primary goal of this project is to develop a novel and marketable solution capable of reliable service delivery in challenging networking environments, suitable for different use cases such as forming adaptive communication network (Mobile Ad-Hoc Network) for first responders and military communications over different networks (satellite, 4G, Wi-Fi).

Through the knowledge transfer process, the key technologies and tools were identified in the specification and design stages for the envisaged solution. The relevant achieved milestones to date are comprising components of the end solution which provides the following benefits: 1) enriching the service portfolio of the company, thus improving the business potential; 2) increasing the understanding regarding requirements from different industries for the knowledge base; and 3) gaining experience in transferring research concepts in commercial solution for the associate. The future goals outlined in the project include completing the development and testing a wide range of functionalities of the end solution in real-world scenarios.

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Our KTP is all in 'vein'

Dr Jaya L Nemchand
University of Surrey
The Whiteley Clinic Ltd

Aligned with: Health and Life Sciences
Stage of project: Established

Endovenous thermoablation is NICE approved for the treatment of leg varicose veins. Pelvic venous reflux (PVR) has been demonstrated to contribute to the development of primary and recurrent varicose veins. During thermoablation, tumescence is used. Tumescence cannot be used for the treatment of PVR. Patients want to avoid tumescence for leg varicose vein surgery. There is a need for a tumescent-less device to ideally treat both leg and pelvic veins.

The KTP at the University of Surrey and The Whiteley Clinic Ltd aims to develop a medical device to treat truncal varicose veins and pelvic veins without tumescence. The experience of medical device development from the KTP will enable the clinic to develop its portfolio alongside its world leading clinical practice.

This vision would be achieved through collaboration and sharing of best practice between the knowledge-based and company-based partners. From the initial project plan, of developing a medical device, there has been other spin out projects with the current knowledge based partner as well as other knowledge based partners.

The KTP accelerated the transformation of the company as a clinical service provider with research interests and capability to a company with a dedicated research, development and teaching department. The new department aims to create and innovate medical devices and improve surgical techniques based on scientific research to lead in transforming patient outcome and experience with a view to reduce cost and stay competitive within the world of phlebology.

This expansion led to the organisation of the 1st International Veins Meeting under the College of Phlebology, an internationally recognised institution with the education of medical professionals as one of its main objectives.

This KTP resulted in significant business growth within The Whiteley Clinic, enabling additional research projects to be initiated in collaboration with the University of Surrey and other academic institutions. Moreover, it has facilitated collaborations with major venous medical device manufacturers opening the pathway for contract research work. From the associate perspective, the experience from this exponential growth has been unparalleled with an opportunity for an absolute fast track growth and career progression.

Spot-the-difference on your train ride – automated geotechnical monitoring using mobile mapping systems

Hao Jing
University of Nottingham
3D Laser Mapping

Aligned with: Emerging and Enabling Technologies
Stage of project: Established

The project objective is to design and build an automated mobile monitoring solution that performs near real-time condition monitoring and hazard warning for railways and highways. With 3D Laser Mapping's expertise in integrated mobile mapping system which consists of a high-grade navigation system and laser scanner, the aim is to integrate a black box solution to process and analyse the data streaming out traditional mobile mapping systems and create a complete hardware and software package that provides the end user with surrounding environment information rather than simple data.

The main challenge of developing such autonomous systems is ensuring that the same data quality and accuracy is produced when the system is working in a variety of environments, including going through urban areas, cuttings and tunnels where navigation solution is degraded due to loss of positioning satellites. Therefore, partnership with the University of Nottingham bridges the gap in expertise.

Another part of the challenge is implementing an efficient data strategy to deal with the mass quantity data coming out of mobile LiDAR systems. Again, the University of Nottingham has extensive experience and knowledge in big data and cloud computing applications for digital economy and location-based services.

The key points of the poster will include the designed solution to the problem, the contributions and benefits of the partnership and up to date outcomes of the project as well as some expected outcomes in the following year.

Family Law Partners and University of Brighton 2016

Samashwin Paul
University of Brighton
Family Law Partners

Aligned with: Emerging and Enabling Technologies
Stage of project: Early

The KTP project is a collaboration of University of Brighton (the Knowledge Base partner), Family Law Partners (the company) and myself (the KTP associate). The goal of the project is to design, develop and market an Artificial Intelligence (AI) based decision support system that can be used by family law solicitors to improve the efficiency and quality of their work.

The increasing demand on lawyers from clients to optimise their work and clients' reluctance to pay for what they perceive as procedural work has resulted in the law firms no longer being able to depend on the 'billable hours' business model to generate profits. Instead firms are turning to technology to improve the efficiency and quality of their service. Recent advances in Artificial Intelligence are enabling machines to perform tasks such as case research, document analysis, case management etc., tasks that previously required human intellect. The potential for AI in the legal sector is vast and is the reason why this project uses AI to create a decision support system.

The system will contain three modules: 1) The financial module analyses the other party's bank statements to ensure they have disclosed

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all relevant financial documentation. It also analyses the statements to identify abnormalities in his/her spending patterns, sources of income and undisclosed accounts. 2) The second module will be the Triage module which reviews a potential client's position and recommends an appropriate course of (legal) action. 3) Finally, the recommender module uses the information from the Triage module and directs clients to either mediation, arbitration or collaborative legal practice.

The benefits of this project are three-fold: Firstly, for the university, the project enables the implementation AI principles to a real-world problem, thereby generating a real life case study of knowledge capture, knowledge modelling and knowledge system development. The lessons learnt from the case can then be fed back into the university curriculum. Secondly, for the Law firm, the project creates a software that can be used efficiency and quality of their service.

Finally, the associate gets first-hand experience in various business areas – project management, software development, marketing, finance etc.

Building design freedom through understanding new materials

Dr Marco Dona
University of Cambridge
Newtecnic ltd

Aligned with: Emerging and Enabling Technologies
Stage of project: Established

The continuous increasing demand for more energy efficient and durable buildings combined with the desire of many architects for complex/free-form geometries have brought the construction industry to look into less common materials. Two examples are Glass-fibre Reinforced Concrete (GRC) and Fibre Reinforced Polymer (FRP). These materials are gradually taking the field to replace less durable steel or concrete systems. GRC and FRP can both be used to manufacture panels of complex shapes with the only geometrical limitation given by the transportation limits. The final envelope is then achieved through on-site mechanical connection systems between adjacent panels. Indeed, the behaviour of the load-bearing systems for GRC and FRP, especially when new joint systems are proposed, is still unclear. There is a lack of knowledge on the possible failure mechanisms and therefore on the performance of the connections. This represents one of the principal barrier to their widespread use in the construction industry.

There is then a need for an efficient procedure that allows to gain the required confidence on the performance of these new systems where unconventional materials are used. The procedure includes a cost effective combination of numerical modelling and experimental investigation of the proposed solutions.

The aim of the project is to develop a design assisted by testing procedure to efficiently investigate the properties of nonstandard materials used for building envelopes. The focus will be on mechanical connections for GRC and FRP panel systems applications.

The project focuses on several areas: 1) Definition of the type of tests and the number of samples to consider in an experimental investigation. 2) Quantification of wind load pattern over the service life of façade components. 3) Modelling of localised stress concentration using Finite Element with particular attention on GRC and FRP panel systems. 4) Investigation of bonding between structural elements, focusing on the adhesive selection and the analysis of bonded connection system between building materials. 5) Apply the proposed testing procedure to real case studies where numerical modelling, material characterisation and experimental tests have been efficiently combined together.

Off-site modular technology – future of construction

Hung Phung Quang
Queen's University Belfast
McAvoy Group

Aligned with: Infrastructure Systems
Stage of project: Early

The project is to improve the structural design and analysis for modular construction. It covers: link of structural model to BIM, link of structural model to fabricator model, improve factory construction and apply VR for construction.

The insect eating revolution: improving the sustainability of insect farming

Douglas Moore
The University of Nottingham
Monkfield Nutrition Ltd.

Aligned with: Health and Life Sciences
Stage of project: Early

The challenge: Population growth and changing diets are predicted to increase global food demand by 70% by 2050. Meeting this demand using traditional agriculture would lead to an unsustainable increase of habitat loss, greenhouse gas emissions and fresh water demand. Insects have been identified by the EU and UN as a sustainable way of meeting this demand due to lower demands on these resources.

Monkfield Nutrition are the largest insect farm in the UK, weekly producing over 4 million insects as pet food. With over 25 years' experience in this sector the company is ideally positioned to exploit this opportunity. The aim: This KTP is intended to make Monkfield Nutrition more competitive in its current market and facilitate its entrance into the human food market.

The tools: Poultry farming is the form of traditional livestock which is most comparable to insect rearing due to chicken's highly industrialised production and high food conversion rate. This efficiency stems from 50 years of intensive development across a broad

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spectrum of areas including: mechanisation, genetics, growth stimulants, nutrition, and feed and environment optimisation. Yet insects, essentially unimproved wild animals, are already more efficient and sustainable at producing high-quality protein. Therefore, using the toolkit developed rearing traditional livestock, and working with very efficient organisms, the potential for improvement is excitingly large.

My role: Currently I primarily focus on researching the use of diet to improve cricket growth rates. Cholesterol has been shown to improve developmental rates in many insect species and, when applied in a mass production setting cricket growth rates, in three commercially important species, were improved by 25% over control diets. Collaboration is now ongoing with a feed producer to incorporate cholesterol into the commercial cricket diet.

Secondly, I am leading the project to prepare Monkfield Nutrition to enter the human food market which should occur by the end of 2017. I am managing grant applications, equipment assessments, food safety certifications and novel food applications.

A wireless-embedded platform that automatically recognises insect images taken from pheromone traps at remote locations

Yuan Liu
University of Buckingham
Russell IPM

Aligned with: Emerging and Enabling Technologies
Stage of project: Early

Pheromone-based traps for insect monitoring have been developed by Russell IPM for various farming insects for over 25 years as part of an integrated pest management. Currently, insect are manually recognised and counted on the trap by specialist workers, which is slow, labor-intensive and highly dependent on the specialist's knowledge. The aim of this KTP project is to deliver a smart trap that incorporates image processing tools and Internet of Things connectivity in a power-efficient embedded system.

The process is automatically processed at regular slots every day. To achieve this, two main intelligent techniques are being developed: image recognition and hierarchical embedded system. This poster presents the results of the work done so far for single-type-insect counting on a BeagleBone Black platform with a Zigbee Wireless Sensor Network. Several multi-species insect recognition is being evaluated before being embedded with this system.

Vision-guided intelligent toolset for automatic control of industrial robots

Naresh Marturi
University of Birmingham
KUKA Robotics UK Ltd.

Aligned with: Emerging and Enabling Technologies
Stage of project: Established

Kuka robotics is one of the world's leading suppliers of industrial robots. With this project, the company plans to integrate advanced AI and machine vision capabilities with their robotic systems to facilitate smart and adaptive control operations. The main objective was to bring in the state-of-the-art computer vision knowledge from the university to the company and build a software toolbox of vision competencies that are industrially robust.

Upon analysing the current market requirements, various adaptive 3D vision tools are developed during this project for detecting, recognising and localising a variety of objects in manufacturing environments. Programmed vision algorithms are also integrated with advanced motion planning techniques and machine learning methodologies to demonstrate challenging tasks like intelligent human-robot collaboration, manipulation of complex industrial objects for car manufacturing etc. Recently developed vision-guided dynamic planning methodology has enabled Kuka's collaborative robot iiwa to function more systematically and intelligently by responding to human actions. These developments not only helped company in reaching new customers but also the university in securing new grants.

Developing vaccines in a can of Coke®: microcarrier use in ambr® 250 high throughput systems

Marco Rotondi
Aston University
Sartorius Stedim Biotech

Aligned with: Health and Life Sciences
Stage of project: Early

Renewed interest in microcarrier-based processes for the large-scale culture of adherent cells for vaccine and cell therapy applications drives the need for effective, high-throughput, single-use, process development tools that can be translated successfully into industrial-scale systems. The automated ambr® 250 platform is one such technology, operating at a volume between 100 – 250mL, and which is both high-throughput and single-use. Sartorius Stedim Biotech Group is the ambr 250 developer and manufacturer, with a large experience in bioreactor production with a high level of automation. The ambr 250 has demonstrated significant success for suspension-based mammalian cell culture applications; however no studies have been reported investigating microcarrier-based processes for the culture of adherent cells.

With any cell culture process, the fluid dynamics characteristics of the bioreactor must be sufficiently well understood to enable successful scale-up to larger-scale bioreactors. With microcarriers, there is an additional challenge as the fluid dynamics must take into account the presence of the particulate solid phase. A critical aspect for cell cultivation on microcarriers is the minimum agitator speed required to achieve complete microcarrier suspension, NJS. Under these conditions, the surface area of the attached cells is available for transfer of nutrients (including oxygen) to the cells and metabolites from them.

Higher speeds hardly increase these transport processes and may lead to damaging fluid dynamic stresses being generated.

The aim of this KTP project is to develop a novel bioreactor for microcarrier applications.

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The Aston University research group has been publishing a number of high ranked papers on cell therapy and bioreactors during the last years, developing a high level of knowledge on microcarrier culture in bioreactors.

As my PhD, I extensively worked on Computational Fluid Dynamics (CFD) simulations and multiphase flow modelling. Combining the different competencies will enable the group to develop a new bioreactor for microcarrier culture. An investigation on how to optimise the whole process for product development will be also part of the project. This may imply the modification of the ambr 250 high throughput software and hardware.

DC-DC converters for offshore windfarms connections

Hassan Taghizadeh-Esfanjani
Loughborough University
GE's Grid solutions

Aligned with: Emerging and Enabling Technologies
Stage of project: Established

Recently, worldwide interest for renewable energy sources has increased dramatically which has led to new high power applications for DC-DC converters. The UK generates more electricity from offshore wind than any other country in the world. The sector is meeting around 5% of annual UK electricity requirements and this is expected to grow to 10% by 2020. Offshore wind farms are receiving more attention because of the more consistent winds that can be found over the oceans. In addition, locating wind turbines offshore overcomes the problems of acoustic noise that are prevalent with onshore turbines. Wind farm power ratings are expected to grow leading to numerous connections between wind turbines and expensive cable collection systems. For large offshore wind farms located far from shore, a High Voltage DC transmission (HVDC) system provides an economical solution for bringing the power back to the grid compared with its AC counterpart. Furthermore a DC grid is more favourable and cost-effective for the interconnection of large offshore parks as it does not suffer from the problems associated with AC grids such as reactive power,

harmonics and limited transmission length. A high power DC-DC converter is a key component to realise future offshore DC grids which is required to interface the offshore wind farm to the offshore DC grid. The role of a DC-DC converter in DC grids is same as a transformer in an AC grid and is essential for the efficient operation of the network. This project aims to develop a compact, modular and high efficient DC-DC converter for connection of offshore wind farms to offshore DC grid. This will improve the overall performance by lowering the construction cost of offshore platforms and cable systems and reduce the losses in the collection system.

Using machine vision and machine learning to create a data warehouse of tyre information

Wajahat Kazmi
Aston University
Wheelright

Aligned with: Emerging and Enabling Technologies
Stage of project: Established

This KTP project was a partnership between Aston University and WheelRight Ltd based in Oxford. WheelRight has already developed a road mounted device which, when driven over by a vehicle with pneumatically inflated tyres, calculates the pressure in all the vehicle's tyres, measures vehicle weight and load distribution and automatically inspects tyre tread condition. The work with Aston University under the KTP was aimed at implementing Machine Vision and Machine Learning techniques to increase the analysis of the images, retrieve additional details and create a data warehouse of tyre information. The goal was to make the process of tyre inspection automatic, accurate and easy to use. In this regard, this project aimed at acquiring tyre sidewall images. State-of-the-art machine learning techniques (deep learning) were used to analyse the images, retrieve manufacturer data and create database of tyre information.

Towards its conclusion in May 2017, this project has produced a product which includes all the components from outdoor cameras and lighting to image acquisition and processing. It automatically detects a driveover, acquires tyre sidewall images, detects tyres in the scene and then reads the text on the tyres (black text on black tyres). The product is in the test/trial phase at the company and is expected to be deployed to a customer site later this year.

Chancellor's Court, University of Birmingham

UNIVERSITY OF BIRMINGHAM

Edgbaston, Birmingham,
B15 2TT, United Kingdom
www.birmingham.ac.uk

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