Introduction

This year's Connected Everything conference ‘Designing a Connected Future’ is approaching fast. It will be held on 25 and 26 June at the Jubilee Conference Centre, University of Nottingham. We are delighted that our key note speakers will be Professor Jan Godsell, WMG University of Warwick and Carol Brigley, Mondelez International. Further details are on the website, where you can also register to attend and, if you haven't already, submit an abstract for a poster presentation. New themes, including 'Creativity and Product Design' will feature.

The Connected Everything Executive Group has just released a Research Challenges report which specifies four key challenges:

1. One hour from design to delivery
2. Right data, right format, right time
3. Feeling the pulse of the “factory"
4. The responsive supply chain

The challenges are presented as provocations, to stimulate debate and discussion, and provide a starting point for identifying specific research gaps to be addressed. The report is intended to support all those working in research and innovation in digital manufacturing and future industrial systems in their analysis and strategies for future work. It is available for download from our website.

A total of eight placements have now been awarded in our Early Career Researcher Placement Scheme. The latest award recipients are Dr Elizabeth Argyle and Sonia Cisneros-Cabrera. Elizabeth's placement is with Rolls-Royce Plc and Sonia will be visiting both The Technical University of Graz, Austria, and the Aalto Business School, Finland. We also held a Shared Learning Workshop on 13 February, at the University of Nottingham, which brought together members of our feasibility study teams, together with the Early Career Researchers who had completed placements. Valuable information, opinions and feedback gathered during the afternoon will help shape future work. Read on to find out more about the network’s activities and for other news from the Digital Manufacturing community.

In the past few months, Connected Everything has provided support to EPSRC with regard to supporting closer links with the African Research Universities Alliance (ARUA), to the project team developing the Brunel Challenge (focussing on engineering design) proposal as part of an ISCF Wave 4 submission and to a number of network members promoting events or job opportunities. We are always happy to connect members with opportunities and information channels. Please get in touch if you have an opportunity that you would like us to disseminate.
Connected Everything Research Challenges report published

Building on the thematic area reports published in 2018, we are delighted to announce the publication of the Connected Everything Research Challenges report, which can be downloaded from the website. The report is intended to support all those working in research and innovation in digital manufacturing and future industrial systems in their analysis and strategies for future work.

The four key research challenges identified in the report are:

1. One hour from design to delivery
2. Right data, right format, right time
3. Feeling the pulse of the “factory”
4. The responsive supply chain

The work behind this report was also used to inform the ISCF Made Smarter proposal, which was approved for funding in the 2018 Autumn Budget Statement.

Connected Everything Conference - "Designing a Connected Future" University of Nottingham, 25-26 June 2019

Delegate registration is now open for Connected Everything's annual conference, which will be held at the Jubilee Conference Centre, University of Nottingham, on Tuesday 25 and Wednesday 26 June 2019. The early bird rate of £75 includes 2 days at the conference and an evening dinner at the city’s Council House.

Contributions from areas of relevance to digital manufacturing are welcome.

Details of the call for abstracts for poster presentations

Conference themes include:

• Creativity and product design
• Industrial Internet of Things
• Data analytics and decision making
• Service design and customisation
• Design for future manufacturing
• Cyber-physical production systems
• The future industrial worker

PhD students and Early Career Postdoctoral Researchers - look out for details of the digital manufacturing career workshop planned for inclusion in the Conference programme on 26 June. A wide range of discipline areas are relevant as current directions in digital manufacturing increasingly draw on the knowledge and skills of people with backgrounds in the whole range of STEM subjects including computer science, mathematics, physical sciences, as well as engineering.

Feasibility Studies

Feasibility study End of Project reports and Case Studies

The feasibility studies funded in round 1 have now all completed and are reporting their findings. You can read about the projects, their findings, and their plans for follow-on investigations in their End of Project Reports. Case studies are also being produced in a similar form to last year’s information sheets. These will provide a brief overview of each project.

View both the End of Project Reports and Case Studies at these links, for these feasibility studies:

Investigating spoken dialogue to support manufacturing processes
Feasibility of capturing crafts-based knowledge in an AI System for future autonomous precision surface manufacturing
Circular 4.0: Using digital intelligence in automotive parts remanufacture to enable a circular economy

Case Studies are available for the following feasibility studies, and their End of Project reports will be added soon.

BREWNET: Intelligent cloud connected sensors for economic small scale process optimisation
Towards additive manufacturing process control using semi-supervised machine learning

Other reports will be uploaded in the coming months.
Computing Craft feasibility study team – paper published

Congratulations to members of the feasibility study team "Computing Craft: Manufacturing cob structures using robotically controlled 3D printing", and their collaborators, on their recent publication.


Spotlight on....Dr Ella Mae Hubbard

Dr Ella-Mae Hubbard is a member of the feasibility study team 'Digitalisation of Collaborative Human-Robot Workspaces'.

Ella-Mae was awarded a PhD in Human Sciences (Ergonomics) at Loughborough University in 2010. She continued at Loughborough University as a lecturer in systems engineering, focusing primarily on systems design and organisational systems. In 2017, Ella became a Senior Lecturer in Systems Engineering and has been Programme Director for the Systems Engineering Undergraduate programme. She is now part of the Intelligent Automation Centre at Loughborough University. Ella’s research interests focus on the impact of human factors (physical, psychological and organisational) on the successful implementation of technological, particularly understanding the impact of increasing autonomy. She also has a pedagogical research interest in the teaching and support of team projects.

Ella was the first technical member of the CIEHF (Chartered Institute of Ergonomics and Human Factors) and is the Technical Member Representative and PR/Media Champion for the CIEHF Council.
More placements funded in the Early Career Researcher Placement Scheme

Sonia Cisneros-Cabrera, University of Manchester

“Would you accept a collaborator selected by the computer?” – Factors behind persuasive advice regarding business partners in Industry 4.0 supply networks

The placement will take place at Graz University of Technology, Austria and Aalto University School of Business, Finland

Sonia Cisneros-Cabrera is an Information Systems postgraduate researcher at The Alliance Manchester Business School, University of Manchester. She obtained her Master’s degree (MPhil) from the School of Computer Science, University of Manchester (2016) for research conducted in the areas of High-Performance Computing, Big Data and Data Quality. Before completing her MPhil she graduated from the Technological University of Coacalco (Tecnológico de Estudios Superiores de Coacalco) as a Computer Systems Engineer and worked for Deloitte Mexico as an internal business technology analyst.

Sonia is currently working on a research project focused on understanding the factors that come into play when accepting advice given by computer systems – called artificial advice givers. For this, she has become involved in the DIGICOR EU project, which is part of the H2020 programme, looking at digitalisation in the context of the Industry 4.0 paradigm.

As part of the Early Career Researcher placement, she developed an end-user study design to collect data from potential end-users of artificial advice givers in the aerospace domain. The study design was developed during the first week of her placement, in collaboration with Professor Alexander Felfernig from the Graz University of Technology, Austria. Professor Felfernig researches human decision making in the context of recommendation systems and is a leader in the knowledge of how humans interact with artificial advisers. Sonia also had the opportunity to collect data using the study-design during an Industry Expo event and this was a success. During her second placement week, Sonia received guidance on the data analysis part of the work. All of this led to proposals and plans for publication of the results in collaboration with TU Graz and The University of Manchester.

A second part of the placement will take place in May at the Aalto University School of Business, Finland, where Sonia will seek to understand how to apply Action Design Research (ADR) method as part of her overall investigation. This part will be done with Professor Matti Rossi who is an author of the seminal paper on ADR and a leading authority in the use of this method.
Dr Elizabeth Argyle, University of Nottingham

ASSIST-ME: Analysing Sociotechnical System Interactions for Supporting Technology integration in Manufacturing Environments

The placement is with Rolls-Royce Plc (Civil Aerospace)

Dr Elizabeth Argyle is a Research Fellow in the Faculty of Engineering at the University of Nottingham and is a member of the Human Factors Research Group. She holds a PhD in Industrial & Systems Engineering from the University of Oklahoma (2016) where her research investigated the influence of information visualization design on end users’ situation awareness and decision making in the meteorological forecasting domain. Dr Argyle’s current work investigates the impact of digital technology on operators and decision makers in manufacturing systems as part of the EPSRC-funded DigiTOP project (EP/R032718/1).

During the ECR placement, Dr Argyle will collaborate with Rolls-Royce to explore human-machine and human-automation interactions within the production environment of complex aero engine structures. Dr Argyle will conduct a Cognitive Work Analysis to model system operations across the Outlet Guide Vane (OGV) value stream with the aim of identifying constraints and requirements for the design of future digital manufacturing systems that support future industrial workers and enhance productivity. The placement will take place over 6 weeks this May and June.

Dr Chris Turner’s recent papers

Towards the sensing factory: Analytics for Cyber Physical Production Systems and new service provision

The placement was at the Department of Automatic Control and Systems Engineering, University of Sheffield

Chris's recent papers, developed from the placement, explore new visualisation modes for Discrete Event Simulation Models. The placement visit facilitated networking and discussions regarding the enablement of live simulation model updating and decision making in real time based on data streamed from production line and shop floor sensor networks. Further meetings between Surrey and Sheffield academics are anticipated.

This conference paper explores the need for new visualisation modes to better enable interaction with increasingly complex and sophisticated Discrete Event Simulation (DES) models. In this research an initial framework for interactive and immersive DES models is put forward along with an extended framework that takes account of the potential for new developments in DES visualisation and the availability of streaming data from production line/shop floor sensor networks.


The use of artificial intelligence techniques for decision making with DES models is an area of growing interest. The exploration of Decision Trees with DES and their visualisation is the central focus of this paper along with a framework for live DES model updating and decision making in real time based on data streamed from production line sensors.

Shared Learning Workshop

On Wednesday 13 February, researchers awarded funding via Connected Everything came together to present and discuss their experiences in a Shared Learning Workshop.

The Workshop had three sessions: presentations from the feasibility study teams outlining their projects' outcomes or progress to date, presentations from the Early Career Researchers who have been on placements and a final session of reflection and feedback on personal experiences and the network’s impact.

The feasibility study teams offered a view of Connected Everything funding having afforded them the opportunity to conduct a highly ambitious and risky project. They had developed new lines of research, as they explored new territory, with new people, while laying foundations for larger projects to pursue.

“The funding has allowed me to work across disciplines in a well-scoped concentrated work, which turns out to be very much more effective in opening up new avenues of research including working with qualitative researchers, working with rigorous theoreticians and linking up with others through the network.” (Feasibility Study team member)

The Early Career Researchers on Placements said the experience had exposed them to the extent of the challenges facing research in Digital Manufacturing, not least the disjuncture between research and real world manufacturing settings and the silos of research existing across domains and institutions. They felt they had benefited by gaining a better understanding of manufacturing settings, accessing new data, forging new connections both in industry and with
other researchers, having time to write for publication and that all this has informed their career aspirations.

The breadth of the research funded by Connected Everything was striking. The umbrella heading ‘Industrial Systems in the Digital Age’ has drawn in study topics ranging from fashion design to brewing beer, from capturing craft expertise to talking with robots, from Additive Manufacturing process control to whole factory automation, from the nanoscale internal composition of built parts to large-scale building of houses with cob. The event was testament to the network’s contribution, forging a community of researchers keen to collaborate on their shared interest in how digitisation can improve manufacturing processes.
News from the Digital Manufacturing community

HVMC Digital Manufacturing Forum

*Digital experts from the UK's leading manufacturing research centres will present their work at the Connected Everything Conference 2019*

The Digital Manufacturing Forum is comprised of representatives from the seven research centres, which make up the [High Value Manufacturing Catapult](https://www.hvmc.org.uk), the government-funded catalyst for the future growth and success of advanced manufacturing in the UK.

The team also work closely with the [Digital Catapult](https://www.digitalcatapult.co.uk), industries and universities to ensure the UK remains at the forefront of manufacturing.

The Forum promotes innovation by supporting the creation, development, adoption and validation of technologies which can improve productivity, sustainability, quality and growth of UK manufacturing. It covers artificial intelligence, machine learning, data analytics, additive manufacturing, robotics and automation, virtual reality and augmented reality, and the Industrial Internet of Things (IIoT).

The team aim to lower the barrier to entry for smaller manufacturers. One recent project demonstrated how old machine tools can be retrofitted with low-cost IIoT sensors, allowing SMEs to reap the benefits of digital manufacturing without having to invest in new machines. The researchers worked with a host of SMEs to understand and overcome the barriers they face in improving their processes through IIoT technology.

To better understand the trends and drivers for digital manufacturing and emerging technology themes, the Digital Manufacturing Forum brings together experts from industry and academia at roadmapping events at HVM Catapult centres around the UK.

The Forum will present highlights from its roadmapping and other work at the Connected Everything Conference in June. The one-hour session will also provide an opportunity for researchers and industry to engage with the Forum, which is now developing a number of cross-centre collaborative projects involving industry partners of all sizes.
UKRI Workshops

**UKRI Artificial Intelligence Regional Workshops, May 2019**

UK Research and Innovation (UKRI) has announced four regional workshops to seek input to the current UKRI Review of Artificial Intelligence (AI), which is anticipated to result in a UKRI strategy for supporting AI research and innovation in the UK.

**UKRI Circular Economy Workshops, June 2019**

Two interdisciplinary meetings will bring together communities with an interest in Circular Economy, to strengthen collaboration and enable greater interdisciplinary working.

**UK-RAS Manufacturing Robotics Challenge, 19-20 June 2019**

As part of UK Robotics Week 2019, Sheffield Robotics, Enabling Sciences for Intelligent Manufacturing, and the Advanced Manufacturing Research Centre (AMRC) will be hosting the **UK-RAS Manufacturing Robotics Challenge 2019**.

The challenge will be held on the 19th and 20th June at Factory 2050 at the Advanced Manufacturing Research Centre in Sheffield, and will bring together young researchers and engineers from different disciplines to develop practical solutions to real-world problems in a competitive environment.

The event is open to final-year masters students, PhD students, early-career researchers, industrial engineers and others with relevant experience in areas including robotics, autonomous systems, computer vision, machine learning, and augmented reality.

For more information please visit [https://esim.ac.uk/news/uk-ras-manufacturing-robotics-challenge](https://esim.ac.uk/news/uk-ras-manufacturing-robotics-challenge)
eFutures2.0: expanding the impact of electronics

Electronics has been at the centre of many innovations that we use regularly and the smartphone has transformed how we engage with the digital world around us and interact with each other. The electronics systems industry is worth £100B to the UK economy and represents 3% of the total UK workforce. The UK is fortunate to have a very strong and vibrant electronics industry led by companies such as Arm and Imagination Technologies.

A lot of this activity is at the high end of the value chain, highlighting the need for advanced design skills and innovative manufacturing processes. Currently, a relatively small but strong academic base has self-formed into a network called eFutures uniting the design and technology communities. Whilst their activities have acted to strengthen the UK electronics research base, there is considerable potential to apply electronics more widely. To this end, the network has been reformed as eFutures2.0 with support from EPSRC, to achieve this goal and to engage more effectively with industry.

The specific objectives are to support and maintain researchers to grow a more vibrant community by continuing high successful, early career researchers 'crucible' events and creating new events to support mid-career researchers; to build bridges between academia and a broader range of industry and existing networks; to achieve better engagement with the electronic systems community.

As electronic technologies have the potential to revolutionise the sensing, capture and processing of information in industrial applications, we are keen to engage with the Connected Everything: Industrial Systems for the Digital Age network. To be successful, we need to overcome the cultural differences between disciplines to allow effective collaboration. eFutures2.0 is looking to achieve this by exploring closer links through joint meetings and discipline-bridging, feasibility studies to accelerate the interaction.
Sector Bulletin

The electronics sector is an integral part of UK manufacturing and generated £8.4 billion and £19.4 billion in gross value added and turnover respectively in 2017.

The Seventh Sector Bulletin report begins by speculating that "with the evolution of the digital age, the sector is well placed to cement itself as a core manufacturing sector, while others go into relative decline".

Read the full report

Steve Aitken, Intelligent Plant's Consultant Director, reports that they have published a Connector for Microsoft’s Power BI

This connector was announced by Microsoft in their March release of Power BI – and allows Industrial site data to be connected to Power BI through the Industrial App Store.

This has made a big difference to Intelligent Plant and has led to them becoming a Microsoft Partner – and means they will now be attending the Microsoft Business Applications Summit in Atlanta.

The Industrial App Store allows any developer be they an Academic Institution or an SME to develop analytics capabilities that can be used on Time-series data for Industrial Clients – if you would like to get involved then contact Intelligent Plant on info@intelligentplant.com

Steve Aitken will be speaking at Connected Everything Conference 2019 so this will be an opportunity to find out more.

WHAT IS POWER BI?

Power BI is a suite of business analytics tools to analyze data and share insights. Monitor your business and get answers quickly with rich dashboards available on every device.
James Dyson Award

The James Dyson Award is an international design award that celebrates, encourages and inspires the next generation of design engineers. It is open to current and recent design engineering students, and is run by the James Dyson Foundation, James Dyson’s charitable trust, as part of its mission to get young people excited about design engineering. This year’s deadline for entries is 11th July - find out more at https://www.jamesdysonaward.org/.

Join Connected Everything at connectedeverything.ac.uk

Connected Everything is led by Professor Sarah Sharples, University of Nottingham, and an Executive Group, with members from 17 organisations. The Executive Group provides guidance to the Network and links to other key strategic funded initiatives.