connected everything.

Newsletter: Issue 10, Winter 2021

Introduction

Happy New Year, we hope you all managed to get a break during the festive season. While 2020 saw some remarkable scientific achievements in vaccine development, it looks like the challenge for 2021 now lies with industry to manufacturer and supply a vaccine globally. In this, similar to the ventilator challenge, there is the opportunity for digital manufacturing tools to once again step up and provide the solutions.

Since our last newsletter, work has been finished on updating the Connected Everything themes for its second iteration. This work has been guided by feedback from last year's conference workshops, and input from the Project team and Executive Group members. The thematic areas are important to Connected Everything as they highlight areas the network believes to be fundamental to digital manufacturing. Connected Everything's definitions for each thematic have been published on our website.

Over the last year, Connected Everything has been working hard to formalise our approach to ensuring Equality, Diversity and Inclusivity (EDI) across the network and its activities. The network has always believed that EDI is central to delivering high-quality research outcomes and without implementing EDI principles throughout our network, it will not be the best. In this newsletter, Connected Everything shares details on how it will ensure EDI always remains a priority of the network.

Looking forward to the next few months promise to be busy for the Connected Everything network. We have launched our final feasibility study funding call and summer school hosting call. Additionally, the Connected Everything Podcast series is set to launch, with episodes covering topics such as what makes a successful feasibility study applications and importance of EDI to research.

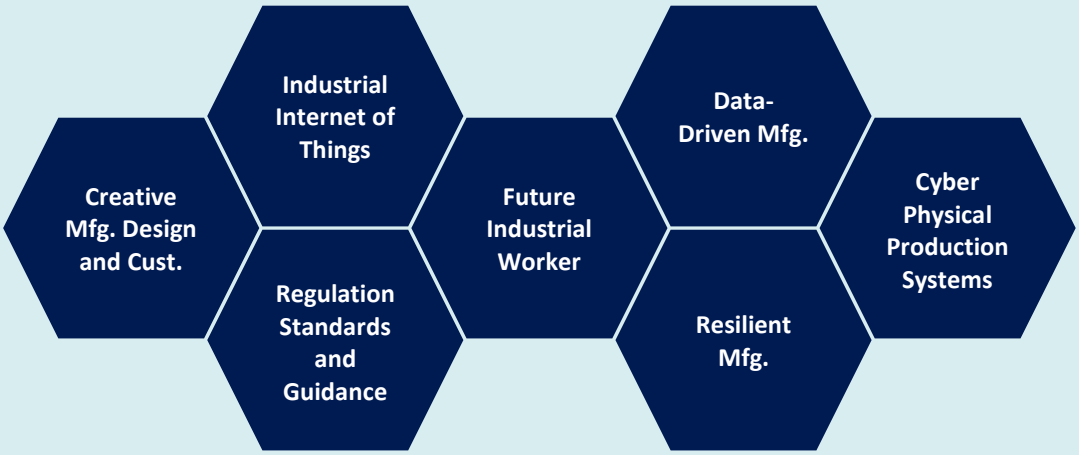
Contents

Please click on the links given throughout the newsletter for further details.

connected everything.

Connected Everything II Thematic Areas

The thematic areas embody Connected Everything's definition of digital manufacturing and guide the network's activities. These areas have been refreshed for Connected Everything's second iteration. The thematic areas were revised in conjunction with industry road-mapping activities to ensure that the work of the Network Plus continues to be aligned with issues of Societal Importance, Industry Priority and Technical Capability. *The figure below contains links to Connected Everything's definition of each theme.*



Planned activities to be guided by the Thematic Areas

- Themes will continue to inform the scope of future feasibility study funding calls.
- The Project Team will investigate hosting specific webinar sessions around each theme to be run throughout 2021 and into 2022.
- Guide on the content of presentations delivered by Connected Everything at external events; for example, the Digital Manufacturing Week 2020 sessions.
- From start to mid-2021, a podcast series will be produced exploring each theme. The format will be panel discussions on each theme between academic and industry thought leaders, project team and/or executive group representatives, early career researchers and PhD students.
- In late 2021/early 2022, 1-page information sheets to be published on each thematic area, informed by the podcast panel discussions.
- Themes will ensure the sustainability of Connected Everything.

connected everything.

Equality, Diversity, and Inclusion

Connected Everything committed to embedding Equality, Diversity and Inclusion (EDI) in all its network activities when the team successfully reapplied for EPSRC funding in 2019.

Connected Everything now has published its EDI principles document (link here) which includes a statement on why this is important and the principles are underpinned by an action plan to ensure all other activities have EDI considerations fully included.

Connected Everything EDI Statement

> "Connected Everything knows that diverse teams deliver high-quality research outcomes. Furthermore, Equality, Diversity and Inclusion approaches lead to happy and healthy research teams. CEII wants to encourage, support and respect ideas from everyone and ensure our inclusive activities are representative of our network's community."

To learn more about the importance of EDI to research, please look out for podcast where Sarah Sharples (Pro-Vice-Chancellor for Equality, Diversity, Inclusion and People at the University of Nottingham) discusses here views and experience promoting EDI. This will be made available on our YouTube channel.

connected everything.

Feasibility Study Call 3

Connected Everything (CEII) is pleased to announce its third round of funding for feasibility studies.

As CEII is funded by EPSRC, our focus is on fundamental ideas that have the potential to be developed into future applications or concepts that can be implemented within Digital Manufacturing. Therefore, proposals should address challenges at low Technology Readiness Levels (TRLs 1-3) and be aligned with at least one of the thematic areas.

For full details about the call, as well as access to supporting documents, can be found on our website by clicking this link.

Also, please head over to our YouTube channel to listen to our first Connect Everything Podcast that features Sarah Sharples (CEII PI), Debra Fearnshaw (CEII Network Manager) and Oliver Fisher discussing what makes a successful feasibility study application.

Key Dates

12th January 2021	Call for proposals goes live
3rd February 2021	Feasibility Study call – Question and Answer session (online).
	To book your place go to Eventbrite
22nd February 2021	Deadline for submissions (5PM)
23rd March 2021	Invitations to Panel Pitch Day issued, unsuccessful proposals advised
27th April 2021	Panel Pitch Day (online)
6th May 2021	Successful proposals informed
25th May 2021	Kick off meeting (online)
June 2021	Feasibility studies begin

All feasibility studies should have completed before May 2022.

If you have any questions regarding this call, please contact the Connected Everything II Network Manager, Debra Fearnshaw (email: debra.fearnshaw@nottingham.ac.uk).

Update from Feasibility Studies Teams

Studying mental stress factors in occupational safety in the context of smart factory and COVID-19, *Trent University*

The project is focused on the study of mental health while working in collaboration with robots on factory floor. To create such an environment in the laboratory setting, two Universal robots (UR-3 and UR-5) are setup to create collaborative tasks along with the EEG and fNIRS equipment in the Human Factors Laboratory in the Department of Engineering. The experiments are currently in design stage in order to evaluate the correlation between mental stress in participants against the tasks of varying production speed, task complexity, collaboration time and payload capacity. The ethics document for the experiments is in its final stage of approval for which a one hour of experimental routine has been designed for each participant. For the accuracy of the envisaged experiments, it is planned that the participants will be randomly selected from the employees of our industrial partner, having varied knowledge and experience as our primary subjects. Initial results of the study are planned to be published in 31st European Safety and Reliability Conference in 2021.

Embedded Intelligent Empathy (EiE), *University of West England*

This project aims to create a beta version of a tool to help designers systematise empathy in their design process. Currently, in the field of design and architecture, there is no definitive method for incorporating empathy. Furthermore, computational design has grown rapidly as the preferred method for many design practices where the use of algorithms can automatically generate optimal solutions. The optimisation process does not allow for designer's empathy as it bypasses non-quantifiable values such as intuition. This project is a step towards a Data-Enabled empathy in design using computational design methods. A systematic literature review is being conducted to investigate the research gap and to bridge three design fields: empathy, soundscape and computation. Research has previously quantified ephemeral qualities of human perception such as soundscape and aesthetics. These studies used Multidimensional scaling to identify attributes that affect perception. In this study, we use soundscape attributes as a testbed to quantify empathic values. This is in preparation for planned co-design sessions with our industrial partners, to collate a dataset. The collected data will be embedded as an algorithm deriving a plug-in for Grasshopper 3D.

Manufacturing of 3D-printed morphing origami solar sails for the next generation of CubeSats, *University of Liverpool*

At the University of Liverpool, we are exploring low-cost Additive Manufacturing techniques for origami self-reconfigurable solar sails for next generation of CubeSats. The sail reconfiguration is achieved by harnessing the effect of the sun radiation pressure and adjusting reflectivity of the origami facets (i.e., sunglasses' photochromic lenses). In

this study, we focus on the design of the origami folding lines from where a different angular displacement of two adjacent facets is applied. Past work on solar sails and origami robotics (i.e. current available folding methods, the pattern design, thick origami issues), were investigated and a trading-off in manufacturing of the hinges mechanism of two adjacent facets is under study. Moreover, we considered several constraints including: (1) the maximum printable space available, (2) material compatibly, (3) equivalent force model for lab testing as electro-magnetic to simulate the folding in 1-g environment. In space the folding procedure is triggered by Polymer Device Liquid Crystals (PDLC) by changing the opacity level on the surface to modulate the intensity of the sun radiation. Starting from a substrate of mylar, the crises of the origami structure are printed on top in the shape of equilateral triangles made with Thermoplastic polyurethane (TPU an elastic material, which showed great compatibility with mylar. To augment the overall mechanical properties, the Polylactic acid (PLA) was added to. Three different patterns have been prototyped: (a) the cartilage-like pattern('skeleton') where the folding line is fully stretchable and it is made only of TPU; (b) the mechanical pattern, where simple PLA hinges are designed as an embedded mechanism c) investigates both a) and b) design by also including electro-magnetic circuit embedded to the sail for the folding demonstration.

Summer School Hosting Call

We are pleased to announce a call for our Summer School host for 2021.

This call invites applications from UK Higher Education Institutions to host the 2021 Summer School on behalf of the EPSRC funded Network Plus, Connected Everything. The Summer School should be organised around a particular area of focus that is likely to appeal to a wide cross-section of students. The expectation is that there will be up to 30 PhD students and recent graduates attending the Summer School, which will run virtual over 3-4 days.

For information about the application process, conditions of funding and more, please refer to the call document that can be found here.

The deadline for applications is **Monday 15 February 2021 at 5 pm**.

If you have any questions regarding this call to host the 2021 Summer School, please contact the Connected Everything II Network Plus Manager, Debra Fearnshaw email: debra.fearnshaw@nottingham.ac.uk, telephone: 0115 84 66238

Connected Everything at Digital Manufacturing Week, *9-15th November 2020*

Connected Everything virtual stand

Connected Everything was an exhibitor at the Smart Factory Expo that took place during the Digital Manufacturing Week Virtual Show. Through our virtual booth, we met many enthusiastic people, keen to find out more about our objectives and hear about the feasibility studies which were both the centre-piece of our exhibit and which are at the heart of the network. We were also able to attend a number of talks at the conference to hear from industry leaders about the state of the UK manufacturing industry and learn what industry is doing to embrace for digital manufacturing.

For this event, Connected Everything also hosted two workshops titled "*Manufacturing in 2050 - high-level review of challenges & analysis for digital manufacturing*". The workshops were run by Project Team members Dr Nicholas Watson and Dr Fiona Charnley. The workshop explored the future challenges facing Digital Manufacturing as we move towards 2050. First Nicholas and Fiona shared some of our predictions as well as give examples of insights from Connected Everything feasibility studies, before handing the discussion over to the delegates to get their views.

Some insightful and thought-provoking discussions took place, the outcomes of which shall be shared in a future article for The Manufacturer.

Members' News

Introduction from Nightingale HQ an AI Start-up

Nightingale HQ is a Welsh-based AI start-up helping manufacturers to get more out of their data and deliver greater efficiencies. We're developing a trusted marketplace for AI tools and services where manufacturers can access to the right resources, skills and expertise they need to successfully adopt AI and digital technologies. Successfully adopting AI means overcoming core barriers including a lack of skills/knowledge and having the right technology infrastructure. Our vision is to help manufacturers to get more out of their data so that they can innovate faster.

We are new to the Connected Everything network, but we look forward to connecting with many of you and contributing to this space. Link to our website for more information.

Digital Manufacturing Centre partners with Produmax to advance AM in the UK

The Digital Manufacturing Centre (DMC) has announced a pioneering new partnership with high precision engineering expert Produmax, aimed at developing digital capabilities in UK additive manufacturing. Kieron Salter, Chief Executive Officer at the DMC, stated: "The partnership between the Digital Manufacturing Centre and Produmax signifies the coming together of two experienced teams and industry players, both investing in disruptive technology and the future of British manufacturing. The facility itself will be unique and a pioneer for many connected engineering and production technologies, but it is our key partnerships with highly regarded companies like Produmax that will help to fulfil the DMC's true potential." More details available here.

AI Roadmap

An independent report, carried out by the AI Council, providing recommendations to help the government's strategic direction on AI. The report sets out suggested directions across four pillars: Research, Development & Innovation; Skills and Diversity, and Data, Infrastructure and Public Trust. Link to full report here

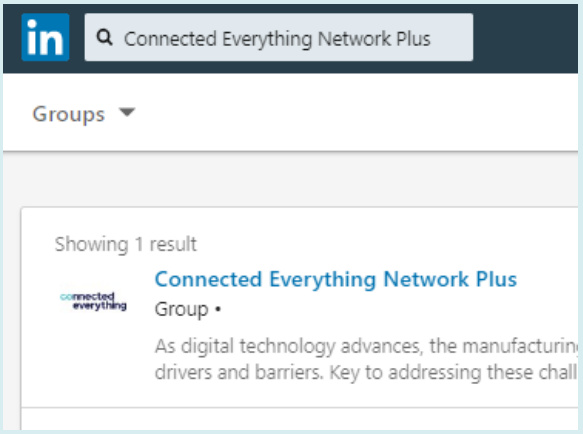
connected everything.

Reminder to Join Connected Everything's LinkedIn Group

Earlier this year, Connected Everything launched a LinkedIn Group for members to chat and network informally. The group now has over 70 members and is has become a great resource for members to be able to connect with one another directly.

To join the follow these simple steps:

1. Sign in or up to LinkedIn here.
2. Search for *"Connected Everything Network Plus"* in the **search bar**, located in the top left corner.
3. Use the **Filter Tools**, below the search bar, to display only **Groups**
4. Click on the Connected Everything Network Plus Group
5. Click the **Request to join** button.



Join Connected Everything at connectedeverything.ac.uk

- Visit our website
- Find out about forthcoming events and activities
- Let us know what would be useful to you
- Promote an event through Connected Everything
- Interact with members through our LinkedIn group