EXCEPTIONAL RESEARCH THAT MAKES AN IMPACT

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CASE STUDY: USING LOW-COST TECHNOLOGIES TO HELP SMEs MOVE TOWARDS DIGITAL MANUFACTURING

A series of proof-of-concept demonstrators built by researchers from the University of Cambridge show how easily small and medium-sized companies can improve productivity by using existing and readily available digital technologies that can be implemented on a low-cost basis.

THE CHALLENGE

Manufacturing organisations increasingly see Internet of Things (IoT) connected machines as critical to improving the productivity of their operations. These machines are able to capture and communicate real-time data more accurately and consistently than previously possible, allowing organisations to break open data silos and gain access to information at every level.

However, for many small and medium-sized companies, moving towards digital manufacturing can seem expensive, risky and out of reach. The perception of digital solutions is that they require significant initial investment and ongoing operating costs.

To tackle this problem, a team from the Digital Manufacturing on a Shoestring project based at the Institute for Manufacturing, University of Cambridge, in collaboration with the University of Nottingham, has begun to deliver a toolbox of solutions that can be readily adopted by small and medium-sized manufacturers, using off-the-shelf, affordable technologies.

By tackling some of the challenges of implementing digital solutions without big budgets or in-house digital expertise, the project is bringing these solutions into many small-scale manufacturing environments for the first time.

THE PROJECT

The innovative project, which involves a range of small manufacturers, technology partners including the Raspberry Pi Foundation and Siemens, and manufacturing networks such as the Scottish Manufacturing Advisory Service (SMAS) and Make UK, exploits low-cost, commercially available technologies in mobile computing, sensors and analytics software.

Working closely with individual companies to address their unique needs, the project team has developed a number of proof-of-concept solutions to things like inventory tracking and voice-activated orders, with industry pilot partners testing their adaptability in industrial settings.

"We hope these solutions will help small companies put a 'toe in the water' in the digital space." Professor Duncan McFarlane, Institute for Manufacturing.

The Shoestring approach begins with developing an understanding of priority business areas for digitalisation, using requirements workshops together with on-site visits to companies (as well as online workshops added since the start of the COVID-19 pandemic). Following digital assessments, the Shoestring team classify many of the commonly experienced challenges and priorities facing manufacturers and create a list of top priority requirements for proposed low-cost digital solutions.

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This has led to the development of a toolbox of solutions, a number of which have been developed into demonstrators through funding from Pitch-In, which addresses barriers to the successful development, introduction and exploitation of IoT. The solutions incorporate low-cost industrial and consumer components (such as Raspberry Pis) and low-cost sensors (such as Bluetooth low-energy beacons, off-the-shelf sensors and motion cameras), combined with existing cloud computing platforms, human-machine interaction (low cost AR/VR technologies) and IoT suites.

One example includes a digital job-tracker which has been piloted by a small family-run manufacturer for, initially, a low three-figure sum. Where the company previously used a paper sheet to track orders through the system, low-cost scanners are now being used to digitise the location and status of jobs. This cross-site job tracking pilot enables workers to print tracking labels, record when a job enters and leaves the facility using barcode scanning, and then store all these records centrally in the cloud, so that live job progress can be viewed at any time.

This simple but effective solution demonstrates the combination of openly available and other low-cost off-the-shelf technologies to collect and record typical manufacturing activities observed on a shopfloor.

THE IMPACT

The project has demonstrated the use of off-the-shelf, low-cost and openly available IoT technologies for developing digital solutions for manufacturing small-medium sized enterprises.

As well as tackling the perceived costs of digitalisation, the project is addressing the challenge for small manufacturers who may lack in-house digital skills, knowledge or confidence to develop solutions. By working in partnership with small manufacturers and offering hands-on support, Digital Manufacturing on a Shoestring is helping company staff become more confident in terms of digital decision-making and investment.

"Shoestring has shown us that you don't need to invest in expensive technology and that there is real value from a low-cost solution. Understanding a company's requirements and what is possible can be a real game changer – it means companies will actively want to find solutions."
Will Bridgman, Chairman, Warren Services.

The project is also encouraging student involvement via 'Hackathons' – online events providing students with the opportunity to build prototypes with cutting edge digital technologies and receive feedback from industry leaders.

Looking ahead, the Shoestring team are developing a web-based portal to allow users to design their own Shoestring solutions. To help them finalise the framework for the portal and the approach to putting solutions together, the team are running more pilots with industry partners.

SEE ALSO

Schönfuß, B., McFarlane, D., Athanassopoulou, N., Salter, L., de Silva, L., Ratchev, S. (2019) **Prioritising low cost digital solutions required by manufacturing SMEs: A shoestring approach** Studies in Computational Intelligence, Springer Verlag

McFarlane, D., Ratchev, S., Thorne, A., Parlikad, A., de Silva, L., Schönfuß, B., Hawkridge, G., Terrazas, G., Tlegenov, Y. (2019) **Digital manufacturing on a shoestring: Low cost digital solutions for SMEs** Studies in Computational Intelligence, Springer Verlag

Hawkridge, G., Perez Hernandez, M., De Silva, L., Terrazas, G., Tlegenov, Y., McFarlane, D., Thorne, A. (2019) **Tying Together Solutions for Digital Manufacturing: Assessment of Connectivity Technologies & Approaches Conference paper** IEEE International Conference on Emerging Technologies and Factory Automation

PROJECT AND TEAM

M123: Demonstration of low-cost automation solutions for SME adoption of digital manufacturing.

Professor Duncan McFarlane and Dr. German Terrazas, Institute for Manufacturing, University of Cambridge.

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PITCH-IN

Pitch-In aims to collaboratively identify and address barriers to the successful development, introduction and further exploitation of Internet of Things technologies across four key sectors, Cities, Energy, Health and Wellbeing and Manufacturing. The project, run by a consortium of four universities (Sheffield, Cambridge, Oxford, Newcastle) is funded until 2021 through Research England's **Connecting Capability Fund**. Pitch-In has sponsored a number of demonstrators, pilots and hackathons in the Shoestring project.