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Industry 4.0: Retrofitting of Legacy Machines for Smart Manufacturing

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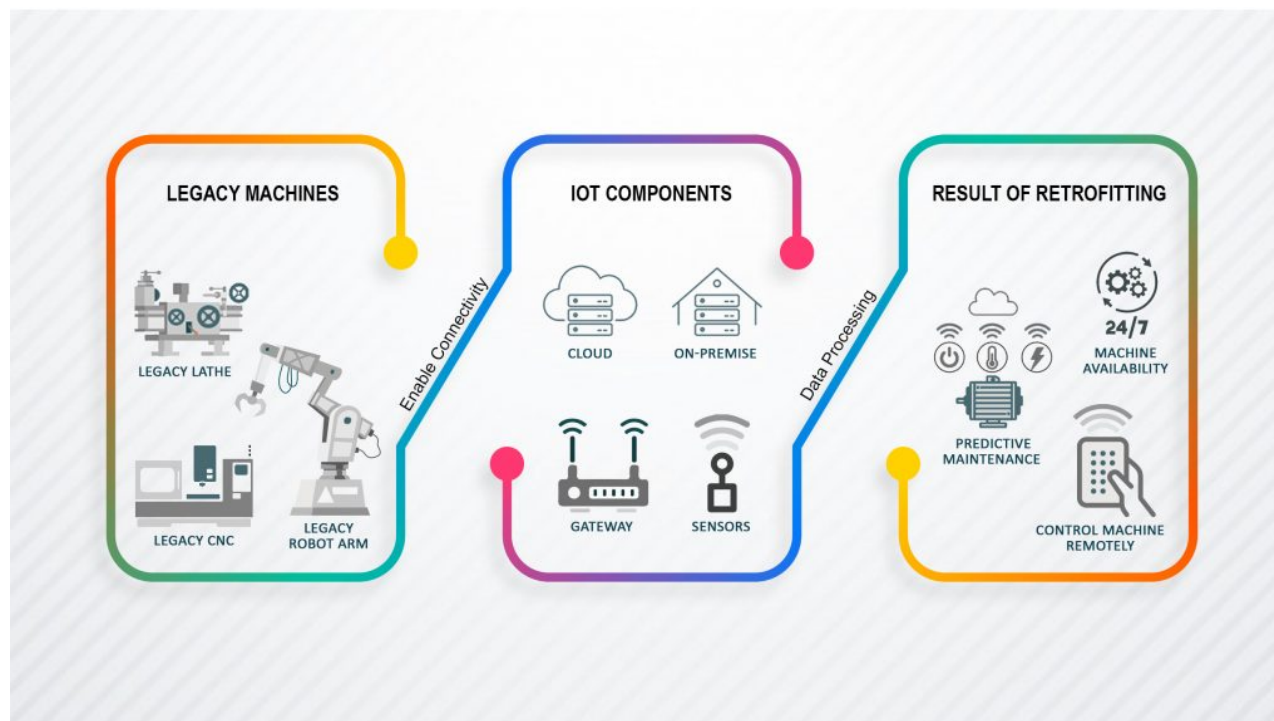


Figure 1: The process of retrofitting legacy machines with possible benefits

Industry 4.0 technologies and digitised processes are foundational for the implementation of smart manufacturing processes within vertically and horizontally integrated production environments. They also allow for new ways of revenue generation from data-driven services, enable predictive maintenance based on real-time data analytics, as well as largely autonomous manufacturing scheduling and resource allocation with cloud computing and the Industrial Internet of Things (IIoT) as their backbone.

However, the UK manufacturing sector is predominantly built on Small and Medium-sized Enterprises (SMEs) that for various reasons cannot always afford to employ latest cutting-edge technology. Accordingly, there is a growing need for SMEs to look for affordable alternatives to upgrade their legacy machines towards Industry 4.0 conformity to remain competitive in a rapidly changing market. Such an approach is retrofitting. By adding sensor technology and IIoT

networking capabilities to legacy machines they can be integrated into the enterprise-wide information technology infrastructure, which then allows to reap some of the benefits of digitally monitored and controlled smart production processes (see Figure 1).

Typically, there are three retrofitting approaches available for consideration. Cheapest and easiest to implement are so-called starter kits that do not require direct interoperability between operational technology (machines) and informational technology (ERP, MES, etc.). A second approach is aimed at enabling network integration capabilities by updating the software of programmable logical controllers (PLCs), and a third and most comprehensive solution adds hardware components to achieve full OT-IT-integration and interoperability.

Unfortunately, there is no unique one-size-fits-all retrofitting solution available as the devil is in the details of each companies' specific setup and requirements. For example, overcoming compatibility issues between legacy and modern-day network protocols and data integration standards can be challenging, and likewise a retrofitting solution may require the incorporation of short-distance and low-power wide-area networks. At another level, a large variety of IIoT devices and sensors for a multitude of application purposes can be selected, and of course they also vary in terms of other aspects, such as cost or cybersecurity capabilities.

To aid SMEs make informed decisions about their retrofitting needs, understand available options, and assess technical feasibility and financial viability of suitable alternatives, a team of researchers from the Systems Realization Laboratory at the University of Liverpool are developing a corresponding decision-based framework and online toolkit. To support our work towards this goal, we would like to encourage you to participate in a short survey to provide your views on the retrofitting requirements specific to your business or setup. As a small token of appreciation, a £100 Amazon voucher will be raffled off among all participants. – [Please follow this link to the survey \(https://liverpool.onlinesurveys.ac.uk/retrofitting-survey\)](https://liverpool.onlinesurveys.ac.uk/retrofitting-survey).

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