Smart Manufacturing Solutions

Loughborough University

Our Vision

To deliver a step-change in UK manufacturing business effectiveness by integrating state of the art technologies from leading industrial and academic organisations into high volume manufacturing processes.

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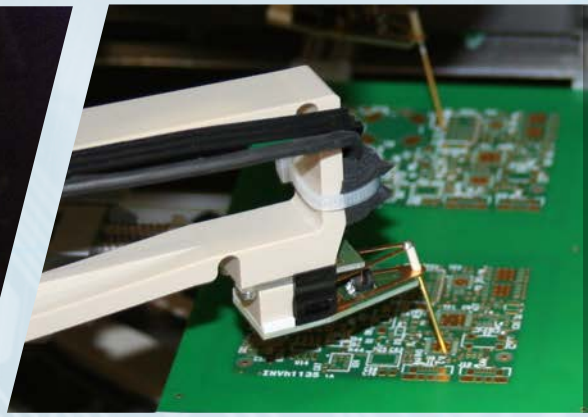
Smart Technology for the Internet of Things

Developing On-demand Intelligent Systems and Services for Smart Manufacturing



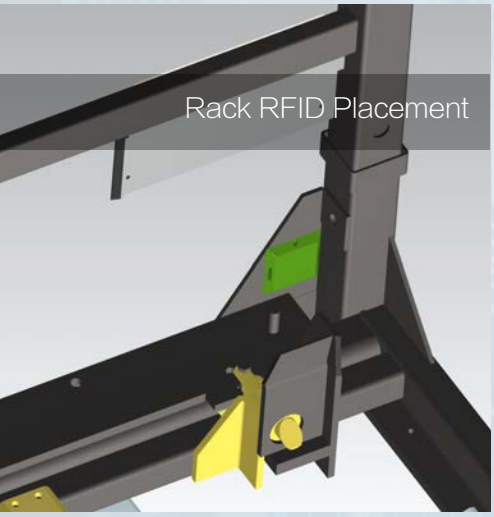
EIIS is a spin-off from Loughborough University, specialising in the provision of distributed systems to industry to increase yield of products and processes.

- Reusable ambient intelligent systems
- Increased business and engineering efficiency
- Reduced complexity manufacturing systems
- Agile manufacturing and scheduling
- Cross supply-chain collaboration

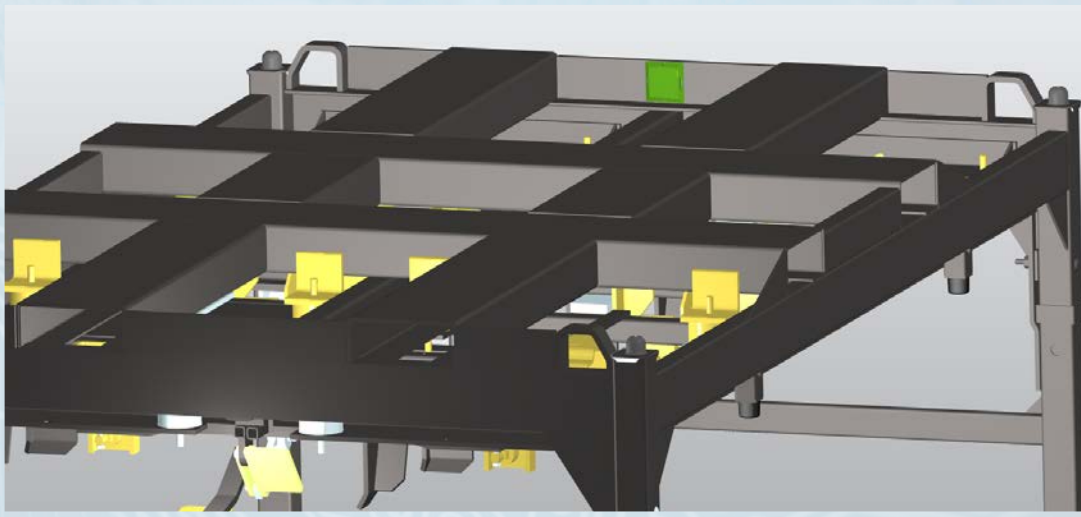
Global Supply Chain Traceability

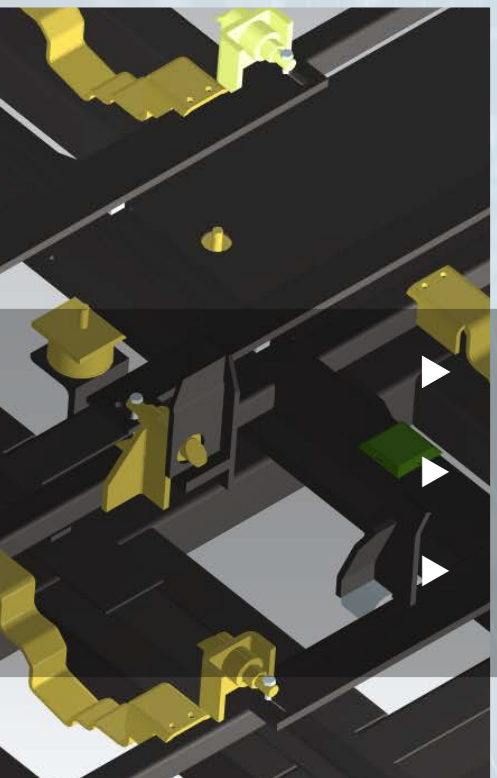
RFID System to Monitor Shipment and Storage in the Automotive Industry

Tracing engine racks in transport between manufacturing plants poses a major challenge. Lack of coordination in the return of empty, bespoke racks results in line stoppage, bottlenecks and product loss. Full supply chain traceability can then enable optimisation of logistical routes, auditing, rack utilisation and reduction of management costs.



Rack RFID Placement





RFID Tag Engineering

Using low-cost, UHF RFID, the system provides significant reductions in operational costs and production stoppages.

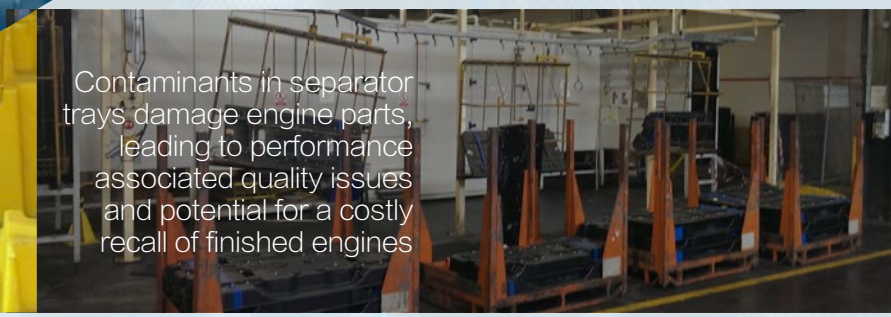
- Increased data storage
- Auto-interrogation
- Non-line-of-sight signals

The EIIS traceability system of RFID portals communicates independently with bespoke web services. With cloud storage and scalability to new and legacy identification technologies, the solution is easily integrated into any domain.

Bespoke web services store traceability data in the cloud

Tags can be monitored from over 10m distance and the system benefits from a bespoke maintenance program:

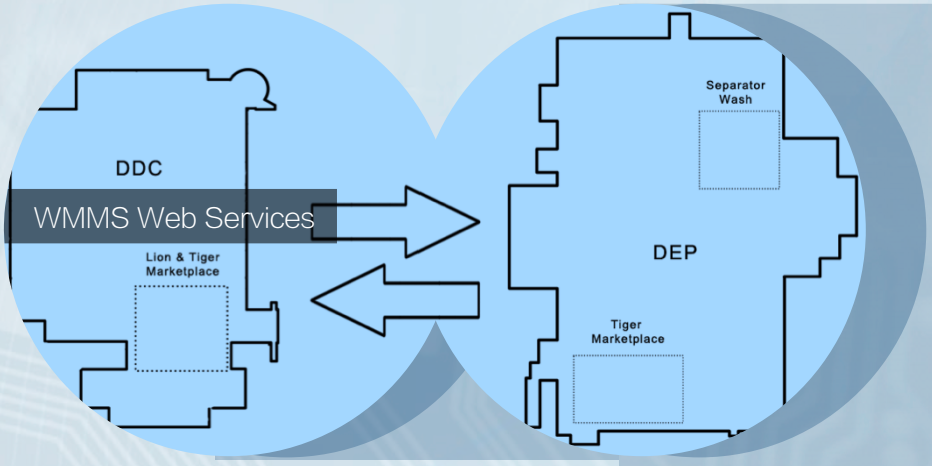
- Checks that rack tags are read
- Runs detailed regular health checks
- Executes concurrent to operation
- Ensures maximum uptime



Contaminants in separator trays damage engine parts, leading to performance associated quality issues and potential for a costly recall of finished engines

Case Study: Washing Monitoring

Our Wash Monitoring and Management System (WMMS) provides supply chain traceability and quality control, by tagging component separators with RFID transponders.



- High visibility and traceability of cleaning scheduling
- Mounted portals providing wash timing guarantees
- Custom web services to query quality control
- Real-time processing and support for audits

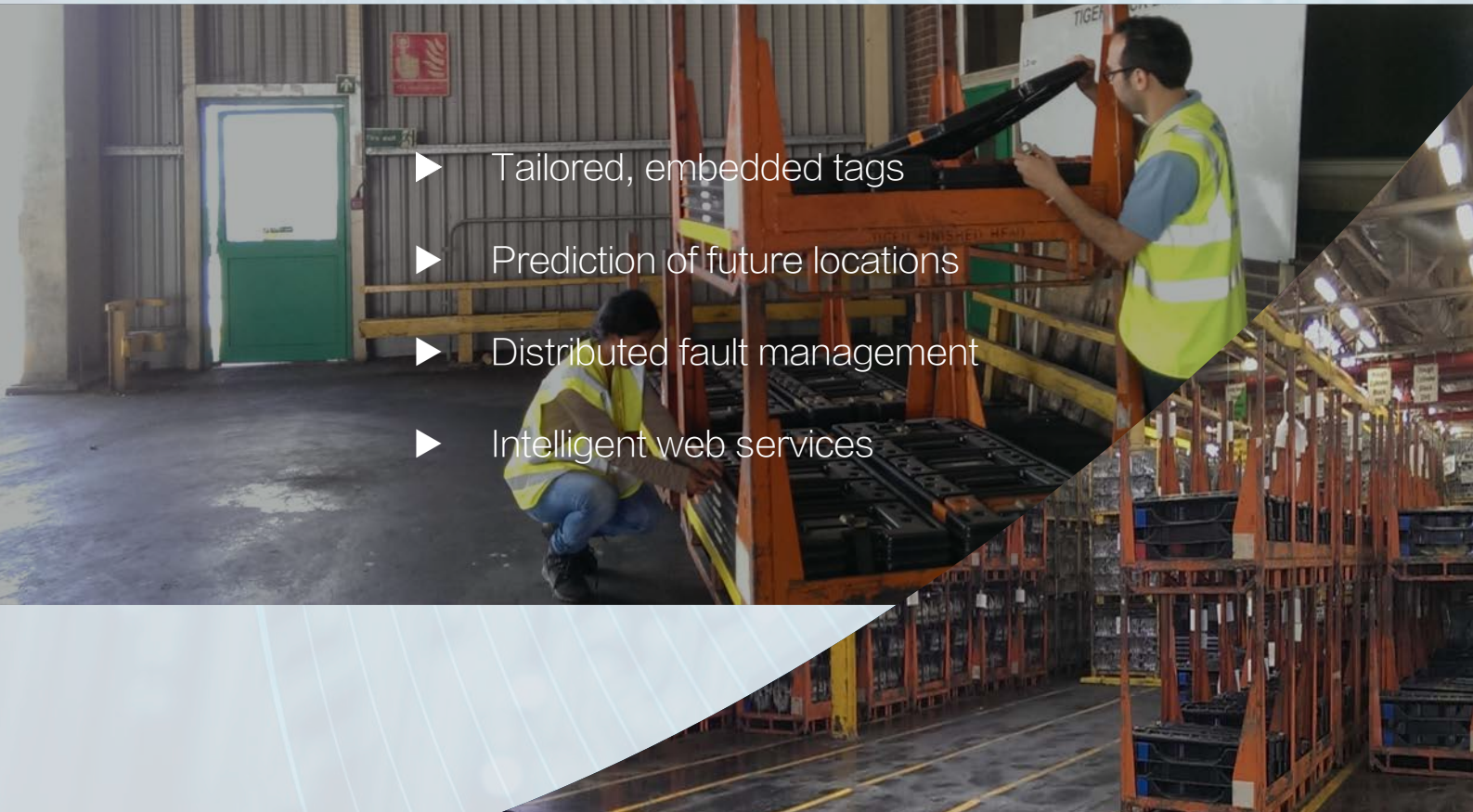
Supertag: Precision Tracking

Advanced Algorithms for Indoor Tracking and Inventory Monitoring

Autonomous Monitoring

EIIS low-cost, low-power Supertags extend resource monitoring to all stages of the supply chain.

Tracking assets in complex environments will be extended to autonomous requirements prediction for the smart factory.

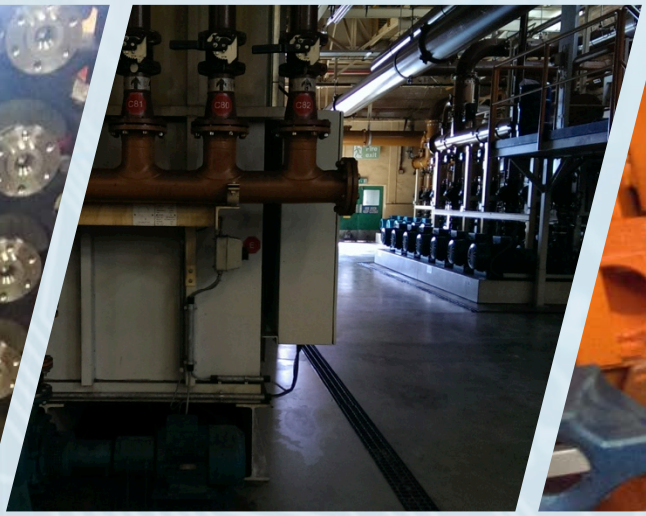


- Tailored, embedded tags
- Prediction of future locations
- Distributed fault management
- Intelligent web services

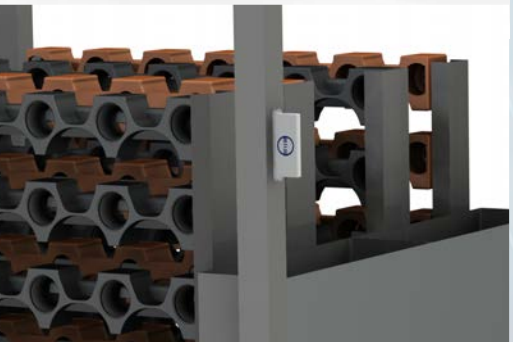
RFID on Metal Components

Engineering RFID Tags for Operation in Harsh Environments

We have overcome a major research challenge and designed a RFID tag that can be mounted successfully on metallic objects. Item-level tracking is no longer reliant on changing the structure of the item.



EIIS Tag Placement



Improved Tag Performance

- Low cost, high-performance, flexible and lightweight solution
- Optimisation of complex impedance, bandwidth and size of tag
- Robust, reusable design

Monitoring Crankshaft Machining

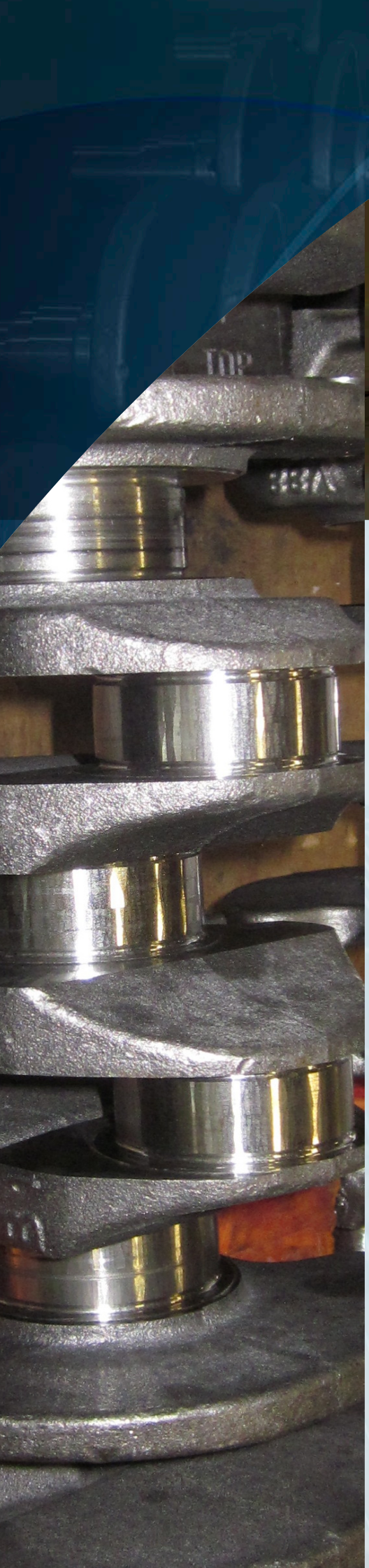
Recording Unique Processes In Manufacturing and Assembly

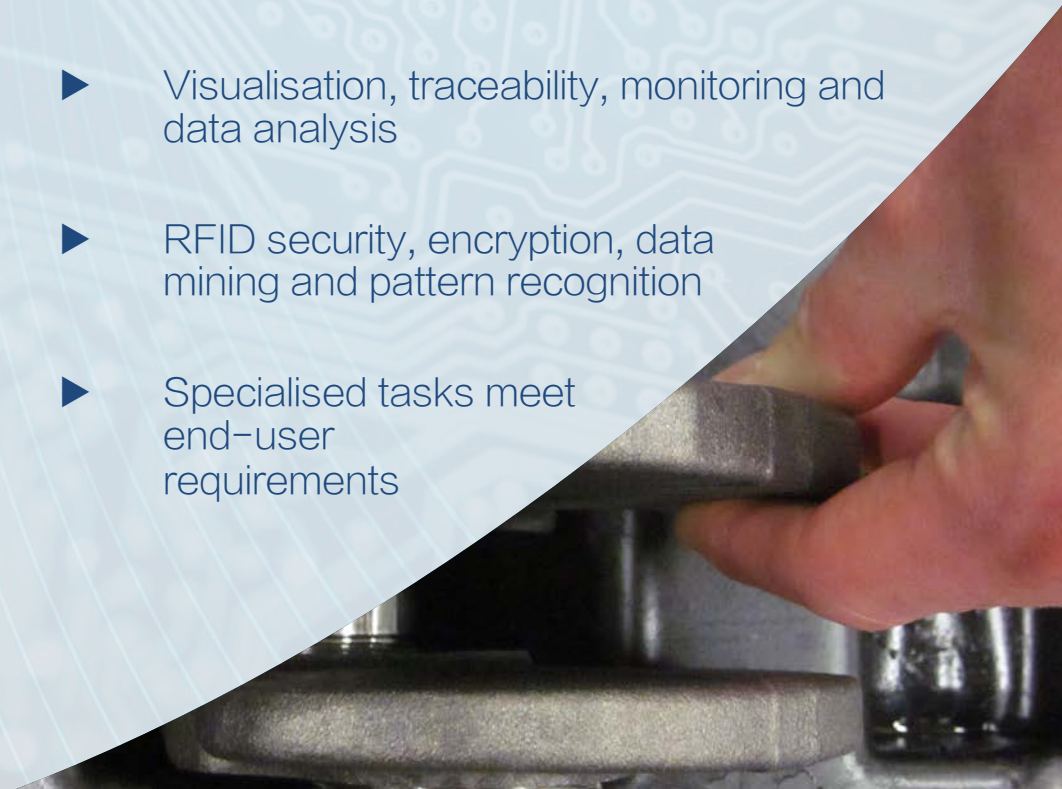
Robust Monitoring

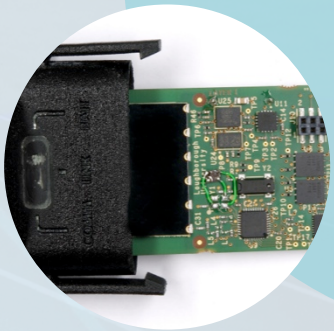
Attaching robust UHF RFID tags to crankshafts, with readers mounted on machines enables traceability and improved resource management. Tags embedded in bolts can be attached to every crankshaft prior to machining and assembly.

Distributed Services

- Visualisation, traceability, monitoring and data analysis
- RFID security, encryption, data mining and pattern recognition
- Specialised tasks meet end-user requirements

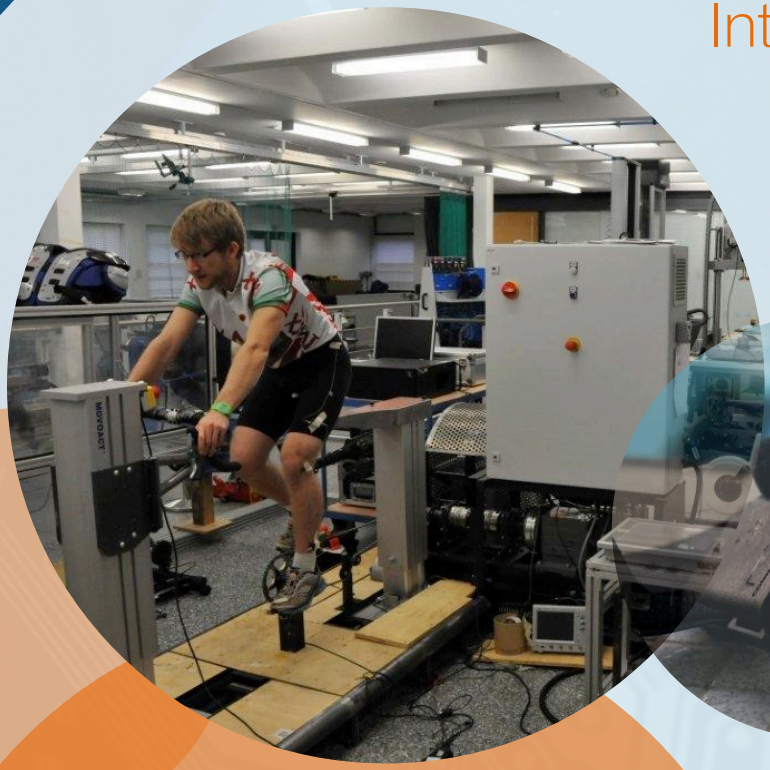






Tuning Athlete Performance

Integrating Sensors for Performance Monitoring of the Athlete as an Asset



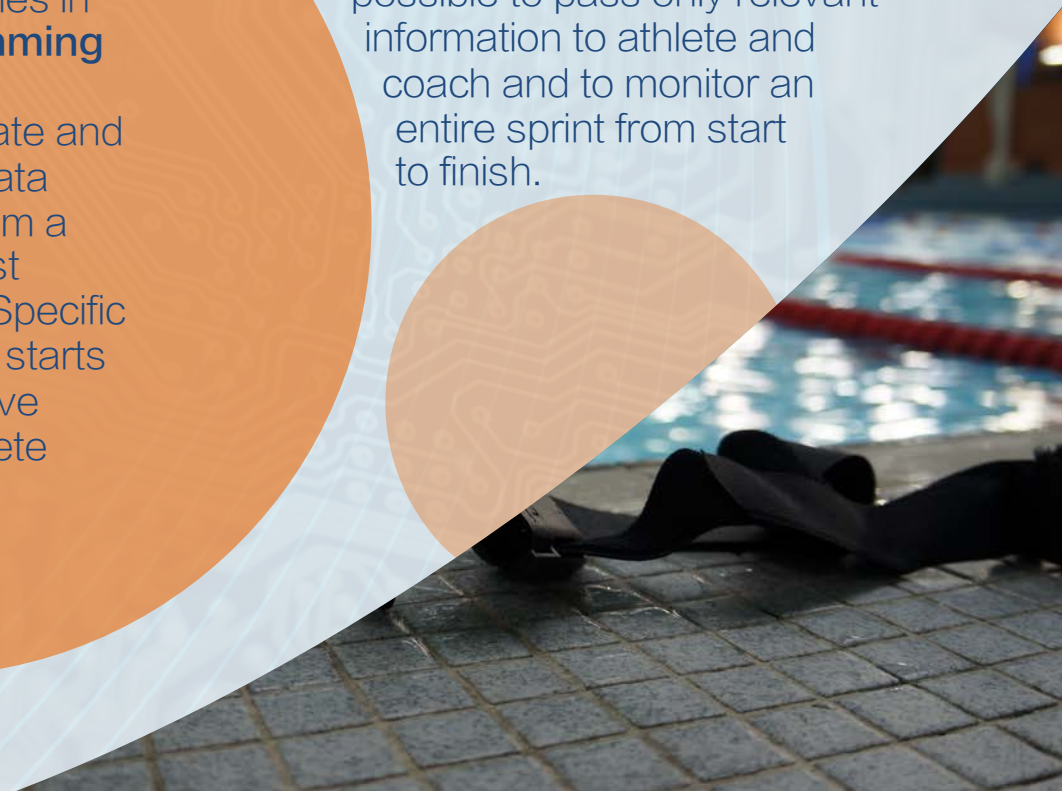
Several projects are looking into supporting athletes in producing as much power as possible. This involves implementing mechanisms as diverse as providing accurate geometry measurement, implementing novel mechanical models and recreating the feel of the road on the automated cycling ergometer.

Current **Cycling** ergometers tend to be non user friendly with limited functionality and extensibility. We can harness their potential to provide a repeatable, controllable setup to test the mechanical, biomechanical and biophysical influences on athlete performance.

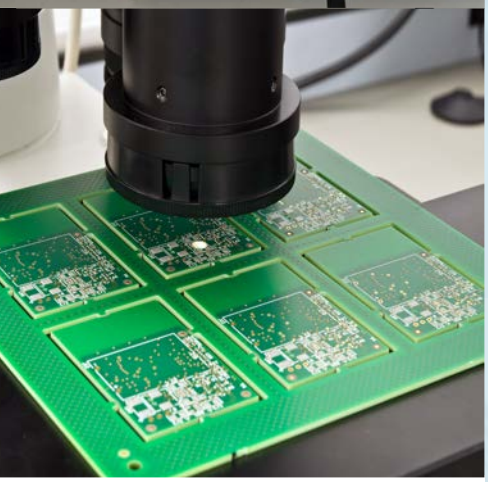
Focus on the acquisition of kinetic and kinematic data allows our control mechanisms to simulate the athletic experience.

Providing quick, reliable feedback on **sprint performance** has previously been limited to the starting block or expensive infrastructures of of force plates and light gates. With custom made software, developed to support a wireless inertial measurement unit, it becomes possible to pass only relevant information to athlete and coach and to monitor an entire sprint from start to finish.

Feedback capabilities in performance **swimming** are improved by combining force plate and pressure sensor data with information from a network of low-cost wireless sensors. Specific work on swimming starts has shown a positive contribution to athlete race capability.



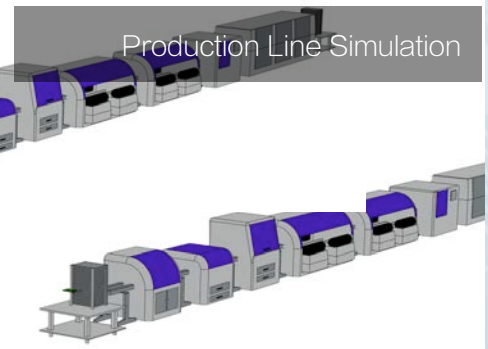
Embedded Tag PCAs at the MTC



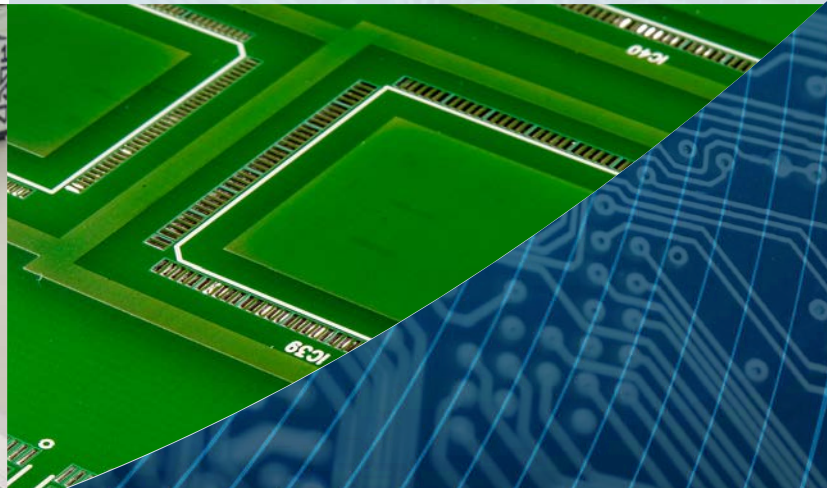
An Integrated End-to-end Supply Chain Monitoring System

Physical models of solder paste application and reflow are integrated into EIIS discrete event simulations for PCA manufacturing. Bayesian networks then support prediction of failure in first time yield of high complexity, tagged products.

- RFID and sensors uniquely embedded within PCA
- Real time location of the product within the supply chain
- Visualisation and monitoring of the manufacturing line
- Machine-system integration



Production Line Simulation



Intelligent Electronics Assembly

Increasing Yield in the Manufacturing Supply Chain

Manufacture Right First Time

Our integrated software toolkit enables the prediction of sources of quality and reliability, as well as providing root cause analysis capabilities.

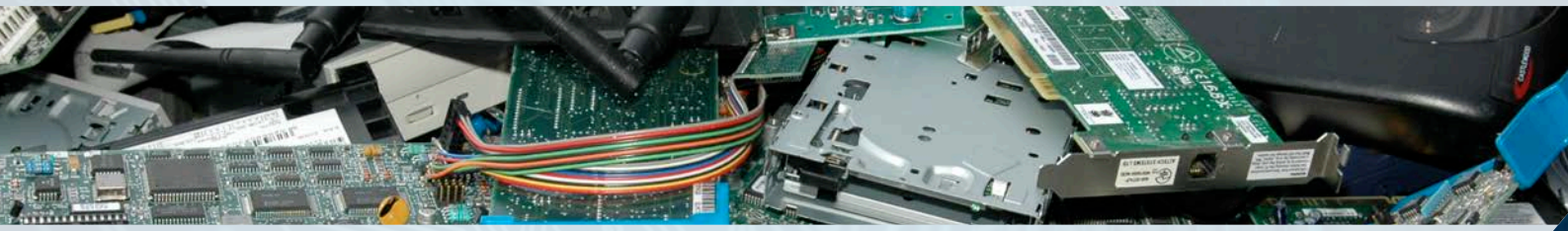
This strain is reduced using dynamic modelling to:

- Increase yield of electronics components susceptible to failure due to strain loading
- Identify suitable locations for components during product lifecycle
- Reduce new product introduction time
- Provide line optimisation

Electronic Components Recycling

Monitoring the Recycling of Assets, Materials and Components at S2s

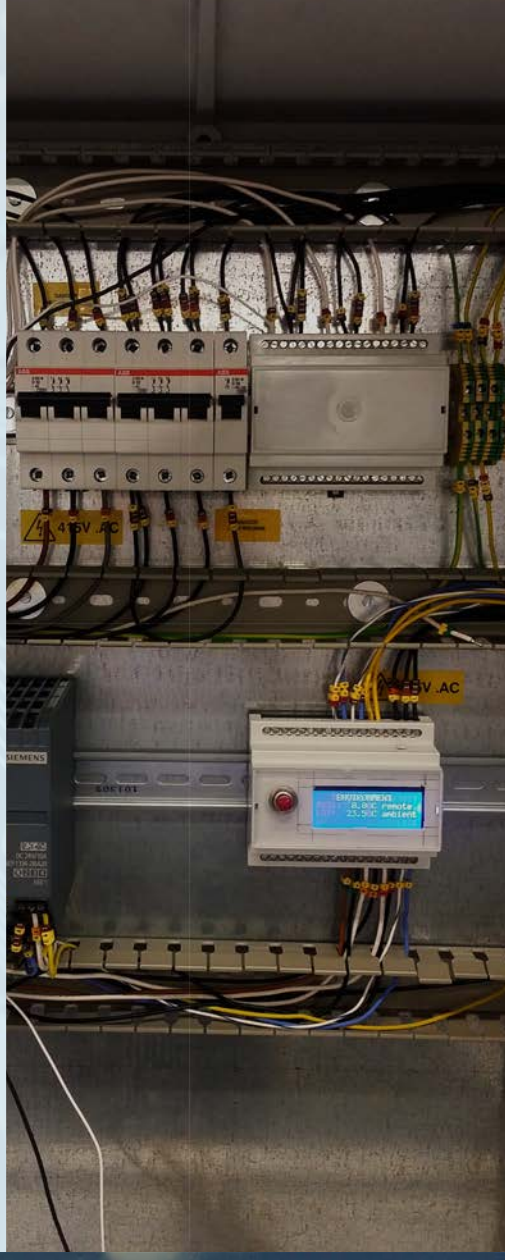
Our recycling solution monitors assets and processes from receipt of equipment by a reuse organisation up to sale or donation.



RFID enabled workbenches track tagged containers. Web services then provide real-time information on goods as they pass through stations such as visual inspection, data erasure, functional testing and PAT testing:

- Cost analysis support for repair and resale of assets
- Assurances that process order is maintained
- Traceable repair and inspection

Smart Energy Consumption



Sustainable Resource Management to Reduce Costs

Deployment of our energy management solution enables companies to maintain production volume and achieve cost savings through bespoke improvements in shop-floor efficiencies.

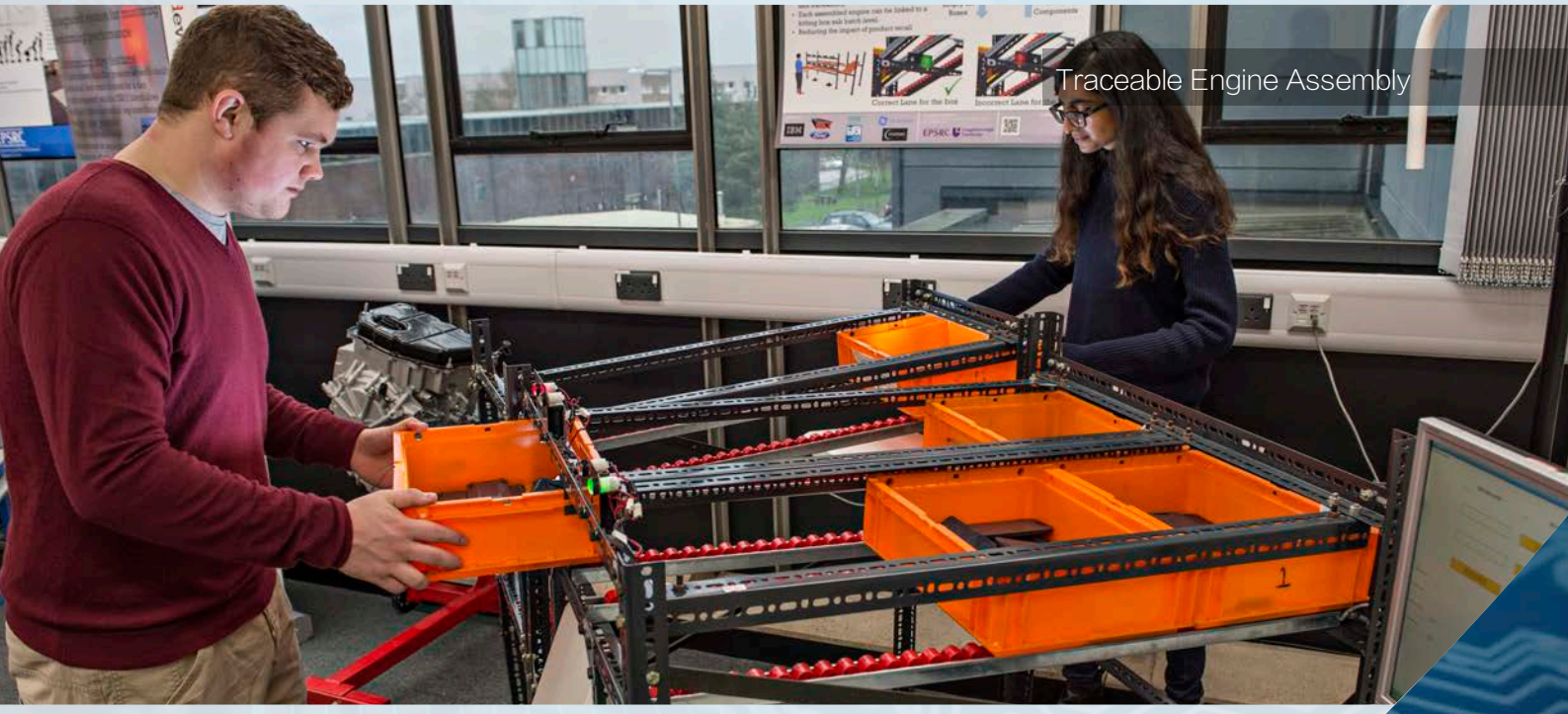
Interfacing with the existing production information system, the energy monitor abstracts data to EIIS middleware to provide energy analytics to clients.

- Monitors real-time machine consumption and production patterns
- Flags up overuse and idling outside of business processes
- Provides access to intelligent automation and detection
- Prevents up to 27% of energy wastage

A Kitting-Loop Checking System

Coordinating the Picking Process for Sub-batch Level Components

Components placed in the line for engine assembly are currently monitored with paper barcodes. Visual similarity of components and damaged barcodes cause problems for product traceability, with the potential for entry of incorrect components into the supply chain.



Traceable Engine Assembly

- Web service: link assembled engines to sub-batch level in kitting-loop
- Improved kit box visibility for verifiable component picking
- Increased control and traceability during assembly

Secure Document Track and Trace

Tailoring Hardware and Software for Document State Monitoring

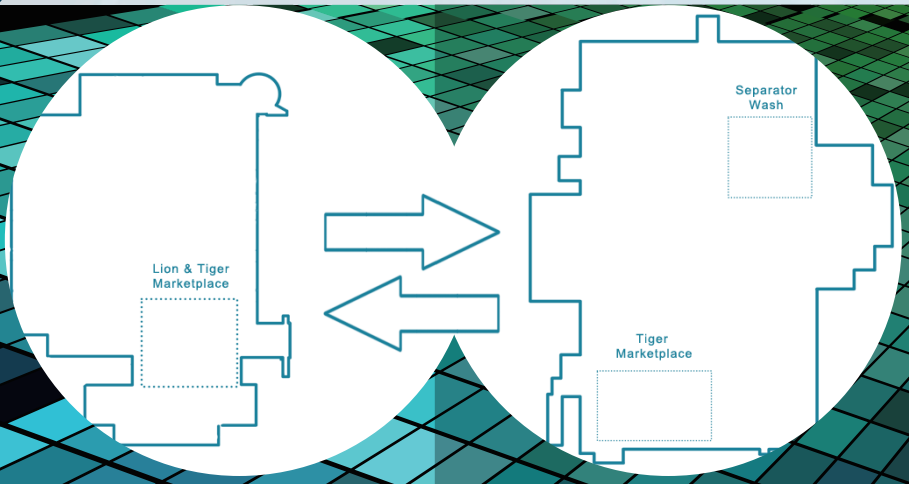
When business rules demand the use of printed documents, EIIS secure document tracking manages access, transfer and storage.

RFID tracking is combined with implementation scenario evaluation through discrete event simulation and enterprise modelling. This enables control of the state of and information in the documents.

- Authentication and traceability
- Agile change management
- Frees up 45–59% of staff time
- Better resource use

Smart Services and Web Solutions

Custom-Designed, Integrated EIIS Solutions for Industry



While EIIS devices yield large quantities of monitoring data, intelligent algorithm design and semantic technology are used to provide innovative forecasting and harness the value of available knowledge.

Smart networks and cloud computing enable us to expose services as API based endpoints without stipulations on client infrastructure. Access to timely information provided by integrated systems becomes ubiquitous.

- Rapidly orchestrated
- Collaborative
- Manageable
- Scalable
- Reliable

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