Innovate UK

Results of Competition: Accelerating Innovation in Rail 5 - Disruption to Trains - 0-12 Months

Competition Code: 1709_INNV_RAIL5

Total available funding is £7.9m

Note: These proposals have succeeded in the assessment stage of this competition. All are subject to grant offer and conditions being met.

Participant organisation names	Project title	Proposed project costs	Proposed project grant
FEONIC TECHNOLOGY LIMITED	Feonic Hybrid Powercell	£126,934	£88,854
ACTIVE-PCB SOLUTIONS LIMITED		£33,595	£20,157

Project description - provided by applicants
Feonic specialises in developing and miniaturisation powerful smart-material products and has been producing and selling a range of maintenance free, solid-state audio devices for over ten years under world-wide patent protection. Laboratory results at Feonic show that when the smart-material in one of these audio products is subjected to external vibrations, electrical energy is generated and can be harvested and stored in ultra or super-capacitors very efficiently. Unlike most mechanical vibration harvesting devices Feonic technology does not need to be tuned to specific resonant frequencies, but harvests power over a wide frequency range. Following a number of documented rail accidents caused by failing train wheel bearings there is a real need to monitor the bearings temperatures in order to recognise and therefore predict change possibly avoiding potential failure. The use of antiquated battery technology - with its need for battery replacement every few years, is hampering the widespread deployment of wireless connected sensors in many markets. This project sets out to produce a small, lightweight power generator that harvests and stores sufficient energy from the train's mechanical vibrations to be used to create a maintenance-free autonomous power generator for wirelessly connected sensors for this and other markets. A Feonic Hybrid Powercell will harvest and store power from a wide range of vibration frequencies commonly found in transportation, rotating, large machines -in many different industrial fields. This power will be used to monitor and report any number of functions, for any number of possibilities in the emerging Internet of Things without maintenance support or battery replacement.

Note: you can see all Innovate UK-funded projects here
https://www.gov.uk/government/publications/innovate-uk-funded-projects Use the Competition Code given above to search for this competition's results

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GETTRIK LTD.	TRIKCL	£414,000	£289,800
CLICKS AND LINKS LTD.		£288,000	£201,600
Project description - provided by applicants			
We aim to revolutionise the rail industry by providing an automatic drone asset mapping and 3D location based reporting system, that will enable mapping , review and maintenance of assets. The existing method of asset mapping requires intensive manual work. Engineers need to take a photo and make measurements manually of the area of interest. This data is logged in a paper report which makes it difficult to search, compare and utilise afterwards. Further innovation and Artificial Intelligence (AI) is limited because there is no method of recording accurate asset data and their location. We are proposing a new 3D database and interface system that can generate, store, visualise and utilise 3D data online in real time. Our platform can generate 3D model from camera/drone/satellite images, import other 3D asset data, integrate with real time monitoring sensors, and enable multiple users to search, compare, annotate the 3D model and related data in real time. Our solution can be used via multiple platforms either on desktop, tablet, in a VR immersive or exported to AR devices for on site use. Our system would make it faster to survey, inspect, maintain and repair rail assets, and provide a more accurate way to track and compare changes in 3D. With an accurate data position, we could have a more accurate AI that can assist in decision making of predictive and preventive maintenance that was not possible before and provide 'Minimal disruption to train service'.			

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
JR DYNAMICS LIMITED	Pantograph carbon strip wear detection system	£321,559	£225,091
UNIPART RAIL LIMITED		£60,676	£30,338

Project description - provided by applicants

The majority of electric trains are fitted with a pantograph that transmits power from overhead lines to the locomotive. The pantograph is in constant contact with the overhead lines. The guide horns are fitted with a carbon contact strip which is a sacrificial component that is a consumable. Damage to overhead lines due to worn pantograph carbon contact strips can cause catastrophic failures that can lead to de-wirements, costing milions of pounds and service disruptions. Currently there are no known methods for detecting the wear on the carbon strip on a real time basis and as such, the carbon strip is replaced on periodic bases, often prematurely, causing unnecessary expense, added maintenance time and cost. There are static systems which capture and analyse pantograph carbon wear at a given point and place in time, they do not provide anything more than a snapshot in time of the condition of the collector strips. JR Dynamics LTD (JRD) developed a concept for a system that would accurately detect the carbon wear and thus reduce maintenance costs and times. JRD's vision is to equip all pantographs with a low cost carbon strip wear monitoring system (CWD) that conveys to the train operator the state of wear in real time and thus avoiding premature replacement and unnecessary changeovers. The objective is to create an intelligent low cost system that is supplied and retrofitted to existing pantographs with little disruption or costs. Revenue will be through the supply/integration of the sacrificial wear monitor technology, through to data capture and analysis as part of maintenance optimisation where the access to the data is chargeable. Such models have already been put in practice by JRD through the supply of the PANDAS; pantograph impact detection system and thus this model of charging has already been accepted by train operators. The project will focus on created a CWD that integrates with existing pantographs with minimal modifications and disruptions while meeting legislation and rail regulations to ensure that the product is accepted and approved by the rail authority. The innovation will be the production of a modular carbon strip and a carbon strip wear detection base that will contain the necessary sensors and telematics.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
IOTICS LTD	RODIO: Railway Optical Detection of Intrusions and Obstacles	£185,446	£129,812
FINCORE LIMITED		£170,736	£102,442
NETWORK RAIL INFRASTRUCTURE LTD		£5,315	£5,315
TATA STEEL UK LIMITED		£58,865	£29,433
VORTEX IOT LIMITED		£165,843	£116,090

Project description - provided by applicants

RODIO is an industrial research project developing a scalable solution to address the complex challenges of remote condition monitoring (RCM) of rail tracks. The RCM challenges identified by Network Rail include tree fall, rock fall, trespassing, animal intrusion, landslide and subsidence. The emerging internet-of-things (IoT) technologies can offer low-power and remote sensing and data communication for the RCM problem. However, technical and scalability challenges include powering and maintenance of sensors and wireless connectivity in network wide, remote and harsh environment. The project aims to develop near real-time detection and identification of intrusions and obstructions on rail tracks. The system performance will be analysed and evaluated through a live pilot deployment in TATA Steel Port Talbot (Wales). Exploitation and deployment of low-power IoT solutions, artificial intelligence and edge computing on the existing rail network will deliver state-of the-art RCM systems which will be beneficial to the UK rail infrastructure, train operators, passengers and freight customers. The project team including IOTICS, Vortex-IOT, Fincore, TATA Steel UK and Network Rail Infrastructure, brings together multi-disciplinary expertise, resources and skills from IoT, Machine Learning and Edge Computing to heavy industry and key rail-sector partners.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
RAILVIEW LIMITED	Industrial research of a disruptive technology to monitor the health of rail subsurface infrastructure (hidden) assets in real time using innovative radar and visualisation technologies - Infrastructure Monitoring System (INFRAMONIT)	£528,283	£369,798
CREATE TECHNOLOGIES LIMITED		£97,632	£68,343
MERMEC UK LIMITED		£48,000	£33,600
NETWORK RAIL INFRASTRUCTURE LTD		£20,914	£20,914
SPEARHEAD INTERACTIVE LIMITED		£511,869	£358,308

Project description - provided by applicants

Industrial research of disruptive technologies to monitor the health of rail subsurface infrastructure (hidden) assets in real time using innovative radar and visualisation technologies -- Infrastructure Monitoring System (INFRAMONIT). This project simply addresses the global challenge of how to maintain subsurface infrastructure. It focuses on Intelligent Maintenance based on trainborne inspection which provides accurate, timely information for condition-based intervention and reduces the need for workers to be on or about the operating railway. INFRAMONIT can see below the surface to inspect rail substructure, rail ballast, drainage systems, subgrade, water pipes and utilities, tunnel linings, retaining walls and bridge surface structures. Rail infrastructure must meet the future needs of passenger and freight customers and should be more reliable, more readily available and easier to maintain. INFRAMONIT provides the innovations that monitor the health of the infrastructure assets in real time using smart, built-in sensors and novel radar technology. The planned research is a critical investigation for the purpose of product development leading to an improvement in the current state-of-the-art. It will create a prototype demonstrator which will be tested in a laboratory with simulated infrastructure failures for technology validation. It targets a better way of monitoring and visualising the status of infrastructure to avoid disrupting train services by developing a technology that automatically delivers preventive maintenance plans so that maintenance can be completed before a failure occurs. This project will provide a new smart technology to inspect and maintain resilient integrated rail infrastructure. The system is innovative, unique and the transport infrastructure managers involved from Network Rail are confident it has a large market potential. The SMEs will use the project to commence the commercial development of this disruptive technology of infrastructure inspection radar. There are two main foci of innovation, the first is the novel rotational kinematics of the antennae, which allows data to be collected continuously from a three-hundred sixty-degree swath about the longitudinal axis of the vehicle. This offers a significant competitive advantage over current state of the art systems, which consists of several vertically fixed antennae uniformly positioned along the vehicle's lateral axis. The second focus is on fundamental processing software to transform the raw radar data into subsurface visualisations, which will be developed in parallel with the prototype. Key words: radar, inspection, visualisation, preventative maintenance, rail infrastructure, resilience, capacity, failure, repair, planned maintenance.

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Participant organisation names	Project title	Proposed project costs	Proposed project grant
RCM2 LIMITED	Multi-sensor condition monitoring for predictive maintenance of rail infrastructure using optical fibre sensors (OptRail)	£398,644	£279,051
Brunel University London		£248,476	£248,476
SURREY ADVANCED CONTROL LIMITED		£120,883	£84,618
TWI LIMITED		£121,553	£121,553
YELTECH LTD		£389,500	£272,650

Project description - provided by applicants

Maintenance of rail infrastructure is a major cost to the rail industry, costing over **£1billion p.a**. in the UK and representing **18% of Network Rail's expenditure**. It is also a major source of network disruption from both planned and unplanned maintenance operations. Rail usage and demand for rail services is increasing rapidly, placing more traffic on the rails and increasing requirements for maintenance. **Predictive maintenance** uses data and models of the rail track and its condition to estimate remaining useful life and target maintenance where it is needed to reduce unnecessary maintenance prevent unplanned reactive maintenance in case of failure. The savings can be huge. Network Rail have identified that reaching world-class predictive, risk-based maintenance strategies could deliver the following benefits: * **25-35%** **reduction** in maintenance costs * **70%+** **reduction** in the number of service failures * **35-45% reduction** in down time following failure * **20%+ increase** in workforce productivity * fewer unplanned, reactive interventions delivering enhanced workforce safety. Implementation of these strategies requires accurate, detailed and up to date knowledge of the state and condition of the railway infrastructure. This cannot be obtained using traditional manual inspection and new technologies for monitoring track and infrastructure condition, and automating data acquisition, analysis and maintenance planning will be essential to deliver these benefits. This project will develop a novel automated system for maintenance planning of track maintenance, using a unique combination of **optical fibre sensors** developed for use in harsh environments encountered in the oil and gas industry, coupled with new generation **Internet of Things (IoT)** communications technology and **artificial intelligence** to provide **automated decision support** tools for optimisation of maintenance programmes based on continuous real-time monitoring of track condition. The system will complement and interface with existing **digital inspection technologies** such as measurement trains, filling a need for continuous, **real-time monitoring** and model-based prognostics and optimisation. Central to the design of the sensor system are usability and low-cost. OptRail will be developed as a modular system with the sensor elements and interfaces built into a robust package that can be reliably bonded to tracks or embedded in structures with minimum effort and downtime.

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SMART COMPONENT TECHNOLOGIES LIMITED	Smart-X: A remote-condition monitoring technology for voids, nose impact and switch movement at S&C's	£633,137	£443,196
CHG ELECTRICAL LIMITED		£214,478	£150,134
NETWORK RAIL INFRASTRUCTURE LTD		£49,855	£49,855
University of Birmingham		£239,737	£239,737

Project description - provided by applicants

Switches & Crossings' (S&C's) are the costliest and most safety critical asset within the rail infrastructure to maintain. Smart Component Technologies (SCT), and their collaborators University of Birmingham, CHG Electrical Ltd and Network Rail, will develop through this project a technology that can detect track voids and measure nose impact at S&C's, as well as condition of the switch mechanism/drive. This device, which sits within a wider suite of products that have already been developed, will additionally be able to report on the overall health of the S&C, especially when this data is combined with other data inputs gained from additional asset monitoring technologies. The objective is to create a solution that helps rail infrastructure owners, such as Network Rail, to detect and remedy problems at S&C's in a cost-effective manner before they become a critical failure on the network. The project directly addresses challenges identified by Network Rail for 'Reliable and Resilient Switches'. The project outputs will improve automated inspection methods, helping predictive maintenance, whilst furthering understanding of precursors to switch wear and damage. Achieving the above will help keep passenger and freight trains running smoothly, as well as prevent catastrophic events, such as derailments.

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BLOCK DOX LIMITED Loughborough University	COUNTER: Computing train Occupants Using Novel sensing Techniques to Enhance Rail	£377,250 £110,684	£264,075 £110,684

Project description - provided by applicants

CONTEXT: Understanding realtime passenger rail service use is crucial, because overcrowded rail services (annually published as Passengers in excess of capacity, with maximum allowable PiXC of 4.5%) lead to more delays, increased risk of accidents, reduced passenger comfort (highest load measured was 184%, DFT 2012) and decreased passenger satisfaction (National Rail Passenger Survey (NPRS); Transport Focus, 2014) requiring train operators to invest in remedial measures, whilst underutilised services are not cost effective. Knowledge of passenger loading diversity by rail operators is not comprehensive, so services are provided on data collected: at route or network-level not station-level (insufficiently disaggregated); in discrete time episodes rather than continuously (incomplete); based on studies undertaken several years previously (out of date). Historically, the difficulties and expense of collecting and analysing high volumes of good quality data made such management decisions understandable. Recent developments in sensor and information communication technologies mean they are not justifiable today. **NEED**: COUNTER has implications for all types of routine, incidental and disrupted rail travel: crowding penalties (MOIRA2; PiXC), delays (Public Performance Measure), optimising boarding/alighting times, journey suppression, insufficient capacity, customer satisfaction, on-board experience, revenues, congestion, timetabling, train/station design, operational cost reduction, health and safety, pollution, energy saving and facilities management. Accurate intelligence about passenger flows/demand is critical for Intelligent Trains. Despite being the primary challenge facing all train operators obtaining a precise and reliable measurement of real time passenger demand remains difficult based on current techniques, e.g. video imaging/weight sensors. Impact: train demand inefficiently managed. **INNOVATION**: COUNTER offers a platform interoperable with existing Train Management Systems, combining a patent-pending sensor fusion method using wifi fingerprinting and lo-fi infrared sensors with machine learning algorithms to deliver an accurate assessment of real time and predictive passenger counting/flow. **OUTCOME**: COUNTER will generate predicted revenue of £118M within 5 years of launch, along with new jobs and generation of new knowledge with wider applications including all mass transit systems and building management. UK-wide, it will cut delays due to boarding and alighting by 10% (worth ~£5.5m per annum); reduce station and platform accidents by 10% -- i.e. ~ 700 passenger injuries a year; cut rail customer dissatisfaction levels by 10%; attract 0.8% more passengers to UK rail network from higher service quality -- i.e. £75m per revenue per annum; increase revenue from station/platform and train advertising by better qualifying eyeballs/impressions and dynamically trade advertising space (worth ~£160m per annum). **Keywords**: _Sensors, Footfall, Network Capacity_.

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RELIABLE DATA SYSTEMS INTERNATIONAL LIMITED	VALISE - the 'video balise' for precise low cost train positioning	£629,022	£440,316
BALFOUR BEATTY RAIL LIMITED		£99,207	£49,604
FIRST RAIL HOLDINGS LIMITED		£15,131	£7,566
NETWORK RAIL INFRASTRUCTURE LTD		£40,362	£40,362
NOTTINGHAM SCIENTIFIC LIMITED		£153,068	£107,148

Project description - provided by applicants

Precise train positioning is key to the vision for an innovative railway presented by the Rail Capability Delivery Plan 2017\. GPS is problematic for rail and currently the industry relies heavily on signs, transponders and balises in the track to locate a train at a specific point on its path. These are expensive to install and maintain. Each new application that needs them increases the complexity and management burden of the infrastructure. This project takes a completely new, lower cost, approach. Adapting recent developments in technology for autonomous cars, a train will be able to locate itself without needing any infrastructure equipment. Instead of a physical transponder or balise in the track, the system creates a virtual 'Video Balise' - Valise, which is stored in a forward facing camera mounted in the windscreen. The Valise is 'read' as the camera recognises that the train is passing the stored location. The Valise will unlock the potential for many high value applications which cannot economically be delivered with today's expensive physical positioning infrastructure. The project is being delivered by RDS in collaboration with Nottingham Scientific Ltd, Omnicom Balfour Beatty, First Group and Network Rail. RDS will develop the Valise technology and integrate it with its Video Train Positioning System (VTPS) to provide an autonomous low cost system suitable for deployment in service trains. The technology will be trialled in a real-time demonstrator on a First Group train, integrated with the RDS Driver Support System (DSS). The demonstator will show how the technology would be deployed for platform stopping and 'virtual' temporary speed restrictions. Balfour Beatty and Network Rail will validate the performance of the Valise against existing positioning systems and demonstate its use for remote monitoring and survey applications. NSL will bring its R&D experience in 'virtual balise' technology using satellite postioning (GNSS). With this, the project team will develop a safety approach for integerating GNSS and video virtual balises in order to realise a dependable virtual balise capable of use in safety related applications.

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TETHIR LTD	Vehicle Internet Links using Infra-Red transmission of Information (VILIRI)	£274,752	£192,326
BROADBAND ACCESS STRATEGIES LLP		£112,300	£78,610
NETWORK RAIL INFRASTRUCTURE LTD		£24,949	£24,949
Northumbria University		£133,193	£133,193

Project description - provided by applicants

Only a third of passengers on the UK's railways seem happy with the wifi service they receive on the train. People increasingly expect free and reliable internet wherever they go and are frustrated that train journeys interrupt the entertainment and communications they value for lifestyle and work. The problem is not for lack of attention. The Government knows how much this matters to people and has called for rail franchises to include free wifi from 2020\. Although the initiative itself will guarantee no more than 1 Mbps per head, it sends a clear signal to the train operators who have so far found it difficult to justify investment in the infrastructure needed over the timeframe of the franchise contracts. Network Rail Infrastructure Limited (NRIL) is the owner and operator of most of the rail infrastructure in Great Britain and is at the forefront of attempts to find innovative solutions for this market failure. HS2 is the next major railway infrastructure project in the UK and an excellent opportunity to prove high bandwidth, reliable internet services for entire journeys. VILIRI's approach is based on Optical Wireless Communications (OWC) that uses Infra-Red (IR) frequencies to send data between train and trackside at 10Gigabits per second (10Gbps). This is more than enough for all types of internet browsing, real time communications and effectively unlimited capacity for each passenger. The innovation is to use advanced optics with high levels of concentration and carefully matched sensors that can take low power IR signals and process them reliably in real time. This needs transceivers on the train and along the track so that data is transferred by line of sight from each transceiver in turn. The quality of service achievable will support operational communications and security CCTV picture transfers, for example, as well as information and internet for the passengers. The project will enhance the capability of the optical links by advanced signal processing and multiple channels where needed. Care will be taken to ensure that the optics remain clean and clear in all weathers. Most importantly, the business case for installing the system as part of the railway infrastructure will be covered by the revenue that additional internet services will bring while passengers enjoy the basic internet service without direct charges. Capital costs will be reduced by internet connection within the provision of optical fibre that has to be laid for signalling and other functions.

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APOLLO RAIL LTD	SAFRON: Safe Operational Radio Network for mixed-priority communications to trains using a shared architecture.	£166,235	£116,365
NETWORK RAIL INFRASTRUCTURE LTD		£15,955	£15,955
TELERAIL NETWORKS LTD		£166,538	£116,577
University of Surrey		£126,557	£126,557

Project description - provided by applicants

The demand for train-to-track communications are proliferating; with in-cab signalling, passenger WiFi, remote CCTV, passenger counting, e-ticketing and remote condition monitoring (RCM), passenger information systems (PIS), seat reservation systems, driver advisory systems and many other applications jostling for bandwidth. Many of these applications require guaranteed priority, security, and/or safety integrity. Traditionally to satisfy this, these applications have dedicated roof antennas, routers and networking but space on trains is restricted and duplication is costly. The cost and complexity for Train Operating Companies (TOCs) to provide digital connectivity creates a barrier to adoption of new digital data-centric services to make train operation more intelligent. SAFRON will create a prototype for a shared communications architecture such that any data-centric system can use the same connection from train-to-trackside at an assured level of priority, safety and security. This will reduce the cost for the TOC by eliminating duplicate connections and enabling them to make better use of data. We will explore several classifications of train-to-trackside data: * Public * Private * Mission-critical * Safety-related (SIL2) We will explore the requirements for each of these application types, including security, quality of service, bandwidth, and data timeliness. Furthermore, due to approaching obsolescence of the existing lineside GSM-R network, we will assess the suitability of this architecture for safety-critical train control (SIL4). Communications technologies we will consider include 4G LTE and emerging 5G, with the option for falling-back on 3G and GPRS technologies too for resilience. A hardware and software system that can accommodate these application types will be developed and demonstrated to satisfy their respective safety, security, and performance requirements. We will evaluate their performance in the lab in indicative operational and degraded scenarios. A safety and security review will be carried out on the proposed solution, and an approval strategy will be developed for certification and product approval. SAFRON will allow all players in the railway industry to use this fast and ubiquitous network to support the train and trackside to become more closely integrated - working together as one system. SAFRON will be delivered in partnership between Apollo Rail Ltd (Apollo), TeleRail Networks Limited (TeleRail Networks), University of Surrey (Surrey), specifically the Surrey Centre for Cyber Security (SCCS) and the 5G Innovation Centre (5GIC) and Network Rail Telecoms (NR). We have letters of support from project stakeholders including Department for Transport (DfT), Heathrow Express (HEx), Railway Safety and Standards Board (RSSB), and Network Rail Signalling.

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MOBIBIZ LTD	IoT-enabled Platform for Rail Assets Monitoring and Predictive Maintenance (i-RAMP)	£400,000	£280,000
COSTAIN LIMITED		£650,000	£325,000
University of the West of England		£450,000	£450,000

Project description - provided by applicants

In 2016, there were more than 233,000 cancelled rail journeys in the UK out of a total of 7.2 million planned journeys (Office of Road and Rail - ORR, 2016). The majority of these disruptions were caused by asset failures and unscheduled maintenance on the rail network. As a result, over £28 million was claimed by passengers from operators for service disruptions. Data available from rail network assets and users are sources of insight to address challenges experienced by passengers and station operators; unfortunately, this data has not been leveraged for this purposes (Network Rail 2016). This project will develop an IoT-enabled Platform for Rail Assets Monitoring and Predictive Maintenance (i-RAMP). The i-RAMP system is composed of two outputs: (i) Artificial Intelligence (AI)-based Simulation IoT Platform (ASIP), which will provide an interactive and holistic simulation platform to virtually evaluate the entire railway station, alert of potential failures and generate optimal maintenance regimes. (ii) Augmented Reality (AR) Toolkit, which will use mobile AR devices and Head Mounted Displays will support rail station maintenance. The i-RAMP system will employ techniques in Artificial Intelligence (AI), Internet of Things (IoT) and Augmented Reality (AR) to enable predictive and preventive maintenance. The project's outputs will significantly reduce time to fix failures and it will provide better value to the end users. In addition, the i-RAMP system will enable a deeper understanding of customers' behaviours and to predict how services can be dynamically scaled to meet the demand of the passengers. _**Keywords**_: Predictive Augmented Reality for Rail Maintenance, IoT-based Intelligent Rail Stations, Enhancing Customer Experience in Rail Stations.

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PERPETUUM LIMITED TWI LIMITED University of Southampton	MONAXLE - Live monitoring of train axles with autonomous wireless systems	£843,542 £150,580 £160,163	£590,479 £150,580 £160,163
Project description - provided by applicants			
Currently train axle inspections are required on every axle, every year. This is because an axle failure can lead to a derailment and significant damage. Train axle failures have caused major loss of life, with a consequential increase in both non-destructive testing and manual inspection that is expensive and disruptive to efficient rolling stock maintenance. This project aims to develop a method for detecting axle cracks on trains with on-board self-powered monitoring. The vision is to use continuous live monitoring of axles with low cost self-powered wireless systems that are easy to install and will replace expensive and disruptive NDT methods in maintenance sheds, eliminating inspections between major overhauls. It is intended to show that very significant cost reductions for train operators could be achieved as well as improvements in safety. The project will develop advanced low power signal processing and sensing techniques suitable for use in Perpetuum's harvester powered sensor platform on a test rig that will be built at Southampton University, using the key expertise of TWI Ltd., in NDT and fatigue cracks. This is a completely new approach to the serious issue of ensuring that cracks in train axles can be safely identified at reasonable cost. The project will be undertaken by experts at Perpetuum Ltd, University of Southampton and TWI Ltd...			