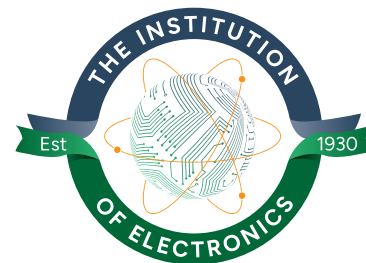


ELECTRON

THE QUARTERLY NEWSLETTER OF THE INSTITUTION OF ELECTRONICS



Autumn 2024

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ENGINEERING DESIGN SHOW



The Engineering Design Show, held at the Coventry Building Society Arena on 9th. and 10th. October, was described as ‘the UK’s biggest celebration of mechanical, electronic and embedded design’, with media partners including electronic specifier, Engineering Update, MEPCA Magazine, Process Engineering Control and Manufacturing, Sustainable Engineering and the UK Gasket and Sealing Association.

In addition to 53 presentation spread across five theatres, and 217 exhibitors, key features this year included a dedicated start-up zone showcasing new products from Structural Evolution, Electrogear Solutions, Infinicity, and HAL Robotics, along with 3D printers and scanners from Construct 3D, Nexa 3D, and Central Scanning, sponsored by Conex Portal UK. In addition The Innovation Zone featured Creative Hubb Limited’s EOD Bomb Disposal Suit, a complex garment consisting of multiple layers of meta and/or para aramid materials. There was also a Race to Place Games Zone that afforded the opportunity to experience

being behind the driver’s seat of a Formula One simulator.

Spotlight on Universities

There was strong representation this year from Britain’s universities with Nottingham Trent University in particular showcasing the work of 25 product designers including RemBot, a conversational robot designed to support ageing and dementia care, and JigSound, a revolutionary sound system that combines today’s technology with the timeless design of Indian furniture. The latter involved a study of how speakers can manipulate sound in order to achieve the optimum audio, with its creator Amar Randhawa, BA Product Design, offering the following description:

‘ Located at the bottom of the speaker is a dedicated 6-inch sub-woofer and a 4-channel port system, which provides deep, rich base. Its location allows sound waves to bounce off ground surfaces, improving its effectiveness and range. Four tweeters circle the top of the

EDITORIAL TEAM

James Clark
tel: 01200 538 640
email: jim@spirecity.go-plus.net

ADMINISTRATION

Sai Kasam
email: admin@institutionofelectronics.ac.uk

HONORARY TREASURER

Alan Hollinshead
tel: 0151 203 9115
email: alan.hollinshead@institutionofelectronics.ac.uk

DESIGN TEAM

Wayne Hodkinson
tel: 0151 528 8805
email: wayne@whdsolutions.co.uk

MEMBERSHIP ENQUIRIES

email: membership@institutionofelectronics.ac.uk

REGISTERED OFFICE

The Institution of Electronics
118 Pall Mall, London,
England, SW1Y 5EA.



speaker at a 45 degree angle. This not only directs sound appropriately but creates a 360 degree immersive experience.'

Elsewhere in the exhibition Aston University showcased its innovative 3D-printed wheelchair, whilst the University of Hertfordshire promoted the 'Robot House', a four-bedroomed house close to the College Lane campus in Hatfield in which the ground floor has been adapted into a unique research facility for human-robot interaction. This is equipped with the latest generation of robotics platforms, including state-of-the-art care robots for assisted living.

Primary Engineer

Exhibitor Primary Engineer is an educational not-for-profit organisation founded in 2005 which aims to engage primary and secondary school pupils and teachers from across the country with the inspirational world of engineering and technology.

Primary Engineer training programmes for primary school teachers are complemented by the annual Leaders Award Competition in which primary and secondary school pupils interview engineering and technology professionals, identify a problem, and design an innovative solution.

Tens of thousands of pupils take part each year, all recognised with a certificate graded by engineering and technology professionals. These pupils are celebrated at regional awards events and exhibitions, with designs being selected to be developed into prototypes by university and industry partners.

In the University of Southampton publication Engineering Design Show 2024 the role of the University of Southampton as hosts for the Primary Engineer Public Exhibition and Award Ceremony is outlined.

University of Southampton Design Projects

Also featured in the publication is the array of ongoing graduate projects at the University of Southampton. These include:



Quadcopter UAV: second year multirotor design, build and test activity in which students work in groups of five to design and build a quadcopter capable of flight with an integral self-levelling camera gimbal. Assessments are made of aircraft and gimbal performance using a state-of-the-art motion capture system.

Eurobot: A second year undergraduate design activity in which students work in groups of five to design one or two autonomous robots that compete in a pick and place timed exercise. Teams use techniques such as computer aided design (CAD), laser cutting, 3D-printed parts, wiring, soldering and computer programming in C and Python.

Soundseeking Robot: A second year design project in which a team of five designs, builds and tests a robot that seeks out and moves towards a sound source before stopping in close proximity.

Wearable Med-Tech: Teams design a device that can be worn by a person recovering from a knee operation by measuring the motion of a person's knee.

Marine Craft Concept Design: Students work in groups of three or four to develop a database containing information such as operational specifications, appropriate hull form choices, statutory regulations and environmental issues as a basis for concept design.

Formula Student STAGX: Students from all university undergraduate years design, build, test and race a single-seater race car before competing in Formula Student UK at Silverstone.



UNIVERSITY OF LEEDS PIONEERS CONCEPT OF SELF-REPAIRING CITIES

The University of Leeds has announced that it is to pioneer a £4.2 million research project into the concept of self-repairing cities using specially designed maintenance robots.

The project involves the use of drones that will be stationed around the city both to perform repairs, for example to damaged streetlamps, and for inspection, for example of road surfaces. As well as being able to work around the clock these drones can quickly identify small cracks and potholes before they present a much more serious hazard.

Another application that is envisaged is the use of robots to inspect pipes that are too narrow for people to climb through, such as water pipes that lose thousands of litres a year.

Reference: Goulding, S., 'Developing Drive Systems for Autonomous Maintenance Robots', Process Engineering Control and Manufacturing, Issue 70, 2024, p.98-99.

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FURTHER DEVELOPMENTS IN ROBOTICS

First UK Robotics and Autonomous Systems Cluster

The Manufacturing Technology Centre (MTC) and the University of Birmingham have together established Britain’s first robotics and autonomous systems (RAS) ‘cluster’ in the West Midlands with the objective of connecting relevant parties such as suppliers, integrators, users, universities and local authorities with the region’s two High Value Manufacturing Catapult Centres to improve the uptake of RAS by British industry.

The concept follows benchmarking around the Danish city of Odense, which has helped to turn Denmark into one of the world’s leading nations for robot adoption. Denmark is now ranked twelfth in the world for robot density, as against the UK at 25th. Denmark currently has over 300

robotic companies employing 8,500 people with a combined turnover of 2.4 million euros and a pipeline of start-ups and skilled personnel which is feeding the robotics sector.

Chief Automation Officer for the Manufacturing Technology Centre, Professor Mike Wilson, states:

“ Creating the first UK Robotics and Autonomous Systems regional cluster will strengthen the presence of crucial technology and support growth potential.

The work we are doing with the University of Birmingham will attract other related businesses as well as universities to engage and enthuse younger generations, supporting the deployment of RAS and raising the UK’s global rankings in robot use.”

Reference: ‘West Midlands Robotics “Cluster” could drive UK Automation Boom’, Drives and Controls, July/August 2024, p.13.

Robotic System overcomes Parts-feeding Challenges

Two Italian companies have devised a robotic parts-feeding system to address the common challenges of feeding and sorting. The Infinifeed system, designed by Doma Automation and integrated by Tera Automation, uses machine vision to manage the feeding process, eliminating the need for multiple feeders for different components or complex programming for the handling of diverse shapes.

Operation is based on a pair of parallel belt conveyors that move in opposite directions with items moving from one belt to the other under the influence of gravity. Users capture images of

items to be handled, mark gripping points and send the information to the vision system which then instructs a robot as to which items to pick up. Precision feeding ensures consistent and accurate placement of parts while high-speed operation improves throughput and reduces cycle times.

The robots are Scarva robots from Shibaura Machines’ THE Series and the system has magnetic removable shells and sides to simplify cleaning and maintenance.

The system is said to ‘represent the next step in industrial parts feeding’.

Reference: Drives and Controls, July/August 2024, p.22.

Robotic Cell protects Satellites from Solar Radiation

A French robotics company has developed a robotic cell that places thousands of tiny reflectors with an accuracy of 0.2mm onto large panels that are used to protect satellites from solar radiation.

Akeoplus has developed the system for aerospace manufacturer Thales Alenia Space to automate the placement and bonding of optical solar reflectors onto protective panels measuring up to 5m x 3m. These act as outer walls fitted with up to 7,000 reflectors, each measuring around 40mm x 40mm.

Previously the optical solar reflectors (OSRs) were mounted by hand by two or more people lying on mats using glue. Now, two robots are used, the first a small one that takes an OSR from a tray and places it onto a vacuum backlight under a camera which takes a picture. This is then inspected by MVTec’s Halcon machine vision software for breaks and scratches. A ‘shape matching’ technique is then used to determine the exact position of the OSR and checks that its size and shape corresponds to the model in the design plan.

It is important to determine the position of every reflector accurately because the robot grips each one slightly differently. It is moved to the next production step with an accuracy of around 0.2mm. If the component is fine then it is placed under a glue dispensing nozzle. Once the glue has been applied the robot picks up the OSR again and places it where the second robot, with

a longer working envelope, can grab it for further processing.

This Kuka robot moves the part in front of a second image processing system where a camera captures images of the applied glue. These are then analysed to ensure that the glue is evenly distributed and that it is in a precise pattern as specified by Thales engineers.

The OSR is then aligned precisely with the robot arm as a first step to placing it in the correct location on the satellite panel. A third high-resolution camera now takes images of the OSR, which is aligned using algorithms that determine a 3D transformation between the coordinates of the OSR corners and the coordinate system of the vacuum gripper that is holding the OSR.



The corners of the OSR are determined by the intersection of its edges and from this a coordinate system can be defined where the corner of the OSR is centred and aligned with its edges. The coordinate system of the robot effector is determined by hand-eye calibration of the robot.

As the 2.4 metre-long robot arm is not 100 per cent accurate, Akeoplus has developed an iterative servoing process that allows the robot to mount the OSR precisely on the 18 square metre panel.

The Cycle time for gluing and positioning of the OSRs is now under 45 seconds and a large panel can now be covered with solar reflectors in five days by one employee instead of seven days by two employees.

[Reference: ‘Reflecting the Challenges of protecting Satellites’, Drives and Controls, July/August 2024, p.34]



Robotic Berry Harvester matches Human Pickers

A robotic berry harvester, known as Fieldworker 1, can now harvest berries at the same speed and to the same quality as human pickers, providing growers with a predictable cost per berry.

Fieldworker 1 by Fieldwork Robotics is powered by AI-based technology that allows it to detect berry ripeness accurately with the aid of four global cameras, eight end effector cameras and spectral frequency.



Each payload has four arms with each arm being positioned on a z-axis so each arm can travel up and down the z-axis for maximum height and reach. Each z-axis has a dedicated global camera that scans the bush to detect the location and ripeness of the berries. When a suitable berry is identified the arm moves up the z-axis to a position such that it can extend out on an x-y movement. At the end of each arm two further cameras are located on the end effector, which is in effect a cup that removes the berry from the bush.

It is intended that fleets of Fieldworker 1 robots will operate with one operator running multiple robots across the field. Both day and night operation is envisaged and the first trials are set to be conducted on berry farms in Australia in the coming months.

Reference: Ford, J., The Engineer, October 2024, p.9.

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Breakthrough helps free up Space for Robots to ‘think’

Researchers at King’s College London have devised a way to give robots complex instructions without the use of electricity for the first time, which is envisaged to free up more space in the robotic ‘brain’ to allow robots to ‘think’.

The technique involves transmitting a series of commands using a new type of compact circuit that utilises variations in pressure of a fluid inside it, creating the potential for a new generation of robots with bodies that could operate independently from their built-in control centre, with this space being able to be deployed instead for more complex AI-powered software.

The innovation is also envisaged to enable the creation of robots that can operate where electrically powered devices cannot work, such as irradiated areas that destroy circuits, and in electrically sensitive environments such as MRI rooms.

The technology involves a reconfigurable circuit with an adjustable valve, which is incorporated into the robot’s hardware. This valve acts in a manner analogous to that of a transistor in a normal circuit such that engineers can send signals directly to hardware using pressure to mimic binary code. The robot can then perform complex activities without



the need for electricity or instruction from a central ‘brain’, so allowing for a greater level of control than that which is possible with current fluid-based circuits.

Post-graduate Researcher at King’s College London, and author of the study, Mostafa Monsa, forecasts:

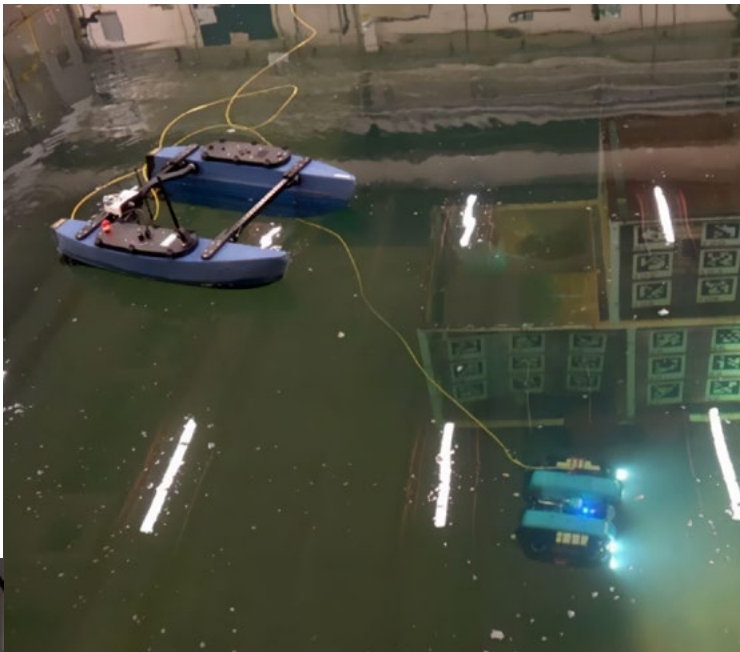
“ Ultimately, without investment in embodied intelligence robots will plateau. Soon, if we do not offload the computational load that modern day robots take on, algorithmic improvements will have little impact on their performance. Our work is just a first step on this path, but the future holds smarter robots with smarter bodies.”

Reference: Miles,S., Electronic Specifier, 11th. October

AI Development for Wind Turbine Autonomous Robots

The National Robotarium in Scotland is assisting the application of AI and control systems that could enable underwater robots to operate autonomously with high precision in turbulent areas, potentially revolutionising maintenance and repair of offshore wind turbines.

Heriot-Watt University is currently leading the project with the support of Imperial College London, geo-data specialist Fugro and underwater software development expert Frontier Robotics.



The objective is to dramatically reduce the requirement for large maintenance vessel deployment in offshore wind farm operations and for personnel to have to work in hazardous offshore environments. Through this project autonomous underwater robots could perform many essential maintenance tasks on offshore wind turbines, including taking precise measurements, conducting visual inspections, cleaning structures and repairing identified defects.

A key challenge in such deployments is keeping the robot arm or tool steady against a structure whilst being buffeted by currents and waves, and to achieve this advanced control systems and machine learning algorithms are being developed to allow the robots to adapt to real-time changing conditions. Additionally, 3D semantic mapping capabilities are being developed so that the robots can create detailed maps of their underwater environments, with the robots subsequently enabled to navigate complex structures and identify components that require attention.

Another aspect of the project is the coordination of Remotely Operated Vehicles (ROVs) and Electric ROVs deployed from Uncrewed Surface Vessels, which is important for achieving fully autonomous inspections and reducing the need for support vessels and divers.

David Morrison, Project Manager at the National Robotarium, comments:

“ Our trials are showing promising results in enabling underwater robots to maintain stable contact with offshore structures in challenging conditions. If successful, the technology could transform offshore wind maintenance, potentially reducing fuel consumption of maintenance missions by up to 97 per cent, from 7,000 litres per day to just 200 litres. This could significantly lower both operational costs and the carbon footprint of maintenance.”

Reference: Miles, S., ‘AI enables Autonomous Robots for precision Offshore Wind Farm Repairs’, Electronic Specifier, 25th. October.



ADVANCED RAIL TIP MEASUREMENT IMPROVES INSPECTION TIME OF MILLING WHEELS

Specialists in the design and production of bespoke machinery, DPMS, in collaboration with Bowers Group, have devised an advanced rail tip measurement solution that reduces the inspection of milling wheels time by 97.5 per cent, transforming industry standards.

A key aspect of maintaining and upgrading railway infrastructure is the milling process in which train-mounted wheels with rotating carbide tips remove irregularities and defects from rail surfaces so as to enhance train performance. Consistent monitoring and maintenance are required for effective rail grinding, but inaccurate measurement of milling wheel-cutting heads can lead to uneven rail surfaces affecting train stability and causing excessive wear on both the grinding wheel and the rail.

In order to address these challenges DPMS developed a tip measurement station that

allows for the synchronised inspection of both the left and right milling wheels and is tailored to lift grinding wheels from the track and relocate them into a mobile unit.

Once the wheels are positioned on a jig and firmly fixed in place within the unit, a frame containing five reader heads is gradually moved to a reading position. These reader tips gauge the highest point of each tip in their respective rows. The wheels are rotated using a motor, allowing the reader tips to capture the highest point of each cutter and transmit the collected data to a control sheet.

Initially there were mounting constraints which prevented simultaneous measurements from being obtained, whilst the Bluetooth data transfer had difficulty handling the large volume of data collected. In order to address this dial indicators were replaced with Sylvac PSi Inductive Probes so as to allow a direct connection to a laptop. These probes offer long-lasting precision guidance tested for up to 13 million cycles, whilst at the same time offer high data speed and IP65 protection.

This improvement enabled all five readout heads to be mounted in a stack, allowing immediate measurements and data collection simultaneously. With this more measurements could be taken at the same time, removing the need for manual measurement input.

The end result was substantially improved data reliability and vastly reduced measurement time for both left and right milling wheels, with inspection time being reduced from over an hour to just 90 seconds.

Reference: 'Connected Metrology Solution reduces Time', Supply Chain Solutions, Issue 21, September 2024, p.44.



SMART SENSORS AID AUTOMATED SANDWICH PRODUCTION

In many automated processes specific information is essential to ensure the smooth running of systems, typically provided by optical, inductive, ultrasonic sensors or cameras. In Germany, however, one producer, Weber Maschinenbau, which specialises in developing slicing systems for the food industry, has turned to the lesser-known smart 2D profile sensors.

In the company's complex sandwich processing operation precise edge control, margins and positioning data are essential, with the robot in the roll section, for example, needing to know the roll height and centre (lengthwise and crosswise) and whether the roll is properly aligned on the belt. A key question, therefore, is can one sensor provide the entire measured value calculation and deliver the calculated coordinates correctly in the units (millimetres) required?

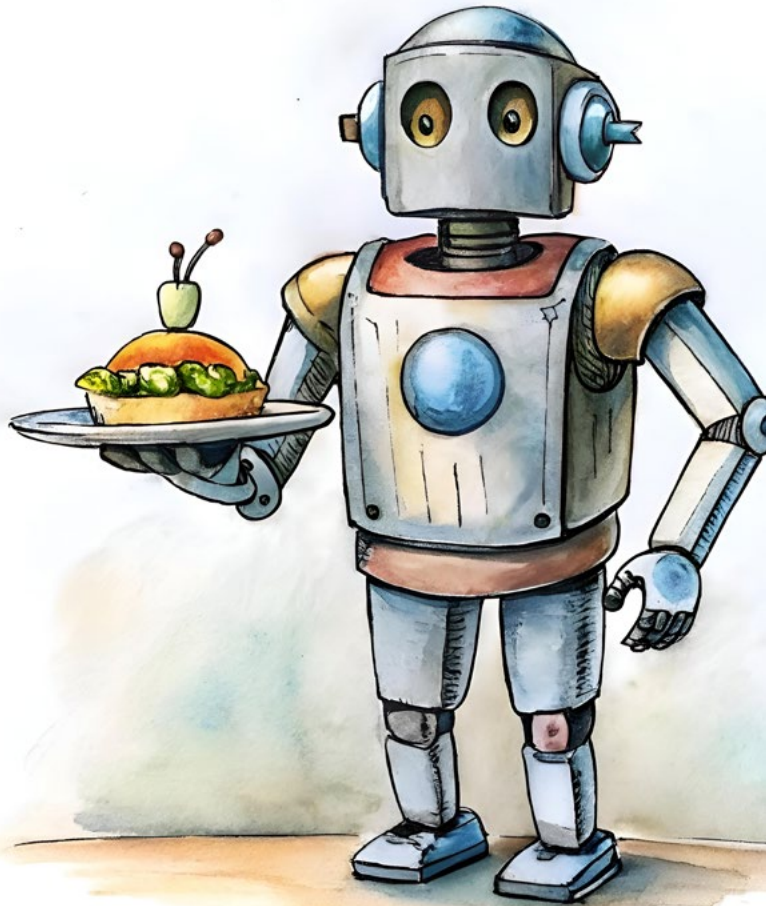
The OXM 2D sensor, developed by Baumer, provided the answer thanks to its integrated measurement and evaluation functions. This sensor thus provides the entire measured value calculation, including the calculated coordinates in millimetres. It also measures the bread height and each edge so as to calculate the exact centre of the roll, enabling suction pads to gently lift off the finished product.

On the sandwich line the sensor also determines the lateral position and height of the sausage and cheese slices on the belt allowing the gripper to position the slices accurately on the bottom half of the sandwich.

In addition to the sandwich lines the company also uses the sensors on the slicers that cut and portion cold cut ready for packaging. Here,

the sensors deliver the position data required for precise alignment of slices of salami, ham and cheese, which is essential for the finished product to be consistently placed in the same position in the packaging process.

Reference: 'Complex Sandwich Processing aided by Smart Sensors', Industrial Plant and Equipment, August/September 2024, p.18.





A SMART BUILDING CASE STUDY: SIMMTRONIC

Simmtronic, a leader in lighting control systems and smart building infrastructure, has recently undertaken a major refurbishment of its manufacturing site in Hoddesdon. The aim was to create a smart building that would improve the working environment and reduce energy consumption, whilst at the same time showcasing the technology that it develops and supplies.

The centrepiece of the retrofit was the creation of a digital twin, that is, a real-time virtual representation of the physical building powered by a web of sensors and automated systems.

Simmtronic’s own SPQ7 environmental sensors were installed allowing key factors such as carbon dioxide levels, humidity and temperature, to be measured, as well as volatile organic compounds. These sensors feed real-time data into the Building Management System, enabling automatic adjustments to be made to optimise air quality, lighting and energy consumption based on occupancy and environmental conditions:

‘When carbon dioxide levels rise in an area, the system increases fresh air intake, ensuring optimal air quality without excessive energy use. This precision-driven approach ensures that energy is only used when and where it’s needed, dramatically reducing waste and wear on equipment.’

Occupancy sensors are used to automatically switch off lights in unused areas and in daylight linking technology adjusts artificial lighting based on natural sunlight.

Integration of smart access control using HID readers allows employees to enter the building with a tap on their mobile phone via Apple Wallet, whilst corridor lighting is controlled through entry points.

A major challenge was the integration of systems from different manufacturers, particularly with the HVAC units being installed at different times and operated on various protocols, but modern units helped to overcome this.

The real-time data generated from the various sensors and control systems has enabled a 15 to 20 per cent reduction in energy consumption, which is anticipated to improve further during the winter months.

It is concluded that ‘smart building retrofits can deliver tangible benefits beyond just energy savings’ and that ‘retrofitting is not just a technological upgrade but a sound financial decision offering long-term savings and a more sustainable way to operate buildings’.

Reference: ‘How Simmtronic successfully retrofitted its Manufacturing Site’, Electrical Review, Vol.258, No.3, Autumn 2024, p.6-7.



MODELLING THE COMPLEX PHYSICS OF 3D-PRINTED COMPOSITES

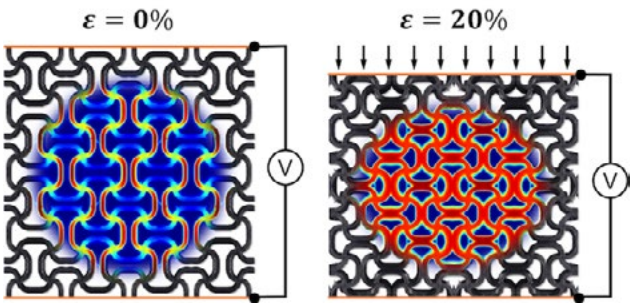
Researchers from the University of Glasgow have created the first system capable of modelling the complex physics of 3D-printed composites that can detect strain, load and damage by simply measuring electrical current.

This important innovation will allow material scientists to predict how new structures can be fine-tuned to produce specific combinations of strength, stiffness and self-sensing properties. This could have implications across various industry sectors.

In the aerospace and automotive fields it could enable real-time structural integrity monitoring in aircraft, spacecraft and vehicle components. In civil engineering it could assist in the creation of smart infrastructure capable of continuously assessing the condition of bridges, tunnels and high-rise buildings. It could also be extended to robots in automated manufacturing and to defence to monitor the integrity of body armour.

The integration of carbon nanotubes in advanced 3D-printed materials enables the material to conduct an electrical current and for its structural integrity to be measured thence using the principle of piezoresistivity. Changes in electrical current can indicate damage and so act as a signal for preventive maintenance.

The research team combined extensive laboratory experiments with computer modelling to create lightweight lattice structures from polyetherimide (a plastic) mixed with carbon nanotubes. These were then tested for stiffness, strength, energy absorption and self-sensing capabilities. Modelling was then deployed in order to predict how these materials would behave under various loads. Testing followed using infrared thermal imaging to visualise electrical current flow and its relation to material performance. Findings revealed that the models



could accurately predict how such 3D-printed materials would respond to differing stress levels and how electrical resistance would be affected, which is envisaged to have an important role in advancing additive manufacturing by enabling better prediction of material performance prior to the creation of physical prototypes.

Professor Shaumugam Kumar of the James Watt School of Engineering, University of Glasgow, states:

“Imparting piezoresistive behaviour to 3D-printed cellular materials allows them to monitor their own performance without added equipment. This means we can create low-cost easy-to-manufacture materials with the ability to detect damage and measure its extent. These autonomous sensing architected materials offer great potential for the development of advanced new components.

With this study we have developed a comprehensive system of capable of modelling the performance of self-sensing, 3D-printed materials. Informed by rigorous experimentation and theory, it’s the first system of its kind that models these materials across multiple scales and incorporates various physics.”

[Reference: West,P, ‘Enabling Future Generations of Self-sensing Materials’ , Electronic Specifier, 7th. October]

ACCIDENTAL DISCOVERY ENABLES 3D-PRINTED ACTIVE ELECTRONICS

Scientists at the Massachusetts Institute of Technology (MIT) made an accidental discovery whilst working on a project fabricating magnetic coils which could have major implications for the electronics industry.

Whilst the team was using extrusion printing, it noticed a spike in resistance when a large amount of electrical current passed through the material being used, namely a polymer filament doped with copper nanoparticles. This spike was then followed by a return to normal levels, a property that is normally associated with semiconductors.

This discovery prompted further investigation which later revealed that this material was in fact exhibiting behaviour that was characteristic of transistors, which are fundamental components for controlling electrical signals in active electronics. The fact that this material could be processed using standard 3D-printing rather than involving the use of traditional semiconductors made it a significant discovery.

Investigation followed into whether the effect observed could be applied more widely in the field of electronics and it was found that it was possible to 3D-print resettable fuses and logic gates using copper-doped polylactic acid that allowed for current control similar to that of semiconductor-based transistors, but without the requirement for silicon or cleanroom conditions.

The material operates through an effect known as the polymeric positive temperature coefficient, or PPTC, such that when the material heats up due to the flow of electrical current, its resistance increases dramatically causing the current to cease. The material then cools, resistance falls, and current begins to flow again.

Traditional fabrication of components such as transistors typically requires expensive specialised equipment, hence the ability to 3D-print active electronics marks an important step forward.

Whilst the performance of these 3D-printed components still lags behind that of silicon-based transistors, basic control applications, such as turning motors on and off, can be achieved. As the technology advances further applications are envisaged in areas such as space exploration where spare parts and electronic components could be printed directly on spacecraft, helping reduce large inventories. Looking further ahead, fully functional 3D-printed electronic systems that combine both mechanical and electronic components in a single manufacturing step, may be possible so revolutionising how electronic systems are designed and produced.

Reference: Miles, S., '3D-printed Active Electronics', Electronic Specifier, 23rd. October.

WORLD'S THINNEST SILICON POWER WAFER

The thinnest silicon power wafers ever manufactured, with a thickness of just 20 micrometers, and a diameter of 300 millimetres, have been unveiled by Infineon.

Produced in a high-scale semiconductor fabrication facility, the new ultra-thin silicon wafers are only a quarter as thick as a human hair and half as thick as current ultra-thin wafers of 40 to 60 micrometres.

Halving the thickness of a wafer reduces its substrate resistance by 50 per cent, which reduces power loss by over 15 per cent in power systems relative to solutions based on conventional silicon wafers. This is especially relevant in high-end AI server applications where growing energy demand is driven by ever higher current levels, most notably in power conversion where voltages have to be reduced from 230V to a processor voltage of under 1.8V.

The new technology in particular boosts the vertical power delivery design, which is based on vertical Trench MOSFET and allows a very close connection to the AI chip processor, reducing power loss and enhancing overall efficiency.

In order to achieve the 20 micrometre thickness engineers developed an innovative wafer grinding technique that compensated for the fact that the metal stack that holds the chip on the wafer is thicker than 20 micrometres, significantly influencing the handling and processing of the back side of the wafer.

Adam White, Division President Power and Sensor Systems for Infineon, states:

"The new ultra-thin wafer technology drives our ambition to power different AI server configurations from grid to core in the most energy efficient way. As energy demand for AI data centres is rising significantly, energy efficiency gains more and more importance. For Infineon, this is a fast-growing business opportunity. With mid-double-digit growth rates, we expect our AI business to reach one billion euros within the next two years."

The company anticipates a replacement of the existing conventional wafer technology for low voltage power converters within the next four years.

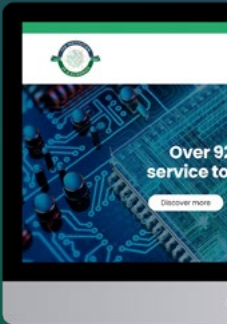
Reference: Tyler, N., 'Infineon unveils World's thinnest Silicon Power Wafer', New Electronics, 29th. October.

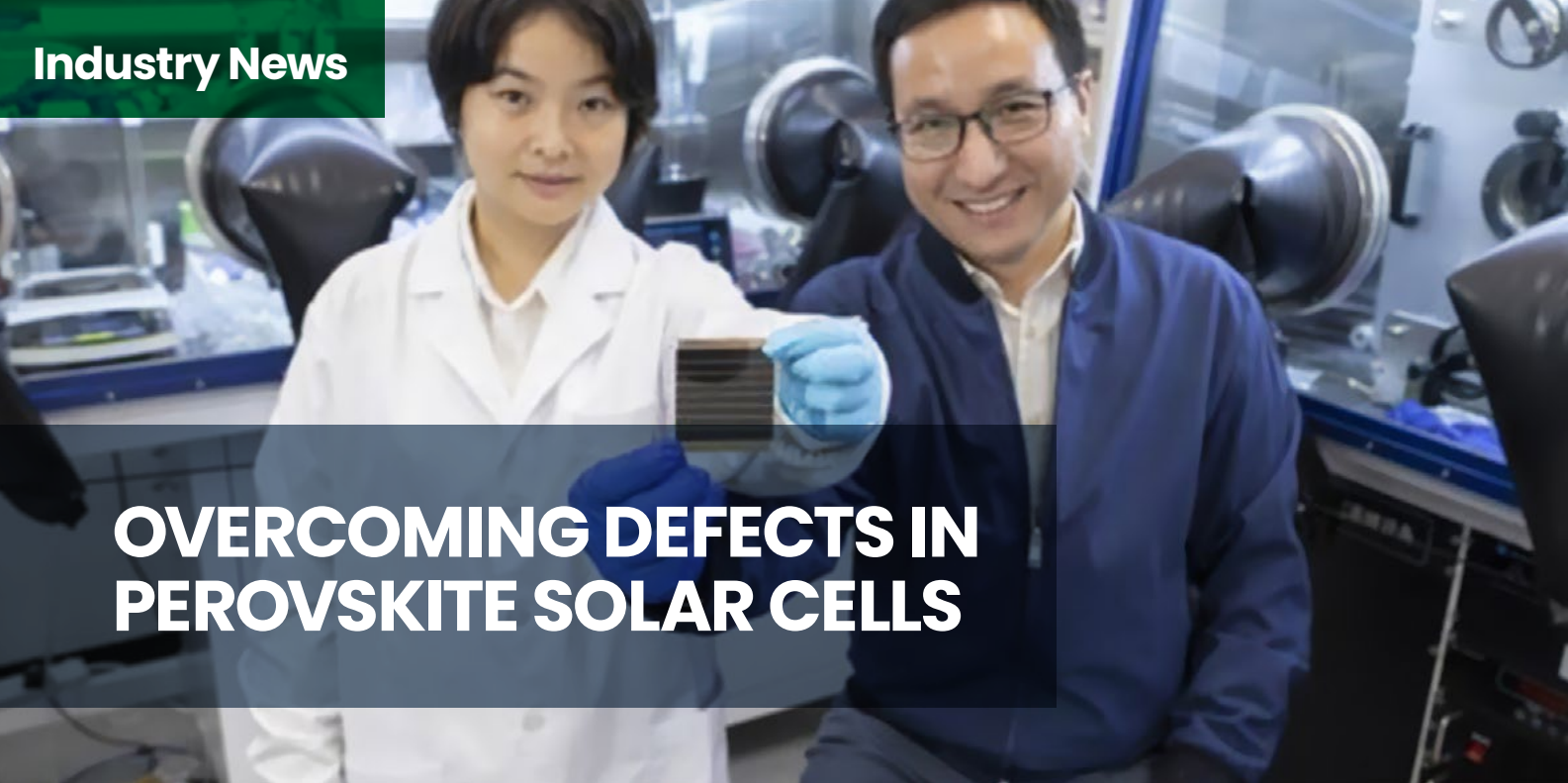
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OVERCOMING DEFECTS IN PEROVSKITE SOLAR CELLS

Perovskite solar cells are known for their unique crystal structures and their suitability for photovoltaic technologies, which convert light into electricity, but they have been prone to defects.

Now, researchers at the Hong Kong University of Science and Technology have applied passivation techniques, which help reduce defects in materials, in order to improve the efficiency of perovskite solar cells. Such technologies have, until now, had a limited effect on enhancing long-term stability, but the team has made a breakthrough through the application of amino-silane molecular technology to the passivation of perovskite solar cells.

The team identified the types of amines – primary, secondary and tertiary – and the combinations of them that could improve the surfaces of perovskite films where defects typically form. This involved both ‘ex-situ’ (outside the operational environment) and ‘in-situ’ (within the operational environment) techniques to observe the interactions between the molecules and perovskites.

The result was a significant increase in the photoluminescence quantum yield, or PLQY, indicating fewer defects and improved material quality. This is notably important for the creation of so-called tandem solar cells, which combine multiple layers of photoactive materials in order to absorb different parts of the solar spectrum and thereby maximise efficiency.

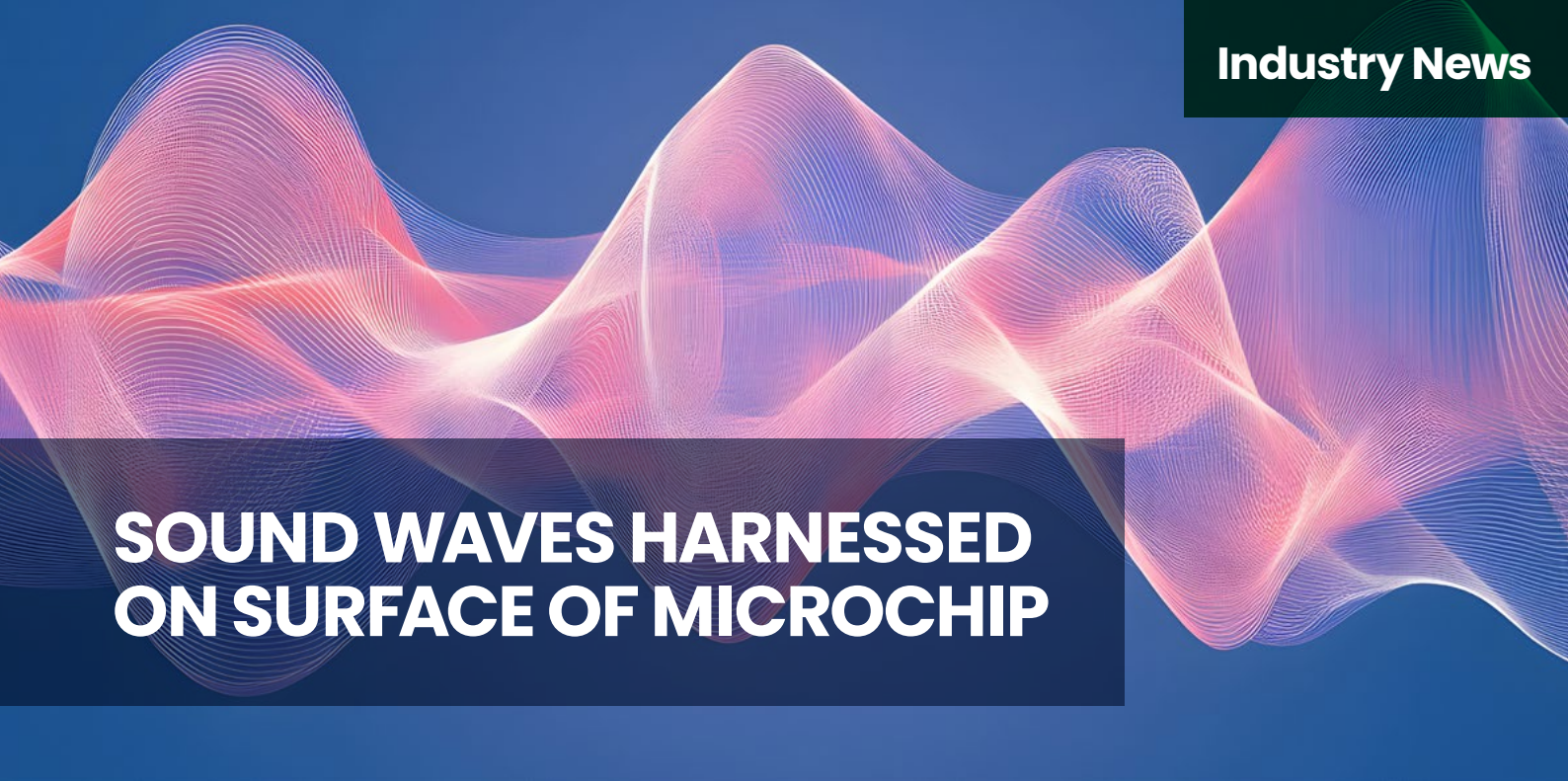
The methodology involved fabrication of solar cell devices in medium (0.25 square centimetres) and large (1 square centimetre) sizes that exhibited low photovoltaic loss across a broad range of band gaps while at the same time maintaining high voltage output. Surprisingly the devices achieved open-circuit voltages beyond 90 per cent of the thermodynamic limit, placing them among the best in the field when benchmarked against some 1,700 data sets obtained from existing literature.

The study also highlighted the exceptional operational stability of amino-silane passivated cells, with these cells maintaining high maximum power point efficiency and power conversion efficiency even after 1,500 hours of ageing, with the best achieving a champion maximum power point of 19.4 per cent and a champion power conversion efficiency of 20.1 per cent. This was under the International Summit on Organic Solar Cells (ISOS)- L-3 protocol, a standardised testing procedure.

Assistant Professor Lin Yeng-Hung from the HKUST Department of Electronic and Computer Engineering says:

“ This treatment is similar to the hexamethyldisilazane priming process widely used in the semiconductor industry. Such similarity suggests that our new method can easily be integrated into existing manufacturing processes, making it commercially viable and ready for large-scale application.”

Reference: West, P., ‘Boosting Solar Cell Efficiency and Durability’, Electronic Specifier, 1st. October.



SOUND WAVES HARNESSSED ON SURFACE OF MICROCHIP

Scientists at the University of Sydney have, for the first time, used lasers to produce, control and detect high-frequency sound on the surface of a microchip.

The design of the chip incorporates a special glass made from a combination of germanium, arsenic and selenide, that is GeAsSe, which enabled the obtaining of some remarkable results including measurements that indicated strong interactions between light and sound.

With the aid of a technique known as stimulated Brillouin scattering, which is created by an enhanced feedback loop between photons (light) and phonons (sound), light is enabled to move around the chip creating sound vibrations as it does so. The feedback process allows light waves, produced by lasers, to ‘couple’ with the sound waves so as to enhance the power of the feedback effect.

Anticipated future applications of stimulated Brillouin scattering include 5G/6G and broadband networks, sensors, satellite communication, radar systems, defence systems and radio astronomy.

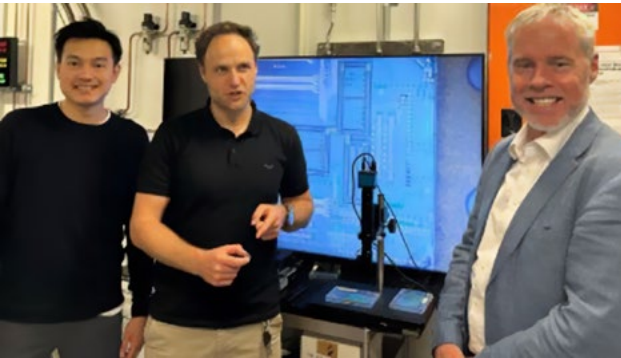
Senior Author and Project Lead, Dr. Moritz Merklein of the University of Sydney Nano Institute and School of Physics explains:

“ The use of sound waves on the surface of a microchip has application in sensing, signal processing and advanced communication technology. We can now start to think about new designs for chips that use light and sound instead of electricity.

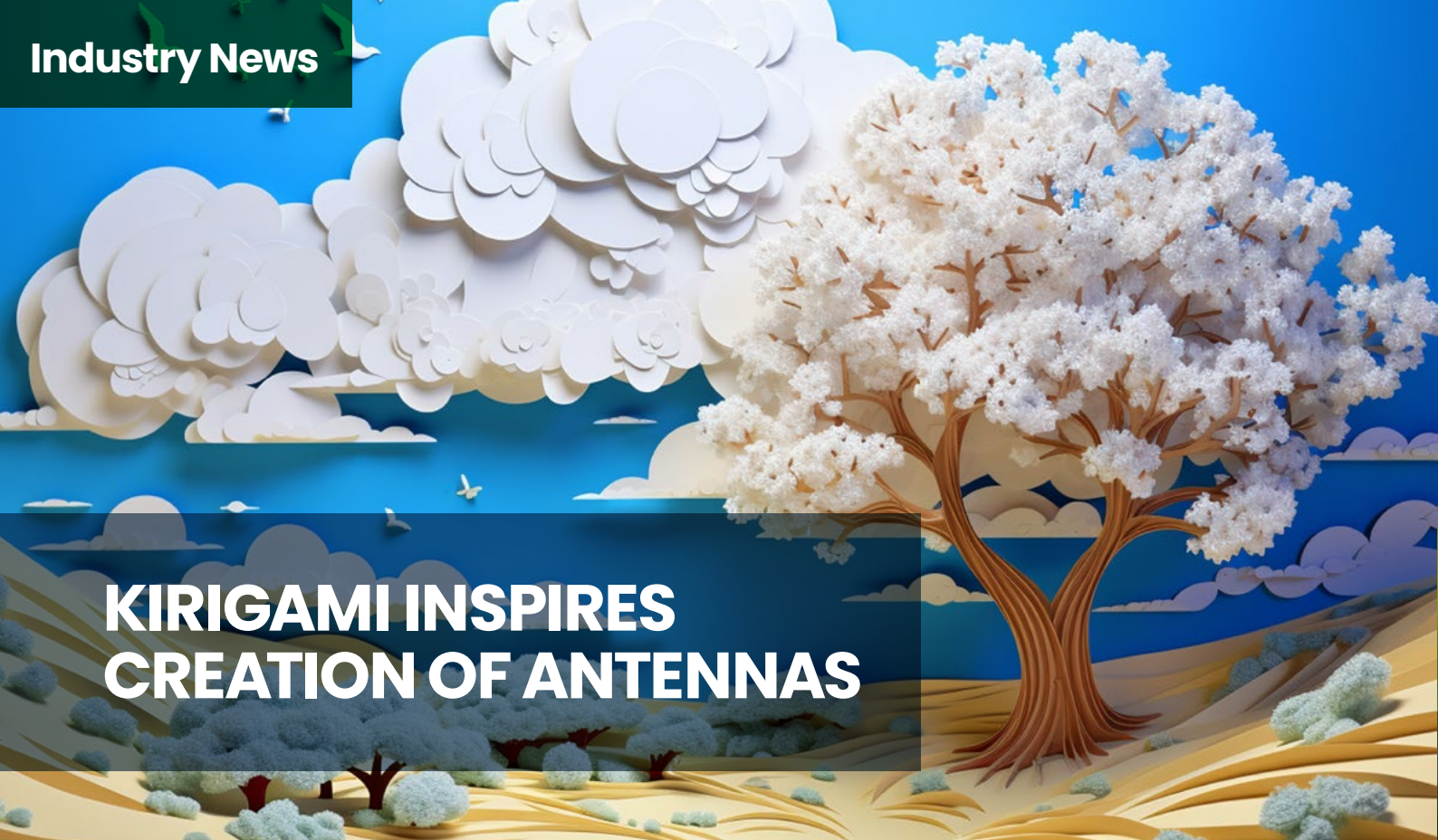
The material is considered as a soft glass. This means that unlike many materials it operates as a guide for the high-frequency sound waves and lets them more freely interact with the light waves we put into the chip.”

Lead Author Govert Neijts, a student from the University of Twente in the Netherlands, who spent nine months at the University of Sydney laboratories, adds:

“ Typically surface acoustic waves are ‘excited’ using electronics. Here we use photonics, or light energy, to produce the sound wave. This approach has multiple advantages, chief of which is that light does not produce the heat in the chip that electronic excitation causes.”



Reference: ‘Earthquake on a Chip: Scientists harness Sound Waves on the Surface of a Microchip’, University of Sydney, 23rd. October. The Institution thanks the University of Sydney for this submission.



KIRIGAMI INSPIRES CREATION OF ANTENNAS

Researchers from the University of British Columbia in Canada and Drexel University in the United States are now turning to the ancient Japanese art of kirigami, the art of cutting and folding paper to create designs, as a model for the future manufacturing of antennas.

Kirigami was used to turn a single sheet of acetate coated with conductive MXene ink into a flexible 3D microwave antenna, the transmission frequency of which was able to be changed by pulling or squeezing it, representing a new way of quickly and cost-effectively manufacturing an antenna by coating MXene ink onto a clear, elastic polymer substrate material.

Typically, microwave antennas are reconfigured either electronically or by changing their shape. Adding the necessary circuitry to control it electronically tends to increase complexity with the result that the antenna becomes bulkier, vulnerable to malfunction and more expensive to manufacture. That leaves changing the shape of the antenna as the alternative.

The researchers created a variety of shapes and forms with flexible, lightweight and durable features that are important for moveable robotics and aerospace applications. MXene ink was coated onto a sheet of acetate where it can adhere strongly to the substrate and can be adjusted to the transmission specifications of the antenna.

MXenes are already widely used in electromagnetic shielding, biofiltration and energy storage. They are also highly efficient in transmitting radio waves and can be readily adjusted to block and allow the transmission of electromagnetic waves, making them potentially suitable for telecommunications.

The methodology involved use of kirigami to make a series of parallel cuts in the MXene coated surface. By tugging at the end of the sheet an array of square shaped resonator antennas were enabled to spring from the 2D surface, causing the angle of the array to shift.

Two kirigami antenna arrays were tested and a prototype of a co-planar resonator subsequently created. Such a component was envisaged to be particularly useful in the development of certain types of sensors.

The resulting antennas were found to be effective at transmitting signals in the frequency bands of 2-4 GHz, 4-8 GHz and 8-12 GHz. It was also found that altering the geometry and direction of the substrate could enable the waves from each resonator to be redirected.

Under test the frequency produced by the resonator was observed to shift by 400 MHz as its shape was changed, a useful property for potential use as a strain sensor for the monitoring of infrastructure conditions.

Dr. Yuri Gogotsi, Distinguished University and Bach Professor at the Drexel College of Engineering, and Co-author of the research, states:

“For wireless technology to support advancements in fields like soft robotics and aerospace, antennas need to be designed for tunable performance and with ease of fabrication. Kirigami is a natural model for a manufacturing process due to the simplicity with which complex 3D forms can be created from a single 2D piece of material.”

Author of the paper Dr. Omid Niksan of the University of British Columbia adds:

“Our goal here was to simultaneously improve the adjustability of antenna performance as well as create a simple manufacturing process for new microwave components by incorporating a versatile MXene nanomaterial with kirigami-inspired designs. The next phase of this research will explore new materials and geometries for the antennas.”

Reference: Gittins, C., ‘Harnessing the ancient Art of Kirigami to create Antennas’, IoT Insider, 20th. October.



NEW MILESTONE FOR WIRELESS ELECTRIC VEHICLE CHARGING

Researchers at the Oak Ridge National Laboratory, in collaboration with Volkswagen Group of America, have successfully demonstrated a wireless power transfer of 270 kW to a Porsche Taycan, a new record for wireless electric vehicle charging.

Current industry standards for wireless charging systems for light-duty vehicles cap at 20 kW with efficiencies at 92 per cent. Now, by utilising uniquely designed lightweight polyphase electromagnetic coupling coils, a much higher power density has become possible, reducing the size and weight of the charging system that is integrated into the undercarriage of the vehicle.

Omer Onar, Leader, Vehicle Power Electronics Group at ORNL, says:

“The receiver coil designed for the Porsche Taycan research vehicle can achieve eight to ten times higher power density compared to existing systems.”



Further research is looking at the use of rotating electromagnetic fields to enhance efficiency and reduce voltage issues.

Reference: ‘US Researchers achieve new Milestone for wireless EV Charging’, Electrical Review, 2nd. August.

ADVANCES IN DRONE DEPLOYMENT

Wireless Technology to recharge Drones in Flight

The University of Texas at Dallas is pioneering wireless technology to transfer electromagnetic waves to and from long distances, potentially allowing drones, or unmanned aerial vehicles, to recharge without needing to recharge at power stations.

This ‘power beaming’ is seen as being ‘a significant advance in wireless recharging’ which is currently limited to the transfer of power via low frequency electromagnetic waves over very short distances.

A major challenge of power beaming has been trying to prevent electromagnetic waves from scattering and to address this the research team has devised a system of transmitters or smaller antennas, known as phased-array antennas, to effectively steer the electromagnetic waves along a targeted path. Telemetry is then used to track the movements of a UAV in real-time to ensure that the signal moves in the intended direction.

Amazon poised to deliver Packages by Drone in UK

Amazon has been selected by the Civil Aviation Authority to take part in a trial of beyond visual line of sight drone flights in which operators do

not have to retain sight of drones as they are flown.

Amazon intends that its Prime Air service will be in a position to deliver small packages within an hour of being ordered, possibly as early as Christmas.

The trials will gather key safety data, including how drones detect and avoid other aircraft, by monitoring the electronic signals that they transmit so as to be visible to other airspace users and air traffic control.



The trial is being described by the CAA as helping to inform future policy development and regulations that will allow drones to operate more easily and be integrated with other airspace users.

Amazon aims to conduct its trials within seven miles of one of its fulfilment centres using its MK30 drone which can carry packages weighing up to 4.8lbs.

Other participants in the trial include Airspec, specialists in drone inspection of offshore wind farms; the National Police Air Service, looking at the use of uncrewed aircraft in policing; NATS, looking at inspection applications in the North Sea; Project Lifeline, piloting medical deliveries by drone; and Project SATE, looking at the co-existence of drones and aircraft at Orkney Airport.

Nokia selected to deliver Drones-as-a-Service in Switzerland

Swisscom Broadcast has selected Nokia to supply a nationwide Drones-as-a-Service network in Switzerland. Some 300 Nokia Drone-in-a-Box units will be deployed enabling emergency response, perimeter protection and infrastructure inspection.

This Nokia Drone Networks project follows Nokia’s Citymesh deployment in Belgium and will support Switzerland’s public safety and Industry 4.0 development. In particular, it utilises mission-critical industrial edge computing (MXIE) with the support of 3GPP technologies for beyond visual line of sight autonomous operations.

Drones will be operated remotely gathering relevant information within the first minutes following an emergency, providing first responders with critical operational awareness.

Public safety agencies will be able to access the nationwide drone network by simply requesting a drone flight, similar to Swisscom Broadcast’s ride-sharing service.

Nokia and Swisscom are working closely with regulatory bodies to ensure that all operators comply with regulatory frameworks, most notably with regard to spectrum and aviation safety aspects.

The project is noted for its integration of drones with docking stations, a ground control station, a payload with video and thermal cameras, related software and service components.



Reference for each of the above: Tyler, N., ‘A Revolution in Drone Deployment’, New Electronics, Vol.57, Issue 10, October 2024, p.18–20.



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MEDICAL FOCUS

Using AI to improve Diagnosis of Inflammatory Arthritis

Researchers at the Henley Business School have been awarded £600,000 from UK Research and Innovation to pioneer a project that will use machine learning to revolutionise the early detection of inflammatory arthritis, a condition which, if diagnosed late, can lead to long-term loss of mobility. Around 400,000 people in the UK are estimated to be living with it.

This ‘power beaming’ is seen as being ‘a The project will use artificial intelligence to assist doctors to identify the signs of this crippling condition before it becomes far worse. The AI

will analyse large sets of referral data with the machine learning system, RMD-Health, serving to identify patterns that may not be initially obvious to clinicians.

The project is set to last 18 months and will involve collaboration with the University of Oxford and the Royal Berkshire NHS Foundation who will be testing the AI system in real-world clinical settings.

Reference: Miles, S., ‘AI aims to transform early Arthritis Detection and Treatment’, Electronic Specifier, 18th. October.

Breakthrough in neural Control of Prosthetic Hands

Researchers at the German Primate Centre – Leibnitz Institute for Primate Research in Gottingen have developed a new protocol for brain-computer interfaces (BCI) that has achieved a major advance in prosthetic hand control.

When tested on rhesus monkeys the new method demonstrated precise manipulation of prosthetic hands using neural signals alone.

Previously BCI research has focused on signals that govern speed of movement, but this latest research has found that the neural signal responsible for different hand postures play a more crucial role in controlling prosthetic devices. This is anticipated to enhance the fine control of neural prostheses, potentially restoring some or all mobility to individuals with conditions

such as paraplegia or amyotrophic lateral sclerosis, where muscle paralysis limits the use of limbs.

Neuroprostheses, which use BCIs to bridge damaged nerve pathways and translate brain signals into movements, are not new, but the limited fine motor capabilities of current hand prostheses has hindered their practical use.

In this experiment two rhesus monkeys, which share similarities with humans in nervous system development and fine motor skills, were trained to move a virtual avatar hand displayed on a screen using their own hand movements. A data glove, equipped with magnetic sensors, recorded the results. The monkeys then learned to control the virtual hand by thought alone, with neuronal activity in the cortical brain areas that control hand movements being monitored.

In order to improve the algorithm that converts neural data into movement the BCI protocol was adjusted so as to prioritise not just the end point of a movement, but also its execution path.

Comparison between the movements of the virtual hand and the real hand, as recorded previously, showed a high degree of precision, validating the effectiveness of the new protocol.

Andres Agudelo-Toro, First Author of the study at the Neurobiology Laboratory of the German Primate Centre, explains:

“How well a prosthesis works depends primarily on the neural data read by the computer interface that controls it. Previous studies on arm and hand movements have focused on the signals that control the velocity of a grasping movement. We wanted to find out whether neural signals representing hand postures might be better suited to control neuroprostheses.

Deviating from the classic protocol, we adapted the algorithm so that not only the destination of a movement is important, but also how you get there, that is the path of execution. This ultimately led to the most accurate results.”

Hansjorg Scherberger, Senior Author and Head of the Neurobiology Laboratory, adds:

“In our study we were able to show that the signals that control the posture of a hand are particularly important for controlling a neuroprosthesis. These results can now be used to improve the functionality of future brain-computer interfaces and thus also to improve the fine motor skills of neural prostheses.”

Reference: West, P., ‘Researchers achieve Breakthrough in neural Control of Prosthetic Hands’, Electronic Specifier, 21st. October.

3D-printed Medication for Toxoplasmosis

Toxoplasmosis is a parasitic infection that affects over a billion people across the world. It is particularly harmful to pregnant women, whose children can suffer blindness, deafness, seizures and mental health issues. Tablets exist, but these adult drugs are expensive and have to be altered by pharmacists to make them suitable for children, with a resultant variation in quality, strength and stability.

Now, researchers at Texas A and M University are applying 3D-printing to create a form of the drug that is specifically tailored for children with the help of a \$3.1 million grant from the National Institutes of Health.

The type of 3D-printing being used is that of biofabrication, which allows for precise, patient-specific adjustments to be made to drugs, medical models and implants. Different forms of the process are used to address different medical applications. In this case Selective Laser Sintering is used to produce dissolvable tablets by adjusting laser and material parameters to create dose consistency and stability. Other methods, however, such as extrusion-based printing and inkjet printing, can also be applied for layering ingredients to allow for controlled-release tablets that have to be administered over time without re-dosing.

The ultimate objective is to be able to supply the appropriate 3D-printing machines to hospitals so that medical facilities will be available to produce personalised doses on demand. Selective Laser Sintering has enabled control of factors such as hardness, dissolution rate and speed of absorption into the body. Longer term objectives include application to, for example, limb regeneration.

Reference: Miles, S., ‘3D-printing Medicine for Children’, Electronic Specifier, 29th. October.

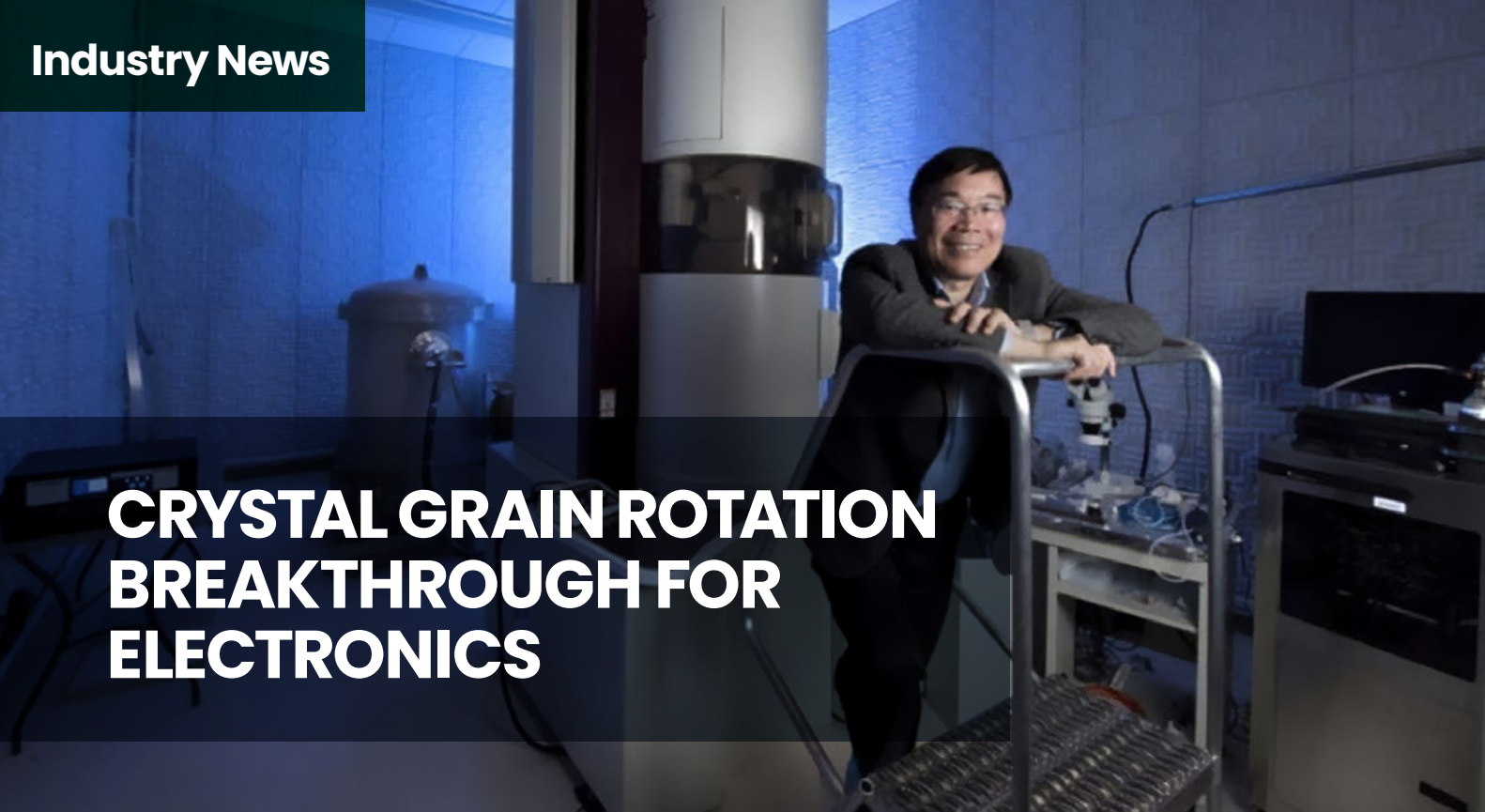
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CRYSTAL GRAIN ROTATION BREAKTHROUGH FOR ELECTRONICS

Researchers at the University of California, Irvine, have, for the first time, achieved atomic-scale observations of grain rotation within polycrystalline materials, which are fundamental to electronics, aerospace and solar technologies.

With the aid of advanced microscopy, the team heated samples of platinum nanocrystalline films and observed grain rotation mechanisms in fine detail, which were groundbreaking for the understanding of atomic-scale behaviour in such materials.

Four-dimensional scanning transmission electron microscopy, referred to as 4D-STEM, combined with high-angle annular dark-field STEM, enabled the movement of grain boundaries to be captured with extreme clarity. A machine learning algorithm was then developed to interpret the complex 4D-STEM data and extract critical information, in particular the role of disconnections at grain boundaries as a driving force for grain rotation.

In polycrystalline materials grain boundaries are interfaces that impact on material efficiency due to imperfections, and this study revealed that grain rotation occurs as a result of the motion of disconnections, that is line defects that combine step and dislocation characteristics.

Machine learning analysis also revealed that there was correlation between grain rotation and changes in grain size caused by shear-coupled migration along grain boundaries.

Xiaoqing Pan, University of California Irvine Distinguished Professor and Director of the University of California Irvine Materials Research Institute, comments:

“ Scientists have speculated and theorised on phenomena occurring at the boundaries of crystalline grains for decades. Now, through the use of the most advanced instruments available to the scientific community, we have been able to transition from theory to observation.

Our results provide unequivocal, quantitative and predictive evidence of the mechanism by which grains rotate in polycrystals on an atomic scale. Understanding how disconnections control grain rotation and grain boundary migration processes can lead to new strategies for optimising the microstructures of these materials. This knowledge is invaluable for advancing technologies in various industries including electronics, aerospace and automotive.”

Reference : West, P., ‘Grain Rotation Breakthrough for Electronics’, Electronic Specifier, 28th. October.



USING BLOCKCHAIN TO IMPROVE FOOD SAFETY

A study at the American University of Ras Al Khaimah (AURAK) is integrating IoT and blockchain in order to improve food safety with collaboration from the University of Naples.

The World Health Organisation estimates that about 600 million people (one in ten) globally become ill each year due to ingesting contaminated food, with around 420, 000 fatalities.

In this study blockchain is being used to provide a transparent record of a food product’s journey from farm to table, enabling quick identification of sources of contamination in the event of an outbreak, such as microbial pathogens, heavy metals, undeclared allergens and foreign bodies and materials.

Blockchain notably enables comprehensive traceability of food products with each stage of the supply chain, from production through processing to distribution, being recorded on a blockchain. IoT devices can then monitor food products in real-time, using sensors to capture and transmit data on their location, storage duration and conditions.

Immutable records are created so as to maintain a decentralised tamper-proof ledger of every transaction or change in the supply chain and provide detailed information on the origin and handling of food.

A major advantage of this system is its ability to facilitate streamlined recalls. In the event of

a food safety issue the blockchain can quickly identify and isolate the affected products, simplifying the recall process and minimising the impact of incidents.

Dr. Tahseen Arshi, Associate Provost for Research and Community Service at AURAK, states:

“ Our study investigates how technologies such as IoT and blockchain can revolutionise how food is monitored, traced and managed across the supply chain, enhancing transparency, accountability and efficiency. ”

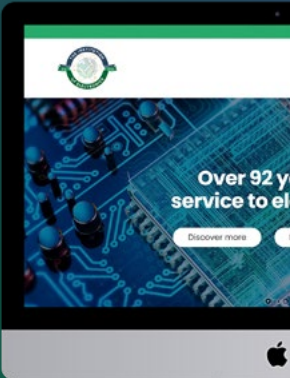
Reference: ‘AURAK researchers integrate IoT and Blockchain for Food Safety’, IoT Insider, 5th. September.

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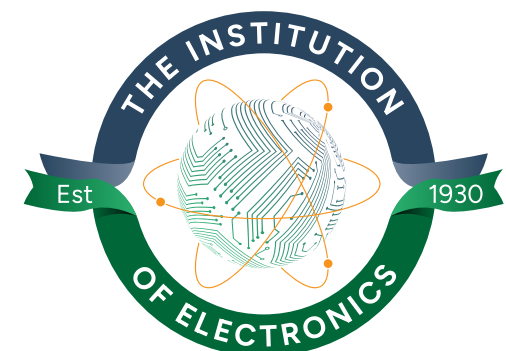
- Corporate Members become people of letters, able to display post nominal letters, being a useful accreditation to show employers and others they are recognised for their achievements.
- The Institution of Electronics is one of the oldest Institutions specifically for electronics engineers both professional and amateur.
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- Members have access to historic publications on electronics.
- Members can request on email address in the form you@institutionofelectronics.ac.uk
- Members are invited to "Coffee and Chat", our regular virtual opportunity to chat with one another, regarding issues currently affecting them and "Networking" with like-minded, experienced, people.
- Members can provide copy for inclusion in Electron.
- Student members can enter the National Electronics Competition.

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FROM THE ARCHIVES

- BOOKS FOR FURTHER READING**
1. “Nuclear Radiation Detectors.” J. Sharpe. (Methuen, 1955).
 2. “Radioisotope Laboratory Techniques.” R. A. Faires and B. H. Parks. (Newnes, 1958).
 3. “Atomic Energy and its Applications.” J. M. A. Lenihan. (Pitman, 1957).
 4. “The Measurement of Radio Isotopes,” 2nd Ed. D Taylor. (Methuen, 1957).

Institution Activities

The second half of our 1957/58 Programme of Lectures will be as follows:

NORTHERN DIVISION

Manchester

The following meetings will commence at 7 p.m. in the Reynolds Hall of the Manchester College of Science and Technology:

Friday, 28th February:
“**SILICON JUNCTION POWER DIODES**”

A lecture to be delivered by D. F. TAYLOR, Esq., B.A., Ph.D.

Friday, 28th March:
A FILM SHOW ON ELECTRONIC TOPICS
including the 16mm. Mullard Ltd. films:

The Manufacture of Germanium Transistors.
The Junction Transistor in Radio Receivers.
The Linear Accelerator.
Discharge Through Gases.
Ultrasonics (Industrial Applications).

Belfast

The following meetings will commence at 7-30 p.m. at the Union Hotel, Belfast:

Tuesday, 21st January:
“**ELECTRONICS AND THE HOLLERITH MACHINES**”

A lecture to be delivered by G. S. AITKEN, Esq., A.M.Inst.E.

Tuesday, 18th March:
A FILM SHOW ON ELECTRONICS
including the films:

The Manufacture of Tektronix Precision Cathode-ray Tubes.
Computers in Production.
Mirror in the Sky.

LONDON DIVISION

The following meetings will commence at 7 p.m. in the Assembly Hall, the University of London Institute of Education, Malet Street, London, W.C. 1:

Thursday, February 27th:
“**THE PRINCIPLES AND MANUFACTURE OF GERMANIUM TRANSISTORS**”

A lecture, illustrated by sound films, to be given by C. H. GARDNER, Esq., of Mullard Ltd.

5. “An Introduction to Electronics for Physiological Workers.” I. C. Whitfield. (Macmillan, 1953).

REFERENCES

1. Franklin, E., and James, J. B. Proc. I.E.E., Vol. 103, Pt. B. (1956).
2. Linvill, J. G. Proc. I.R.E. 43, 7 (1955).
3. Kandiah, K. Proc. I.E.E., Vol. 101, Pt. 11, No. 81 (1954).
4. Goulding, F. S. I.R.E. Nat. Convention Record, 1956, Pt. 9.

Thursday, 27th March:

“**DESIGN PROBLEMS OF TELEVISION TRANSMITTERS**”

A lecture to be given by J. E. NIXON, Esq., B.Sc.(Eng.), A.M.I.E.E., of the Marconi Wireless Telegraph Co. Ltd.

Thursday, 24th April:

“**RADIOASTRONOMY AND THE SPUTNIKS**”

A lecture, illustrated by slides and tape recordings, to be given by F. G. SMITH, Esq., M.A., Ph.D., of the Mullard Radio-astronomy Observatory, the Cavendish Laboratory, Cambridge.

Thursday, 29th May:

“**ANALOGUE COMPUTING IN PROCESS CONTROL**”

A lecture, to be given by H. R. BLACKWELL, Esq., B.Sc., of the Systems Division, Elliott Brothers (London) Ltd.

SOUTHERN DIVISION

The following meetings will commence at 7 p.m. in the Lecture Hall of the Anglesea Road Annexe of the College of Technology, Portsmouth:

Friday, 14th March:
A FILM SHOW ON ELECTRONIC TOPICS
including the following sound films:

The Principles and Manufacture of Germanium Transistors.
The Manufacture of Cathode-ray Tubes.
Mirror in the Sky.
Particles Count.
Numerical Control.

Friday, 11th April:

“**DESIGN PROBLEMS OF TELEVISION TRANSMITTERS**”

A lecture to be given by J. E. NIXON, Esq., B.Sc.(Eng.), A.M.I.E.E., of the Marconi Wireless Telegraph Co. Ltd.

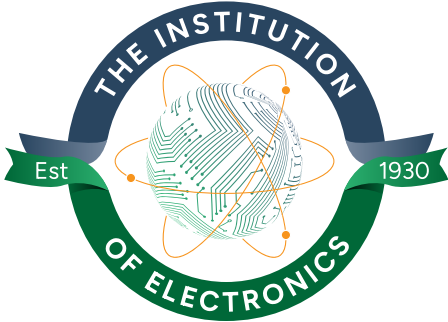
Friday, 23rd May:

“**ANALOGUE COMPUTING IN PROCESS CONTROL**”

A lecture to be given, by H. R. BLACKWELL, Esq., B.Sc., of the Systems Division, Elliott Brothers (London) Ltd.

OUR THIRTEENTH ELECTRONICS EXHIBITION AND CONVENTION

The 1958 Electronics Exhibition and Convention, organised by our Northern Division, will be held at the Manchester College of Science and Technology during the period July 10th to 16th, inclusive (omitting Sunday, July 13th). Details, and tickets of admission, will be distributed to all members.



National Electronics Competition

Entries

The benefits to you:

- Learn how to write a technical paper
- Have your project promoted in an Institution publication
- Be in with a chance of winning a category award
- Join the Institution of Electronics and help guide its future development

Entry requirements:

- Applicants must attend an Arkwright-affiliated school, but applicants do not have to be Arkwright Engineering Scholars
- Applicants must complete a project where electronics are integral to its successful function
- Application is free to students holding student membership of the Institution of Electronics
- Applicants must report on their project using a simplified ‘Technical Paper’ format and a two-minute video

Entry categories:

1. Any student –Year 11 (England & Wales), S4 (Scotland), Year 12 (Northern Ireland)
2. Any student –Year 12 & 13 (England & Wales), S5 & S6 (Scotland), Year 13 & 14 (Northern Ireland)
3. Arkwright Scholars
4. Arkwright alumni in 1st / 2nd year of an undergraduate degree

National Electronics Competition

An exclusive competition for students of Arkwright affiliated Schools.

The Institution of Electronics was founded in 1930.

After a period of relative inactivity the Institution is partnering the Arkwright Scholarships Trust to rejuvenate its membership with the ‘brightest and best’ future leaders of UK electronics and to provide benefit to the UK’s electronics education and industry.

This competition will give the Institution the chance to champion the cause of young people pursuing electronics projects within the curriculum, extra-curricular and at home.

Applicants become student members of the Institution and will be invited to join the task-force that will plan the next phase of the Institution’s development as an incubator for future leaders of the electronics industry.

What to do next?

- Read the application guidelines on the next page
- Read the example technical paper
- Complete your electronics project
- Complete your technical paper and video
- Post the video to YouTube
- Submit your application to the Institution by email
- Ensure you hold current membership of the Institution of Electronics

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Guidelines for application

Your project:

- The project you submit can be anything, provided that electronics are integral to its successful function. We expect most applicants to use a project they have already completed or are working on at university, school (curricular or extra-curricular) or at home. There is no need to create a new project specifically for this competition. All projects must be complete and functioning when the technical paper and video are submitted
- An applicant can submit multiple projects – each one needs its own technical paper and video, but they must be submitted en masse in one email to the email address below.
- Applicants must report on their project using a simplified ‘Technical Paper’ format and a two-minute video

The ‘technical paper’:

- When Engineers, Scientists and Technologists submit their work to be published in a peer-reviewed journal or at an international conference, they must write a ‘technical paper’ to a rigid formatting specification. To give applicants an early experience of this, we require applications in such a format. An example technical paper is provided [here](#). Our example is a paper ‘converted’ from the D&T project portfolio prepared by Arkwright Scholar Vaughan Jubb-Buckley as part of his school-based GCSE project.
- Submit your paper in exactly this format i.e. the same text font, size, style and colour, and the same main Headings (Sections 1 to 8). You can change subheadings and of course you must delete the example text and images and add your own (you do not need to add the same number of images as in the example. Use however many images suits your project the best). Use the same bracketed number format where you want to refer to a reference document (e.g. the example paper contains two references quoted in sections 2 and 3.2). Don’t forget to change the footer. Maximum of 10 pages total please (yes we know the example paper is 12 pages long!)

The video:

- Produce a video (maximum two minutes) and post it to YouTube to: showcase, demonstrate and explain the main functional features and technical aspects of your project.
- Apart from its short duration we provide no other guidelines for the video—be creative!

The prizes:

- Each submitted project will be assessed by a panel of experts on its form, function and innovation
- All technical papers adjudged to be of an adequate quality will be published in an Institution of Electronics publication (great for your CV)
- All applicants (and their teachers if the applicant is still at school) will be invited to take part in the task force that will plan the next stage of the Institution’s development
- The winner of each category (see the categories on the previous page) will receive £200 plus a certificate

Competition deadlines:

- Entries will be accepted from 1st July each year. The closing date is 31st August each year –late entries will not be accepted
- Results will be available mid October each year; Winners will receive their awards in November by arrangement with their school
- Institution publication, containing submitted papers of adequate quality, will be published the following year

How to apply:

- Send an email to the membership officer admin@institutionofelectronics.ac.uk with the subject “National Electronics Competition”
- In the email state: your full name; your school (prior school if you are now at university), your university if you are at university; the category number (1-5) that you are entering
- In your email include: your technical paper(s) as an attachment to the standard specification, in an editable format (e.g. Microsoft Word); and a link to your YouTube video(s)
- Please note: Entry for existing student members is free, if you are not currently a member please visit <https://institutionofelectronics.ac.uk/membership-grades/> and pay the £10.00 membership fee to join as a student member




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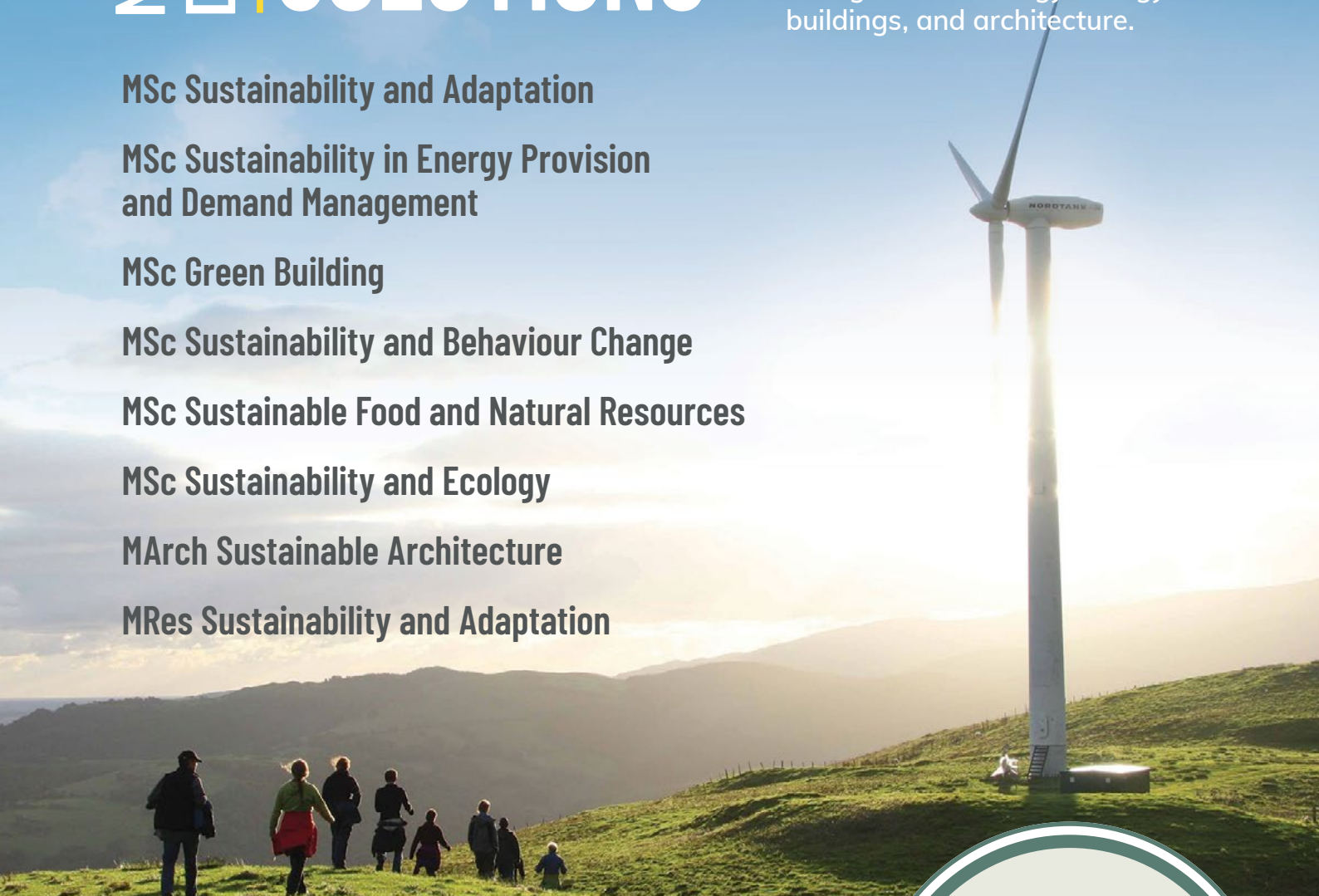
MSc Sustainability and Behaviour Change

MSc Sustainable Food and Natural Resources

MSc Sustainability and Ecology

MArch Sustainable Architecture

MRes Sustainability and Adaptation





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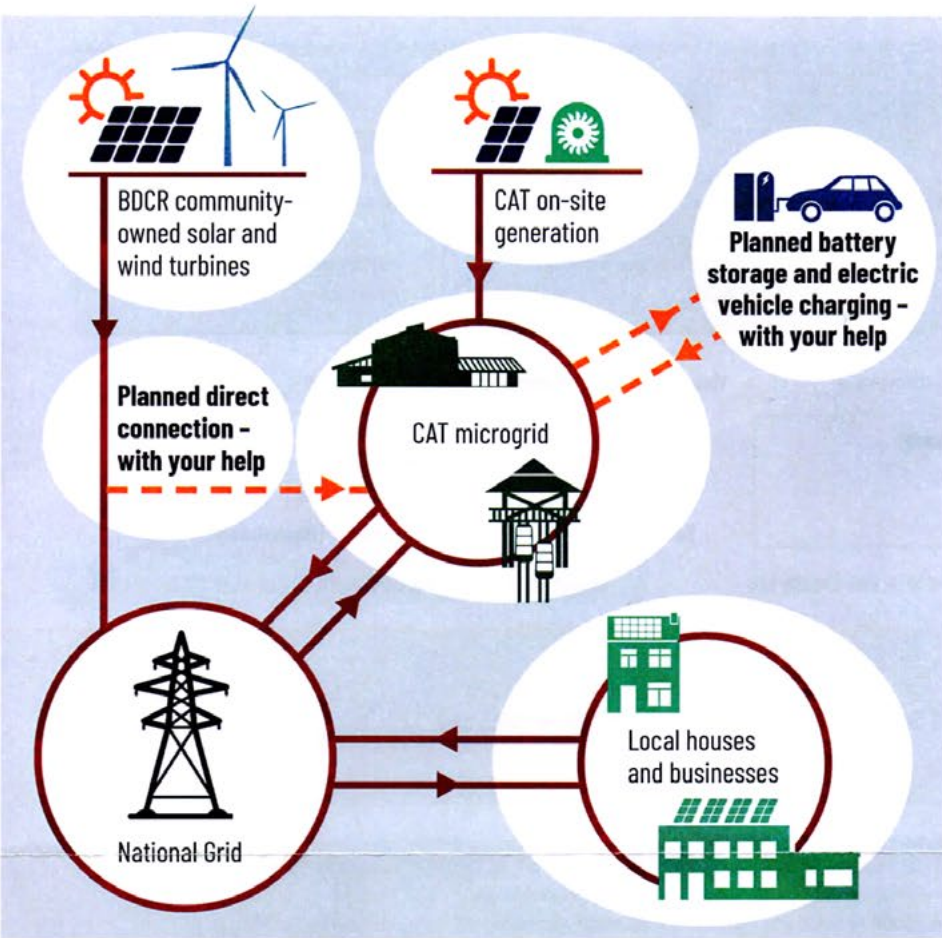
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The plan to power CAT using local renewables



Connecting CAT to cheap, local, community-owned, renewable energy is part of our strategic plan to develop our home in Mid Wales to reach more people and make an even bigger impact.

But we can't do it alone. Powering CAT on renewables takes a whole community.

By working in partnership with BDCR, Dulas Engineering and local people – and with your support – we can write the next chapter of CAT's story and take urgent action on the climate and biodiversity crisis.

"As part of our latest project to install 300kWp of ground-mounted solar generation, we are intending to 'private wire' approximately 40kWp straight to CAT. It will bypass the National Grid and enable CAT to purchase the electricity directly from BDCR.

This should hugely reduce CAT's future energy costs. We think this will be enough to power their entire eco centre for the summer months!

CAT has a long history of supporting community-owned energy projects, and I know this is something that fits their values perfectly. Thank you to everyone who gives CAT their support to help make this exciting project happen."



Tim Brewer
BDCR Ltd

"With more and more people using electric vehicles, being able to provide enough charging points is essential for CAT to welcome new visitors and guests.

The Dulas electric vehicle charger with battery storage will be an integral part of CAT's new on-site power plans. It is designed to maximise the power available for charging vehicles, while limiting the power drawn from the microgrid. By storing excess power generated, it can also be used to reduce the power drawn from the grid at peak times for other needs on site.

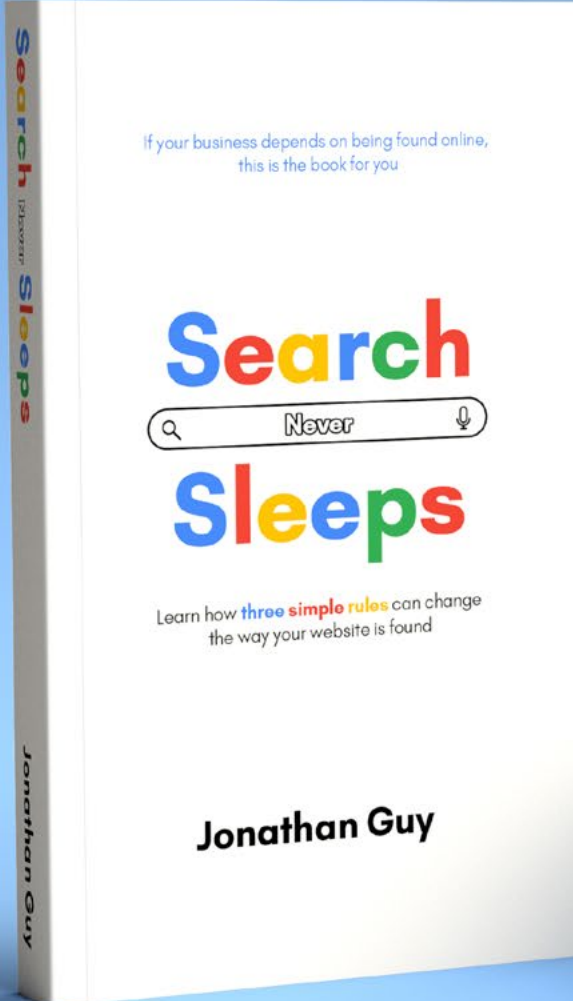
As a company that was born at CAT, we're delighted to be playing a part in securing its future and ensuring it can go on inspiring change."



Andy Skipton Carter
Dulas Ltd

Make your Business the first to be found on Google

Why are electronic engineers expected to understand everything about digital marketing on top of running a business?

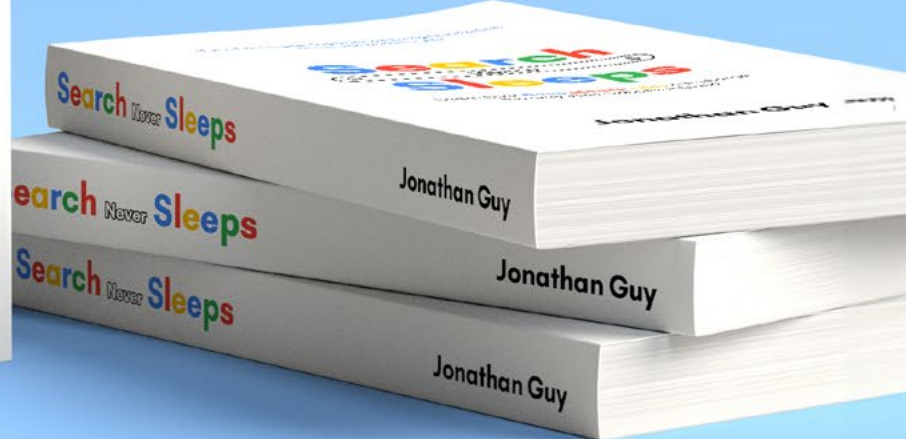


Search Never Sleeps brings SEO (Search Engine Optimisation) back to basics with Jonathan's straightforward and insightful explanation of the three rules of the world's most popular search engine, Google.

By delving into the 'why' instead of focusing solely on the 'what', Search Never Sleeps emphasises the value of effective, sustainable, and ethical SEO for SMEs (small and medium sized enterprises).

Featuring real-life examples, key takeaways, clear case studies, simple diagrams, and a whole host of useful tips that anyone can put into practice, Search Never Sleeps artfully covers the SEO essentials as well as more complex topics for advanced SEO technicians.

If you own or run a website, you need this book.



Jonathan Guy is the Founder and MD of award-winning digital marketing agency, Aqueous Digital.



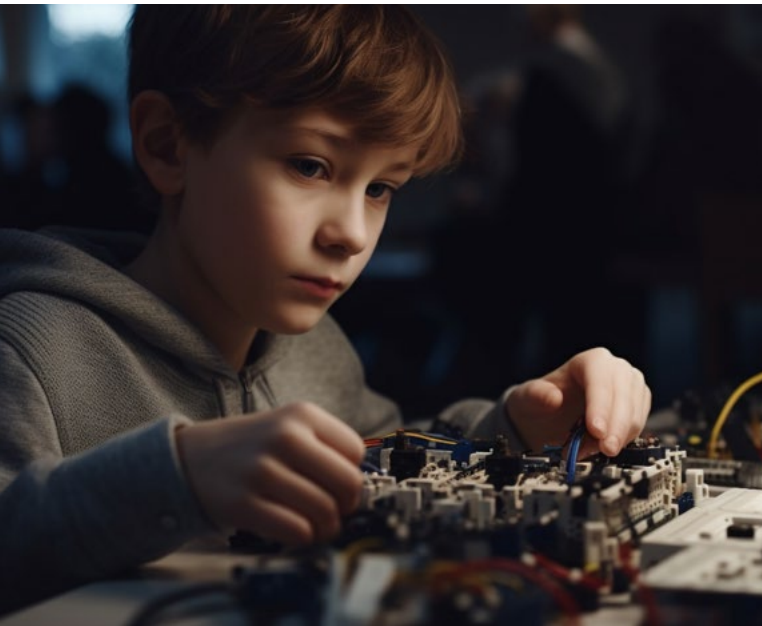
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DOLGELLAU: A HISTORIC WELSH TOWN EMBRACING A DIGITAL FUTURE

A Framework for Digital Innovation

The initiative is built around three pillars: Knowledge, Making, and Application.

These pillars reflect Dolgellau’s desire to not only embrace technological advances but to actively engage the local community in the process.



The “Knowledge” strand is dedicated to expanding STEM learning and providing access to vital resources for skill development.

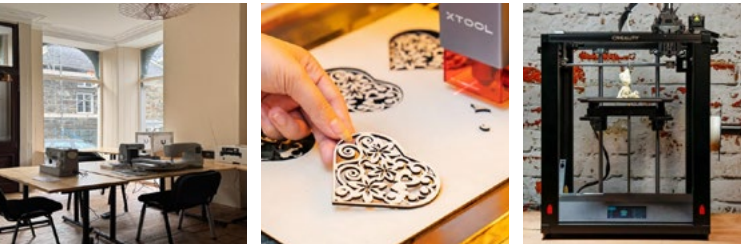
Plans include offering practical tools like coding kits, robotics, and even access to AI-based development platforms.

The aim is to prepare the town’s youth and tech enthusiasts for the evolving digital landscape by equipping them with critical competencies and hands-on experience.

Empowering Makers and Entrepreneurs

The “Making” strand of the initiative draws inspiration from Menter Môn’s successful Ffiws programme, which has been a catalyst for innovation across other areas in Wales.

Here, Dolgellau plans to establish its own “Maker Space,” equipped with advanced facilities such as high-quality 3D printing and computer-controlled laser cutting machines.



This resource will provide a launchpad for business and start-up ventures, artisans, and craftspeople. Whether it’s developing digitally curated products or exploring new forms of artistic expression, the Maker Space will be a crucial asset in promoting both creative and tech-centric enterprises.

Moreover, there’s a strong focus on collaborative projects.

By inviting other local groups to participate, the initiative seeks to foster cross-pollination between tech professionals and community members, establishing Dolgellau as a melting pot for innovation, creativity, and practical skill development.

Bridging Heritage with Modern Technology

A particularly exciting aspect of the initiative is the focus on the “Application” strand, which leverages IoT and digital applications for real-world benefits. Dolgellau was recently established as a Community Internet of Things (IoT) Hub by Menter Môn, and Arloesi Dolgellau hopes to help businesses and residents capitalise on the opportunities that come with being a Smart Town.



Current efforts are centred around distributed IoT projects that aim to explore data analytics, sensor-based applications, and other emerging technologies. Discussions are ongoing to broaden these initiatives, which hold the potential to transform the way local infrastructure operates—enhancing connectivity, monitoring environmental data, and driving smart solutions in the town.

Adding to this digital framework is a designated

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community garden situated to the rear of the Ty Newyddion building. This garden is being developed as a real-world sensor laboratory, designed to provide practical opportunities for experimenting with connected devices and environmental monitoring. The idea is to integrate nature and technology, creating a living space where IoT applications can be tested and refined. The garden reflects the town’s broader ambition: to bridge modern technology with the natural and cultural richness of Dolgellau.

Arloesi Dolgellau is a bold step towards redefining what it means to be a digitally connected community. By embracing local heritage and fostering digital creativity, the hope is that this small Welsh town can demonstrate how rural communities can access technology and develop digital skills to meet the demands of the future while staying grounded in their cultural identities.

A story of Serendata

by  Sysdoc

A Data-led Transformation

LET'S SET THE SCENE

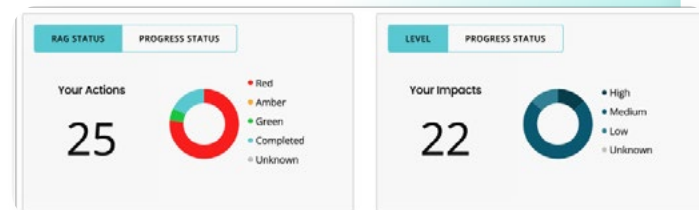
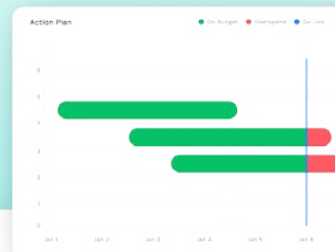
The client decided to proceed with their ERP transformation programme without using Insight, and instead used an excel spreadsheet 'tracker'.

Nine months later, the lack of visibility of risks, alongside the lack of ownership of impacts and mitigating actions in the business, led to a no-go decision, and a six month delay at a cost of £1m to the business.

SO, WHAT DID WE DO?

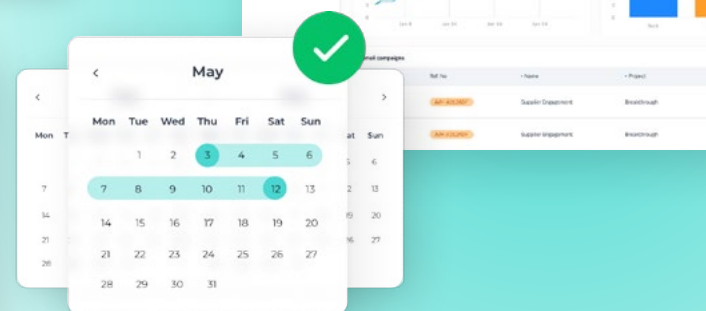
Within two weeks of the no-go decision, Insight was brought in to replace the impact tracker excel spreadsheet.

Leveraging the tool for a real time view of progress reporting, the change team were able to drive accountability and ownership of actions into the business.



WHAT WERE THE RESULTS?

The business was able to deliver a successful go-live within six months. Insight was carried forward into the next phase of the global rollout, and the leadership team also earmarked three additional programmes to be brought into the tool in order to leverage a data-led view of the bigger change portfolio across the wider business.



[→serendata.co.uk](https://serendata.co.uk)

AQR Safe Water®

GLOBAL TECHNOLOGY BUSINESS OPPORTUNITY

About Air Quality Research Ltd ('AQR'):

- Established 2008.
- Developed a novel highly Advanced Oxidation Process for fluid disinfection.
- UK patent, granted in 2022.
- Independently verified to produce hydroxyl radicals (Nature's most effective disinfection agents).
- Technology validation report from the National Measurement Lab (NML, formerly the Laboratory of the Government Chemist).
- Platform technology with a wide range of applications.

The opportunity:

We have spent 10 years developing this highly novel and disruptive technology, funded through raising over £1m in a combination of Government innovation grants and private equity. The technology has been commercially tested in UK pilot trials and is ready for market. The technology has a wide range of applications in worldwide markets, including but not limited to:

- Drinking Water treatment (municipal and bottled water).
- Waste Water treatment.
- *Legionella* control.
- Industrial Process water treatment & Vegetable / fresh produce washing.
- Milk sterilisation & Medical applications.

The Price:

We are flexible about how this is taken forward – license or sale of technology.

There is an Engagement Fee of £5,000.00. This fee will enable engagement on a priority basis (first come first served), the engagement fee will also cover any initial Consultancy required.

AQR SafeWater® - Key features & Benefits:

- Low power so can be operated using mains or renewable energy.
- Requires no added chemicals and does not create harmful disinfection byproducts.
- Requires no expensive replacement parts.
- Flexible, due to the modular design, for point-of-use small-scale treatment making it ideal for rural, dispersed and remote island communities.
- Proven effective disinfection in raw surface waters of particularly low optical clarity (< 12 %), removing the need for pre-treatment.
- Remote monitoring and operation, reducing maintenance requirements and ensuring effective operation performance autonomously.
- Easy to install, operate and maintain (based on a domestic central heating boiler model), making it ideal for householders and small communities in remote locations.

Contact:

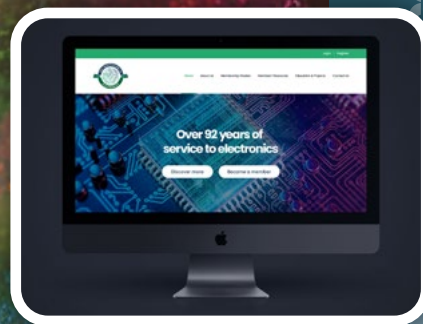
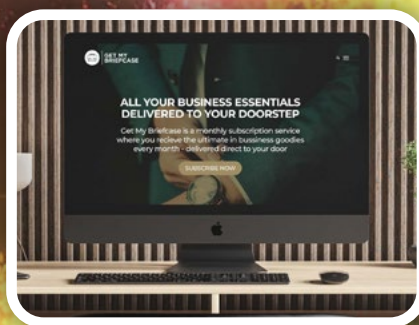
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