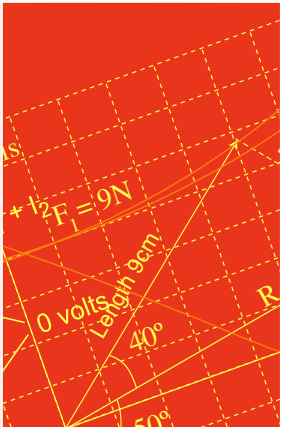
SciFest

Inspiring and Promoting Excellence in STEM Education

PROGRAMME

SciFest 2024 National Final



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Boston Scientific
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EirGrid

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SciFest 2024


STEAM ACADEMY

SciFest 2024 National Final

SciFest 2024 was funded primarily by Intel Ireland, Boston Scientific, EirGrid and Mallinckrodt Pharmaceuticals, and was supported by a number of other organisations and institutions, including the Department of Education. The SciFest STEM fairs were hosted locally in schools and regionally in the Technological Universities (13 venues), Dundalk Institute of Technology, DCU and St Mary's College, Derry. SciFest symbolises a highly successful collaboration between education, Government and enterprise and between the second and third level education sectors.

Welcome from
Sheila Porter

SciFest Founder and CEO

Welcome to the SciFest 2024 National Final. It is a pleasure to extend a warm welcome to our talented students, their families, teachers, guests and distinguished judges. Today is an exciting occasion, where we come together to celebrate the creativity, hard work and passion of our finalists – students who represent the very best of SciFest. Each of the students here today has already excelled at a regional SciFest@College STEM fair, emerging as a winner among thousands. They represent the finest in young STEM talent in Ireland, and it is an honour to recognise their outstanding achievements here today.

This year, SciFest saw over 15,000 students participate across the country, a remarkable testament to the interest, talent and enthusiasm for STEM among Ireland's young people. As we prepare to enter SciFest's 20th year, I am immensely proud of how far we have come and the incredible future that lies ahead, thanks to all the students and teachers who have participated in the programme since the first SciFest STEM fair took place in 2006 in the Institute of Technology in Tallaght (now TU Dublin Tallaght).

SciFest would not be possible without the generous support of our partners, Intel Ireland, Boston Scientific, EirGrid and Mallinckrodt, and our long-standing collaborators at the Technological Universities, Dundalk Institute of Technology and Dublin City University. To each of our partners, our sponsors and supporters, thank you for your commitment to fostering a passion for STEM and supporting the next generation of scientists, engineers and innovators. A special word of appreciation is due to the hundreds of dedicated teachers who mentor, support and encourage the students participating in SciFest each year.

To our finalists, I wish you the very best of luck. Today is a celebration of your achievements, and no matter what happens, you are all champions of STEM and an inspiration to us all. Enjoy this moment, and may it be the beginning of an exciting journey ahead!

A Message from Sarah Sexton

Director of Public Affairs,
Intel Ireland

Intel Ireland is proud to continue our support of SciFest. We are a science and technology company with people at the core of what we do. Every day we use science, technology, engineering and maths (STEM) in pursuit of world-changing technology that improves the life of every person on the planet.

SciFest provides an important platform for student-centred, inquiry-based approaches to learning and skill development. Students are encouraged to pursue their interests in the fields of STEM, to pursue their own scientific investigations, to create models and analyse data and to defend their results while receiving expert feedback in their investigations.

Scifest provides an inclusive environment for students to create innovative projects while developing a wide range of vital skills. In a world that is characterised by constant change, these skills will benefit students in whatever path they choose in the future.

At Intel, we recognise the value in educating the young people of today to help them to flourish and reach their full potential. It is the inquisitive minds of today that will create the innovations of tomorrow. Having seen the excellent work done by students participating in SciFest, we are confident that the future of the STEM industries in Ireland are in very capable hands.

Congratulations to SciFest for another incredibly successful year and to those participating today, we wish you all the best of luck. Everyone involved, from students to parents and teachers should be extremely proud of their accomplishments.

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A Message from Philip LeTutour

Director, Manufacturing Engineering,
Boston Scientific Galway

On behalf of Boston Scientific, we are delighted to welcome everyone to the SciFest 2024 National Final. Each year, students present exciting, interesting, and innovative projects that never fail to impress. It's always inspiring to see the creativity and ingenuity that students bring with their projects.

As a medical devices company with a strong emphasis on research, development, and innovation, Boston Scientific is always on the lookout for top talent in the fields of science, technology, engineering, and bio-medicine. Promoting STEM subjects, especially at the secondary education level, is of utmost importance. Our goal is to inspire students to develop and pursue a passion for these subjects, ensuring a steady influx of science and engineering enthusiasts at the tertiary level. In doing so, we contribute to shaping the scientists and engineers of the future.

SciFest provides an excellent platform for students to research, explore, and develop their own ideas. Scifest event allow students to nurture a passion for STEM subjects and create a positive impact on the world around us. At Boston Scientific, our commitment is to advance healthcare while giving back to the communities where our employees live and work.

STEM education is a top priority for our business, our patients, and our communities. We are delighted to see such high-quality talent once again participating in this year's National Final. STEM events like Scifest, motivate young individuals to pursue their education in STEM-related fields, which will help build a brighter society and a brighter future for everyone. We witness this reality every day in our business – the diligent STEM students of today become the pioneers of healthcare innovation in the future.

Boston Scientific want to congratulate all the students on their excellent projects here today. We wish you all the very best of luck in your endeavours today and in your future careers.

Boston Scientific
Advancing science for life™

A Message from
Claire Wallace

Interim Head of Strategy and Sustainability, EirGrid

EirGrid is thrilled to once again support SciFest and warmly welcomes you to the SciFest National Final 2024.

This marks our fourth year partnering with SciFest, and it has been inspiring to witness the program's remarkable growth, as students across Ireland dedicate time to research and develop groundbreaking projects.

Being associated with a programme that aligns so closely with EirGrid's values holds great importance for us. SciFest's mission to advance STEM education across Ireland is something EirGrid views as immensely valuable.

As the transmission system operator of Ireland's electricity grid, EirGrid is preparing the grid to support 80% renewable energy by 2030—a mission that demands expertise, creativity, and a commitment to lasting positive change.

Supporting STEM education, especially in fields core to engineering and problem-solving, drives innovation and empowers young people to explore fields in energy, as we work toward our climate goals.

EirGrid is dedicated to guiding Ireland's electricity grid transition to low-carbon, renewable energy, and we engage actively with communities and stakeholders across Ireland. Our partnership with SciFest is a meaningful part of this engagement.

We are proud to support a program that offers secondary students a platform to explore and develop their ideas for a cleaner energy future. Congratulations to all the students on their impressive projects, and we wish you all the best of luck today.

EirGrid

A Message from
Paul O'Neill

Executive Vice President, Quality & Operations,
Mallinckrodt Pharmaceuticals

Mallinckrodt is delighted to welcome you all to the SciFest National Final 2024. As an innovation-driven specialty pharmaceutical company, we are delighted to partner with SciFest to promote STEM subjects across second-level education in Ireland. Science, technology, engineering, and mathematics are essential disciplines in today's world, and we are honoured to be a new partner in this year's competition.

Mallinckrodt has a proud history of operations in Ireland for over 30 years. Our Blanchardstown, Dublin 15 facility is home to our corporate headquarters and global functions including manufacturing, global device engineering and innovative research and development. We develop medicines and therapies that address unmet patient needs and improve outcomes for patients with severe and critical conditions.

Our commitment to improving patient outcomes is grounded in science, innovation and R&D. This makes SciFest an ideal fit for supporting our shared mission to nurture young STEM talent in in schools all over Ireland. SciFest's STEM fairs provide young students with an exciting opportunity to design, research, and explore unique ideas, guiding them through the process of investigation and discovery.

In partnership with SciFest, our ambition is to inspire young students to pursue future careers in STEM and to see the opportunity before them, equipped with these disciplines, to enhance human health and improve the lives of patients all over the world.

We commend all of the students for their participation in SciFest's STEM fairs this year and congratulate those exceptional projects that have qualified for the National Final 2024. We also acknowledge parents, caregivers and teachers for igniting a spark of curiosity, creativity, and critical thinking in these young minds, which will inspire the healthcare scientists, engineers, and innovators of tomorrow.

Mallinckrodt
Pharmaceuticals

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SciFest 2024 National Final

A CELEBRATION OF EXCELLENCE IN STEM

PROGRAMME

THURSDAY 28 NOVEMBER
ONLINE: www.scifestfinal2024.ie

7.00pm	*Welcome to the SciFest 2024 National Final* Philip Smyth, Broadcaster and Science Communicator
7.05pm	*The Key Elements of a Successful Scientist* Dr Caoimhe de Fréin
7.30pm	*Why We Need to Play More* Fionn Ferreira
7.50pm	*Navigating Your Career in the Tech World* Mary O'Donoghue

FRIDAY 29 NOVEMBER
VENUE: Marino Conference Centre, Griffith Avenue, Dublin 9

8.00	Arrival and set up of projects
9.40	**Opening of Exhibition**
9.45	Judging (09.45 - 11.00 – Judges only)
11.00	Judging and viewing of projects (exhibition hall open to invited guests, parents and teachers)
13.00	Lunch
14.00	**Awards Ceremony** ~ Introduction: Philip Smyth, Broadcaster and Science Communicator ~ Noelle Campbell, Senior Management Consultant and Vice-Chair of the SciFest Board ~ Jack Shannon, SciFest STEM Champion 2023 ~ Samantha Cristoforetti, ESA Astronaut (by video)
14.35	**Presentation of Awards** ~ Achievement in STEM Awards ~ Main Awards
15.30	~ SciFest STEM Champion 2024 Award ~ Teacher of Excellence Award
15.45	Photographs

SciFest 2024 Judges

National Finalists Judging Panel

Dr Ruairí de Fréin	*Chair (TU Dublin)*
Mr Mark Lyons	*Assistant Chair (Alumnus)*
Dr Manuel Lopez Vernaza	*Laboratory Analyst, Plant Science Division, Department of Agriculture, Food and the Marine*
Dr John Power	*Health Engineering & Materials Science Research Hub, TU Dublin Tallaght*
Mr Bernie Capraro	*Retired EU Talent Development Programme Manager*
Mr Paul Hennessey	*Commercial Consultant, University of Galway*
Prof. Paul McCabe	*School of Biology and Environmental Science, UCD*
Mr Paul Nolan	*Group Development Manager Dawn Meats Group*
Mr Jim Cooke	*Teacher of Mathematics*
Ms Michelle O'Flaherty	*Director QP Quality Operations, Vertex Pharmaceuticals*
Mr Colin Mac Hale	*Chief Revenue Officer, Santegic*
Ms Gillian Place	*ISE Public Engagement Officer, UL (Immersive Software Engineer)*
Dr Joe Mac Donagh	*Lecturer, TU Dublin and Research Ethics board at St James's Hospital and Tallaght Hospital*
Mr Oisín O'Sullivan	*Alumnus - multiple award winner at SciFest-UL Final Year, Immersive Software Engineering*
Mr Mark Tattersall	*Software Engineer – Meta*
Dr Brian Smith	*Science Educator*
Ms Noelle Campbell	*Senior Management Consultant, Dublin*
Ms Nicole Geissel	*Firhouse Educate Together Secondary School*
Mr Timothy McGrath	*SciFest STEM Champion 2019, Software QA Engineer at Motorola Solutions*
Ms Kate Duffy	*Alumna, PhD Student Cancer Biology, UCD*
Mr Eoin Collins	*Process Engineer, Intel Ireland*
Mr Brian McCormack	*Systems Engineering Manager, Mallinckrodt Pharmaceuticals*
Mr Kuba Aksamski	*Design Verification Engineer, Mallinckrodt Pharmaceuticals*
Dr Noelle Ameijenda	*EirGrid, Senior Lead Engineer*
Mr Declan Cahalane	*Assistant Chief Inspector, Department of Education*
Ms Dympna McCoy	*Inspector, Department of Education*
Ms Michelle Bolger	*Education Officer, NCCA*
Ms Emma Griffin	*Professional Learning Leader, Oide*
Mr Kevin Logan	*Professional Learning Leader, Oide*

Boston Scientific Medical Devices Finalists Judging Panel

Ms Catherine Tattersall	*SciFest: Chair*
Mr Eoin Hayes	*Medical Device Engineer, Boston Scientific, Clonmel*
Mr Kevin Byrne	*Senior Project Manager, Boston Scientific, Cork*
Ms Mike Walsh	*R&D Manager, Boston Scientific, Galway*
Ms Jennifer Egan	*Inspector, Department of Education*

EirGrid Cleaner Climate Finalists Judging Panel

Mr Rory Geoghegan	*SciFest: Chair*
Ms Abbey Corr	*EirGrid, Graduate Engineer*
Mr Manuel Hurtado	*EirGrid, Senior Engineer*

Awards

SCIFEST STEM CHAMPION 2024
Trophy, €500 and an all-expenses-paid trip for the student(s) to represent Ireland at the Regeneron International Science and Engineering Fair (ISEF) in Columbus, Ohio in May 2025.

SCIFEST STEM CHAMPION 2024 RUNNER-UP
Trophy and €500.

BERLIN LONG NIGHT OF SCIENCE AWARD
Trophy and an all-expenses-paid trip for the student(s) and their teacher to attend the Long Night of Science in Berlin in June 2025. *Supported by the Department of Foreign Affairs.*

BOSTON SCIENTIFIC MEDICAL DEVICES GRAND AWARD
Trophy and €500. *Sponsored by Boston Scientific.*

EIRGRID CLEANER CLIMATE GRAND AWARD
Trophy and €500. *Sponsored by EirGrid.*

INTEL TECHNOLOGY AWARD
Trophy and €500. *Sponsored by Intel.*

MALLINCKRODT STEM EXCELLENCE AWARD
Trophy and €500. *Sponsored by Mallinckrodt Pharmaceuticals.*

SCIFEST STEM OUTREACH VIDEO AWARD
Trophy and €300.

SCIFEST SOCIAL SCIENCES AWARD
Trophy and €150.

SCIFEST LIFE SCIENCES AWARD
Trophy and €150.

THEA AWARD
Trophy and €75. *Sponsored by the Technological Higher Education Association.*

ISTA AWARD
Trophy and €75. *Sponsored by the Irish Science Teachers' Association.*

SCIFEST JUNIOR SCIENTIST OF THE FUTURE AWARD
Trophy and €75.

SCIFEST JUNIOR TECHNOLOGIST OF THE FUTURE AWARD
Trophy and €75.

STEM ACHIEVEMENT AWARDS
Engraved plaques.

TEACHER OF EXCELLENCE AWARD
This award is presented to the teacher of the student/s who win the SciFest STEM Champion 2024 title. The winning teacher receives an engraved trophy and will accompany the SciFest STEM Champion 2024 to the Regeneron International Science and Engineering Fair (ISEF) in Columbus, Ohio in May 2025.

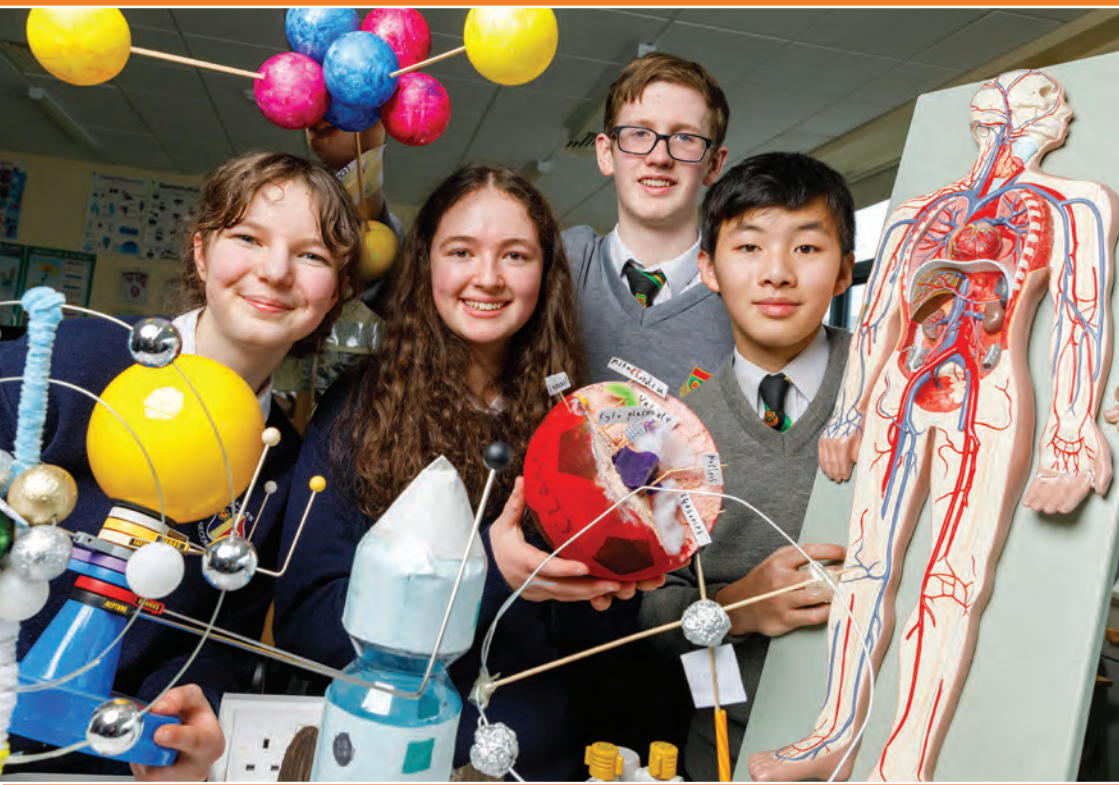

SLURRY
SAFETY


climate change
Conclusion: Plant growth

SCIFEST 2024

NATIONAL FINALISTS

PROJECT ABSTRACTS



SciFest@ATU Sligo 2024

[STAND 1] Title of Project	**FEATHERED FREQUENCIES: THE INVENTION OF A BIRD DETERRENT SOUND SYSTEM TO ELIMINATE BIRD STRIKES**
Students	Megan Bohan, Ríona O'Farrell
School	Ursuline College, Finisklin, Sligo
Teacher Mentoring Project	Anthony Carolan

Abstract

We have successfully invented a bird repellent sound system that is effective in deterring birds from jet engines and turbine blades, by using a natural predatorial bird call.

Following extensive research on topics such as bird hearing capabilities, stimuli, behavioural patterns and interpreting their calls and armed with a significant amount of prior research, we visited locally Ireland's largest raptor research centre. There we spoke to experts and recorded various birds of prey calls which we later analysed to determine frequency and decibel levels. To ensure further plausibility of research we conducted an experiment which factored in a decrease in decibel level relative to distance from the emitting sound source, mimicking the change in sound registered from a plane in flight. Through use of a sound distance propagation app we determined the distance ahead of the plane our sound would reach the bird. Considering the speed of the bird at advancing and retreating positions and the plane's advancing position we were able to assess the time it would take for the sound to reach the bird. Using the Doppler formula, we determined the frequency our chosen sound would need to be played at in order to reach the bird at the deterrence frequency of 2650 Hz. We liaised with an ecologist who provided information for our research on turbine blade strikes.

SciFest@TU Dublin Grangegorman 2024

[STAND 2] Title of Project	**PARAFIBREBUILDS – STRENGTH IN CONSTRUCTION**
Students	Oscar Rey, Ben Ma, Harry King
School	Sutton Park School, St Fintan's Road, Sutton, Co. Dublin
Teacher Mentoring Project	Joanne Hanratty

Abstract

Our project aims to hypothesize a new material for construction purposes based off the unique structure of Kevlar. Our goal was to create a similar aramid fibre that could surpass the faults of Kevlar®.

We began our work by researching the mechanical properties of Kevlar. After finding more information about the properties of Kevlar we decided to find a way we could keep the flexibility and tensile strength of Kevlar, while also making it stronger compressively. We saw the exact capabilities of Kevlar by running tests such as the Charpy and Izod tests. We used a modelling software called Avogadro and created electronic configurations digitally.

We created the original chemical structure of Kevlar and introduced fluorine into the chemical structure. Once we completed this, we used a quantum mechanics program called MOPAC to test for the microscopic qualities of Kevlar and our new fibre, which was called polytrifluorobenzene – diaminobenzene (PTFD). Comparing the predicted microscopic qualities of both fibres, we found that the predicted compressive strength of the PTFD fibre was higher than that of Kevlar.

In conclusion, the PTFD fibre is more suited to construction than Kevlar. This fibre will allow for greater building projects in the future. While we are aware that the PTFD fibre will likely be difficult to produce, we believe the benefits of this fibre will outweigh the costs.

SciFest@DCU 2024

[STAND 3] Title of Project	**ARE GEIGER-MÜLLER COUNTERS RELIABLE IN DETECTING BACKGROUND RADIATION LEVELS?**
Student	Zuzanna Komon
School	St Joseph's Secondary School, Convent Lane, Rush, Co. Dublin
Teacher Mentoring Project	Daniel Murray

Abstract

The primary goal of this project was to investigate simultaneous increases and decreases in radiation levels detected by Geiger-Müller counters in close proximity, despite the random nature of radioactive decay. The rise and fall in radiation seemed more like a pattern than random noise, suggesting the possibility of density fields. Having a better understanding of the type of random noise could be useful in calibrating radiation detectors such as X-Ray and Gamma Ray telescopes. I measured with five Geiger counters (FS2011, QA060, XH-901, BELLA, RAD 100) at different intervals. At 35-second intervals close together, the correlation here was low at <0.6 so I performed a speed read using shorter intervals, hypothesising that radiation fields were changing in density faster than our detectors could register. With 5-second intervals, keeping the same close distance, significant correlation was found between the counters. Far apart, no correlation was detected, suggesting the presence of small, transient hotspots or cold spots, passing by us in mere seconds. Radiation levels in the school ranged from 0.082 to 0.124 µS/h per room, averaging 0.101 µS/h, falling into the average 0.08-0.15 in Ireland. This was made into a detailed heatmap of the school. From 0.025 to 0.043 µS/h, the GM counter deviations highly affect the readings. Conclusively, three counters exceeded their claimed specs, meaning they could cause false positives of much higher readings. As the values I discovered are not uniform (gaussian), a Wiener filter would best eliminate the noise.

SciFest@ATU Donegal 2024

[STAND 4] Title of Project	**A COMPARATIVE STUDY OF THE PHYSICOCHEMICAL CHARACTERISTICS AND HEALTH-PROMOTING PROPERTIES OF DONEGAL HEATHER HONEYS VS MANUKA HONEY**
Student	Ethan Dewhirst
School	St Columba's Comprehensive School, Glenties, Co. Donegal
Teacher Mentoring Project	Ruth McPolin

Abstract

This project aims to compare New Zealand's Manuka Honey 300 MGO and my own Raw Heather Honey from Donegal, focusing on health-promoting properties of raw honey. The project also includes additional research, including on botulism – honey can pose a significant threat to infants below the age of 1, due to contamination by adulterated honey through the dilapidation of the honey industry in more than half of European Honey.

The lab tests began with a well diffusion assay and were conducted four times. This result showed Manuka led with a difference of 83 µm, a very small margin. The broth inhibition assay conducted twice showed the percentage reduction in S. Aureus. For the percentage reduction it showed heather reduce more in the higher dilutions and then Manuka takes the lead from 6.25% concentration onward to 0.4%. The last test was the DPPH assay showing Manuka honey produced slightly more antioxidants with a 5.45% difference.

The findings from my tests showed similar antioxidants in my heather honey as in the Manuka honey; antioxidants help prevent damage to body cells and are essential for health and wellbeing. However, heating both honeys above 50°C reduces these antioxidants and overall quality.

The aim of this project is to inform people there is no need to spend so much money on expensive honey to get health benefits; and supporting local beekeepers and purchasing local jars is more sustainable. Future research into Ireland's honey would benefit not only bees and beekeepers but also all of Ireland's biodiversity.

SciFest@NorthWest 2024

[STAND 5] Title of Project	**A.R.I. (AUTONOMOUS RECYCLING INDUSTRY)**
Students	Ashton Mui, Niall Manson, Callum Baillie
School	Ballymena Academy, 89 Galgorm Road, Ballymena, Co. Antrim
Teacher Mentoring Project	Kathryn Wylie

Abstract

2.1 billion tonnes of waste annually ends up being transported to landfills, creating devastating effects on the environment and wildlife. One of the main reasons some people do not recycle is because they are simply unable to. People with this problem include the visually impaired and physically disabled.

To address this issue, we developed A.R.I. (Autonomous Recycling Industry). This machine enables household and office recycling to be undertaken accurately and independently by everyone. It consists of several labelled boxes for different types of waste. We designed, programmed and 3D printed a prototype robotic arm with a claw to select items for recycling. This is done by using motors to control the arm and a Mega Arduino to house the software which uses inverse kinematics. The claw's built-in camera lens identifies the object with an artificial intelligence using machine learning technology. Wheels on the base of the compartment unit form an AGV, which can move itself freely to a destination on collection day. It navigates using omni-directional wheels for effortless movement. In addition, our app for IOS and Android can be used to identify waste on the fly with full accessibility for the visually impaired, meaning anyone can use our AI without needing to purchase A.R.I.'s full mechanism.

To conclude, we believe this project to be successful as it solves the problem of accurate household recycling. Feedback from visually impaired users suggests the concept provides a method of recycling that is user-friendly, fun and fit for its purpose.

SciFest@TU Dublin Tallaght 2024

[STAND 6] Title of Project	**ENHANCING DATA SECURITY IN AI TRAINING USING ZERO-KNOWLEDGE PROOFS FOR SECURE METHODOLOGY DEVELOPMENT**
Student	Addison Carey
School	Celbridge Community School, Maynooth Road, Celbridge, Co. Kildare
Teacher Mentoring Project	Zita Murphy

Abstract

Ensuring the security and privacy of sensitive data during AI and machine learning model training has become a critical challenge. Training AI models on datasets containing financial, medical, or other regulated information requires robust encryption methods and strict adherence to privacy regulations. As AI becomes increasingly integrated into essential services, the need for secure data-handling methodologies is more urgent than ever. My project aims to address these concerns by integrating Zero-Knowledge Proofs (ZKPs) into the AI training process. ZKPs are cryptographic protocols that allow one party to prove possession of certain information to another party without revealing the information itself. By applying ZKPs, I aim to develop an algorithm that enables AI models to process encrypted data without exposing the raw data. This approach minimizes data exposure risks, ensuring privacy while maintaining model performance.

I started this project in February 2024 and developed a basic ZKP algorithm that encrypts input data, which is then used through a simple linear regression model. My project also incorporates data visualization through a Flask-based interface. While my current model uses a small dataset and basic encryption, I am planning to scale to larger datasets and to refine the algorithm using stronger encryption and cryptographic hash functions to enhance the zero- knowledge aspect further.

While ZKPs can be difficult to integrate into the world of AI, I believe my project demonstrates a novel application of ZKPs in AI, offering a potential solution to one of the biggest challenges in secure AI model training.

SciFest@TUS Limerick 2024

[STAND 7] Title of Project	LUMOS – USING LARGE LANGUAGE MODELS TO ASSIST THE VISUALLY IMPAIRED
Students	Soumyadeep Saha, Swapnil Pahari
School	Ardscoil Rís, North Circular Road, Limerick
Teacher Mentoring Project	Aisling Mullen

Abstract

"The eye, the window of the soul, is the principal means by which the central sense can most completely and abundantly appreciate the infinite works of nature." (Leonardo Da Vinci). Can you imagine life without this window? Around 300 million people across the globe are visually impaired. Our investigation, "Lumos", aims to assist those visually impaired using modern 21st century technologies such as transformers and Large Language Models (LLMs).

The idea is simple: the user straps on a wearable, which they can speak to, by holding down a button on the device. Then the user gets a response, like talking to a human. The wearable contains a camera module, and a Raspberry Pi. An innovative radar feature may be implemented. The project is simple: a wearable was designed to be compact, intuitive, and able to run Edge AI using methods of optimising LLMs and transformers, through quantization and others. The VQA (Visual Question-Answering) model will be further fine-tuned and rigorously tested. Metrics and data regarding the model were collected in a Juypter notebook, which could be used to further optimise the model. The base model performs at approximately 80-84% accuracy at a latency of 1-3 seconds on Cloud TPU. We expect the mobile model to perform with over 70% accuracy on VQAv2 and others, favouring large token count.

In conclusion, our project aims to positively impact daily activities such as navigation and communication for visually impaired individuals, contributing to greater independence and accessibility.

SciFest@TUS Limerick 2024

[STAND 8] Title of Project	**FINDING HABITABLE EXOPLANETS ON THE NASA DATABASE WITH THE HELP OF AI**
Students	Lillie Li, Miles Bueno
School	Coláiste Chiaráin, Croom, Co. Limerick
Teacher Mentoring Project	Edel Farrell

Abstract

In this project we plan to use YOLO to code an AI to identify exoplanets. We'll then use a couple of calculations to find if the planet is potentially habitable. To do this, we first researched different ways of identifying exoplanets manually. We discovered many methods to identify exoplanets such as direct imaging, radial velocity, gravitational microlensing and transit light graphs. We decided to use the transit light graph method as it is relatively simpler than the other methods, requiring less work and/or specific machinery and has been the most successful in discovering new exoplanets.

After choosing our method, we found various websites with telescope data. We ended up using the graphs from Andrew Vanderburg's website which can be found in the references section. We also had to build on a theory we had on finding if they were habitable.

To do this we first conducted some research on factors that affect the habitability of a planet. Once we knew what makes a planet able to sustain life we were able to use various mathematical formulae to figure out if the planet we found is habitable. The research can be found under their own respective headings and the formulae can be found under the heading "Experimental methods".

We had to go through lots of problems with the website such as it being down, data issues and buggy code, false measurements and miscalculations but eventually we found a solution to every problem we faced.

SciFest@Dundalk IT 2024

[STAND 9] Title of Project	**CNK AGRI SOLUTIONS**
Student	Conor King
School	Patrician High School, Castleblayney Rd, Carrickmacross, Co. Monaghan
Teacher Mentoring Project	Linda Healy

Abstract

If cattle are weighed before dosing instead of estimating their weight, then there will be less error as the cattle then receive the correct doss.

Our first experiment was investigating how much percentage error there is by estimating the dose needed. In our investigation we measured cattle by estimating their weight, and wrote down the dose we thought they would need. We then weighed the cattle to see their weight. We used this measurement as the most accurate reading to calculate their percentage error. (Beef - The dos and don'ts of dosing dairy-beef calves - Teagasc Agriculture and Food Development Authority.) Our conclusion is that the use of the weigh scales makes the accuracy of the process far greater than guesswork. The accuracy shown by the remedy amount ranges from 13.4% to 2.3% and averages at 5.55%, which can be costly to the farmer and to the animals missing the remedy and becoming immune to it.

Our next experiment was making a control gun that will accurately read the weight, then send a signal to a receiver gun that will accurately calculate the volume of dose that is needed. We have created the program which will allow the gun to function as described and we are currently working on the accuracy to have the minimum error possible. After this experiment we plan to have a fully functional gun with all functions and data accessible for recording. We are in the process of designing the computer program to make sure it's as accurate as possible.

SciFest@TU Dublin Grangegorman 2024

[STAND 10] Title of Project	**INVESTIGATING THE EFFECT OF MICROPLASTIC CONCENTRATIONS ON PLANT GROWTH AND NUTRITION**
Students	Emmalise O'Boyle, Cara Mullen
School	Loreto Secondary School, Balbriggan, Co. Dublin
Teacher Mentoring Project	Daniel Toomey

Abstract

Microplastics are an emerging contaminant of concern to our crops, and we believe it is essential to understand the consequences of this contamination on our food chain. Our study investigates if having microplastics in soil affects a plant's ability to absorb nutrients from the soil, hence negatively impacting its growth and nutrition. We grew garden cress in soil containing 0%, 5% and 7% (w/w) microplastics.

To measure root growth, we calculated the area of roots covering the bottom of each sample's container. We held a grid over the roots and counted the number of boxes that were half full or more. We crushed our cress plants to create a solution, on which we performed titrations to analyse which group absorbed more calcium from the soil.

After analysing the data we had gathered on root area and dispersion we found that, although the root area decreased from 560 mm^2 in group 0 to 468 mm^2 in group 7, the t-tests showed no statistically significant difference between the groups in both root area and dispersion. This suggested that the microplastics did not have an impact on root growth.

Once the titrations were completed we found the median value for each sample and used that in our t-test. It showed no significant difference in calcium concentration between group 0 (average value = 1.86E-03) and group 7 (average value = 1.43E-03) when $p < 0.05$ ($p = 0.17$). This indicates that the microplastics did not have a statistically significant impact on the plant's ability to absorb nutrients from the soil.

SciFest@TUS Thurles 2024

[STAND 11] Title of Project	**EXTRACTING LATEX FROM DANDELIONS AND USING IT TO MAKE A GLUE TO FIND A SUSTAINABLE ALTERNATIVE SOURCE FOR LATEX**
Students	Seána Dunne, Miriam Senior, David Fitzpatrick
School	Mountrath Community School, Dysartbeigh, Mountrath, Co. Laois
Teacher Mentoring Project	Laura Thompson

Abstract

We wanted to find a sustainable alternative source for natural latex. Because of climate change it is getting harder to grow the rubber tree. Dandelions, contain the same raw material that is used in rubber production.

Latex was extracted from dandelions by cutting up the root and dissolving it in methylated spirits. This was left to sit for 48 hours before being filtered. The filtrate was distilled using a Liebig Condenser to separate the latex from the methylated spirits. We were then left with our latex.

Next we made the glue. We combined the latex with epoxy resin and calcium carbonate in a ratio of 50% latex, 30% calcium carbonate and 20% epoxy resin. This was left to dry for 48 hours at room temperature. We then tested this by putting the glue on 2 pieces of wood, screwing a hook into one end and place the other end in a vice. We then attached a digital pull scale to the hook and hooked all of this to a crane. The crane was raised and the process was videoed to pinpoint the exact moment the glue failed. We collected this data and used the tensile strength formula which is $s = F/A$, where s is the tensile strength and F is the force required to break the glue, and A is the cross-sectional area. The glue had a tensile strength of 193 psi.

This has shown that it is possible to make glue out of the latex found in dandelions.

SciFest@ATU Galway 2024

[STAND 12] Title of Project	**MAN'S BEST FRIEND TO THE RESCUE: USING FURRY FILTERS TO IMPROVE IRISH WATERWAYS**
Students	Hannah Rainey, Nicole Lally
School	Dominican College, Taylor's Hill Rd, Galway
Teacher Mentoring Project	Dee Everard

Abstract

Purpose: Ireland has freshwater and marine environments; both can become polluted by oil, a toxic substance that can be harmful to wildlife and destroy ecosystems. We wanted to research a method for removing toxic oils from Irish waterways.

Description: Our idea was to test whether waste dog hair could be used as a cheap and easy way of removing surface oil from water.

Methodology: We made a floating device with dog hair and developed a method to test how much oil could be absorbed by the floating dog hair filter under different conditions.

Data: In pilot experiments we showed that the dog hair filters absorbed oil and found the oil saturation volume. We demonstrated that the dog hair filters were effective in fresh and saltwater conditions and that different dog hair types were equally effective at absorbing oil. Finally, while our filters were not efficient at absorbing large oil slicks, we showed that dog hair and floating filters were effective when used with sedimentation tanks to remove oil during the water purification process.

Conclusion: In summary, we have shown that our floating dog hair filter could be used to absorb contaminating oil from the surface of water. Clipped dog hair is a waste product and repurposing the dog hair into filters could be used as a strategy to reduce landfill burden and as a cheap way of improving the quality of Irish waterways.

SciFest@ATU Galway 2024

[STAND 13] Title of Project	**MITES BEE GONE! AN INVESTIGATION OF IRISH HONEYBEES AND THEIR NATURAL CONTROL MECHANISM OF THE PARASITIC VARROA MITE**
Student	Orlaith Connors
School	Gort Community School, Ennis Road, Gort, Co. Galway
Teacher Mentoring Project	Tim Collins

Abstract

Ireland is home to a significant population of black bee or *Apis mellifera mellifera* (A.m.m.). The ectoparasitic mite, *Varroa destructor* is the most significant pathological threat to A.m.m., leading to significant mortality and morbidity in its colonies (Van Eagelsdorp et al, 2008; Dietmann et al, 2012). Evidence and protection of colonies with clean behaviour influences sustainability.

This project investigates if *Apis mellifera mellifera* display evidence of heritable traits of hygienic behaviour, including (i) removal of dead larvae, (ii) recapping, and (iii) grooming. These traits act as defence mechanisms against the Varroa mite. Eight colonies in two apiaries were selected for examination in September 2023 in South Galway. The first apiary (A) was treated chemically for Varroa 18 months previously. Apiary (B) was treated eight months previously. Both displayed evidence of hygienic behaviour but neither displayed evidence of the higher hygienic behaviour of recapping. Apiary A performed better than Apiary B thus supporting my hypothesis that chemically untreated bees will perform better levels of heritable hygienic behaviour than treated bees. The Sugar Shake Test and the Pin Kill Test showed significant differences between apiaries.

In April and July 2024 Apiary A was examined for grooming behaviour and removal of dead larvae. Apiary B was not available due to colony losses. Apiary A continued to display strong levels of heritable hygienic behaviour. Breeding for varroa-resistant honeybees is a focus of current research. With reference to recapping, there is European evidence of recapping but there is minimal work done on this phenomenon with A.m.m. in Ireland.

SciFest@DCU 2024

[STAND 14] Title of Project	**MUSHROOMS VS NORMAL BUILDING MATERIAL**
Students	Robyn O'Hanlon, Emilia Aherne, Elodie Wallace
School	St Conleth's College, 28 Clyde Road, Dublin 4
Teacher Mentoring Project	Diego Cavallaro

Abstract

When starting our project we wanted to find out whether in the future mycelium could replace normal building materials such as wood and/or insulation.

Mycelium is a form of fungi/mushroom that feeds on substrates, like the ones we tested such as coffee, flour, cardboard, pine needles, and then binds them together to create a strong material.

In our project we tested the strength, fire resistance and insulation properties of a mycelium-based material (and also tested different substrates in the mycelium) compared to normal building materials.

To conclude this project, our hypothesis in the beginning was: "If mycelium can withstand tests of fire, pressure and insulation, then it would be a viable, cheap and sustainable replacement for building materials like wood and foam insulation."

Mycelium has on the whole proven to be a viable replacement for more traditional building materials. Although mycelium cannot replace wood for building large structures as it cannot hold as much weight, it still has considerable strength and, from the data from our experiments, in the future it could be used to replace wood in furniture.

It was a very exciting development to find that in our experiments mycelium with flour and wood chips was better at insulating than fibreglass insulation itself.

Lastly, we have shown that mycelium is an exciting new direction in helping stop climate change by being an easy way to reduce the amount of carbon produced in creating normal building materials (by making it yourself) and also by recycling old kitchen waste.

SciFest@MTU Cork 2024

[STAND 15] Title of Project	**INVESTIGATING WHETHER CHILDHOOD IMAGINARY COMPANIONS IMPACT SOCIAL COMPETENCE AND COPING SKILLS IN TEENAGE YEARS**
Student	Lily Cahill
School	Kinsale Community School, Kinsale, Co. Cork
Teacher Mentoring Project	Shaun Holly

Abstract

Play is one of the most important ways that children acquire the social and emotional skills essential for healthy psychological development. The development of positive social skills is linked to better mental health outcomes and is a critical competency in adolescence.

Research demonstrates the positive impact having an Imaginary Companion(IC) has on social-skills development in childhood. ICs have also helped children cope with adverse events such as loneliness, illness or loss. Few studies have sought to understand the experience and impact of childhood ICs in adolescence. Using a quantitative survey design, the first study explored whether an imagery companion in childhood impacts social competence in adolescence. Participants (n = 346) were secondary school aged volunteers who anonymously completed a self-report questionnaire pack in a classroom setting. The pack consisted of two questionnaires evaluating social competence in five separate domains. Four subscales from the Adolescent Self Perception Profile (SPPC) titled Social Competence, Global Self-Worth, Close Friendships and Behaviour Conduct were used. The Short Form Self-Regulation Questionnaire(SSRQ) was also used.

For the second study, seven secondary school aged volunteers were interviewed. Participants had direct experience of IC. The interviews were semi-structured questions based on participants' experience and use of ICs. Interviews were transcribed verbatim and analysed following guidelines for Interpretive Phenomenological Analysis.

Findings indicate that ICs in childhood have a positive impact on the development of specific social competence and behavioural skills required in adolescence. Findings also point to ICs' mental health benefits in supporting children and adolescents during challenging times

SciFest@MTU Kerry 2024

[STAND 16] Title of Project	**WOULD PEOPLE LIVE ON AN ISLAND IF IT HAD THE NECESSITIES?**
Students	Abbie Mazzelle, Emma Heaphy
School	Presentation Secondary School, Greenville, Listowel, Co. Kerry
Teacher Mentoring Project	Catherine Kennedy

Abstract

Our project, "Would People Move to an Island if it had the Necessities?", explores the exciting possibility of resettling individuals to uninhabited islands off the Irish coast as a solution to the housing crisis affecting over 13,000 unhoused individuals in Ireland.

By utilising random sampling, public data, and insights from the Central Statistics Office, we gathered valuable information on participants' attitudes toward island living. Our surveys, completed by over 300 diverse respondents, revealed that 64% said they are willing/somewhat willing to relocate on the islands and 64.7% considered sustainability a key factor in their relocation decisions. We engaged with policymakers, including Minister Heather Humphreys, to gain insights into initiatives like "Our Living Islands," which align with our research goals.

Our findings highlighted the potential of approximately 60 uninhabited islands to accommodate an estimated 34,500 people (about twice the seating capacity of Croke Park) presenting a unique opportunity to address homelessness and the housing crisis while promoting sustainable living through renewable energy sources. While there are practical challenges, such as infrastructure, the willingness among the public to consider island relocation is encouraging. Our research underscores the potential of these islands as viable housing solutions. By advocating for eco-friendly practices and wildlife conservation, we propose a holistic approach to tackle Ireland's housing crisis while fostering environmental awareness. We believe that our findings can inspire positive discussions and policy changes aimed at alleviating the housing challenges facing Ireland, paving the way for innovative living solutions that benefit both people and the planet.

SciFest@SETU Carlow 2024

[STAND 17] Title of Project	**WE MOSST REMOVE HEAVY METALS FROM WATER: A BIOLOGICAL SOLUTION TO HEAVY METAL POLLUTION**
Student	Alice Giles
School	St Mary's College Arklow, St Mary's Road, Arklow, Co. Wicklow
Teacher Mentoring Project	Joanne English

Abstract

I was inspired to do this project after reading a paper from a University in Sweden, where they removed arsenic from water using a native moss. I wondered if something similar could be done to my local river, The Avoca River, which is highly polluted with heavy metals, especially copper.

I created and analysed an online survey using SPSS software to gather information on the effects that heavy metals have on humans. I collected river samples, with my local LAWPRO officer. The school purchased non-native mosses, Java Moss and Egeria Densea, for me to carry out my first round of testing in March. I submerged the moss in the river water and tested it over a ten-hour period. I tested it using 15in1 test strips and also tested it using an ICP-MS machine. The water, from the moss tests, was tested for quantities of ten common metals in water.

I met Joanne Denyer, a Bryophyte expert, in Devils Glen Woods, to locate native mosses to repeat my experiment. We collected *Fontinalis Antipyretica* and *Rhynchostegium Riparioides* and repeated the above experiment with one addition. On consultation with Stephen Kavanagh of NORRI Ireland I also added discarded oyster shells, to investigate if the pH of the water could be altered. All water samples were tested in the same way as the previous experiments.

After completing this project I found that moss is successful in reducing heavy metals in water and oyster shells are successful in increasing the pH of water.

SciFest@SETU Waterford 2024

[STAND 18] Title of Project	**WHAT'S IN YOUR CONCEALER?**
Students	Kate Smith, Kamila Swider, Anna Brooks Silva
School	Coláiste an Átha, Kilmuckridge, Gorey, Co. Wexford
Teacher Mentoring Project	Ciarán O'Brien

Abstract

Our project focused on investigating whether commonly used makeup products, specifically concealers, could contribute to skin issues like acne and flare-ups by harbouring bacteria or mould. Concealers are frequently used to cover blemishes and redness, making them an ideal product to test for microbial contamination.

We selected six new, unopened concealers from different brands to see if they could grow mould when exposed to conditions like daily use. Our hypothesis was that certain concealers, due to their formulation or packaging, might be more prone to contamination. We used petri dishes, nutrient agar, sterile cotton swabs, and an incubator to simulate a makeup bag environment. After preparing the petri dishes with nutrient agar, we swabbed each concealer and applied the samples to the dishes, which were then incubated for two weeks. To replicate warmth and moisture, we covered the incubator with a lab coat.

At the end of the experiment, we found that some concealers showed significant mould growth, while others had minimal contamination. This variation could be due to differences in preservatives, packaging, or exposure to air. Our findings underscore the importance of being cautious with makeup products, as mould can contribute to skin issues. It's essential to regularly check expiration dates, avoid sharing cosmetics, and practise proper hygiene to reduce the risk of contamination and skin problems.

SciFest@TUS Thurles 2024

[STAND 19] Title of Project	**A STATISTICAL ANALYSIS OF FATALITIES ON IRISH ROADS COMPARED TO NORWEGIAN ROADS FROM 1996 TO 2023**
Student	Robert MacSweeney
School	Rockwell College, Cashel, Co. Tipperary
Teacher Mentoring Project	Helen Murray

Abstract

The purpose of my project was to suggest ways in which we could lower the traffic fatality rate in Ireland, focusing on education as a key factor. I used Norway as a case study of a country pioneering the way forward in driver education, teaching higher-order skills such as spatial awareness, foresight and cautiousness throughout the stages of driver learning. With a similar population size to Ireland of 5.408 million, Norway has had roughly half the number of road fatalities over the past couple of years.

Knowing that correlation doesn't necessarily mean causation, I also looked at strict traffic enforcement and better road design in Norway as possible contributors to this obvious difference between the two countries. My main sources were the CSO, the RSA, An Garda Síochána, the European Commission, Statistik Sentralbyrå, RTE and The International Association of Traffic and Safety Sciences, among others. I also looked into possible further paths of study such as relating the teaching of hand-eye coordination/fine motor control skills in writing to driving, where these skills are also essential. In addition, when teaching spatial awareness and visualisation skills, e.g. learning to deconstruct and reconstruct a 3D shape to and from its net, links to driving could also be created from an early age.

My main conclusions are to follow the example of Norway by adjusting our testing system to educate people on driving's higher-order skills and to test those skills accordingly and also to use the template of Vision Zero to examine road design in Ireland.

SciFest@TU Dublin Blanchardstown 2024

[STAND 20] Title of Project	**SKILLBUILDERZ**
Students	Daniela Perju, Grace Garrigan
School	Loreto High School Beaufort, Grange Road, Rathfarnham, Dublin 14
Teacher Mentoring Project	Grainne Ryan

Abstract

We aimed to address the issue of children spending too much time on their devices and not enough learning necessary skills. We took advantage of this dependency by creating a fun and educational website that encourages children from ages 8-13 years to learn life skills through video tutorials.

We created surveys to assess which skills to include. We split the site into three age categories: 8-9, 10-12 and 13+, and surveyed each category individually. We surveyed children of that age with permission from their schools. We used the data gathered to finalise our website content.

From our surveys we learned that most children in the ages 8-9 and 10-12 categories were not able to tie a tie, and 52.9% wanted to learn how. First aid was the least known skill in the 13+ category and was requested by 40%. This was a common theme throughout out results. 95% of children had access to a device, so children have means of accessing our website.

Site features include: a shared photo gallery, a badge reward system and a recommended links section. We created 18 tutorials demonstrated by children of that age group. A sample group then tested our website and gave feedback. 91% of people rated our website "very good" or "good".

Conclusively, children spending too much time using technology and not enough learning necessary skills is a rising problem and will harmfully impact future generations. We hope our site will address this issue and bring awareness to this modern problem.

SciFest@TUS Athlone 2024

[STAND 21] Title of Project	**OWN YOUR CYCLE, OWN YOUR GAME**
Student	Michaela Gillooly
School	Glenamaddy Community School, Church Street, Glenamaddy, Co. Galway
Teacher Mentoring Project	Aoife Collins

Abstract

My project is an investigation into the negative stigmatism around females speaking out about their periods and the effects their menstrual cycle has on their athletic performance.

As a female athlete, I persevere with the struggles of menstruation. I experience low energy, excruciating abdominal cramps and mood swings which mentally and physically diminish my performance. My aim is to investigate if other female athletes endure similar experiences. I'm trained by male coaches and I also coach alongside males and it's difficult to speak out about this issue.

After conducting research, I discovered that over 60% of girls quit sport by the age of 16 or 17, and one of the main reasons for this is discomfort during menstruation. This is extremely concerning as adolescents are required to get a minimum of 1 hour of exercise daily. My findings are collated from a sample group in my school population and a ladies' football team. I conducted fitness testing and surveys. I analysed my data using Leaving Certificate and College level statistics on Microsoft Forms and Posit Cloud. I interviewed elite-level female athletes about their experiences while exercising on their period. I sought advice for younger girls who may be struggling with managing their menstruation and exercising. I found out menstruation is in fact affecting females' athletic performance. I created brochures providing recommendations on how to play at your best while on your period. I created a lesson plan for junior cycle SPHE students on menstruation and a useful resource with HerMoves.

SCIFEST 2024

NATIONAL FINALISTS / BOSTON SCIENTIFIC MEDICAL DEVICES FINALISTS

PROJECT ABSTRACTS

SciFest@TU Dublin Blanchardstown 2024

[STAND 22] Title of Project	**A STUDY INTO BIOCOMPATIBLE PATCH DESIGNS FOR ASD CLOSURES IN TGA PATIENTS**
Student	Shauna Esmonde
School	Loreto Secondary School, St Michael's, Navan, Co. Meath
Teacher Mentoring Project	Rachel Glennon

Abstract

This project is aimed at investigating the potential for improved biocompatibility for patch designs for ASD Closures. ASD is a congenital heart defect whereby there is a hole in the septal wall dividing the left and right atria. This can create abnormal haemodynamic performance within the heart. An ASD closure is a surgical operation used to correct this abnormality, often by using a patch to close up the hole.

I used a combination of practical and theoretical methods to conduct this project. I created my own plastics and ran tests, including petri dish testing for bacterial resistance and using Hooke's Law to test for strength and durability under pressure in the heart. I came to the conclusion that, out of all tested plastics, my bioplastic was the strongest and most flexible.

SciFest@TU Dublin Tallaght 2024

[STAND 23] Title of Project	**VIPMOD: VISION IMPAIRED PERSON'S MOVING OBJECT DETECTOR**
Student	Maura Moore-McCune
School	The King's Hospital School, Palmerstown, Dublin 20
Teacher Mentoring Project	Ciaran O'Connor

Abstract

Purpose: Over 2 billion people worldwide are vision impaired. I am vision impaired and find it difficult to gauge a car's speed or distance. I have been involved in near road accidents when cars approached me on my blind side. Unable to find a suitable device, I began developing VIPMOD: Vision Impaired Person's Moving Object Detector. The aim of my project is to design an app which detects fast moving objects, so that vision impaired people can live safer and more independent lives.

Method: This project evolved through six prototypes. The first three prototypes used Micro:bits. Prototype 4 uses GPS technology. Prototype 5 is an app which uses TensorFlow.js Image Classification model to detect oncoming vehicles and other objects. The app displays the object's name, vibrates and issues a text-to-speech warning. Prototype 6 is an application that estimates the speed of oncoming objects. It uses a YOLOv8 model to analyse input footage.

Results: Prototype 5 was tested in a controlled setting, with 95% accuracy (316 trials). Vision Ireland will be testing VIPMOD in the WayFinding Centre - an indoor environment replicating the real-world experience of using public transport for vision impaired people.

Conclusion: From the data collected, I conclude that VIPMOD has the potential to improve road safety for all road users, particularly for vision impaired. I am collaborating with Dr Anna Zamansky and her team from Haifa University, to further develop VIPMOD. I aim to develop the VIPMOD app to promote safety and independent travel for all.

SciFest@ATU Sligo 2024

[STAND 24] Title of Project	**CHROMATIC WAVES**
Student	Bláithín Brady
School	Ursuline College Sligo, Finisklin Road, Sligo
Teacher Mentoring Project	Anthony Carolan

Abstract

Chromatic Waves is an investigation into the use of white, pink and brown noise to alter brain wave activity. White and pink noise (20-20,000 Hz) contain all audible frequencies. However, as the frequency of pink noise increases, its intensity lowers. Brown noise has a lower frequency range of just 1-150 Hz. The five most prominent brain waves are alpha, beta, theta, gamma, and delta. The delta wave is commonly associated with periods of relaxation and sleep in the brain.

To measure the impact of white, pink and brown noise in enhancing relaxation, the Muse2 headset was used to record EEG data of 15 participants. During the experiment, thirty seconds of silence was allowed followed by a minute of brown, pink and white noise. The experiment was conducted in a quiet room in the school to ensure there was no interference from background noises.

Once the data was collected, the mean brain wave intensity during each interval was calculated. The mean silence intensity was compared to the mean intensity during periods of noise, and the z-score was calculated. The z-scores for all participants were averaged to understand the difference in brain wave activity between silence and white, pink and brown noise.

After analysing and plotting the data, the results indicated that no tone group altered the brain wave activity by a significant amount. All average values remained between -1 and +1 standard deviations from the silent mean.

SciFest@TUS Limerick 2024

[STAND 25] Title of Project	**FACIAL REHABILITATION: A TECHNOLOGICAL APPROACH FOR BELL'S PALSY PATIENTS**
Student	Nell McMahon
School	Desmond College, Station Rd, Newcastle West, Co. Limerick
Teacher Mentoring Project	Donal Enright

Abstract

This project aimed to address the facial muscle immobility associated with Bell's Palsy by developing a technological solution to assist in rehabilitation. Bell's Palsy often causes facial drooping, speech impairments and difficulty in closing one eye. Despite medication, regaining full muscle control can be a challenge for many patients. Inspired by techniques developed by my grandmother and informed by interviews with past sufferers, I hypothesised that a handheld device designed to stimulate facial muscles could improve recovery outcomes. The project focuses on designing a simple, user-friendly device to aid in facial muscle exercises and enhance rehabilitation efforts at home.

Data: Participants diagnosed with Bell's Palsy were recruited for the study, where they used the device daily as part of their rehabilitation routine. The effectiveness of the device was monitored through assessments of muscle function, patient-reported outcomes and overall improvement over time, compared to conventional methods. I have, with the assistance of a GP, assessed the movement of a patient's forehead, eyes and mouth movement over 14 days, using the House Brachmann Scale whilst using the device in conjunction with medically approved steroids. I classified the result over Normal, Mild, Moderate, Severe or Total Paralysis.

Conclusions: By providing a technological aid that complements medical treatments, this project sought to improve the quality of life and rehabilitation outcomes for individuals with Bell's Palsy. The results include quicker recovery times, improved muscle control and a reduction in long-term facial dysfunction.

SciFest@DCU 2024

[STAND 26] Title of Project	**A CONTINUED STUDY ON USING MACHINE LEARNING TO IDENTIFY RADIOLUCENCIES ON PANORAMIC DENTAL RADIOGRAPHS (OPGS)**
Student	Kamaya Gogna
School	St Joseph's Secondary School, Convent Lane, Rush, Co. Dublin
Teacher Mentoring Project	Daniel Murray

Abstract

Dental radiolucencies appear as darker regions in X-ray images, indicating reduced tissue density, which can suggest conditions ranging from benign lesions to serious pathology. Radiolucencies are broadly categorized into intraosseous (within the tooth structure) and periapical (in surrounding bone), each type exhibiting distinct morphological features. My project employs machine learning, specifically integrating active contour models and fuzzy logic, to streamline the classification and analysis of these radiolucent areas.

Active contour models assist in the segmentation of X-ray images by dynamically outlining regions of interest, a crucial step for isolating radiolucent areas accurately. Fuzzy logic, designed to handle imprecision in medical imaging, improves the algorithm's ability to classify areas with overlapping or ambiguous boundaries, enhancing diagnostic accuracy.

Using reinforcement learning principles, I developed a neural network-based classification algorithm, which I rigorously coded and tested. Training involved supervised learning with labelled datasets, allowing the model to iteratively optimize for increased accuracy. Once validated, the algorithm was deployed through two website prototypes, enabling accessible, real-world application of the tool for healthcare professionals.

Machine learning-based classification not only expedites radiolucency analysis but also handles large datasets with a consistency and efficiency that would be challenging for manual assessment. This project applies advanced machine learning methodologies and holds potential as a diagnostic aid, allowing dental professionals to better identify and evaluate radiolucent regions, ultimately supporting more timely and precise patient care.

SciFest@Dundalk IT 2024

[STAND 27] Title of Project	**THE NRG GUARD: THE MODIFIED MOUTH GUARD THAT ALLOWS THE USER TO INSTALL A SPORT SOLUTION INTO A POCKET ON THE MOUTH GUARD, SLOWLY RELEASING THE SOLUTION**
Student	Cian Rafferty
School	Patrician High School, Rockdaniel Road, Carrickmacross, Co. Monaghan
Teacher Mentoring Project	Linda Healy

Abstract

WThe NRG Guard project aims to aid athletes who encounter issues with digesting highly-concentrated sport solutions, as well as promoting the use of mouth guards in contact sports.

Dietary supplements are becoming increasingly popular among athletes. These solutions are highly concentrated and are consumed very quickly before carrying out exercise. As the athlete's system is being exposed to high additive content in a short space of time, it leads many athletes to suffer from cramping and nausea.

With the modern game advancing, and players adapting to reach higher performance and fitness levels, sport solutions and supplements have become highly sought after. The NRG Guard aims to eradicate both of the problems highlighted above, leading to a safer environment for the athlete, while allowing them to perform to the best of their ability.

I have investigated various solution makeups, and the temperature range that these tablets dissolve at in saliva when performing exercise. This temperature range was found to be between 38-41 degrees Celsius. The average time taken to dissolve a tablet at this temperature was roughly 23 minutes.

Using this data we can predict that the solution would dissolve at an appropriate rate, where the NRG Guard would provide benefit to the athlete for the given 30-40 minutes per half. The purpose of this investigation is to make a mouth guard that would enable a supplement to dissolve in this time frame. I have investigated different designs for the mouth guard for it to be at its most optimal form.

SciFest@MTU Cork 2024

[STAND 28] Title of Project	**NO MORE ICE, ICE BABY!**
Student	Gráinne Ní Chróinín
School	Gaelcholáiste Charraigh Uí Leighin, Carrigaline Education Campus, Carrigaline, Co. Cork
Teacher Mentoring Project	Seán Ó Finn

Abstract

Purpose of the Project: The purpose of this project was to develop a targeted cooling device for managing post-surgery swelling, addressing the limitations of traditional ice packs that are impractical and difficult to use.

Description of the Project: This project involved researching thermoelectric effects, specifically the Peltier Effect and the Thomson Effect, to create a cooling device. Comparative tests were designed to assess the cooling capabilities of both effects under varying voltage conditions. While the Peltier cooler proved to be more effective, it presented risks of overheating and needed a transfer system to safely convey cooling to the target area. Material testing involved analysing the thermal conductivities of copper and brass plates, and insulating techniques were applied to enhance performance. An Arduino-based control system was developed to monitor temperatures throughout the process.

Data: Initial trials indicated that applying heat sinks and fans significantly reduced the temperatures on the Peltier cold plate, achieving a 50% reduction relative to ambient temperatures. Tests on material conductivity revealed the necessity of insulation to prevent the cold plates from acting as radiators, and the application of a silicone insulator increased heat transfer efficiency through copper cables.

Conclusions: The project concluded that the Peltier Effect is the most suitable technology for targeted cooling applications post-surgery. The development of a prototype heat pump demonstrated proof of concept, leading to what I currently have today for this submission.

SciFest@TU Dublin Grangegorman 2024

[STAND 29] Title of Project	**MACHINE LEARNING POWERED INTRUDER DETECTION SYSTEM IN THE CONTEXT OF OUR MEDICAL APPOINTMENT COMPUTING SYSTEM SOFTWARE (MACSS)**
Student	Max Grogan
School	St Andrew's College, Booterstown Avenue, Blackrock, Co. Dublin
Teacher Mentoring Project	Laura Brogan

Abstract

This project aimed to develop the best Intruder Detection System (IDS) for the Medical Appointment Computing System Software (MACSS), designed to address Ireland's 10% of people who lack access to General Practitioners due to inaccessibility, lack of funds and lack of user organization. MACSS aims to increase accessibility to GPs across Ireland and manage their appointments, invoices, medical history, prescriptions, and test results thus improving the quality of the Irish healthcare system.

The project involved creating a demo website, which has received positive feedback from a GP, 50 user testers, and five readability tests.

The IDS was created using the KDD Cup 1999 dataset. The data was then processed by Reading Data, Data Processing, Categorical features, distribution, data correlation, feature mapping and modelling. Seven algorithms were tested: Gaussian Naïve Bayes, Decision Tree, Random Forest, SVM, Logistic Regression, Gradient Boosting, and ANN. The Decision Tree model was found to be the best machine learning model for the IDS and further development was made.

The research involved extensive investigation into the state of the Irish healthcare system, interviews and articles about IDS functions. The effectiveness of the software was proven through user testing, readability testing and GP input. Training time, accuracy and testing confirmed that the Decision Tree model was the best model for the IDS, and data processing results further verified its effectiveness.

Check out the software demo here: www.macss.ie

SciFest@TUS Athlone 2024

[STAND 30] Title of Project	**SECURE HANDS: AIDING IRELAND'S EMERGENCY SERVICES WITH INTERPRETATION OF IRISH SIGN LANGUAGE (ISL) USING A MOBILE APPLICATION**
Student	Dana Carney
School	Mount Saint Michael, Claremont, Claremorris, Co. Mayo
Teacher Mentoring Project	Stephanie Hogan

Abstract

In crisis situations, effective communication is vital, yet Irish Sign Language (ISL) users face significant barriers when interacting with emergency services, which primarily understand only a fraction of the population. Research indicates a profound lack of ISL proficiency among emergency responders, often relegating ISL users to reliance on others for communication, thereby risking dehumanisation and heightened danger, especially in cases of crime or domestic violence. This project proposes the development of the "Secure Hands" app, designed to bridge the communication gap through machine learning and text-to-speech technology. The app aims to interpret basic ISL gestures into text for responders, while also verbally conveying messages aloud.

Before engagement, ISL users will receive instructional videos and texts explaining the app's function. The app will incorporate incentivised learning features to educate emergency responders on ISL phrases. A comprehensive literature review and quantitative surveys have highlighted the urgent need for such a solution. Collaborations with experts in app development and ISL users have informed the app's design, ensuring it meets the community's needs.

Initial prototypes using Teachable Machines will transition to TensorFlow for enhanced capabilities. The app's efficacy will be evaluated through trials involving both emergency responders and ISL users in simulated emergencies, followed by quantitative and qualitative feedback. This innovative approach aims to significantly reduce communication barriers, thereby improving safety and accessibility for the ISL community within emergency service contexts.

SciFest@TUS Limerick 2024

[STAND 31] Title of Project	SMART OTOSCOPE
Students	Laura Brennan, Aoibhilinn Heath, Caoimhe Greene
School	Desmond College, Station Rd, Newcastle West, Co. Limerick
Teacher Mentoring Project	Donal Enright

Abstract

The purpose of this project was to create a Smart Otoscope that transforms any smartphone into a diagnostic tool for remote ear infection assessment. It was developed to reduce the stress and inconvenience for children and their caregivers caused by in-person doctor visits for ear infections. The device enables real-time remote diagnosis by allowing users to capture clear images of the ear canal and eardrum.

The project involves designing an external device that can be easily attached to a smartphone, accompanied by a user-friendly app. The app assists in adjusting the device, attaching a disposable ear speculum, and capturing high-quality images of the inner ear. The system includes adjustable lighting and alignment features to ensure clear visualisation. Once the images are captured, they can be securely transmitted to a physician for diagnosis.

Data collected includes images of ear canals and eardrums, which are stored and transmitted through the app for evaluation by healthcare professionals. The Smart Otoscope's digital capabilities allow access to expert medical diagnosis from virtually anywhere, democratising healthcare by making it more accessible, especially in remote locations.

In conclusion, the Smart Otoscope offers a significant advancement in telemedicine. It reduces the need for in-person visits, alleviates pressure on healthcare systems, and provides a convenient solution for families. By improving access to timely ear infection diagnosis, the device ensures better patient outcomes while minimising stress and logistical challenges associated with traditional healthcare appointments.


AFFECTS OF VIOLENCE ON CONTACT SPORT PLAYERS

SCIFEST 2024

NATIONAL FINALISTS / EIRGRID CLEANER CLIMATE FINALISTS

PROJECT ABSTRACTS

SciFest@TUS Athlone 2024

[STAND 32] Title of Project	**A CRYSTAL-CLEAR WAY TO SLOW DOWN IRELAND'S ENERGY CRISIS**
Student	Fionn Campbell
School	Moate Community School, Church Street, Moate, Co. Westmeath
Teacher Mentoring Project	Mairead Cusack

Abstract

This investigation designed and tested a prototype system that would allow existing road infrastructure to be adapted to harvest waste kinetic energy from traffic. The system relies on piezoelectricity, the charge that occurs in specific materials when subject to strain. It consists of a piezoelectric speed ramp for harvesting impacts from slow-moving traffic in urban settings and a 'cat's eye' to absorb vibrations from fast-moving vehicles on motorways.

A small-scale speed ramp prototype was developed which incorporates piezoelectric diaphragms consisting of a piezoelectric ceramic film on a brass plate. The device was tested by measuring its power output after being impacted with increasing quantities of kinetic energy and repeating the process using increasing numbers of diaphragms. It was found that the addition of diaphragms maximises energy absorption. After optimisation, allowing the device to hold more diaphragms, continued testing found that with twenty diaphragms, it could produce c. 810 μW of power when impacted with 3.34 J. As each diaphragm contains just 0.8 g of piezoelectric ceramic, huge potential was indicated for wide-scale implementation using much larger masses.

A prototype piezoelectric cat's eye which absorbs vibrations imparted by vehicles on the surrounding road surface is now in development. Its ability is being tested currently by stimulation with vibration from increasing distances.

Together, if implemented on a large scale, these two devices form a system which is suitable for harvesting energy from all forms of traffic. Given the possibilities posed during testing, it is crystal-clear how this system could help to slow down the energy crisis.

[STAND 33] Title of Project	**HOW "GREEN" ARE THE LOCAL GAA CLUBS? COMPARING THE CARBON FOOTPRINTS OF OUR RURAL GAA CLUBS**
Students	Matthew Daly, Rory Maguire
School	Presentation College Headford, Church Rd, Headford, Co. Galway
Teacher Mentoring Project	John Toner

Abstract

Our project aimed to measure the carbon footprints of two GAA clubs, driven by our passion for sport and concerns about climate change. Further research revealed this was the first significant study on the environmental impact of GAA clubs, highlighting the project's importance. To expand our analysis to a national level, we added a third urban club to assess nationwide emissions.

We evaluated travel, electricity and oil use in the three clubs. Oil and electrical emissions were calculated through energy and oil bills, while travel emissions were derived from a survey sent to nearly 1,500 members, yielding over 300 responses from the rural clubs and nearly 80 from the urban club. Using survey responses, we developed a formula to find individual GAA travel emissions, which we than extrapolated across the rest of clubs.

Our findings showed that GAA clubs have a substantial environmental impact. For example, Caherlistrane GAA players drove nearly 440,000 km for training and matches in one season. Annaghdown (Rural club) had the highest annual carbon footprint at 53,397 kg of CO2, followed closely by Caherlistrane (Rural) with 48,213 kg, with St James's GAA club (Urban) emitting 16,721 kg. If each of the 2200 Irish GAA clubs had similar footprints, the GAA could account for about 111million kg of CO_2 annually—approximately 0.2% of the nation's total emissions. Travel was the primary contributor, making up over 90% of emissions for Caherlistrane and over 95% for St James's. We also compiled suggestions for clubs to reduce their carbon footprints.

SciFest@DCU 2024

[STAND 34] Title of Project	**BEECAUSE**
Student	Manus Ó Baoighill
School	St Patrick's Cathedral Grammar School, St Patrick's Close, Dublin 8
Teacher Mentoring Project	Amy Clancy

Abstract

This project aimed to develop and test an Internet of Things (IoT) enabled beehive to help monitor the health of bee colonies remotely. Locating bees remotely can help protect bees from harmful environmental factors such as pesticides and pollution.

The project involved building two different types of beehives: a traditional National Hive and a modern Flow Hive. Each hive was equipped with sensors to monitor temperature, humidity, hive activity (via microphone) and visual data through a camera. Power was provided by solar panels and a car battery. Data was collected remotely through an integrated microcontroller connected to the internet via a mobile hotspot.

The project tested how effectives this could be by monitoring two hives placed in an isolated area. Initial indications were that remote monitoring using IoT technology could effectively assist beekeepers to manage hive health without disturbing the bees frequently.

My main finding from the project was that IoT-enabled hives are a viable solution for beekeepers, enabling them to monitor bees in remote and pesticide-prone areas. Future improvements will include more accurate humidity and temperature sensors, integrating CO2 sensors to predict hive health more effectively and gathering more data to enable statistical models to be developed. This technology can play a key role in enhancing bee health management in Ireland.

SciFest@ATU Donegal 2024

[STAND 35] Title of Project	**CÉ MHÉAD LEICTREACHAIS IS FÉIDIR LE ROTH UISCE SIMPLÍ A GHINIÚINT, AGUS AN LEOR É CHUN ROINNT SOILSE A LASADH?**
Students	Áine Ní Fhearraigh, Muireann Haicéid, Kerry Magner
School	Pobalscoil Ghaoth Dobhair, Na Doirí Beaga, Leitir Ceannain, Co. Dhún na nGall
Teacher Mentoring Project	Susan Lynch

Abstract

Mar gheall ar an méad báistí anseo i nDún na nGall shocraigh muid teacht ar dhóigh chun leictreachas saor in aisce a chruthú trí roth uisce a cheangal le bun fánphíobáin a chasfaidh le fórsa an uisce a bhailítear ar an díon ag titim síos an fánphíobán. Bhí go leor rothaí uisce éagsúla againn le roghnú astu ach sa deireadh shocraigh muid dul leis ar dearadh roth uisce uas-scairde mar go raibh sé ar an gceann ba éifeachtaí. Tá tonnadóir le poll beag dírithe ar an roth uisce ionas go mbailítear an t-uisce taobh istigh den fánphíobáin agus beidh níos mó fórsa ag cruthú chinn é a bhrú amach as an bpoll beag. Rinne muid chlóbhuail 3D as an soicéad seo ionas go mbeadh sé furasta é a chuir ag bun an fhánphíobáin féin. Tá mótar d/c ceangailte le acastóir an roth uisce agus athraíonn sé an fhuinneamh cinéiteach go fuinneamh leictreach. Rinneamar raon de thástálacha éagsúla m.sh. méid na báistí inár ngairdín a thomhas ar feadh 6 seachtaine agus ag choinneáil súil ar Met Éireann ar feadh bliana iomlán. Ní raibh ach cad againn aon mhéadar den fhánphíobán uisce a úsáid mar gheall ar chúiseanna sábháilteachta mar nach dthig linn dul suas ar dhíon ar tí mar bheadh sé ró dainséarach.

SciFest@TU Dublin Blanchardstown 2024

[STAND 36] Title of Project	**INVESTIGATING THE DIURNAL EFFECT IN CLEAN ENERGY PRODUCTION**
Students	Isobel Grimes-Merrigan, Niamh Kearns
School	Loreto Secondary School, St Michael's, Navan, Co. Meath
Teacher Mentoring Project	Rachel Glennon

Abstract

Our project aims to investigate a way to effectively produce energy from piezoelectric crystals. Piezoelectric materials produce a voltage when they are subjected to mechanical stress. The main application of this is pavement tiles with piezoelectric crystals inside them. When people walk on these tiles the crystals are compressed so they produce a voltage which is then collected. However, this requires the input of human energy. We believe by taking advantage of thermal expansion, mechanical stress can be created from unused energy to compress the crystals.

Our investigation is conducted by first growing potassium sodium tartrate tetrahydrate ($KNaC_4H_4O_6{\cdot}4H_2O$), also known as Rochelle crystals. They are subjected to thermal expansion by heating water placed inside a balloon with the crystal inside a container above it. As the water expands, the crystal is pushed up into a dowel just resting on top of it, placing mechanical stress onto the crystal and causing it to produce a voltage.

As of right now we have results showing that our theory works. 501 mV was produced during indoor testing, where we heated the project and 80 mV produced outdoors, where the sun heated the project. However, Ireland isn't the ideal climate to test our project, so we hope to be able to test our project in a warmer climate. We also had some problems with the balloon bursting and corroding our wires, so we are looking into what could be used instead for more efficient and green results.

[STAND 37] Title of Project	**WHAT MATERIAL IS THE BEST INSULATOR FOR HOUSING?**
Students	Cian Murphy, Musa Njie
School	Coláiste Chiaráin, Croom, Co. Limerick
Teacher Mentoring Project	Edel Farrell

Abstract

Given Ireland's sustainability goals for 2030 and the housing crisis plaguing Ireland, this project intended to investigate alternative materials to see if they could be viable as insulation for housing. Five materials commonly sent to landfills as waste were tested: paper, blankets, towels, cushions and moss. We investigated to see how efficient each material is as an insulator. This is measured as the U-value, with a lower value indicating a lower rate of heat transmittance. The hypothesis was that a blanket would be the most effective alternative insulation material due to it commonly being used to insulate ourselves.

We designed a hot box, which simulates a room, to calculate the U-value. With the insulator in the centre, the hot box was cooled to a stable temperature to represent the outdoor temperature. The cool chamber remained at this temperature. A heat source was placed into the hot chamber and left until the chamber reached a stable temperature. This gave us our temperature difference. We measured the wattage of the heat source(ø) and the area of the component (A). We used the formula: U-value = $ø/A(T_{outdoor} - T_{indoor})$ to calculate the U-value of each material.

Our research found our hypothesis was incorrect as the cushion displayed the lowest U-value. The cushion had a comparable U-value to current industry insulators. Our data suggests that 'waste' items, such as a cushion, are viable materials to use in housing. This would allow construction of more houses, reduce waste being sent to landfills and create more sustainable houses.

SciFest@MTU Cork 2024

[STAND 38] Title of Project	**THE EFFECTS OF IMPORTED PLANTS IN THE IRISH ENVIRONMENT (AND WORLDWIDE)**
Student	Mar Doblado Fernández
School	Coláiste Pobail Bheanntraí, Seskin, Bantry, Co. Cork
Teacher Mentoring Project	Sharon Kingston

Abstract

This project examines the ecological effects of importing non-native plants, with a special emphasis on the introduction of Whitethorn hedgerows to Ireland.

Because Whitethorn hedgerows are good for the environment, the Irish government encourages farmers to plant them. However, because of the high demand, non-native Whitethorn species that spread fire blight have been imported. Native flora is seriously threatened by *Erwinia amylovora*, which causes the devastating disease known as fire blight.

By drawing comparisons to the catastrophic consequences of the diseases that affect Whitethorn, the project highlights how urgently the risks related to the action of importing plants must be addressed. The disease has spread in Ireland in 2023, with 17 cases recorded, but County Dublin is the one with the most cases, despite laws like plant passports.

The study lists the signs and symptoms of fire blight and ash dieback, which are diseases that Whitethorn hedgerows can get, and emphasises how common it is in garden centres.

After presenting this project in SciFest in April 2024 at MTU Cork, the project started to focus on fire blight disease and its spread to the whole world, starting with its origins in California, USA until it can be found in a lot of countries around the world.

Finally, this project emphasises how crucial it is to strike a balance between ecological preservation and agricultural demands, and it offers some viable ways to both meet agricultural needs and slow the spread of the multiple diseases and risks that non-native hedgerows have.


Conclusion:
Recommendations:
ATU
17
Sup-herb antioxidants
ATU
18
CHILLING EFFECTS
Sup-Herb Antioxidants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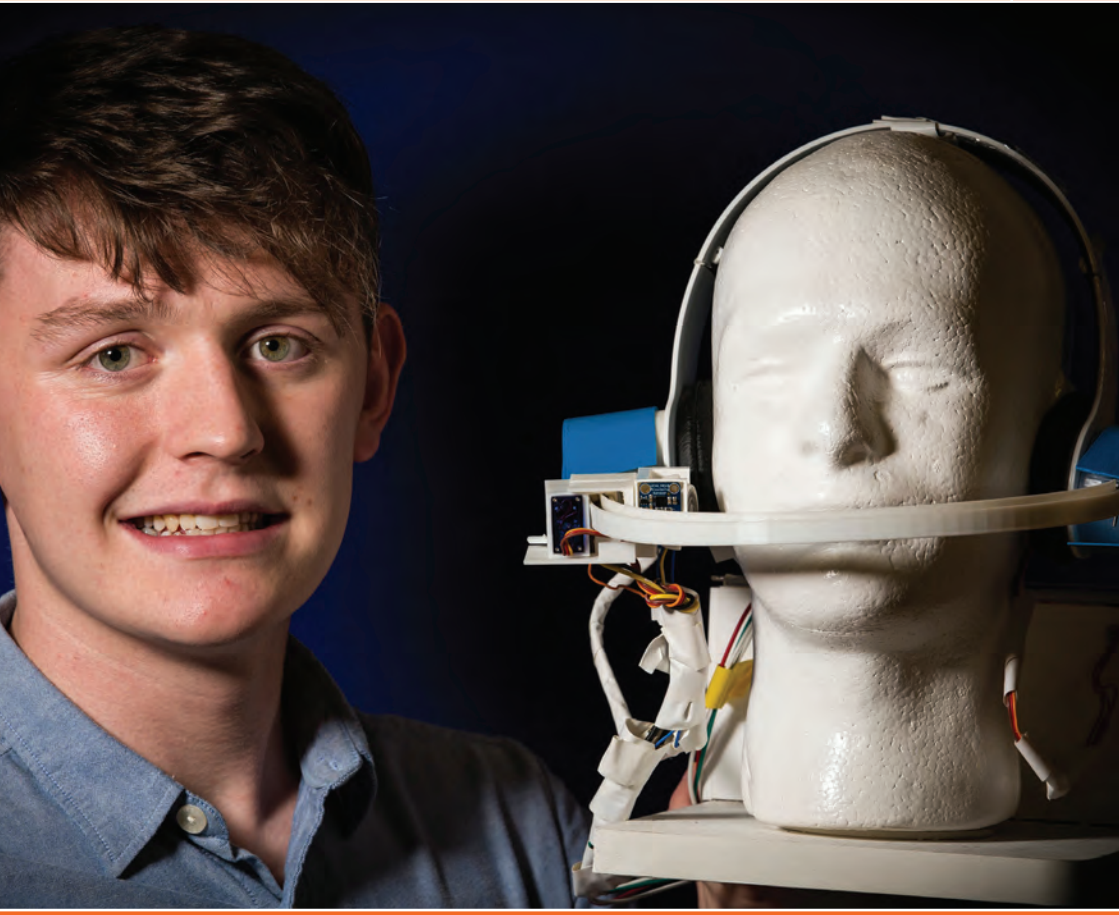

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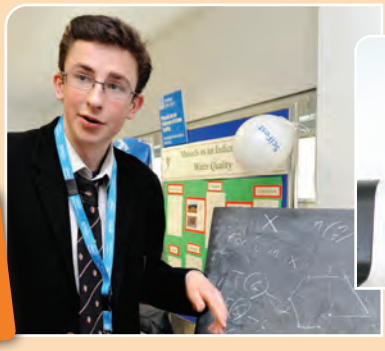

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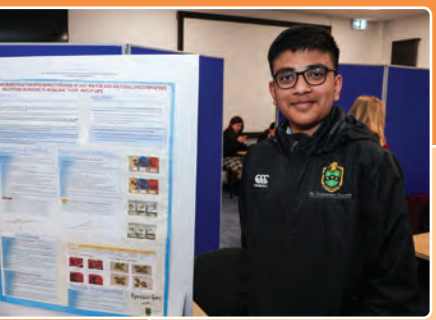


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Alan Dunne	School Liaison Officer
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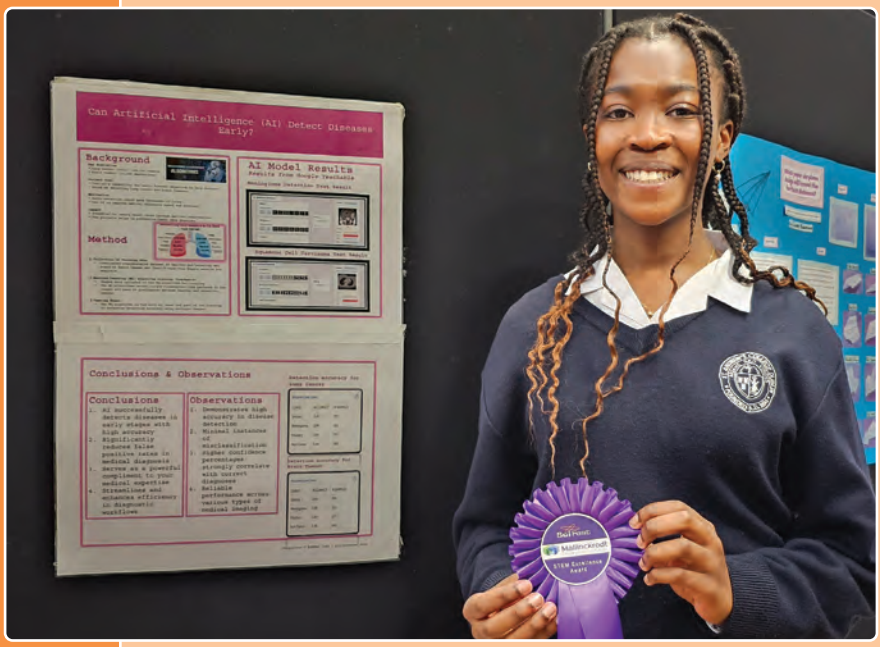
Can Artificial Intelligence (AI) Detect Diseases Early?
Background
Method
AI Model Results
Conclusions & Observations
Conclusions
Observations


HYPOTHESIS
EQUIPMENT
BACKGROUND RESEARCH
Results

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