

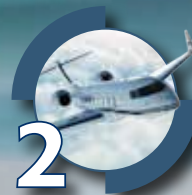
Directorate of Innovation Technology
Transfer and Commercialisation

Available Technologies @ Unisa

Unisa's 10 Catalytic Niche Areas:



1
Marine Studies



2
Aviation and
Aeronautical Studies



3
Automotive



4
Energy



5
Space Study and Square
Kilometer Array



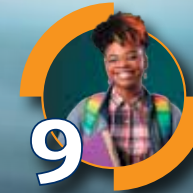
6
Fourth Industrial
Revolution and
Digitalisation



7
Natural Sciences
(Biotechnological
studies)



8
Health Studies/Medicine



9
Feminist, Womanist,
Bosadi Theorisations



10
Student Support and
Co-Curricular Activities

Define tomorrow.



Prof Puleng LenkaBula
Unisa Principal and Vice-Chancellor

Universities occupy a unique and influential space within society. They are not merely centres of knowledge creation but are engines of innovation, catalysts for economic development, and stewards of transformative ideas. As the University of South Africa (Unisa), the largest open distance and e-learning institution on the continent, we embrace this responsibility with clarity and purpose. Our mandate compels us not only to generate knowledge but also to translate it into innovations that address societal challenges and foster progress for humanity.

This publication, showcasing technologies available for commercialisation, exemplifies that mission. It consolidates innovations developed by our researchers, students, and partners. These technologies have the potential to reshape industries, strengthen public services, improve the quality of life, and open new economic opportunities.

These innovations reflect the depth and excellence of Unisa's scholarship. They also align with the university's Catalytic Niche Areas, which steer our research and innovation agenda. Whether advancing the Fourth Industrial Revolution, promoting a Just and Sustainable Transition, contributing to Health and Wellness, or reimagining Education for Sustainable Futures, the technologies showcased here embody Unisa's commitment to staying at the forefront of transformative research. More importantly, they demonstrate our dedication to narrowing the gap between research and real-world impact. Commercialisation is not merely an economic pursuit; it is a pathway for societal transformation. It transforms ideas into enterprises, problems into opportunities, and knowledge into prosperity. As we navigate an era characterised by rapid technological change, complex global challenges, and an urgent need for inclusive development, Unisa recognises its role as a cornerstone in South Africa's

innovation ecosystem. Innovation thrives when academia, industry, government, and communities collaborate—and this publication reflects that spirit of partnership. It presents technologies ready for investment, incubation, deployment, and scaling. It invites entrepreneurs, policymakers, funders, and industry leaders to join us in unlocking their potential.

To our innovators: congratulations. Your work enhances Unisa's reputation as a leader in open scholarship, innovation, and societal engagement. Your creativity and dedication are central to our mission.

To our partners: thank you for accompanying us on this journey. Commercialisation is a collective effort, and your support ensures that research outcomes find pathways into markets, communities, and industries where they can create meaningful change.

As Vice Chancellor and Principal, I am proud to present this volume and the extraordinary work it embodies. I believe that within these pages lie not only technological solutions but also the seeds for enterprises, industries, and impact-driven initiatives that can forge a better future for South Africa, Africa, and the world.

I invite readers, collaborators, and investors to explore, engage, and join Unisa in transforming these innovations into sustainable and scalable contributions to society.

Together, let us continue advancing knowledge in the service of humanity.

Prof Puleng LenkaBula
Principal and Vice Chancellor
University of South Africa (Unisa)



Prof Mpho Ngoepe

Acting Vice-Principal: Research,
Postgraduate Studies, Innovation
and Commercialisation

It is a privilege to present this DITTC Technology Book, an essential milestone in Unisa's journey towards becoming a leading driver of research commercialisation, entrepreneurship, and innovation-led development in South Africa. This publication brings together a selection of technologies that embody Unisa's commitment to transforming academic outputs into impactful, market-ready solutions.

Unisa's position as Africa's largest Open Distance and e-Learning institution affords us a unique opportunity and responsibility to cultivate knowledge that not only advances scholarship but translates into tangible societal and economic benefit. Through the Directorate of Innovation, Technology Transfer and Commercialisation (DITTC), we continue to strengthen institutional pathways for invention disclosure, intellectual property protection, industry partnerships, licensing, and the development of high-potential academic spinouts.

Many of the technologies showcased here are deeply aligned with Unisa's Catalytic Niche Areas, including the Fourth Industrial Revolution, Health and Wellness, Sustainability and the Just Transition, Economic Reconstruction and Development, and Education for Sustainable Futures. These innovations reflect the forward-looking spirit of our researchers, and their potential to contribute to national priorities—from service delivery improvements to digital transformation, scientific advancement, and enterprise development.

As we enhance our innovation ecosystem, DITTC remains committed to identifying and nurturing commercialisation pathways, creating environments where Unisa technologies can progress from prototype to enterprise, and ensuring that our research agenda supports inclusive economic participation. The growing interest in spinout formation where Unisa-originated intellectual property serves as the basis

for new companies is evidence of this progress. We have made great strides in supporting our students in establishing innovation-based startups. Supported by the DITTC UniVentures, these startups are making significant inroads in deploying innovative, value-added products and services, and creating ways to reduce unemployment.

To our researchers: your creativity, perseverance, and dedication drive Unisa's innovation engine.

To our industry partners, funders, and collaborators: we value your support and invite you to explore opportunities to license, co-develop, or invest in the technologies presented in this Book.

This publication is more than a catalogue; it is an invitation to build enduring partnerships, stimulate entrepreneurship, and accelerate innovation for societal benefit. I trust that it will open new horizons for collaboration and strengthen Unisa's position in South Africa's innovation ecosystem.

Prof Mpho Ngoepe

Acting Vice-Principal: Research, Postgraduate Studies,
Innovation and Commercialisation
University of South Africa (Unisa)



Prof Les Labuschagne
Executive Director: Research,
Innovation and Commercialisation

It is with great enthusiasm that we present this portfolio of technologies emerging from the University of South Africa's (Unisa) visionary Catalytic Niche Areas (CNAs).

This document showcases a curated selection of innovative technologies developed within our dynamic research ecosystem—now ready for commercialisation. Each featured technology reflects the culmination of rigorous scientific inquiry, real-world application, and our commitment to addressing critical industry and societal needs.

Our goal is to bridge the gap between research and the marketplace by providing partners, investors, and entrepreneurs with access to solutions that are poised to deliver meaningful impact. The technologies presented span diverse sectors and offer opportunities for collaboration, licensing, and development into commercially viable products and services.

Each innovation has been assessed for:

- Scalability within high-growth sectors such as aviation, automotive, renewable energy, and biotechnology
- Societal impact, including job creation and contributions to sustainable development in South Africa and across the continent
- Collaborative readiness, supported by Unisa's inter-, trans-, and multidisciplinary CNA frameworks and robust stakeholder partnerships

For discerning investors, this collection offers a gateway to:

1. Licensing and joint-development opportunities facilitated by Unisa's Directorate of Innovation, Technology Transfer, and Commercialisation
2. Early-stage commercial prospects aligned with national and continental priorities—including aviation networks, renewable energy expansion, coastal and marine industries, SKA astronomy, and digital transformation initiatives
3. High-impact ROI potential, underpinned by Unisa's international science diplomacy, award-winning research outputs, and global visibility—evidenced by successes such as the Sasol Solar Challenge

Investment Benefits

Partnering with Unisa offers significant advantages:

- Access to cutting-edge innovation: Early entry to breakthrough technologies with strong intellectual property foundations
- Reduced R&D risk: Validated research outputs that shorten development cycles and lower uncertainty
- Market differentiation: Exclusive or preferential access to technologies capable of transforming competitive positioning
- Scalable opportunities: Solutions designed for adaptability across multiple industries and markets
- Partnership Models
- Unisa offers flexible collaboration frameworks to suit diverse business needs:
- Licensing agreements granting commercialisation rights under mutually beneficial terms
- Joint ventures to co-develop products and share in market success
- Research collaborations that enhance or customise technologies for specific applications
- Equity investment in spin-off ventures or technology-driven startups originating from our research programmes

Our conviction is clear: these technologies are not merely scholarly achievements—they are platforms with the potential to disrupt industries, accelerate economic development, and generate sustainable returns. We invite you to explore this portfolio, engage with our commercialisation team, and join Unisa in transforming academic excellence into real-world impact.

Prof Les Labuschagne

Executive Director: Research, Innovation
and Commercialisation
University of South Africa (Unisa)



Mr Ayanda Noma

Director: Innovation, Technology Transfer and Commercialisation

As we conclude this edition of the Unisa Technologies Book, showcasing technologies available for commercialisation, I would like to extend my heartfelt appreciation to the researchers, innovators, students, and partners whose dedication and vision made this publication possible. The technologies presented here reflect many years of rigorous inquiry, experimentation, refinement, and collaboration. They also demonstrate the strength and potential of Unisa's innovation ecosystem.

The Directorate of Innovation, Technology Transfer and Commercialisation (DITTC) exists to ensure that the knowledge generated within our university is translated into meaningful impact. Through intellectual property protection, technology development support, commercialisation guidance, industry partnerships, and the facilitation of academic spinouts, our directorate is committed to building pathways that translate research into real-world solutions.

The innovations featured in these pages remind us that our institution is rich with ideas that can transform sectors, improve lives, and contribute to national and global priorities. Whether aligned with Unisa's Catalytic Niche Areas, ranging from the Fourth Industrial Revolution and sustainability, to health, economic development, and future-focused education, each technology here represents a step toward a more innovative, inclusive, and prosperous society.

To our external partners, we invite you to engage with us as we advance these technologies. Your partnership is essential in helping these innovations reach communities, markets, and industries where they can deliver tangible value.

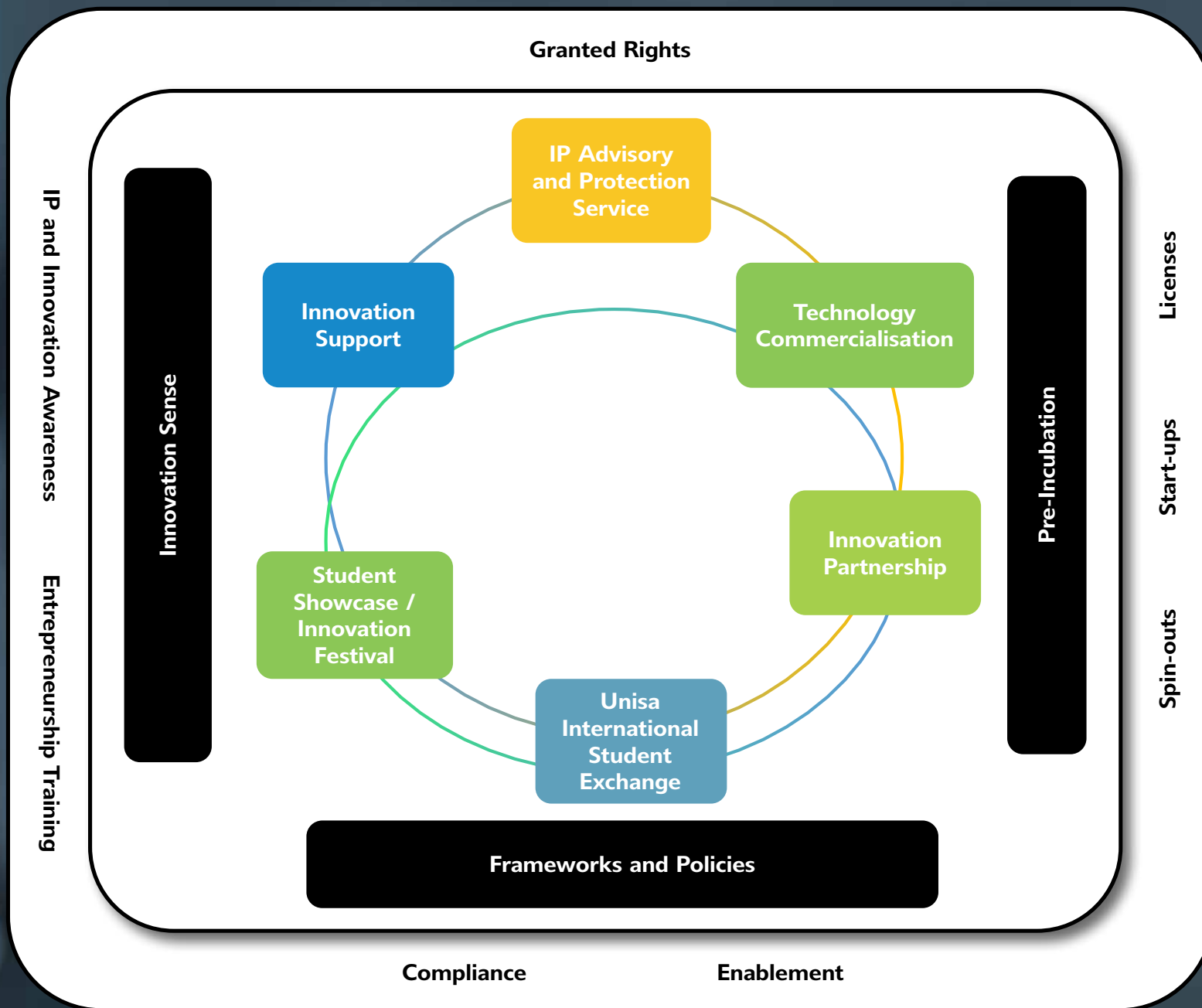
To our Unisa innovators, thank you for your courage, creativity, and commitment. Your work continues to affirm Unisa's position as a university dedicated to advancing knowledge in the service of humanity.

This book will serve not only as a record of our achievements but also as an inspiration for deeper engagement, new opportunities, and future breakthroughs.

We look forward to building, innovating, and transforming together.

Mr Ayanda Noma

Director: Innovation, Technology Transfer and Commercialisation
University of South Africa (Unisa)



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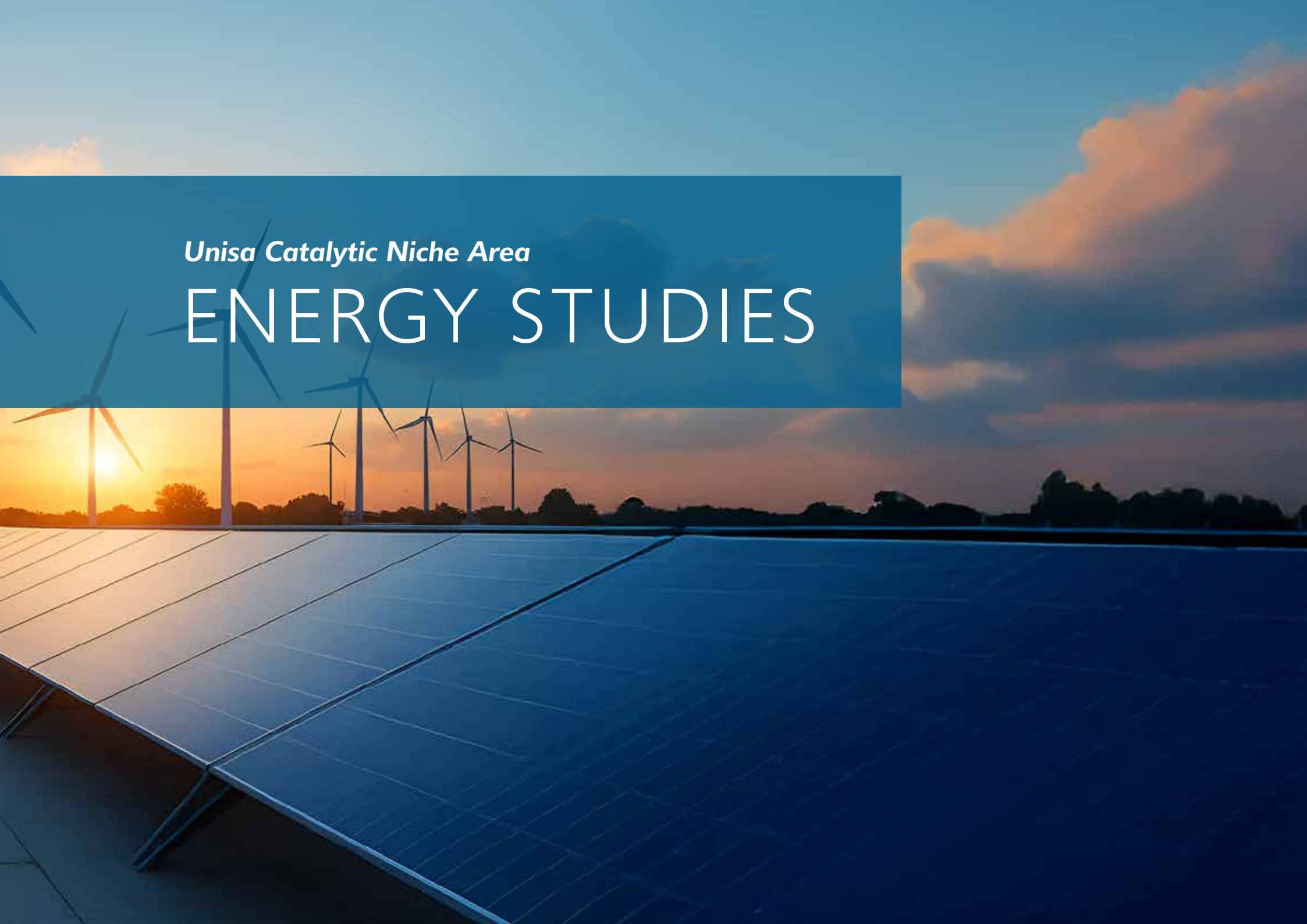
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Unisa Catalytic Niche Area

ENERGY STUDIES

OptiSwitch™ System

Green Energy Network

“Smart Power, Always On.”

Technology

This invention presents a plug-and-play energy management system designed for South African households, integrating Internet of Things (IoT) controls, opto-isolation, and delayed switching technology. It enables automated, safe, and intelligent switching between grid power and local renewable energy sources using optical coupling to prevent damage and power surges. It also allows for external control of load distribution to optimise household energy use and manage loads across municipal regions. The technology is also adaptable for water management networks and larger grid islanding applications.

Market need

South Africa faces prolonged scheduled electricity blackouts (load shedding), disrupting homes, businesses, and essential services. Most households cannot afford expensive imported solar or energy management systems that need specialised installation and maintenance. There is an urgent need for an affordable, easy-to-use, and locally producible solution that lowers reliance on the national grid, emphasises green energy use, prevents system damage from unsynchronised power sources, and helps municipalities manage distributed loads more effectively.



Features

- Smart Energy Switching: Automatically transitions between grid and renewable power sources without interruption.
- IoT-Enabled Controls: Real-time monitoring and remote management via connected devices for convenience and precision.
- Opto-Isolated Safety: Optical isolation ensures complete separation between power networks, preventing damage and electrical hazards.
- Renewable Integration: Seamlessly connects with solar panels, wind systems, or hybrid microgrids.
- Scalable Architecture: Suitable for single households, apartment complexes, and municipal applications.
- Can also be configured for water management systems and broader smart city infrastructure.



Benefits

- Reduces load on the national grid by prioritising the use of renewable energy over grid electricity.
- Useful from individual homes to large-scale utility grid management.
- Eliminates risks of power back-feeding and equipment damage.



Industry

Energy

Potential Applications

- Residential Energy Management: Optimises energy use for households adopting renewable technologies.
- Community and Rural Electrification: Provides off-grid communities with safe, reliable, and intelligent power switching.
- Municipal Load Management: Enables cities to balance distributed energy loads and prevent grid overload.
- Commercial and Industrial Use: Supports energy efficiency and redundancy for business operations.
- Water and Utility Networks: Adaptable for managing pumps, pressure systems, and distributed resource networks.

Creator

Prof Lukas Snyman

Stage of development

Lab-scale Prototype

Intellectual property

Patent Protection

Desired relationship

Co-development, Investors

ThermoVolt™

Thermal Energy Conversion using Peltier Cells

“Heat In. Power Out”

Technology

ThermoVolt™ is an innovative renewable energy system that harnesses thermal energy and converts it into electricity using Peltier cells based on the Peltier effect — a thermoelectric phenomenon where a temperature difference across two dissimilar materials generates an electric voltage. This system captures ambient or waste heat from industrial, commercial, or household environments and transforms it into usable electrical power. It integrates advanced electronic control and processing components to maximise conversion efficiency and ensure stable performance under varying thermal conditions.

Designed for sustainability and scalability, ThermoVolt™ provides a clean, fossil-free energy source suitable for powering devices, sensors, or microgrids — particularly in energy-limited or off-grid communities.

Market need

The rising costs of electricity, resource shortages, and the negative environmental impacts of fossil fuels are creating an urgent need for innovative, clean energy solutions. In countries like South Africa, where electricity prices have gone up by about 5% each year and the grid rely heavily on coal, there is an urgent need for affordable off-grid or hybrid renewable systems. Traditional thermoelectric applications mainly focus on cooling, but their ability to generate electricity from low-grade heat is still underused. This technology meets key market needs such as off-grid power solutions, recycling waste heat in industries, household energy independence, and eco-friendly alternatives to diesel generators and coal.



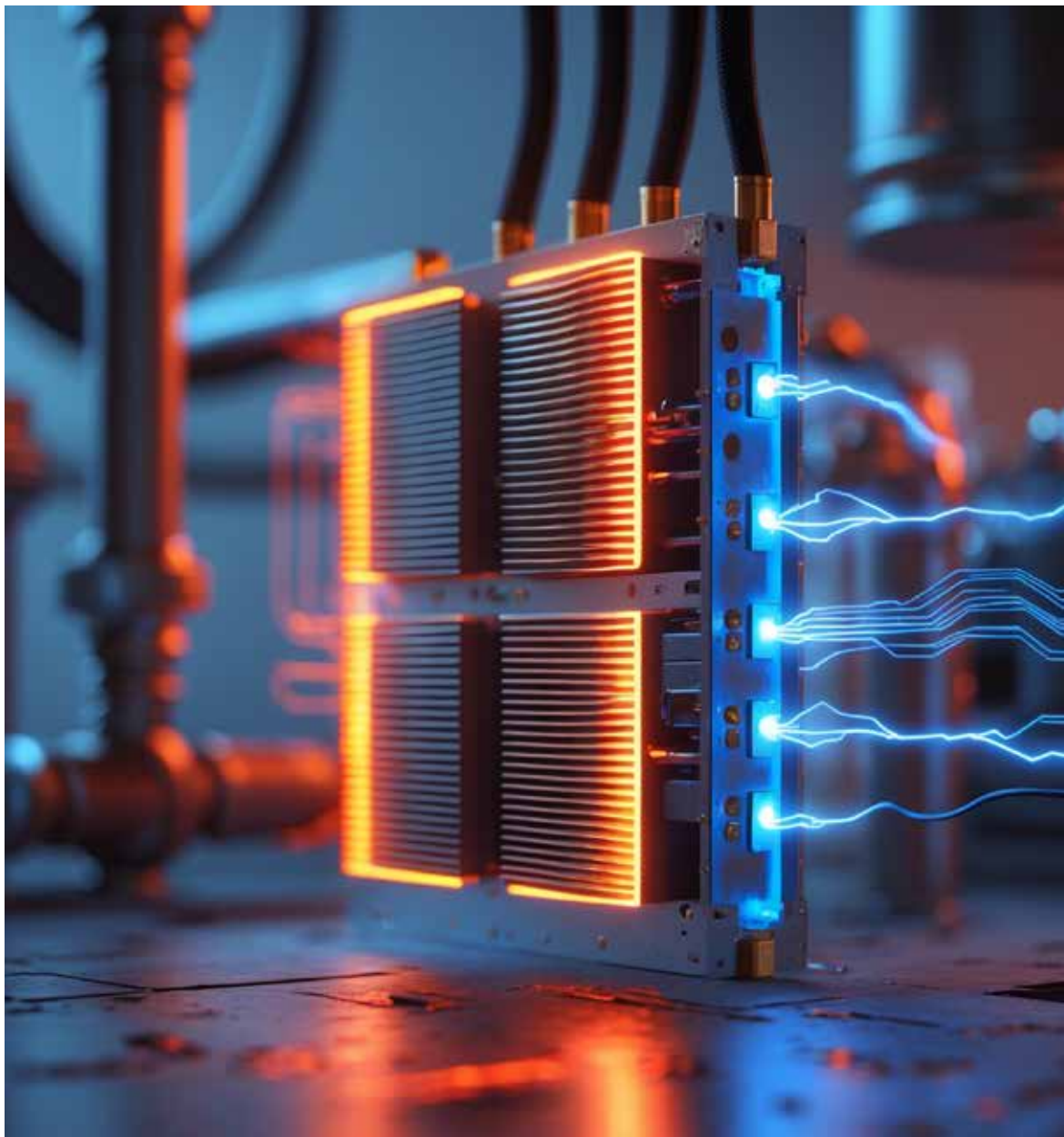
Features

- Converts ambient and waste heat directly into electricity
- Compact, modular design for scalable integration
- Zero emissions, silent operation, and low maintenance
- Enhances energy efficiency and sustainability in existing systems
- Ideal for off-grid and decentralised power applications



Benefits

- Supports climate change mitigation as there are no emissions or combustion.
- Reduces energy bills and minimises reliance on grid or fuel-based sources.
- Empowers rural, remote, or under-electrified communities.
- Integrates locally available and non-toxic materials.



Industry

Energy

Potential applications

- Waste heat recovery in industrial processes
- Energy harvesting for off-grid or low-power electronics
- Renewable power generation for remote and rural environments
- Integration into HVAC, automotive, and manufacturing systems

Creator

Prof Snyman

Stage of development

Early stage

Intellectual property

Patent Protection

Desired relationship

Co-development, Investors

MagneGen™

A method and system for low-cost energy generation using repurposed magnetron magnets and magnetic relaxation effect.

“From Waste Heat to Clean Energy.”

Technology

MagneGen™ is a breakthrough low-cost energy generation system that converts thermal energy into electrical energy using the magnetic relaxation effect in repurposed magnetron magnets—commonly sourced from discarded microwave ovens and other household appliances.

The system harnesses the unique behaviour of ferrite magnetic domains, which revert to a lower-energy state when disturbed by thermal input or electromagnetic noise, producing an electrical output. This energy is captured and converted into usable electricity through strategically positioned induction coils and a thermal energy source (ambient or waste heat).

By combining upcycled components, innovative physics, and sustainable engineering, MagneGen™ offers a scalable, affordable, and eco-friendly alternative for small-scale and off-grid power generation, bridging the gap between waste reuse and renewable energy innovation.

Market need

With electricity costs rising worldwide and increasing demand for sustainable off-grid energy solutions, there is an urgent need for affordable renewable technologies. Many rural and underserved communities lack reliable access to grid electricity, while industries strive to reduce dependence on fossil fuels and enhance energy efficiency. Traditional renewable technologies, such as solar PV and wind turbines, often require substantial capital investment and ongoing maintenance. This invention offers a low-cost, scalable alternative that can operate continuously by utilising waste or ambient heat sources. Reusing e-waste (magnetron magnets) also promotes circular economy principles and supports green technology goals.



Features

- Uses the realignment of disturbed magnetic domains in ferrite magnets to generate electricity.
- Reduces e-waste and material costs by reusing components from discarded appliances.
- Enables electricity to power devices like LED lamps or charge storage units.
- Operates using ambient or waste heat



Benefits

- Converts thermal and electromagnetic energy into electricity
- Utilises repurposed magnetron magnets—reducing e-waste
- Low-cost, scalable, and environmentally sustainable design
- Operates without fossil fuels or moving parts
- Ideal for off-grid and low-resource energy applications



Industry

Energy

Potential Applications

- Off-grid and rural power generation systems
- Waste heat recovery from industrial or domestic sources
- Educational and research platforms for energy innovation
- Sustainable design and circular economy initiatives

Creator

Prof Snyman

Stage of development

Early stage

Intellectual property

Patent Protection

Desired relationship

Co-development, Investors

SunCycle™

Closed-circuit solar thermal energy recirculation and conversion system with Peltier cell electricity generation

“Solar Heat. Endless Power.”

Technology

This invention presents a closed-circuit solar thermal energy recirculation and conversion system designed to optimise solar heat absorption and transform it into usable electrical energy using Peltier cells. Unlike traditional solar thermal or photovoltaic systems, this hybrid solution merges solar thermal collection, thermoelectric energy conversion, and energy storage into a single, integrated, and efficient platform. Using a vertically oriented array of black-painted PVC pipes and thermally conductive materials, the system captures solar radiation, circulates heat via pumps to a thermal reservoir, and converts that heat into direct current (DC) electricity through a bank of Peltier cells. An onboard energy management system stores the electricity in a 12V battery or directs it for immediate use in household or off-grid applications.

Market need

The rising cost of electricity, the environmental impact of fossil fuels, and increasing energy insecurity, especially in developing and off-grid regions, have significantly boosted the demand for low-cost, renewable, and reliable energy solutions. However, existing systems face various limitations, including low efficiency in converting solar thermal energy into electricity, intermittent energy availability due to dependence on weather and daylight, and poor integration between thermal systems and electricity generation or storage. This invention addresses these challenges by recirculating thermal energy for continuous operation and using Peltier cells to efficiently convert wasted thermal gradients into usable electrical energy.



Features

- Rechargeable battery integration for surplus DC electricity storage.
- Lightweight and modular design using low-cost, corrosion-resistant materials.
- Thermal reservoir for heat storage with integrated Peltier cells for thermoelectric conversion.
- Dual circulation pumps for heat transfer and recirculation.



Benefits

- Continuous electricity generation beyond daylight hours via thermal recirculation.
- Suitable for rural or remote installations.
- Lower operational cost with minimal maintenance needs.
- Reduced reliance on fossil fuels, supporting carbon reduction targets.



Industry

Energy

Potential applications

- Off-grid power generation: provides electricity for remote or rural areas without access to the main grid.
- Residential renewable energy systems: supplements household power with a compact, hybrid solar–thermal–electric setup.
- Industrial heat recovery: converts excess or waste heat from industrial processes into usable electricity.
- Sustainable building integration: supports eco-friendly building designs with renewable power and thermal management.
- Emergency and mobile power units: offer reliable electricity for disaster relief, field operations, or mobile labs.
- Agricultural and rural infrastructure: powers irrigation systems, sensors, and small-scale machinery using stored solar energy.

Creator

Prof Lukas Snyman

Stage of development

Prototype

Intellectual property

Patent Protection

Desired relationship

Co-development, Investors

VoltEdge™

High-Performance Lithium-Ion batteries

“Power That Lasts.”

Technology

The invention involves a sol-gel-based uniform carbon-coating process designed to create high-performance lithium-ion batteries. This process uses carbon nanotubes and an improved carbon-coating method that incorporates organic phosphoric acid as both a carbon and phosphorus source. This allows for the production of uniformly carbon-coated lithium-ion batteries with greatly enhanced ion diffusion and electrical conductivity. By overcoming the limitations of lithium iron phosphate (LiFePO₄) cathode materials, this technology addresses issues such as low capacity, low energy density, and poor cycle life that often lead to premature battery failure. The result is a new generation of lithium-ion batteries with longer lifespans, higher energy density, and better safety features, making them suitable for demanding applications such as electric vehicles (EVs), portable electronics, and grid energy storage.

Market need

The global shift toward electrification and renewable energy has intensified the demand for high-capacity, long-life, and safe lithium-ion batteries. Electric vehicles require power sources that deliver higher energy density, longer driving ranges, and extended lifespans without compromising safety, while consumer electronics continue to demand compact, fast charging, and reliable batteries amid concerns about overheating and fire risks. Similarly, grid energy storage systems depend on durable, long-cycle batteries to efficiently store renewable energy at scale. Although lithium iron phosphate (LiFePO₄) batteries are valued for their cost-effectiveness, environmental friendliness, and thermal stability, their limited ion diffusion and low electrical conductivity have hindered broader adoption. The proposed technology overcomes these challenges, enabling LiFePO₄ batteries to achieve the high performance and safety standards required for electric vehicles and large-scale energy storage applications.



Features

- Uniform carbon coating via sol-gel process
- Use of organic phosphoric acid, simplifying processing and improving efficiency.
- Integration of carbon nanotubes
- High-performance cathode material (LiFePO₄)
- Reduces reliance on external electronics for overcharge/short-circuit protection.



Benefits

- Extends run-time for devices and driving range for EVs.
- Greater rechargeability and durability, reducing replacement costs.
- Mitigates risks of overheating, fires, and explosions common in traditional lithium-ion batteries.
- Utilises LiFePO₄, which is non-toxic and environmentally sustainable.
- Reduces processing complexity while enabling large-scale, stable battery production.
- Suitable for EVs, consumer electronics, and large-scale energy storage.



Industry

Energy

Potential applications

- High-energy, long-life batteries for cars, buses, and two-wheelers.
- Smartphones, laptops, tablets, and wearable devices require high-performance, safe batteries.
- Large-scale renewable energy storage for solar, wind, and hybrid power systems.
- Reliable energy sources for factories, data centres, and critical infrastructure.
- Support for remote energy solutions, microgrids, and off-grid electrification projects.
- Lightweight, durable, high-capacity power systems for drones, satellites, and military devices.

Creators

X Liu

Z-Y Yuan

N Chen

Stage of development

Prototype

Intellectual property

Patent Protection

Desired relationship

Co-development, Investors

WindNest™

Self-aligning wind turbine

“Wind Power for Every Home.”

Technology

The invention is a self-aligning rooftop wind turbine designed to generate electricity efficiently for households. Unlike traditional large-scale wind turbines that require expansive open spaces and costly transmission infrastructure, this small turbine can be installed on rooftops. It features a compact, square-shaped blade system with a small radius that maximises torque and energy output, even in local wind conditions. The system also includes a smart microcontroller-based charging unit that automatically detects battery type and status, optimises charging cycles, and ensures quick, safe, and efficient storage of the generated power. Electricity is then fed directly into the household system through a controlled distribution box.

Market need

Energy demand in urban and semi-urban areas continues to grow, while grid electricity remains expensive, unreliable, or scarce in many regions. Traditional large-scale wind farms, though effective, require substantial infrastructure, remote locations, and high capital investment, making them inaccessible for individual households. The increasing demand for decentralised renewable energy solutions is driving the need for compact, affordable, and easy-to-use systems that can be deployed at the household or community level. A rooftop wind turbine that can self-align, efficiently capture wind, and directly supply electricity to homes addresses this need, providing an alternative or supplement to solar power.



Features

- A small-radius blade system arranged in a square format to capture more wind energy and maximise torque compared to thin, large-diameter conventional blades.
- Automatically adjusts to the wind direction for consistent energy capture without manual intervention.
- Microcontroller-based unit that identifies battery type and condition, ensuring optimal charging and storage efficiency.
- Energy is delivered directly into household systems through a controlled distribution box.
- Smaller footprint and fewer components, making it cost-effective and practical for residential use.



Benefits

- Eliminates reliance on large wind farms and long-distance transmission lines, reducing infrastructure costs.
- Provides homes with a reliable and renewable source of electricity, reducing dependency on grid power.
- Compact design and reduced component requirements lower manufacturing and installation costs.
- Optimised charging shortens battery storage time, improving system responsiveness.
- Supports clean, renewable energy generation at the point of consumption, lowering carbon footprint.
- Can be adopted by individual households, communities, or small businesses for distributed power generation.
- Utilises LiFePO₄, which is non-toxic and environmentally sustainable.
- Reduces processing complexity while enabling large-scale, stable battery production.
- Suitable for EVs, consumer electronics, and large-scale energy storage.



Industry

Energy

Potential applications

- Provides households with clean, renewable electricity and reduces dependency on the grid.
- Compact wind turbines suitable for limited-space installations.
- Supply electricity in areas with unreliable or no grid access.
- Complement solar panels for a consistent household power supply.
- A scalable solution for energy generation in local neighbourhoods or eco-villages.
- Automatic charging and energy distribution for household batteries and appliances.

Creator

Prof Lukas Snyman

Stage of development

Prototype

Intellectual property

Patent Protection

Desired relationship

Co-development, Investors

SmartTariff™

Electronic controller for household energy control based on timing and tariff

“Use Power Wisely.”

Technology

The invention relates to a smart electronic controller designed to optimise household energy efficiency. It employs a microprocessor and sensor-based control system that permits selective management of electricity consumption across different household load lines. The system allows both manual and automated switching of individual appliances or circuits based on time schedules or electricity tariff data. By intelligently distributing energy demand throughout the day, the controller reduces peak load on the national grid and lowers electricity costs for users. On a broader scale, it helps balance energy demand, enhancing grid stability and sustainability.

Market need

The global rise in electricity costs, frequent grid overloads, and the shift toward smart energy management have created a strong demand for household-level energy optimisation solutions. Many homes waste energy through uncontrolled appliance use, especially during high-tariff peak periods. Utilities struggle to balance supply and demand, resulting in higher operational costs and increased outages. A smart controller that can automatically manage when and how household electricity is used based on real-time tariff data and consumption patterns directly addresses this gap. It helps consumers lower their bills while enabling energy suppliers to stabilise the grid and reduce peak demand pressure.



Features

- Smart Microprocessor Control
- Sensor-Based Load Monitoring
- Time and Tariff Scheduling.
- Manual and Automatic Mode customisation
- User Interface/Display
- Easily integrated into existing household wiring or new installations.



Benefits

- Automatically shifts appliance use to low-tariff periods, cutting electricity bills.
- Reduces simultaneous peak-time consumption, easing load on the national grid.
- Optimises when and how electricity is used, minimising waste.
- Gives homeowners real-time control and visibility over their energy use.
- Promotes sustainable energy consumption by reducing unnecessary power demand.



Industry

Energy

Potential applications

- Smart home energy management to automate appliance control based on tariff schedules and time-of-use pricing.
- Load shifting and demand response for households to reduce electricity bills and ease pressure on the national grid.
- Integration with renewable energy systems for optimized energy use and self-consumption.
- Utility and smart grid programs enabling real-time demand-side management and dynamic pricing models.
- Commercial or community energy systems for shared load optimization and improved power distribution efficiency.

Creators

Lukas Snyman

R Kene

Stage of development

Prototype

Intellectual property

Patent Protection

Desired relationship

Co-development, Investors

ThermoCore™

Tubular reactor internals

“Cooler Reactors. Smarter Chemistry.”

Technology

This invention relates to tubular fixed bed reactors (TFBRs), specifically to a reactor internal component designed to improve heat transfer performance during exothermic catalytic processes such as Fischer–Tropsch Synthesis (FTS). The technology includes (i) a reactor internal component for a fixed bed reactor, (ii) a reactor tube incorporating the internal component, and (iii) a method of installing the internal component within the reactor tube.

Traditional TFBRs, while simple and scalable, suffer from poor heat removal, high pressure drops, and uneven temperature distribution during highly exothermic reactions. These challenges can lead to the formation of hot spots, catalyst deactivation, reduced selectivity, and even thermal runaway. The proposed invention overcomes these drawbacks by incorporating a novel internal structure that enhances heat transfer within the reactor tube without significantly reducing catalyst loading or increasing pressure drop.

Market need

There is a strong industrial demand for energy-efficient and thermally stable reactor designs for use in chemical, petrochemical, and fuel synthesis industries. Conventional tubular fixed-bed reactors remain popular due to their simplicity, but they are limited by poor heat management in exothermic reactions such as FTS, methanation, hydrogenation, and oxidation. Industrial operators are seeking cost-effective solutions to improve process safety, extend catalyst life, and increase throughput without sacrificing reactor productivity. This invention directly addresses these challenges by providing a scalable retrofit solution that improves heat dissipation and operational stability in existing and new TFBR units.



Features

- High Thermal Conductivity Materials
- Suitable for use in single or multi-tube configurations.
- Simple Installation Method
- Customisable dimensions for different reactor sizes and process conditions.



Benefits

- Improves thermal conductivity and minimises temperature gradients in the catalyst bed.
- Prevents localised overheating.
- Reduces thermal stress and deactivation rates.
- Can be easily integrated into existing TFBR systems without major modification.
- Supports isothermal operation and minimises the risk of thermal runaway.
- Applicable from laboratory to full-scale reactors across chemical and energy sectors.



Industry

Energy

Potential applications

- Fischer–Tropsch synthesis and other exothermic catalytic processes requiring enhanced heat management.
- Petrochemical and chemical manufacturing for improved reactor stability and catalyst longevity.
- Hydrogenation, methanation, and oxidation reactions where heat buildup can affect selectivity and safety.
- Retrofitting of existing tubular fixed-bed reactors (TFBRs) to improve heat transfer efficiency and throughput.
- Design integration in new reactor systems for cleaner, safer, and more energy-efficient industrial operations.

Creators

Shen Jianqi

Xinjing Liu

Diane Hildebrandt

Stage of development

Technology is ready for adoption/ no prototype

Intellectual property

Patent Protection

Desired relationship

Co-development, Investors`

ThermoRay™

A solar-powered system

“Harvest Heat. Power Life.”

Technology

This invention relates to a small-scale, ecologically friendly energy conversion system that generates electricity from ambient thermal energy. The system captures and stores heat from various natural and man-made sources, including sunlight, vehicle exhausts, power plants, industrial processes, and other waste heat streams, and converts it into usable electrical energy. Designed for household or small community use, the system provides a reliable electricity supply even in areas with limited or unstable grid access. It operates through a continuous conversion cycle, ensuring a steady generation of power from available thermal sources. By utilising readily available heat energy that would otherwise be wasted, the system contributes to energy efficiency, sustainability, and environmental conservation.

Market need

A significant portion of global energy is lost as waste heat from vehicles, factories, and power plants. At the same time, millions of households lack reliable or affordable access to electricity. This invention addresses both challenges by providing a sustainable, small-scale energy recovery solution that converts ambient thermal energy into electrical power. The system supports energy independence, reduced grid reliance, and climate-friendly electrification, making it highly relevant for rural communities, remote households, and low-income urban areas.



Features

- Thermal Capture Unit, which collects heat from various ambient and waste sources.
- Energy Storage Module that retains captured heat for continuous conversion.
- Electric Conversion System that converts stored heat into electricity efficiently.
- Easy to install and adapt for different household environments.
- Requires minimal maintenance and uses no fossil fuels.



Benefits

- Uses renewable and waste heat sources, reducing carbon emissions.
- Operates on a sustained cycle for consistent electricity output.
- Low installation and maintenance costs make it accessible to low-income households.
- Can harvest heat from sunlight, engines, and industrial systems.
- Provides clean energy to off-grid and underserved communities.



Industry

Energy

Potential applications

- Household and community electrification in off-grid or energy-scarce regions.
- Supplementary power generation for homes, small businesses, and rural facilities.
- Waste heat recovery from vehicles, factories, and power plants for renewable electricity production.
- Backup or hybrid energy systems integrating with solar, wind, or battery storage units.
- Sustainable energy solutions for eco-friendly housing, smart villages, and low-carbon infrastructure projects.

Creator

Prof Lukas Snyman

Stage of development

Prototype

Intellectual property

Patent Protection

Desired relationship

Co-development, Investors

NanoThermX™

Advanced Stable Nanofluid Synthesis Process

“Enhancing Thermal Performance Through Nanotechnology Innovation.”

Technology

NanoThermX™ introduces a novel method for producing high-performance nanofluids through an irradiation-assisted synthesis process that combines a base fluid with a selected precursor. This innovative approach improves the stability, dispersion, and uniformity of nanoparticles within the fluid, effectively addressing a long-standing challenge in nanofluid technology—agglomeration and sedimentation.

The resulting nanofluids demonstrate superior thermal conductivity, viscosity, dielectric strength, and heat transfer coefficients compared to conventional formulations. By preventing nanoparticle clustering and enhancing interfacial bonding, NanoThermX™ ensures consistent, reliable performance over extended operational lifespans.

This technology offers significant advantages for cooling, lubrication, and energy systems, supporting advancements in renewable energy, automotive, and electronic applications that demand efficient heat management and stability.

Market need

Nanofluids have high potential to become an alternative working fluid for thermal power generation in fossil fuels, nuclear power, biomass, or concentrating solar power, due to higher thermal performances compared to water combustion gases. Due to their improved thermophysical properties, nanofluids have excessive potential for improving heat transfer efficiency. Among the applications of this technology, its use to enhance the heat transfer of solar collectors seems promising. It is therefore not a surprise that the use of nanofluids in solar collectors has become a popular research area. This technology could enable smaller, cost-effective, and much more efficient concentrated solar plants in the future.



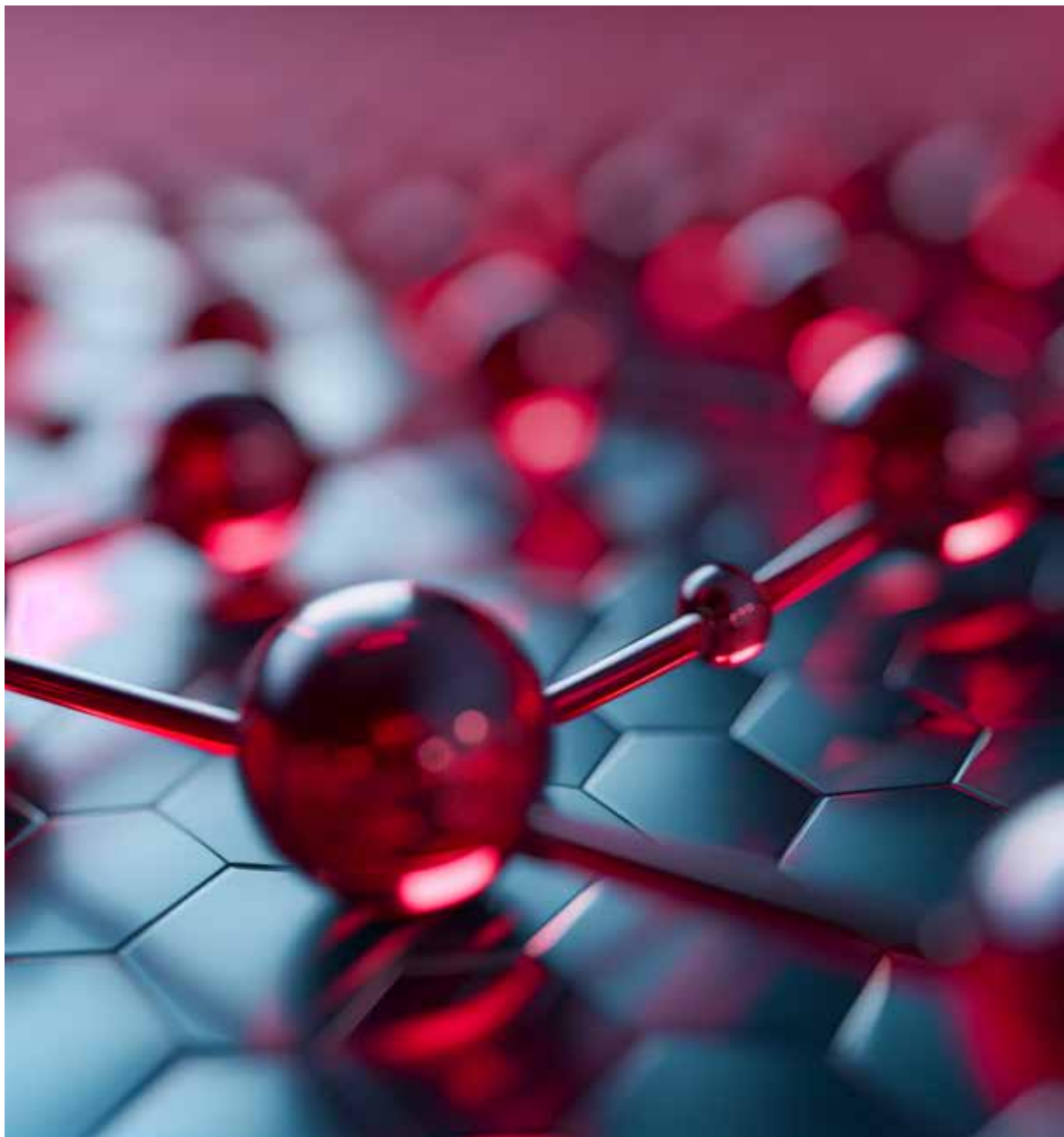
Features

- Continuous and scalable production of nanofluids suitable for industrial applications.
- High stability and uniform dispersion of nanoparticles within carrier liquids such as water, engine oil, transmission oil, or ethylene glycol.
- Enhanced thermal conductivity of up to 200% improvement over conventional heat transfer fluids.
- Clean and eco-friendly manufacturing method, eliminating chemical waste and reducing processing costs.
- Versatile material compatibility, allowing the use of metals, oxides, carbides, and nitrides as nanoparticle sources.
- Improved energy efficiency and heat transfer performance for advanced cooling and thermal management systems.



Benefits

- Irradiation-based synthesis yields uniformly dispersed nanoparticles
- Enhanced thermal and dielectric properties over conventional nanofluids
- Improved long-term stability against agglomeration and sedimentation
- Scalable and adaptable to multiple base fluids and nanoparticle types
- Energy-efficient production process with minimal chemical additives



Industry

Energy

Possible Applications

- Heat transfer and cooling systems for industrial and electronic devices
- Renewable energy systems (solar thermal, geothermal)
- High-performance lubricants and transformer oils
- Power generation and energy storage applications

Creators

Maalik Maaza
Khamlich Touria

Stage of Development

Lab-scale prototype developed

Intellectual Property

Patent Protection

Desired Relationship

Co-development investor

SolarVoltis™

Roof solar/Solar Thermal Energy Collector

“Harvest heat, make power.”

Technology

The technology relates to a system that harvests thermal energy from various sources (e.g., sunlight, cars, power plants, factories, and other industries) and converts it to electricity. In this system, heat energy is harvested and then stored in a storage tank, using water as an energy storage medium. Hereafter, it flows along a gradient to an energy radiator and converts a portion of the thermal energy into electrical energy through a special semiconductor array device. To ensure maximum harvesting and conversion efficiency, the system runs cycles both during the day and at night, creating a continuous supply of electricity to household appliances.

Market need

Although photovoltaic (PV) technology supports global energy demand and the quest for low-carbon emission technology, the cost of PV is still high, and the efficiencies of commercially available systems remain low (approx. 10%). Energy is also stored in expensive high-technology battery systems, while PV cells are only active during peak solar irradiation hours during daytime. Thermal harvesting systems, however, are much more efficient when it comes to collection (approx. 90%), they can be stored easily in water and are extremely cost-effective and environmentally friendly. Our developed system can harvest and store thermal energy at an extremely low cost. The stored heat is used for supplying hot water in households, while 30% of the harvested energy can be converted to electricity through specially developed semiconductor and electronics control technology.



Features

- Thermal energy is harvested from solar and other energy sources
- Thermal energy is effectively stored in special systems
- Continuous conversion cycles to electricity



Benefits

- Extremely cost-effective and sustainable
- Continuous electricity supply
- Environmentally friendly
- Limited moving parts extend the lifetime of systems
- Scaled systems are possible to supply all the energy needs of a household.



Industry

Energy

Potential Applications

- Household and small business power generation, providing both electricity and hot water from a single integrated system.
- Supplementary energy system for residential buildings to reduce reliance on grid electricity.
- Hybrid renewable installations combining thermal and photovoltaic systems for improved efficiency.
- Industrial and commercial facilities requiring low-cost waste heat recovery and electricity generation.
- Rural electrification projects offering affordable, continuous off-grid power and heat supply.

Creator

Prof Lukas Snyman

Stage of Development

Prototype

Intellectual Property

Patent Protection

Desired Relationship

Co-development Investor

PolyGen™

Plastic-to-Energy Anaerobic Gasification

“Turning Plastic Waste into Power.”

Technology

The invention relates to an energy-generating system that uses polyethylene plastics (which would normally cause environmental pollution) to produce synthesis gas (syngas). Unlike conventional gasification processes that rely on oxygen, this system ensures that the gasification of polyethylene to generate syngas occurs in an aerobic environment. A novel feature of this system is its ability to recover a portion of the latent heat of water, leading to a significant improvement in energy production compared to more conventional designs. This system converts non-recycled plastics into power, transforming harmful waste material into something useful.

Market need

Due to low production costs and flexible material properties, plastic finds applications in multiple areas. The disposal of plastics without landfilling remains an environmental concern; however, as plastic does not decompose, the expected improvement in standards of living is not expected to lead to a decrease in plastic production. Gasification can help with the management of plastic disposal processes while ensuring energy generation.



Features

- Anaerobic gasification
- Recovery of latent heat
- Polyethylene plastic feedstock



Benefits

- Higher energy production and a simplified gasification process
- Low energy costs
- Efficient method of plastic waste disposal



Industry

Energy

Potential Applications

- Conversion of plastic waste into synthesis gas (syngas) for electricity generation and industrial fuel.
- Waste-to-energy plants seeking to reduce landfill use and environmental pollution.
- Municipal solid waste management systems integrating plastic recovery and clean energy production.
- Industrial operations utilizing syngas for heating, power generation, or chemical synthesis.
- Sustainable energy projects promoting circular economy practices through plastic valorisation.

Creator

James Fox

Stage of Development

Prototype

Intellectual Property

Patent Protection

Desired Relationship

Co-development partner, Investors





Unisa Catalytic Niche Area

BIOTECHNOLOGICAL STUDIES

DiaPatch™

A nano-emulsified phyto-drug for transdermal treatment of diabetes

“Healing Through the Skin.”

Technology

The invention relates to a nano-emulsified phyto-drug formulation designed for the transdermal treatment of diabetes, particularly Type II Diabetes Mellitus. It uses diosgenin, a natural antidiabetic compound, encapsulated in an oil-in-water nanoemulsion matrix composed of sesame oil and bottle gourd seed oil as the oil phase, with Tween 80 and glycerol as non-toxic emulsifiers. This nanoemulsion enhances diosgenin's solubility, stability, and skin permeability, allowing for controlled and sustained drug release into systemic circulation. The formulation is prepared using a low-energy, ambient temperature process, making it cost-effective and preserving thermolabile bioactives. Delivered as a gel, cream, or transdermal patch, the system provides a non-invasive, natural, and patient-friendly alternative to oral or injectable diabetes treatments, improving bioavailability and treatment compliance.

Market need

Diabetes affects over 500 million people globally, with Type II Diabetes Mellitus being the most prevalent. Current oral and injectable treatments often suffer from low bioavailability, short half-lives, gastrointestinal irritation, and invasive administration, leading to poor adherence and secondary complications. There is an increasing market demand for non-invasive, natural, and patient-friendly drug delivery systems. The proposed nanoemulsified diosgenin formulation directly addresses these challenges by offering a plant-based, transdermal therapeutic alternative that improves patient comfort, drug stability, and long-term glycemic control.



Features

- Utilises diosgenin, a natural compound extracted from Dioscorea rhizome and other medicinal plants, minimising synthetic drug side effects.
- Improves diosgenin solubility, enhances transdermal absorption, and increases bioavailability.
- Non-invasive delivery
- Cost-effective, scalable, and environmentally friendly preparation at room temperature.
- Adaptable as a gel, patch, or cosmetic-grade transdermal product.



Benefits

- Enhanced patient compliance due to painless, easy-to-use application.
- Reduced side effects compared to oral or injectable hypoglycemics.
- Eco-friendly and low-cost production.
- Potential use beyond Type II Diabetes, including gestational and maturity-onset diabetes.



Industry

Drug discovery

Potential applications

- Transdermal treatment of Type II Diabetes, providing controlled drug release.
- Patient-friendly alternative to oral and injectable therapies, enhancing compliance.
- Plant-based antidiabetic therapy using natural bioactive compounds like diosgenin.
- Topical formulations including gels, creams, and patches for non-invasive administration.
- Improved bioavailability of antidiabetic compounds through nano-emulsion technology.

Creators

Prof Titus Msagati

Mrs Oyesolape Basirat Oyelaja-Akinsipo

Prof Enock Olugbenga Dare

Prof Lateef Oladimeji Sanni

Dr Samson Oluwagbemiga Alayande

Prof Deepshikha Pande Katare

Stage of development

Early stage

Intellectual property

Patent Protection

Desired relationship

Co-development, Investors

BioFusion™

Integrated Single-Compartment Anaerobic Digester

“Simplifying Waste-to-Energy for Sustainable Communities”

Technology

BioFusion™ is an innovative single-compartment anaerobic digester engineered to efficiently process organic solid and liquid waste from households, agriculture, and food industries. Unlike traditional multi-stage digesters, BioFusion™ integrates all four biological stages of anaerobic digestion—hydrolysis, acidogenesis, acetogenesis, and methanogenesis—into a single, compact reaction chamber, greatly simplifying construction, operation, and maintenance.

The digester features a durable dual-layer structure consisting of an inner PVC bag and an outer polyester-coated vinyl tarp that provides strength, UV protection, and chemical resistance. Designed to operate across both mesophilic and thermophilic temperature ranges, BioFusion™ ensures optimized methane yield and low maintenance operation. Locally manufacturable and cost-effective, this innovation offers a sustainable, decentralised waste management solution suited to African conditions, reducing reliance on imported systems while enabling clean energy generation.

Market need

Organic waste streams from households, agriculture, and food industries represent a major environmental and disposal challenge. Conventional digesters often require complex compartmentalised systems, imported materials, and high maintenance, which increase costs and reduce accessibility in African contexts. There is a growing demand for affordable, durable, locally manufacturable digesters that can process waste efficiently while producing renewable energy in the form of methane biogas, supporting both environmental sustainability and energy independence.



Features

- Single-compartment design
- Two-layer material system for UV, chemical, and abrasion resistance.
- Supports mesophilic (20–45°C) and thermophilic (50–65°C) operations.
- Reduces reliance on imported materials, cutting costs and supply delays.
- Ease of cleaning.



Benefits

- Single-compartment design reduces complexity and costs
- Locally manufacturable, supporting regional economic development
- Dual-layer construction for strength, UV resistance, and chemical durability
- Operates in mesophilic and thermophilic ranges for efficient methane production
- Easy to maintain and clean, suitable for smallholder or industrial use



Industry

Biotechnology

Possible Applications

- Agricultural, household, and food industry waste treatment
- Renewable biogas production for cooking, heating, and power generation
- Off-grid or rural energy solutions
- Small- to medium-scale community energy systems

Creators

Prof Tonderayi S. Matambo

Dr Grace N. Ijoma

Charles Rashama

Asheal Mutungwazi

Stage of development

Early stage

Intellectual property

Patent Protection

Desired relationship

Co-development Investor

QuantumArray™

Cost-effective Mass Production of SQUIDS MRI Technology

“Scaling Superconductivity for the Future of Imaging.”

Technology

QuantumArray™ introduces an automated, cost-effective manufacturing process for fabricating nano- and micro-scale high-temperature Superconducting Quantum Interference Devices (SQUIDs). The invention leverages a femtosecond laser-based fabrication method integrated with computer-aided automation to produce precise micro- and nano-constriction structures. Unlike traditional methods that are costly, complex, and time-intensive, QuantumArray™ enables pre-programmed, high-precision mass production of superconductors with uniform interfaces and barriers. This results in enhanced reproducibility, improved signal-to-noise ratios, and stronger overall SQUID performance - laying the foundation for scalable, next-generation superconducting devices.

Market need

While thin-film Josephson circuits are now widely producible, the mass production of high-quality SQUIDs remains a major technological bottleneck due to the intricate fabrication process required for reliable high-temperature superconductors. Current methods are limited by high costs, manual precision demands, and low reproducibility, which hinder commercial-scale deployment in MRI systems, quantum sensors, and superconducting electronics. QuantumArray™ directly addresses these challenges by automating the fabrication process, delivering a repeatable, precise, and economically viable method for large-scale SQUID manufacturing.



Features

- Uses computer-aided programming for consistent, reproducible SQUID manufacturing.
- Enables ultra-precise micro- and nano-structuring of superconducting materials.
- Supports advanced SQUID designs using durable superconducting materials.
- Ensures structural integrity and high device performance.
- Produces SQUIDs with superior signal-to-noise ratios for accurate magnetic field detection.



Benefits

- Significantly lowers production expenses through automation and scalability.
- Enables reliable mass production of SQUIDs with minimal manual intervention.
- Produces stronger, more sensitive, and stable superconducting devices.
- Bridges the gap between laboratory prototypes and large-scale industrial production.
- Can be reprogrammed for different device geometries and applications.



Industry

Biotechnology

Potential Applications

- Enables affordable, high-resolution magnetic resonance imaging systems, especially in resource-limited healthcare environments.
- Provides scalable superconducting elements for qubit development and magnetic field measurement.
- Used in ultra-sensitive magnetometers for mineral, oil, and natural resource exploration.
- Supports detection of weak magnetic signatures for surveillance or submarine detection.
- Facilitates precision magnetic field measurements in nanoscale material characterization.
- Used for identifying flaws in metallic structures through magnetic imaging.
- Integration into satellite instruments for detecting cosmic magnetic phenomena.

Creators

Patrice Umenne

Prof Vijaya Srinivasu Vallabhapurapu

Stage of Development

Prototype

Intellectual Property

Patent protection

Desired Relationship

Co-development partner, Investors

CalciteX™ Process

Process to produce precipitated single phase Crystalline 1-D Nano-scaled Calcite manufacture

“Green Chemistry. Pure Results.”

Technology

This technology provides a new, eco-friendly way to produce tiny, one-dimensional (1D) crystals of calcium carbonate (CaCO_3), a common material found in substances like chalk and limestone. Unlike traditional methods, this process operates at room temperature and pressure, using only water and a natural extract from the Doum palm fruit as essential ingredients. The approach is not only simpler and cheaper but also more sustainable, offering a cleaner alternative to existing methods. It also allows better control over the shape and size of the crystals, which can be useful for various applications. This invention presents a cleaner, greener way to produce useful materials without harming the environment.

Market need

Traditional methods for making nanoparticles can be harmful to the environment, using toxic chemicals or high energy. The market need for this technology is driven by the demand for more sustainable, less harmful to the environment, and cost-effective ways to produce materials that are used in many industries, like construction, medicine, and environmental protection.



Features

- Ambient Production Conditions
- Biogenic Additive from Doum Palm Extract
- Single-Phase, High-Purity Calcite Crystals
- Environmentally Sustainable Process
- Morphological Control
- Scalable and Low-Cost Manufacturing



Benefits

- Eco-friendly and non-toxic synthesis using renewable plant-based resources.
- Energy-efficient production at ambient temperature and pressure.
- Reduced manufacturing costs compared to high-temperature or chemical-intensive methods.
- Customisable nanostructure with precise control over crystal shape and size.
- High-purity product suitable for sensitive industrial and biomedical applications.



Industry

Manufacturing

Potential Applications

- Biomedical Materials: Drug delivery systems, tissue scaffolds, and bone substitutes.
- Industrial Fillers and Coatings: Reinforcement and surface modification in plastics, paints, and polymers.
- Catalysis and Photocatalysis: Nano-structured supports for chemical and environmental catalysts.
- Environmental Remediation: Absorption and neutralisation of pollutants and CO₂ sequestration.
- Paper, Paint, and Cosmetics Industries: Functional additive offering improved brightness, texture, and performance.

Creators

Prof Malek Maaza

Ahmed Elsayed Hamza Mohamed

Stage of development

Early stage

Intellectual property

Patent protection

Desired relationship

Co-development, Investors

PhotoNANOX™

Nanocomposites and photosensitisers

“Light-Activated Nanocomposite for Water Purification.”

Technology

PhotoNANOX™ is a cutting-edge photosensitising nanocomposite material engineered to deactivate microbial biofilms and degrade organic contaminants in water systems. The material combines porphyrin-based photosensitisers—specifically indium derivatives—with semiconductor metal oxide nanoparticles such as titanium dioxide (TiO₂). Upon exposure to visible or actinic light, PhotoNANOX™ generates reactive oxygen species (ROS) that destroy microorganisms and break down pollutants at the molecular level.

The nanocomposite can be applied as a surface coating or integrated within polymer matrices (e.g., polystyrene), creating self-disinfecting materials for use in water treatment infrastructure and public health environments. Developed using green synthesis techniques, including orange juice-assisted nanoparticle fabrication and room-temperature processing, this technology represents a sustainable advance in photocatalytic purification and antimicrobial surface design.

Market need

The global demand for clean, safe water is rising, especially in low and middle-income countries facing:

- Biofilm formation in storage tanks and pipelines
- Organic and microbial contamination
- Inadequate or expensive water treatment chemicals
- Energy-intensive or environmentally harmful disinfection methods

The traditional disinfection methods (e.g., chlorine) often fail to address biofilms or produce toxic by-products. There is a strong need for sustainable, effective, and affordable antimicrobial solutions and materials that can be easily deployed in decentralised or infrastructure-limited settings.



Features

- Supports both chemical and physical bonding modes.
- Reacts under specific wavelengths, minimising unintended effects.
- Chemically robust for long-term water infrastructure use.
- Can be used as coatings, embedded in polymer films, or incorporated into filtration systems.



Benefits

- Dual-action technology: deactivates microbes and degrades pollutants
- Operates under visible light: no need for UV activation
- Green synthesis process using eco-friendly reagents
- Versatile integration as coating or polymer additive
- Low-cost, scalable, and energy-efficient for widespread deployment



Industry

Water

Potential applications

- Water purification and disinfection systems
- Antimicrobial coatings for pipes, filters, and tanks
- Self-cleaning surfaces in healthcare, food, and industrial facilities
- Photocatalytic wastewater treatment under visible light

Creators

Dr Muthumuni Managa

Prof Richard Moutloali

Ms. Nonkululeko Malomane

Stage of development

Early stage

Intellectual property

Patent Protection

Desired relationship

Co-development, Investor

NanoLume™ Filter

A life-enabled self-cleaning water filter/water filtration assembly

“Pure Water. Powered by Light.”

Technology

This invention introduces a photocatalytic water filtration system designed to purify contaminated water using nanotechnology, capillary coils, and light-activated self-cleaning filtration. The system incorporates a spongy nanofiber-based photocatalytic filter bed within coiled capillary tubes. When exposed to sunlight or artificial LED light, the embedded metal oxide and carbonaceous nanoparticles degrade pollutants, making the filter self-regenerating. The system is powered optionally by solar panels and rechargeable batteries, making it suitable for off-grid use.

Market need

Global access to clean drinking water remains an urgent issue, particularly in rural and remote communities, disaster-struck regions, and developing countries with inadequate water infrastructure. Many existing water purification systems face significant challenges, including high maintenance requirements, frequent filter clogging or saturation, reliance on stable power sources, and potential chemical contamination. As a result, there is a strong market demand for a water purification solution that is low-maintenance, self-cleaning, solar-compatible, and both portable and affordable, especially for low-resource environments where infrastructure and technical support are limited.



Features

- Photocatalytic Nanofiber Filter Bed
- Self-Cleaning Mechanism
- Capillary Coil Design
- Solar or LED Activation
- Modular and Scalable Architecture
- Energy-Efficient Operation
- Portable and Durable Construction



Benefits

- Self-regenerating filter extends lifespan and reduces waste
- Removes organic pollutants, heavy metals, and microbes with high efficiency
- Operates using solar or LED light. No chemicals required
- Environmentally friendly and cost-effective solution
- Flexible deployment — from households to industrial settings
- Supports UN SDG 6: Clean Water and Sanitation



Industry

Water Purification

Potential Applications

- Rural and Off-Grid Water Supply: Delivers safe drinking water where infrastructure is limited.
- Disaster Relief and Humanitarian Aid: Portable, rapid-deployment purification in emergencies.
- Household and Community Filtration: Continuous, low-cost, self-maintaining water purification.
- Industrial and Mining Water Treatment: Cleans process water and reduces waste disposal costs.
- Agriculture and Aquaculture: Provides clean irrigation or aquaculture water without chemicals.
- Urban Greywater Recycling: Adaptable for smart cities and sustainable water systems.
- Military and Mobile Use: Compact, reliable, and renewable-powered purification.

Creators

Prof Edward Nxumalo
Mr Sithembela Zikalala
Mr Stanford Pedzisai

Dr Nozipho Gumbi
Prof Bheki Mamba

Stage of development

Early stage

Intellectual property

Patent Protection

Desired relationship

Co-development, Investors

FeCycle™

A process for preparing ferric chloride for a water treatment process for producing potable water

“Converting Pollution into Purity.”

Technology

This technology offers an innovative and eco-friendly method for producing ferric chloride (FeCl_3), a commonly used coagulant in water purification, by recovering Fe(III) from acid mine drainage (AMD). AMD is a significant pollutant generated by mining activities and typically contains high levels of iron and other contaminants. The invention allows for converting AMD from an environmental hazard into a valuable resource for water treatment by producing ferric chloride through a controlled chemical process. This process involves extracting and converting Fe(III) under optimised pH conditions to produce a coagulant that meets water treatment standards. This approach provides an alternative, local, and sustainable source of ferric chloride, which is particularly important for regions experiencing supply chain disruptions and increasing chemical treatment costs.

Market need

This technology, by converting locally abundant acid mine drainage (AMD) into a usable chemical input, directly addresses the urgent need for cost-effective coagulant alternatives, promotes sustainable and circular resource use, and improves access to potable water in underserved and resource-limited regions. The technology produces FeCl_3 , which is a chemical used in the treatment of water.



Features

- Transforms hazardous waste into a chemical input via iron precipitation and conversion processes.
- Produces a widely used coagulant for water treatment directly from recovered iron sources.
- Minimises the environmental impact of mining waste while avoiding imported hazardous chemicals.



Benefits

- Converts mining waste into a valuable water treatment resource, reducing environmental liabilities
- Offers municipalities and industries a low-cost, locally sourced alternative to expensive imported coagulants
- Decreases AMD contamination risks and avoids the carbon costs of chemical transportation and manufacturing.



Industry

Water

Potential applications

- Production of ferric chloride for municipal and industrial water treatment
- Environmental remediation of acid mine drainage
- Integration into circular economy systems in mining and water sectors
- Sustainable sourcing of coagulants for potable water and wastewater processes

Creators

Prof Vhahangwele Masindi

Prof Memory Tekere

Ms Mamile Belina Mahlohlhla

Stage of development

Early stage

Intellectual property

Patent Protection

Desired relationship

Co-development partner, Investors

MagheClean™

Acid mine drainage treatment

“Cleaning Mines. Saving Water.”

Technology

The invention uses maghemite nanoparticles at pH levels below 5 to remove sulphate, manganese, copper, nickel, cobalt, and zinc ions from acid mine drainage (AMD). In traditional AMD treatment methods, these contaminants are usually removed only at higher pH levels, which requires expensive alkaline chemicals. Typically, only iron (III) and aluminium (III) precipitate at low pH. Due to the highly acidic nature of AMD, effective pollutant removal demands precise process optimisation. Compared to conventional methods, adsorption offers a more convenient, cost-effective, and efficient alternative. This invention combines adsorption and precipitation processes to achieve high removal efficiencies across multiple contaminants. The achieved pollutant removal rates were as follows: sulphate (89%), manganese (79%), cobalt and zinc (98%), nickel (96%), and copper (100%). Overall, the method significantly reduces chemical usage while providing a cost-effective solution for AMD remediation, with the added potential for recovering valuable resources from treated effluent.

Market need

Several technologies exist for AMD treatment, with neutralisation being the most widely used. This method facilitates metal removal through hydroxide precipitation and sulphate removal as gypsum formation. However, since both metals and sulphate co-precipitate, it becomes economically unfeasible to recover either component from the resulting sludge. The sludge, typically disposed of in landfills, contributes to large tailings that pose environmental risks due to the leaching of metals. There is therefore a critical need for cost-effective AMD treatment technologies that enable the recovery and reuse of valuable resources while minimising environmental impact and reducing chemical consumption.



Features

- Employs maghemite nanoparticles for efficient adsorption of metal ions and sulphate.
- Operates efficiently under acidic conditions typical of AMD and produces less sludge.
- Integrates both adsorption and precipitation mechanisms to achieve higher pollutant removal efficiencies.
- Capable of removing multiple contaminants including sulphate, manganese, copper, nickel, cobalt, and zinc simultaneously.



Benefits

- Reduces treatment costs by operating at natural AMD pH and requiring fewer chemicals.
- Provides high removal rates even under harsh acidic conditions.
- Enables the extraction and potential commercial reuse of metals, transforming waste into valuable resources.
- Minimises sludge formation and landfill disposal.
- Helps mining and industrial operators meet environmental discharge standards.



Industry

Water

Potential applications

- Treatment of acid mine drainage and acidic industrial effluents containing heavy metals and sulphates.
- Use in mining, metallurgical, and electroplating industries for wastewater purification.
- Application in environmental remediation and rehabilitation of contaminated water bodies.
- Enables recovery of valuable metals from treated effluent.
- Supports sustainable water management with reduced chemical usage and sludge generation.

Creators

Dr Kefeni Kebede

Prof Mamba Bheki Brilliance

Stage of development

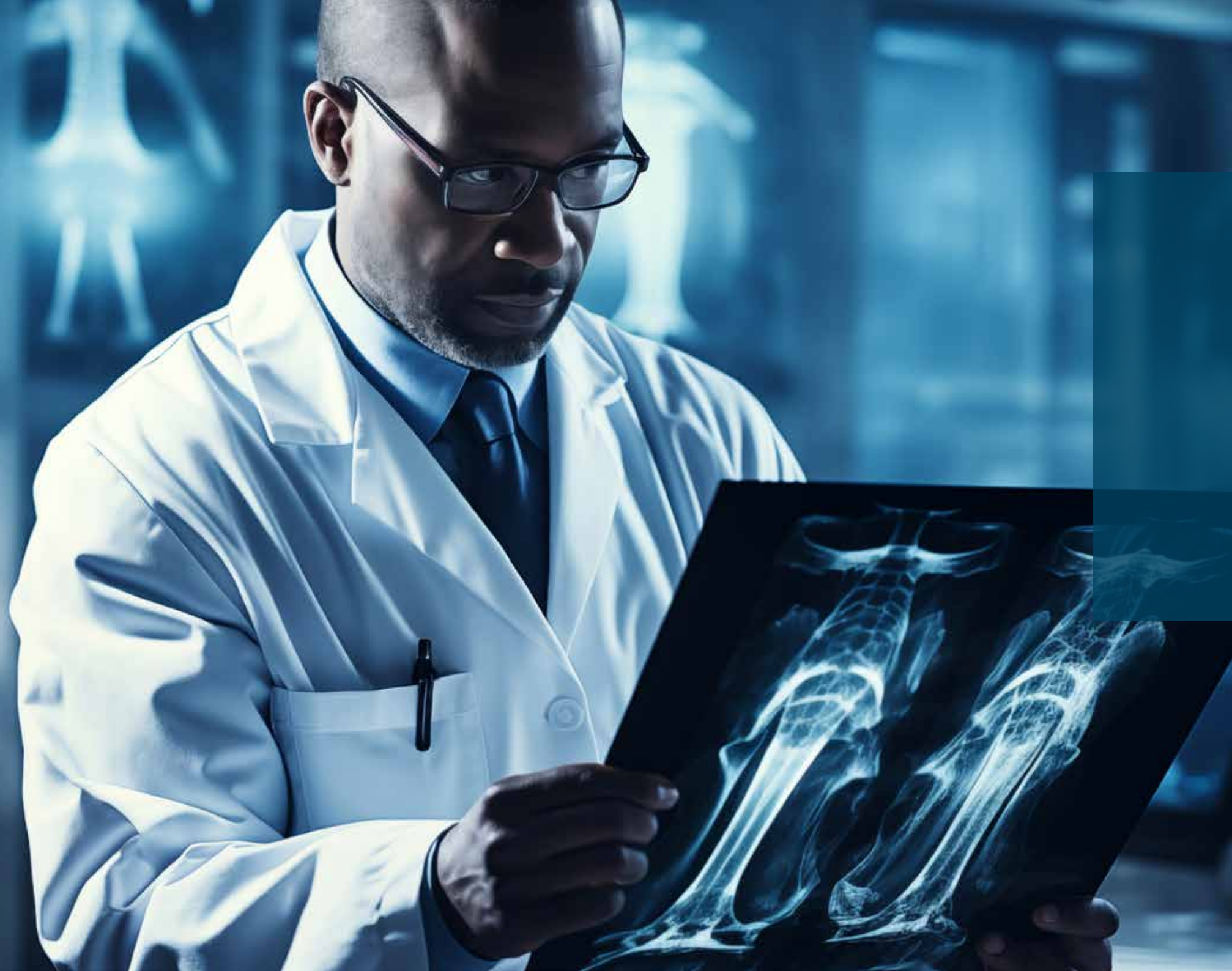
Laboratory prototype

Intellectual property

Patent Protection

Desired relationship

Co-development, Investor





Unisa Catalytic Niche Area

HEALTH/ PHARMACEUTICAL STUDIES

Ezercumin™

Ezetimibe and Curcumin for use in cancer treatment

“Nature Meets Precision in Cancer Care.”

Technology

This invention relates to a pharmaceutical composition comprising ezetimibe, alone or in combination with curcumin, for the treatment of cancers characterised by the overexpression of the oncogene Mdm2. The technology is based on the novel discovery that ezetimibe - an FDA-approved cholesterol absorption inhibitor which can bind to the p53-binding domain of Mdm2, thereby promoting p53 tumour-suppressing activity and inducing apoptosis of cancer cells. The co-administration with curcumin further enhances therapeutic efficacy, particularly in colon cancer, by inhibiting ezetimibe's glucuronidation and prolonging its bioavailability in the target tissues.

Market need

There is a significant market need for safer, more affordable, and effective cancer therapies that target the Mdm2–p53 pathway, which plays a critical role in tumour development and resistance to treatment. Many cancers, including colon, breast, lung, and pancreatic cancers, are characterised by Mdm2 overexpression, yet current inhibitors are limited by poor bioavailability, toxicity, and high cost. The proposed Ezetimibe–Curcumin combination addresses this gap by repurposing ezetimibe, an FDA-approved cholesterol-lowering drug, as a novel anticancer agent capable of disrupting the Mdm2–p53 interaction and inducing apoptosis, while curcumin enhances efficacy by preventing metabolic deactivation and contributing anti-inflammatory and antioxidant effects. With cancer incidence exceeding 20 million new cases annually and increasing global demand for orally administered, low-toxicity, and cost-effective treatments, this technology aligns with key market drivers in targeted oncology therapeutics, drug repurposing, and natural compound-based combination therapies, offering a strong commercial opportunity for both developed and emerging healthcare markets.



Features

- Repurposing of a clinically approved drug (ezetimibe) for oncology use.
- Enhanced anti-tumour efficacy through combination with curcumin.
- Broad-spectrum activity across multiple cancer types, with efficacy in colon and solid tumours.
- Potential for oral administration, improving patient compliance and reducing treatment costs.
- Lower toxicity profile compared to conventional chemotherapeutics and experimental nutlins.



Benefits

- Accelerated clinical translation due to ezetimibe's established safety record.
- Potential cost-effective therapy for cancers with limited treatment options.
- Synergistic therapeutic effect from combining a synthetic drug with a natural compound.
- Targeted action on the Mdm2–p53 pathway, addressing drug resistance in p53-deficient cancers.
- Flexibility in formulation and administration routes to suit various clinical needs.



Industry

Drug Discovery

Potential applications

- Treatment of cancers characterised by Mdm2 overexpression, including colon, breast, lung, and pancreatic cancers.
- Development of targeted anticancer therapies that enhance p53 tumour-suppressing activity.
- Use in combination therapy to improve treatment efficacy and reduce toxicity compared to conventional chemotherapy.
- Potential integration into oral, low-toxicity cancer treatment regimens suitable for both developed and resource-limited healthcare systems.

Creators

Prof Monde Ntwasa
Charmy Starnod Twala

Stage of development

Phase I Clinical Trials completed

Intellectual property

Patent Protection

Desired relationship

Co-development, Investors

Ezecure™

In silico-derived anticancer compound (MTS_42 & MTS_69) targeted towards MDM2/MDM4 - modified ezetimibe drug for cancer treatment

“Reprogramming Cancer at the Core.”

Technology

This invention introduces a novel anti-cancer therapy derived from structural modifications of ezetimibe, a known cholesterol absorption inhibitor. The modified compound has been designed to address ezetimibe's limitations in bioavailability and metabolic stability, especially for oral administration in treating colorectal and other cancers. This new drug variant shows significantly improved pharmacokinetics and pharmacodynamics for dual inhibition of HDM2 and HDM4 (HDMX)—two important negative regulators of the tumour suppressor protein p53.

Market need

Current treatments targeting the p53 pathway often face issues with specificity, metabolic degradation, or limited effectiveness against both HDM2 and HDM4. Ezetimibe was previously identified as a small molecule capable of binding the HDM2 hydrophobic pocket. However, its rapid conversion in the intestines makes it unsuitable for anti-cancer therapy. There is a clear need for stable, orally available small-molecule inhibitors of both HDM2 and HDM4, which would provide better therapeutics for cancers involving p53 suppression, especially colorectal cancer, and drugs that restore p53 activity by preventing its degradation and inhibition.



Features

- Structural modification of ezetimibe enhances metabolic stability and prevents rapid degradation by intestinal enzymes.
- Targeted binding to the p53-binding pockets of both HDM2 and HDM4.
- Improved oral bioavailability and intestinal permeability, making it effective for colon-targeted therapies.
- Simultaneous inhibition of HDM2's E3 ubiquitin ligase activity and HDM4's p53-binding function.



Benefits

- Suitable for oral administration
- Potential for broader application across multiple p53-related cancers beyond colorectal types.
- Enhanced anticancer efficacy by stabilising and reactivating p53 function.



Industry

Drug discovery

Potential applications

- Colorectal cancer treatment: oral therapy targeting p53 pathway restoration by inhibiting both HDM2 and HDM4.
- Broad-spectrum anticancer therapy: potential use in cancers where p53 activity is suppressed, such as breast, lung, and liver cancers.
- Adjuvant cancer therapy: combined use with chemotherapy or radiotherapy to enhance tumour suppression and reduce resistance.
- Drug development and screening: a platform for designing next-generation small-molecule inhibitors targeting the p53 regulatory pathway.
- Personalised medicine: potential use in precision oncology for patients with p53-dependent tumour profiles.

Creators

Prof Monde Ntwasa
Mr. Tshireletso Mentor
Dr Selisha Sooklal

Stage of development

Early stage

Intellectual property

Patent Protection

Desired relationship

Co-development, Investors

DentaForm™

Customizable dental implants

“Formed for You. Built to Last.”

Technology

This invention presents an advanced dental implant that enhances mechanical performance and biological integration through a unique structure combining threaded and porous zones. Designed for use in orthodontic prosthetics, the implant features an elongated, tapered body with a longitudinal axis, including first and second threaded zones separated by a centrally positioned porous zone. The porous zone encourages superior osseointegration by allowing bone ingrowth, while the threaded zones offer strong anchorage and load distribution. The implant is made from biocompatible ceramic materials, such as alumina, using precision additive manufacturing techniques like Lithography-Based Ceramic (LBC) printing.

Market need

The global dental implant market faces challenges in managing implant rejection, mechanical failure under occlusal forces, and ensuring effective bone integration, especially in narrow implants used for anterior teeth. Current solutions often experience stress concentrations, poor load distribution, and limited long-term stability. Additionally, there is increasing demand for more customisable, durable, and biocompatible implants that decrease failure rates and improve patient outcomes. This invention directly addresses these needs by providing a structurally optimised implant that minimises stress concentrations and promotes osseointegration.



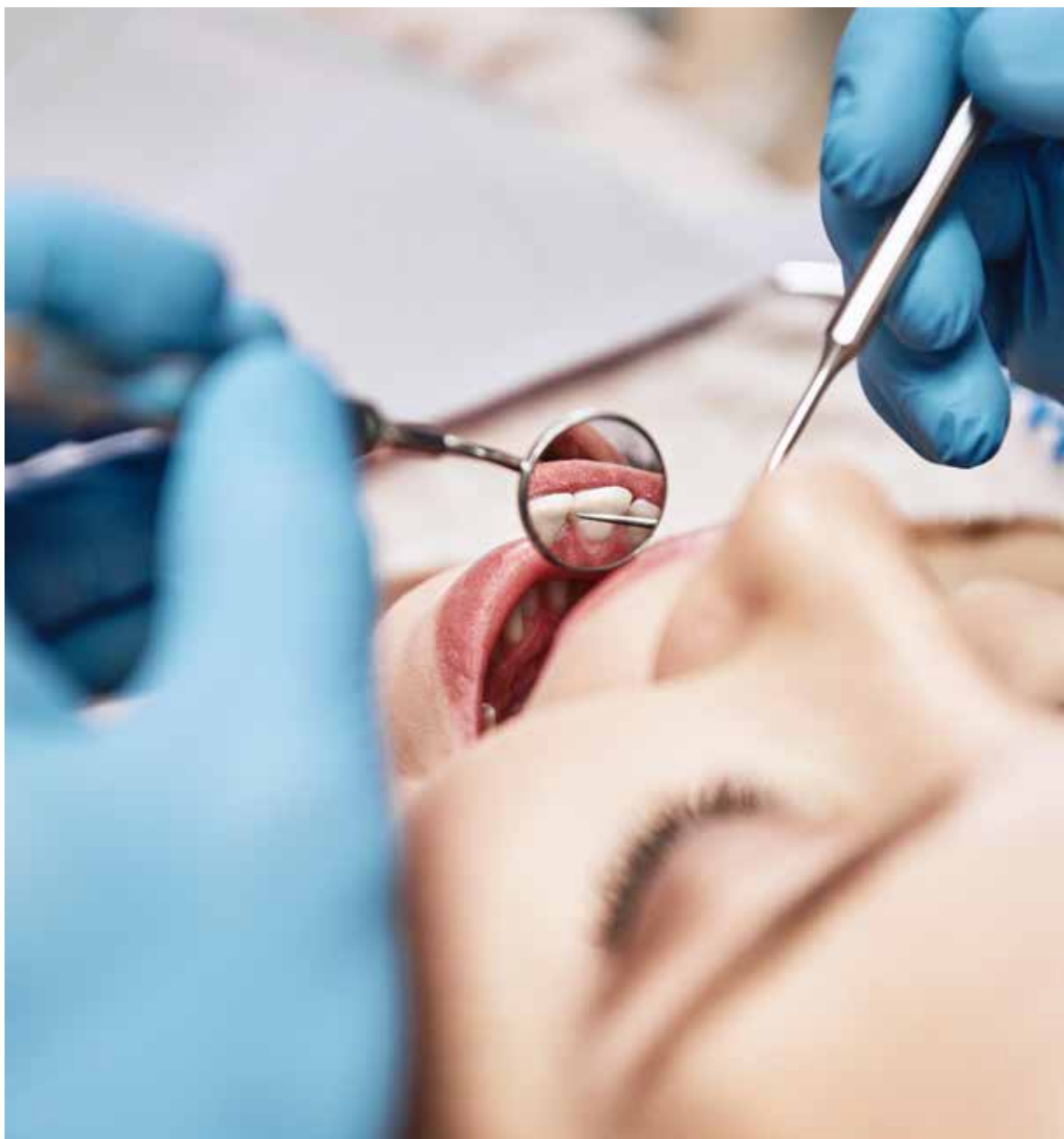
Features

- High-strength ceramic (e.g., alumina), offering excellent biocompatibility and reduced bacterial adhesion.
- Designed to promote bone ingrowth.
- Minimise stress during insertion and usage.
- Lithography-Based Ceramic (LBC) 3D printing for high-precision, patient-specific designs



Benefits

- Porous central zone facilitates bone bonding, reducing the risk of implant failure.
- Chamfered edges and biocompatible ceramics decrease inflammation, discomfort, and allergic reactions.
- Thread geometry and load-sharing design decrease stress and prevent cracking or loosening under pressure.
- Balanced mechanical and biological features support long-term implant success.



Industry

Manufacturing

Potential applications

- Dental and orthodontic prosthetics: replacement of missing teeth with enhanced stability and long-term performance.
- Anterior (front) tooth implants: ideal for narrow spaces requiring strong anchorage and aesthetic precision.
- Bone regeneration and integration studies: research on osseointegration and bone-implant interface improvements.
- Customised dental solutions: patient-specific implants using precision 3D ceramic printing.
- Minimally invasive implant procedures: suitable for patients with limited bone volume or sensitivity to metal implants.
- Advanced dental training and research: educational and clinical applications in dental implantology and biomaterial development.

Creators

Prof Harry Ngwangwa
 Prof Thanyani Pandelani
 Ms Winnie Mtetwa
 Mr Emmanuel Munenge

Stage of development

Prototype

Intellectual property

Patent Protection

Desired relationship

Co-development, Investors

Assistiva™

Automatic Healthcare Assistance Device (AHAD)

“Empowering Every Ability.”

Technology

The invention is a versatile healthcare assistance device designed to help individuals with vision, mobility, and speech impairments. It combines robotics, telemetry, advanced sensors, and voice-control features to provide flexible support. By merging multiple assistive functions into one device, it meets the varied needs of the aging population and people with physical, cognitive, and communication challenges. The device aims to improve independence, safety, and quality of life for users in both clinical and home settings.

Market need

The global population is aging quickly, with rising rates of chronic illness, disability, and age-related impairments. Current assistive devices are often specialised and disconnected, whereby separate tools are needed for speech, mobility, and vision impairments, which can be expensive and bulky. Healthcare systems and families both need affordable, integrated solutions that combine multiple assistive functions into one device. A device that offers multi-functional support can increase user adoption, lower healthcare costs, and improve patient outcomes.



Features

- Robotics integration for assisted movement and mobility support.
- Voice recognition and speech synthesis to enable communication.
- Smart sensors for environmental awareness (obstacle detection, fall alerts, navigation assistance).
- Telemetry and remote monitoring to track user activity, health data, and safety.
- Customisable interface adaptable to user needs and disability severity.
- Portable and user-friendly design for use across different care settings.



Benefits

- Empowers users to perform daily activities with minimal assistance.
- Reduces risks of accidents, falls, and health emergencies.
- Combines multiple assistive devices into one, lowering overall expense.
- Suitable for both institutional healthcare settings and personal use.
- Enables caregivers and healthcare professionals to monitor and assist patients more effectively.
- Improves user confidence, dignity, and communication abilities.



Industry

Manufacturing
Healthcare

Potential applications

- Assists elderly or disabled individuals with mobility, communication, and daily tasks.
- Provides multi-functional patient assistance for nursing staff and caregivers.
- Support physical therapy, mobility training, and cognitive exercises.
- Tracks health, activity, and safety data for telemedicine applications.
- Aids people with vision, speech, or mobility impairments in independent living.
- Enhance safety for high-risk patients in homes or care facilities.

Creator

Maria M Jakovljevic

Stage of development

Early stage

Intellectual property

Patent Protection

Desired relationship

Co-development, Investors

ACTLink™

Coordinating the Efficient Distribution of ACTs Drugs

“Connecting Care. Delivering Life.”

Technology

ACTLink™ is a mobile and desktop application designed to streamline the distribution of artemisinin-based combination therapies (ACTs) used in malaria treatment. The system enhances coordination across the complex, multi-stakeholder supply chain that delivers ACTs to healthcare facilities and patients. Fragmented logistics and poor communication between stakeholders often constrain the distribution of ACTs. ACTLink™ addresses this challenge by enabling real-time coordination of drug delivery through both internet and USSD functionalities—ensuring accessibility in urban, peri-urban, and remote rural areas. By improving efficiency, transparency, and access, ACTLink™ helps ensure the timely availability of ACTs, maximising drug efficacy and improving patient treatment outcomes.

Market need

Access to ACTs remains a significant challenge, especially in remote or under-resourced regions where healthcare facilities are limited. Patients often face long travel distances and financial barriers to obtaining their medication, leading to incomplete treatment and increasing the risk of malaria drug resistance. An integrated, technology-driven coordination tool like ACTLink™ can bridge this gap by facilitating efficient drug distribution, minimising stockouts, and ensuring equitable access to life-saving malaria therapies.



Features

- Accessible via mobile (USSD-enabled) and desktop platforms to ensure connectivity in both high- and low-network areas.
- Monitors and updates stock levels, delivery progress, and distribution patterns in real time.
- Supports various user roles such as the manufacturers, suppliers, health workers, and regulators, with customised access and security levels.
- Automatically triggers restocking alerts based on consumption patterns and supply forecasts.
- Prevents wastage and supports accurate budgeting and supply planning.
- Promotes accountability and coordination among all actors in the supply chain



Benefits

- Enhances collaboration and visibility across the entire ACT supply chain.
- Ensures continuous drug availability even in remote and underserved communities.
- Enables data-driven forecasting and inventory control.
- Facilitates communication and joint decision-making among suppliers, clinics, and health authorities.
- Contributes to malaria control and eradication efforts through reliable and equitable access to ACTs.



Industry

ICT

Potential Applications

- Integration with national malaria control programmes for efficient drug distribution and reporting.
- Used by logistics providers and wholesalers to manage ACT stock levels across regions.
- Enables rural health agents to request and track ACT stock via mobile or USSD.
- Support large-scale malaria treatment campaigns by ensuring the timely and transparent delivery of drugs.
- Provides data analytics for policy planning, funding allocation, and monitoring of drug distribution efficiency.
- Offers supply chain visibility and inventory control for private clinics and pharmacies.

Creators

Prof Marcia Mkansi

Oluka Nigitta

Stage of Development

Prototype

Intellectual Property

Copyright

Desired Relationship

Co-development partner, Investors



Unisa Catalytic Niche Area

FOURTH INDUSTRIAL REVOLUTION AND DIGITALISATION



TraffiGO™

Smart autonomous portable traffic light system

“Smart Traffic. Anywhere.”

Technology

TraffiGO™ is an invention that introduces an intelligent, autonomous, and portable traffic light system designed for efficient management of traffic with minimal infrastructure. By integrating advanced technologies such as solar power, AI-driven traffic control, LIDAR-based vehicle detection, and IoT connectivity, the system offers a dynamic, real-time optimisation of traffic flow, reduces congestion, and supports sustainability. It is easy to deploy and able to operate independently, making it a flexible and cost-effective solution for both temporary and long-term traffic management needs.

Market need

The system addresses a variety of market gaps, making it relevant for urban development, transportation, construction, and emergency response.



Features

- Fully autonomous operation with AI and LIDAR-based vehicle detection
- Solar-powered system with optional battery backup for off-grid use
- Portable and modular for rapid setup and relocation
- IoT connectivity enables remote monitoring, data analytics, and adaptive control
- Reduces congestion while promoting sustainable, low-energy traffic management



Benefits

- Intelligent, adaptive control significantly improves vehicle throughput.
- Low setup and operational costs compared to traditional infrastructure.
- Uses renewable energy and smart operation to minimise environmental impact.
- Perfect for construction zones, roadwork detours, or events where fixed traffic lights are impractical.
- Deployable in disaster zones or emergency reroutes where infrastructure is damaged or unavailable.



Industry

Construction & Roadworks

Military

Security operations

Potential applications

- Temporary and emergency traffic management (e.g., construction zones, accidents)
- Smart city traffic optimisation and congestion reduction
- Deployment in remote or developing regions lacking fixed infrastructure
- Integration with municipal smart transport and IoT networks

Creator

Dr Etienne Alain Feukeu

Stage of development

Early stage

Intellectual property

Patent Protection

Desired relationship

Co-development, Investors

TARWSTM™

Transformable automated robotic workspace

“Your Workspace, Reinvented.”

Technology

This Transformable Automated Robotic Workspace (TARWSTM) is a versatile, foldable, and tech-enabled work surface designed for both professional and educational environments. The system incorporates a wide range of features, including self-sanitisation, temperature monitoring, solar energy storage, wireless charging, and interactive digital capabilities, all aimed at creating an efficient and hygienic workspace. This compact and mobile solution can be transformed and adapted to different tasks and settings, making it a highly flexible workspace solution.

Market need

The TARWS addresses key market needs in a rapidly changing world. From space optimisation and hygiene concerns to tech-enabled productivity and sustainability, this innovative workspace is designed to meet the diverse demands of modern users across home offices, educational institutions, co-working spaces, and healthcare environments. Its combination of advanced technology, customizability, and environmental consciousness makes it a highly appealing solution for individuals and organisations aiming to optimise their workspaces for the future.



Features

- Transforms from a closed storage unit into a full-fledged robotic desk with the push of a button.
- A dual-sided work area features a standard surface and a grid-based side for engineering and technical tasks.
- Integrated headphones with microphone and VoIP system for calls and interactions.
- Powers the workspace independently, ideal for off-grid or remote settings.
- USB, standard plug points, and wireless charging pads to accommodate various devices.



Benefits

- Supports health standards with sanitisation and temperature checks, crucial in the post-pandemic period.
- Ideal for both static installations (schools, libraries) and mobile scenarios (events, rural outreach).
- Built with modularity and adaptability in mind, allowing for upgrades and integration with evolving technologies



Industry

Education

Potential applications

- Home and remote offices – adaptable workspace for professionals needing compact, tech-enabled, and hygienic setups.
- Educational institutions – interactive, transformable desks for digital learning, STEM projects, and collaborative environments.
- Co-working spaces – shared smart workstations that optimise space and provide personalised, automated features.
- Healthcare settings – self-sanitising and mobile work surfaces for safe and sterile environments.
- Engineering and design labs – dual-surface functionality supports precision technical and creative work.
- Field and off-grid operations – solar-powered, portable workspace for remote research, construction, or emergency response teams.
- Corporate and innovation hubs – demonstration units for showcasing sustainable and intelligent workspace solutions.

Creator

Poelinca Desire

Stage of development

Early stage

Intellectual property

Patent Protection

Desired relationship

Co-development partner, Investors

Silavon™

Optimised 650 NM Silicon avalanche LED

“Lighting Silicon’s Potential.”

Technology

The invention relates to an optimised silicon avalanche light emitting diode (LED) that emits light at a wavelength of approximately 650 nm (red light). The device is based on a silicon PN junction structure designed with strategically doped regions and engineered impurity concentrations to enhance photon generation efficiency. It achieves optical emission through carrier recombination between high-energy electrons and low-energy holes within a precisely defined interaction zone.

Market need

Conventional LEDs rely on compound semiconductors such as GaAs or InP, which are costly and incompatible with silicon CMOS processes. As the industry moves toward silicon photonics and on-chip optical communication, there is a strong need for efficient light sources fabricated directly on silicon. This technology addresses that gap, enabling high-speed, low-cost, and compact optical-electronic integration – a critical capability for next-generation computing, communications, and sensing markets.



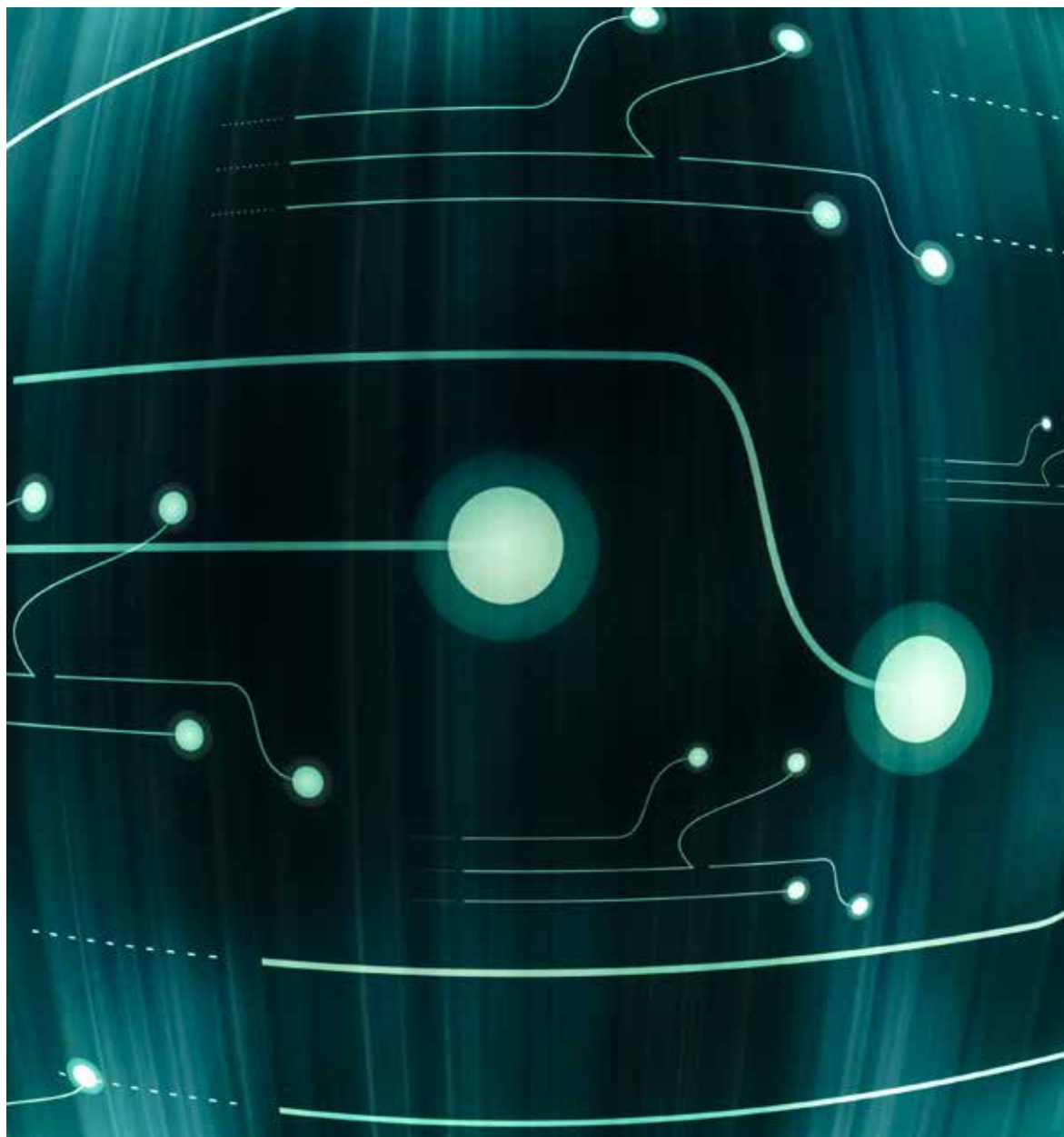
Features

- Emits red light (650 nm) directly from a silicon PN junction, eliminating the need for costly compound semiconductors like GaAs or InP.
- Incorporates a reverse-biased junction that accelerates electrons and a forward-biased junction that injects low-energy holes, creating a controlled recombination zone for efficient light generation.
- A narrow conduction path confines carrier flow, increasing carrier density and light intensity while minimising heat buildup.
- Can be manufactured using standard silicon integrated circuit (IC) processes, allowing seamless integration into electronic chips.
- Operates efficiently at low excitation voltages, reducing risk of thermal damage and improving reliability.



Benefits

- Low-Cost Production
- Facilitates optical interconnects between transistors and chips, reducing latency and energy loss in high-speed processors.
- Enhanced System Performance
- Uses abundant, non-toxic silicon instead of rare or hazardous materials, supporting sustainable manufacturing.
- Reduces administrative workload for supervisors and faculty coordinators.



Industry

ICT

Potential application

- Silicon photonics and on-chip optical communication: integration of light sources directly onto silicon chips for high-speed data transfer.
- Optical interconnects in computing: enabling compact, low-cost, and energy-efficient intra- and inter-chip optical links.
- Sensing and imaging systems: red-light emission for medical diagnostics, environmental sensing, and lab-on-chip devices.
- Consumer electronics: use in displays, optical indicators, and augmented/virtual reality devices.
- LiDAR and optical range finding: red-light sources for compact, low-power distance sensing applications.

Creator

Prof Lukas Snyman

Stage of development

Prototype

Intellectual property

Patent Protection

Desired relationship

Co-development, Investors

DilivariApp™

Grocery Delivery App

“Shared Rides. Smarter Deliveries.”

Technology

DilivariApp™ is an innovative grocery delivery application that connects online shoppers with a network of everyday road users to facilitate efficient, low-cost delivery of groceries. Unlike conventional delivery platforms that depend on dedicated fleets, DilivariApp™ leverages the shared mobility model, allowing ordinary drivers already on the road to pick up and deliver groceries within their routes. This collaborative, peer-to-peer approach reduces delivery costs, enhances supply chain transparency, and promotes local economic participation. The platform links customers and grocery e-retailers within a defined radius, optimising delivery logistics while reducing environmental impact through better vehicle utilisation. By transforming community mobility into an on-demand logistics solution, DilivariApp™ empowers both customers and drivers while making grocery delivery more sustainable, affordable, and reliable.

Market need

While e-commerce has revolutionised retail, last-mile delivery remains a major challenge. Conventional grocery delivery systems are constrained by high operational costs, limited fleet capacity, and inefficient route planning. These inefficiencies often translate into higher delivery fees, delays, and poor customer satisfaction. DilivariApp™ addresses these pain points by decentralising the delivery process by using a shared driver network to create a transparent, real-time, and cost-effective alternative to traditional delivery logistics.



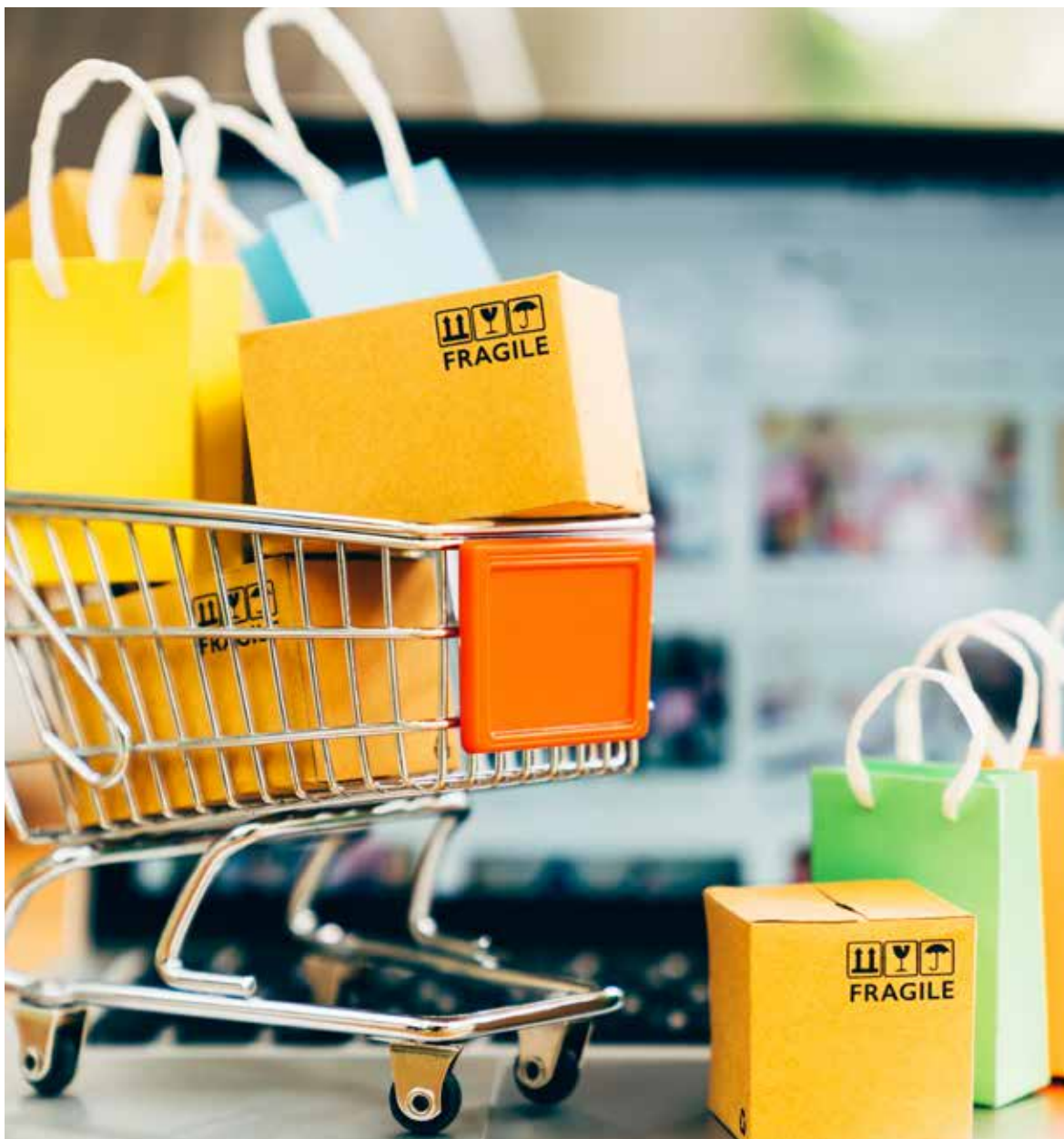
Features

- Uses everyday vehicle owners to complete deliveries within their local areas.
- Enables customers and retailers to track orders and deliveries in real time.
- Ensures accountability, reliability, and service quality.
- Offers integrated, safe, and cashless transactions.
- Optimises delivery efficiency by connecting nearby drivers and customers.
- Retailers can define delivery zones based on demand and location.



Benefits

- Reduces logistics and delivery costs through a shared economy model.
- Real-time visibility and driver accountability ensure smooth service.
- Creates income opportunities for ordinary drivers and part-time earners.
- Reduces redundant trips by utilising vehicles already on the road.
- Faster, flexible, and more reliable delivery for online grocery shoppers.



Industry

ICT

Potential Applications

- Integration with e-commerce platforms for fast, low-cost grocery delivery.
- Expands delivery reach without investing in vehicles or staff.
- Adaptable for small-item delivery beyond groceries.
- Facilitates collective grocery orders for offices or communities.
- Partnership or integration opportunities for mobility service diversification.
- Supports sustainable logistics and circular economy initiatives in urban areas.

Creators

Prof Marcia Mkansi

Stage of Development

Prototype

Intellectual Property

Copyright

Desired Relationship

Co-development partner, Investors



The background of the slide is a photograph of a stone wall in the foreground, composed of many small, rounded, reddish-brown stones. Above the wall, there is a dense canopy of green trees with sunlight filtering through the leaves, creating a bokeh effect. A solid red rectangular box is overlaid on the left side of the image, containing the text.

Unisa Catalytic Niche Area

STUDENT SUPPORT AND CO-CURRICULAR ACTIVITIES

ScholatSyn™

Master's and Doctoral students' supervision enhancement and progress monitoring dashboard

“Smarter Supervision. Better Research.”

Technology

ScholatSyn™ is a digital tool for supervising research and tracking progress, designed to support postgraduate students and their supervisors during the research process. Built using Office 365 and SharePoint and integrated into Microsoft Teams, ScholatSyn™ provides a unified, secure, and easy-to-use platform for managing student research activities. It enables real-time communication between students and supervisors and includes strong reporting and analytics features for quality assurance at the departmental and college levels.

Market need

Postgraduate supervision in many academic institutions remains fragmented and inefficient, especially in institutions with high student numbers and limited digital oversight tools. Existing systems often fail to capture the full research process beyond registration and provide limited capabilities for interactive supervision or quality assurance. Manual tracking, low supervisor engagement due to academic workload, and lack of timely alerts have caused student dissatisfaction, poor engagement, and high attrition rates. ScholatSyn™ tackles these issues by offering a centralised and interactive supervision platform designed to meet academic needs.



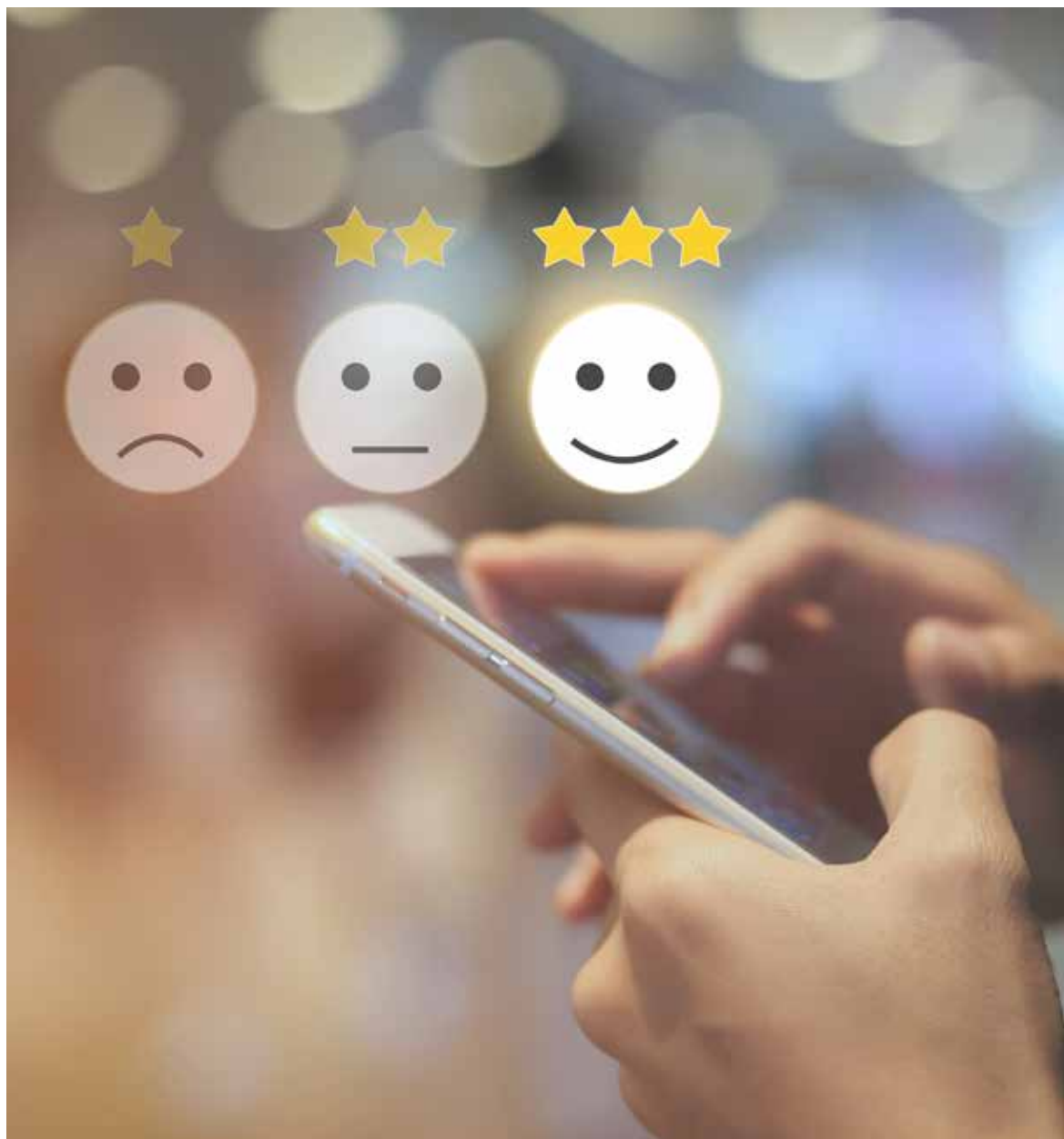
Features

- Facilitates dual interaction between supervisors and students, enabling both to upload documents, approve tasks, and log progress.
- Monitors user activity and sends inactivity alerts to departmental quality assurers to proactively spot supervision challenges.
- Generates reports and statistics by student, supervisor, department, or college, aiding in performance evaluation and oversight.
- Secure login using institutional credentials with role-based access to features and reports.
- Seamlessly integrates with existing Unisa student applications for real-time data retrieval on student profiles, registrations, and analytics.



Benefits

- Enhanced supervision efficiency.
- Improved research progress monitoring.
- Empowers quality assurers to detect supervision gaps.
- Enhanced Student Experience & Retention.
- Reduces administrative workload for supervisors and faculty coordinators.



Industry

Higher Education

Potential applications

- Postgraduate supervision management: streamlines tracking and evaluation of postgraduates.
- Academic quality assurance: provides real-time departmental and institutional oversight of supervision performance.
- Research administration: centralises supervision records, document uploads, approvals, and reporting.
- Institutional performance monitoring: generates analytics for management decision-making and accreditation reporting.
- Online and distance learning support: enhances engagement and communication for remote postgraduate supervision.
- Supervisor workload management: enables supervisors to monitor multiple students efficiently with alerts and task automation.

Creator

Prof Memme Girly Makua

Stage of development

Prototype

Intellectual property

Copyright Protection

Desired relationship

Co-development, Investors

Research Methods Index (RMI)

“Transforming Research Through Insight and Alignment.”

Technology

The Research Methods Index (RMI) is an intelligent matchmaking and assessment tool designed for the academic and research sectors. It predicts an individual's research paradigm and philosophical stance - key factors that influence how research is conceptualized, designed, and interpreted. By aligning researchers with compatible paradigms, RMI helps develop coherent and credible research methodologies. The tool is especially valuable for novice researchers, assisting them in understanding the philosophical foundations of research early in their academic careers. Institutions can also use RMI to match students with supervisors who share similar research perspectives, thereby enhancing mentorship quality, methodological rigor, and overall research excellence.

Market need

Many emerging researchers struggle to select appropriate research methodologies or to justify their methodological choices. This challenge often stems from a limited understanding of the conceptual, ontological, and epistemological foundations underlying research design. Without tools like RMI, researchers risk overlooking these critical paradigms, leading to bias, unexamined assumptions, and weakened scholarly rigor. The Research Methods Index addresses this gap by providing a structured approach to philosophical alignment and methodological decision-making, ultimately improving the depth, quality, and integrity of academic research.



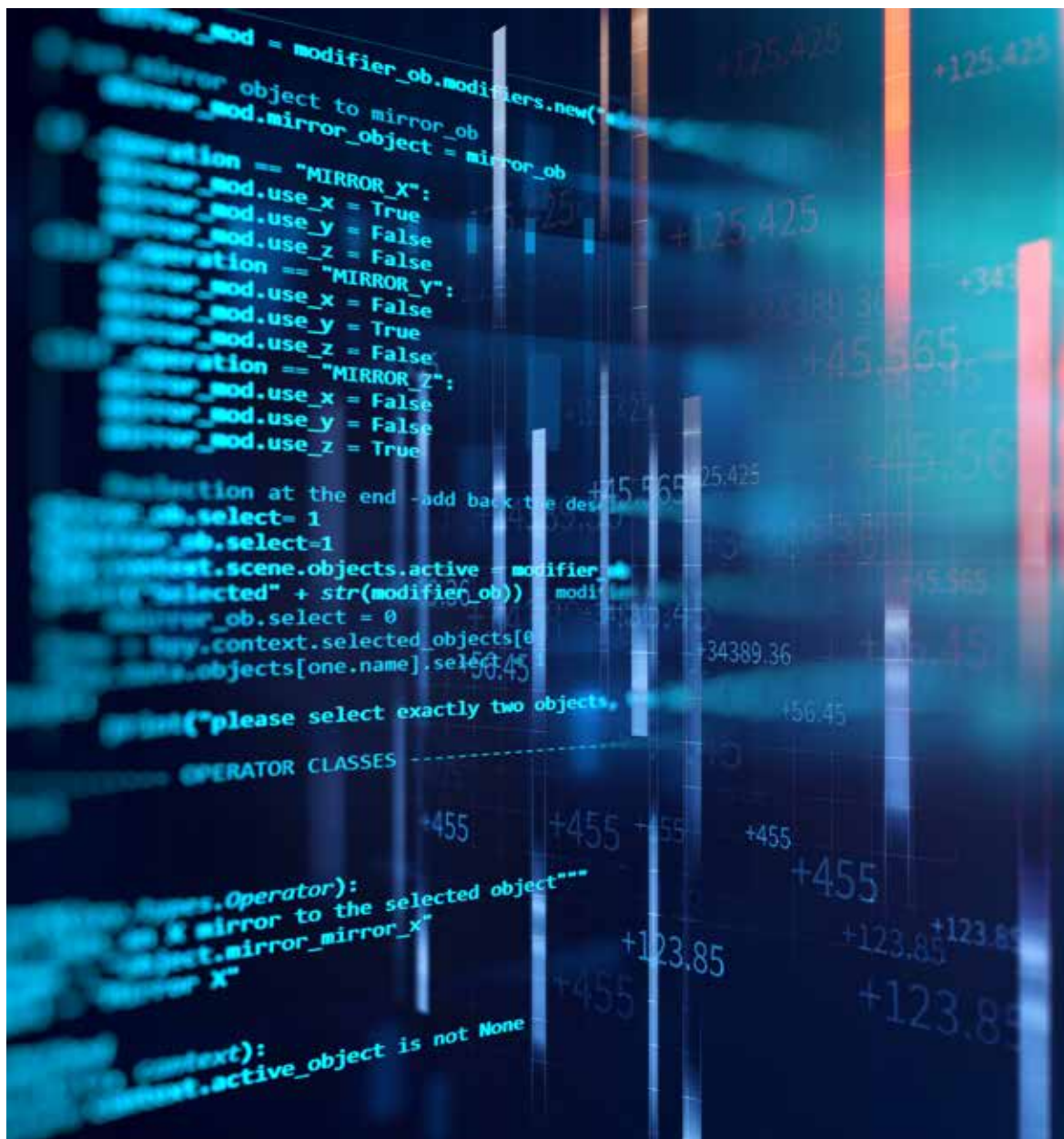
Features

- Uses an automated assessment process to identify an individual's underlying research philosophy and paradigm.
- Matches researchers' philosophical orientations with suitable research questions, methodologies, and supervisors.
- Employs predictive analytics to streamline the decision-making process in research design.
- Simple to use, easily accessible, and adaptable across multiple disciplines.
- Can be tailored for use in diverse academic fields and institutional contexts.



Benefits

- Promotes methodological consistency and strengthens the credibility of research outputs.
- Serves as a teaching aid for lecturers, guiding students through research design and methodology selection.
- Increases understanding of epistemological and ontological foundations, encouraging deeper scholarly reflection and debate.
- Provides a structured platform for continuous learning, collaboration, and innovation in research methodology.



Industry

ICT

Potential Applications

- Integration into postgraduate research training programmes and supervisor-student matching systems.
- Screening tool to evaluate methodological coherence in funding applications.
- Supports internal R&D teams in selecting coherent research frameworks and validating study designs.
- Enhances the rigor and credibility of policy research by aligning philosophical assumptions with analytical approaches.
- Used in capacity-building workshops to strengthen understanding of research paradigms and improve project design quality.

Creator

Prof Marcia Mkansi

Stage of Development

Prototype

Intellectual Property

Copyright Protection and Pending Trademark Application

Desired Relationship

Co-development partner, Investors



An underwater photograph of a coral reef. The foreground shows a rocky surface covered with various corals, including a prominent pink one on the left and a bright orange one in the center. Numerous small, colorful fish are swimming around the reef. The background is a deep blue water column with more fish visible. A semi-transparent blue rectangle is overlaid on the upper left portion of the image, containing the text.

Unisa Catalytic Niche Area

MARINE STUDIES

AquaHarvest™ System

A system for generating liquid water from air

“Water from Air, Anywhere.”

Technology

The AquaHarvest™ System is an innovative water generation technology that produces liquid water directly from air. It uses an air current generator and a specially designed flow body with a constricted section that cools incoming air to near its dew point. As the air exits the outlet, water naturally condenses, providing a continuous source of clean, drinkable water. Unlike conventional dehumidifiers, AquaHarvest™ achieves condensation efficiently using passive thermodynamic principles and can be adapted for off-grid or solar-powered applications, making it suitable for arid and remote environments.

Market need

Access to clean, drinkable water remains a vital global challenge, especially in dry and remote areas with limited infrastructure. Traditional water sources are becoming less reliable because of climate change, population growth, and pollution. While Atmospheric Water Generators (AWGs) present a potential solution by extracting moisture from the air, most current systems are energy-intensive, costly to operate, and depend on grid electricity. These issues limit their scalability and sustainability, particularly in off-grid or resource-limited settings. There is increasing demand for affordable, energy-efficient, and scalable water production systems that can supply fresh water in various environments, including rural communities, disaster relief zones, and agricultural areas.



Features

- Uses aerodynamic principles to efficiently cool air by compressing and expanding it through a specially designed Venturi system.
- Reduces dependency on grid electricity or significant mechanical components like compressors.
- Achieves dew point cooling more effectively, allowing higher water yield per unit of air processed.
- Adaptable for small-scale or large-scale water production, suitable for household, agricultural, or community-level use.
- Can be integrated with renewable energy sources (e.g., solar or wind) for truly off-grid applications.



Benefits

- Lower energy consumption leads to significant savings in water production cost per litre.
- Enables water generation in off-grid, rural, or disaster-stricken areas without relying on external water sources.
- Offers a sustainable alternative to water transportation or groundwater extraction, minimising environmental impact.
- Simplified system architecture reduces mechanical wear and tear, as well as the need for frequent servicing.



Industry

Water Purification

Potential Applications

- Drinking water generation in off-grid and rural communities
- Emergency and disaster relief water systems
- Military, mining, and industrial field operations
- Sustainable water supply for agriculture and eco-lodges

Creator

Prof Lukas Snyman

Stage of development

Prototype

Intellectual property

Patent Protection

Desired relationship

Co-development, Investors

AquaCarbon™

Multi-walled Carbon Nanotube Blended Polyvinylidene Fluoride Membranes for Membrane Distillation Desalination Technology

“Desalinate, conserve energy.”

Technology

AquaCarbon™ introduces a high-performance membrane technology designed for membrane distillation desalination. The innovation integrates multi-walled carbon nanotubes (MWCNTs) into polyvinylidene fluoride (PVDF) membranes to create a robust, highly hydrophobic, and porous structure capable of achieving up to 80% water recovery.

Unlike conventional pressure-driven desalination systems, AquaCarbon™ operates at low temperatures and low pressure, resulting in reduced energy consumption and lower operational costs. The unique nanocomposite design minimises membrane fouling and wetting, ensuring long-term operational stability and reducing maintenance and replacement costs.

This technology represents a major advancement in water treatment, offering an efficient and sustainable solution for the desalination of brackish and seawater, particularly in arid or off-grid regions.

Market need

AquaCarbon™ meets the growing demand for sustainable and cost-effective desalination driven by global water scarcity and rising energy costs. Traditional systems are often energy-intensive, prone to fouling, and costly to maintain, limiting their use in remote or resource-constrained areas. By integrating carbon nanotubes into PVDF membranes, AquaCarbon™ offers a low-energy, high-recovery solution with superior fouling resistance and long-term stability, making it ideal for municipal, industrial, agricultural, and off-grid water treatment applications.



Features

- Membrane with superhydrophobic and superoleophilic mechanisms.
- Membrane is developed using waste-expanded polystyrene.
- Membranes can be used multiple times before being replaced.



Benefits

- Operates at low temperature and pressure, reducing energy use
- Up to 80% water recovery with minimal fouling
- High hydrophobicity and porosity for enhanced performance
- Durable and cost-effective membrane with extended lifespan
- Scalable and compatible with existing desalination systems



Industry

Water

Potential Applications

- Desalination of seawater and brackish water
- Industrial wastewater treatment and reuse
- Off-grid and decentralised water purification systems
- Integration into renewable-powered desalination units

Creators

Edgar Mapunda

Prof Msagati

Prof Mamba

Stage of Development

Prototype

Intellectual Property

Patent Protection

Desired Relationship

Co-development, Investors



A photograph of a car body in a factory setting. The car body is light blue and is positioned on a conveyor belt. In the background, there are orange robotic arms and a yellow safety fence. The scene is brightly lit, and the car body is the central focus.

Unisa Catalytic Niche Area

AUTOMOTIVE STUDIES

Coolionix™

Nanofluids

“Cool Smarter. Save Energy.”

Technology

This invention presents a novel one-step, open-atmosphere laser ablation process for the mass production of nanofluids. The system enables direct synthesis of nanoparticles from solid targets, including metals, oxides, carbides, and nitrides, into various carrier liquids such as water, engine oil, transmission oil, or ethylene glycol. The process eliminates the need for vacuum systems and complex chemical routes, allowing continuous production of stable nanofluids with high thermal conductivity.

Market need

The global market increasingly demands advanced heat transfer solutions as conventional fluids like water and oils fail to meet the thermal needs of high-power, compact systems in automotive, electronic, and energy sectors. Current nanofluid production methods are expensive, complex, and unstable, which restricts large-scale adoption despite their superior heat conductivity. This invention tackles that challenge by enabling a one-step, open-atmosphere laser ablation process for mass-producing stable nanofluids with up to 200% enhanced thermal conductivity. The technology provides a clean, scalable, and cost-effective method for creating high-performance cooling fluids, satisfying the rising industrial demand for efficient, durable, and energy-saving thermal management materials across emerging sectors such as electric vehicles, power electronics, and renewable energy systems.



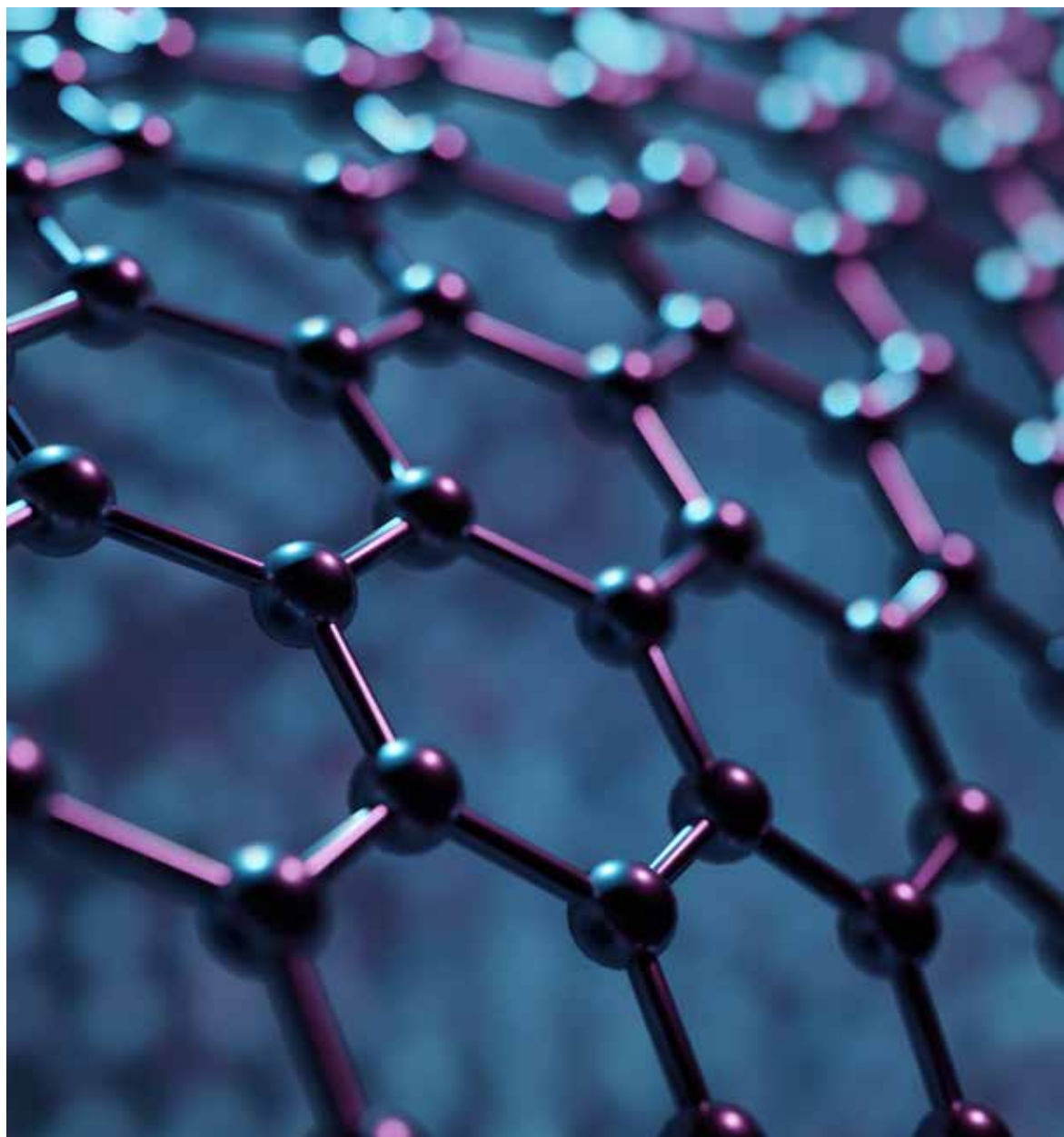
Features

- Produces nanoparticles directly in the host fluid without separate synthesis or dispersing agents.
- Removes the need for vacuum or inert gas environments, reducing system complexity and cost.
- Computer-controlled X–Z displacement and flow regulation ensure consistent ablation and laminar liquid film thickness.
- Applicable to a wide range of target metals (Cu, Al, PGMs), oxides (TiO_2 , Al_2O_3), nitrides (TiN), and carbides (WC, TiC).
- Achieves up to 200% improvement in thermal conductivity compared to pure base fluids.



Benefits

- Enables large-volume manufacturing suitable for commercial applications.
- Nanofluids produced enhance heat transfer in engines, transformers, and electronic cooling systems.
- Reduced maintenance and erosion.
- Integrates with standard laser systems across various power and wavelength ranges.



Industry

Chemical

Potential applications

- Advanced cooling systems for electric vehicles, hybrid engines, and automotive heat exchangers.
- Thermal management in high-power electronics, data centers, and semiconductor devices.
- Renewable energy systems, including concentrated solar power and wind turbine gearboxes, for improved heat transfer efficiency.
- Industrial heat exchangers and process cooling applications requiring enhanced energy efficiency.
- Lubrication enhancement in engines and machinery to improve performance and reduce wear.

Creators

Maalik Maaza

Khamliche Saleh

Stage of development

Lab-scale prototype

Intellectual property

Patent Protection

Desired relationship

Co-development, Investors



Nthabiseng Jane Ramanamane

Lecturer: College of Science, Engineering and Technology
School of Engineering, Department: Mechanical Engineering

Summary of my innovation activities

My innovation activities focus on developing low-cost, high-performance quartz-based filtration membranes designed for sustainable oil–water separation. Through systematic experimentation, surface engineering, and the integration of hydrophilic nanoparticle coatings, I have innovated a membrane system that enhances wettability, increases oil rejection efficiency, and significantly improves flux performance compared to conventional polymeric membranes. My work incorporates advanced characterisation techniques, optimisation methods such as the Taguchi statistical approach, and practical membrane-bed design tailored for off-grid, resource-limited environments. This innovation extends beyond laboratory research by emphasising affordability, environmental sustainability, and scalability for industrial and community applications.

Problem addressed by the innovation

This innovation addresses the persistent global challenge of treating oily wastewater, particularly in regions with limited access to advanced water purification technologies. Industrial sectors such as mining, petrochemicals, and manufacturing generate large volumes of contaminated water, yet existing membrane technologies are often costly, prone to fouling, and unsuited for harsh operating conditions. The quartz-based membrane system solves these limitations by offering a durable, low-cost alternative with improved hydrophilicity, reduced fouling potential, and enhanced separation performance. Ultimately, the innovation responds to the urgent need for accessible, sustainable water treatment solutions that protect the environment while supporting industrial growth and community well-being.

Prof Marcia Mkansi

Operations and Supply Chain Management, FCILT, MBCS, SAP Certified

A brief summary of your innovation activities

ACTs – Health tech

The ACTs application utilizes information and communication technologies to offer real time monitoring of stock levels, degree of stock consumption, overstock-understock alerts which enables stakeholders to capitalize on this management inventory logic to efficiently deploy medicines and quickly respond to sudden disease outbreaks. The application will be most useful to combat the unavailability and understock of malaria medications. This will enable hospitals to timely and effectively provide medicines to those vulnerable thus reducing the impact of malaria in Africa.

Dilivari – Crowd Logistics

Green Dilivari is an innovative solution aimed at reducing road carbon emissions, noise, and congestion while promoting a shared value green distribution model. The software utilises artificial intelligence and an elastic search engine to aggregate live traffic data and geographical coordinates, which are then shared with participating individuals and businesses. Unlike traditional crowdsourcing platforms, Green Dilivari leverages existing cars on the road for order pick-ups and drop-offs, aligning with participants' destinations.

Green – Carbon dioxide (CO₂) Tracker

Green carbon emission tracker is a society-base decarbonisation mobile application and web platform that balances environmental, social, and governance principles. The application exploits IOT technologies to track and monitor in real time carbon emissions footprint for individuals (and society at large) to encourage green transport choices.

Academic Rating Index

The Academic-Staff Rating Index (ARI) is a curated academic intelligence tool designed to better the transfer and adoption of knowledge practices within the academic supervision process. The supervision model functions to enhance the quality of academic supervision within and across institutions of higher learning.

Research Methods Index

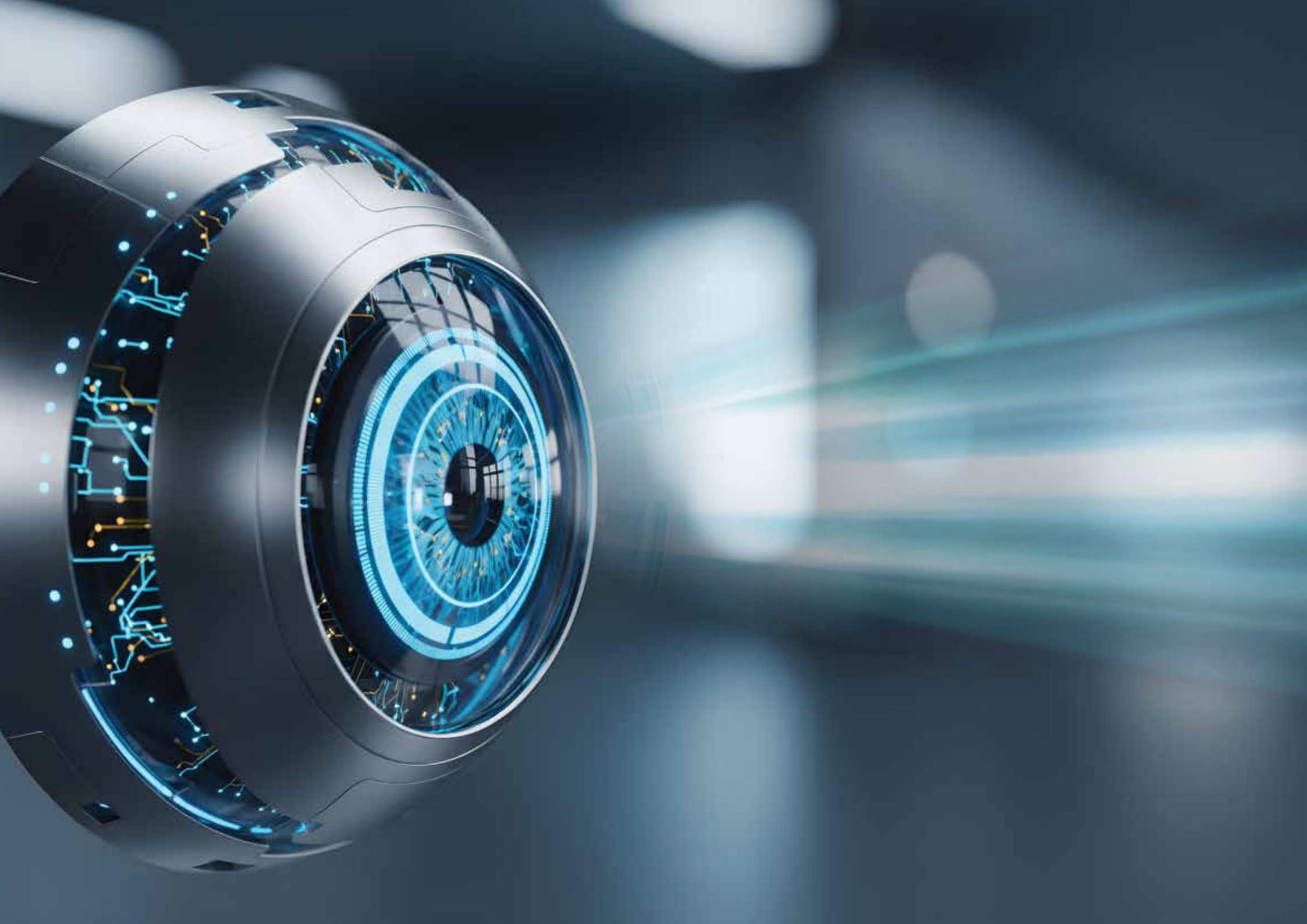
The Research Methods Index (RMI) is a complimentary artificial intelligence tool designed to enhance the teaching and learning of research philosophies and paradigms for students within the classroom and across research contexts.



Summary of Unisa support

My engagement with the UNISA Tech Transfer Office, the DITTC has been highly positive and enriched my expertise in technology development. Key areas of support include:

- Seed funding for multiple innovations
- Intellectual property (IP) awareness and guidance
- Training in human-centred design
- Benchmarking visits to international spinouts, including Switzerland
- International exposure and participation in Startup Day Switzerland
- Facilitation of licence agreements
- Support for pilot project implementation across various regions
- Student exposure to global best practices
- Increased visibility within the innovation ecosystem
- Recognition through innovation awards
- Participation in the Innovation Festival
- Legal and compliance support



CROSS-CUTTING, EMERGING, AND NON-CNA-ALIGNED TECHNOLOGIES

The following technologies represent UNISA's broader innovation ecosystem.

While they are not directly aligned to a current Catalytic Niche Area, they demonstrate interdisciplinary research excellence, applied innovation, and potential future alignment as the CNAs evolve.

ChitoMem™

Biodegradable Transparent Polymer ReRAM Device

“Memory that biodegrades.”

Technology

ChitoMem™ is an innovative biodegradable and transparent resistive random-access memory (ReRAM) device that delivers exceptional resistive switching behaviour (>7 orders of magnitude) while operating at low power. The technology is based on a chitosan-derived polymer composite integrated with aluminium-incorporated zinc oxide (Al–ZnO) nanoparticles, resulting in a film that is biodegradable, transparent, and cost-effective to produce.

Using a simple, scalable fabrication process, ChitoMem™ enables the production of environmentally sustainable ReRAM chips that align with global electronic waste reduction goals and the transition toward eco-friendly, next-generation electronics. This innovation bridges the gap between high-performance electronics and environmental responsibility.

Market need

ReRAM has overcome the challenges faced by DRAM and SRAM, of content loss, by using materials that change resistance in response to voltage. This means that the memory device has good scaling behaviour, which will not result in memory loss in the event of power cuts. However, despite their unique features, the use of these non-biodegradable (inorganic) materials leads to an increase in electronic waste, which is an environmental hazard. Therefore, there is a need to develop an environmentally friendly product with comparative efficiency to reduce electronic waste.



Features

- Chitosan aluminium zinc oxide single-layer biopolymer material
- High-performance parameter
- Two-terminal structure (reduces the amount of hardware required)



Benefits

- Biodegradable and transparent electronic memory device
- High resistive switching ratio ($>10^7$) with low operating power
- Scalable and affordable fabrication using green materials
- Reduces e-waste and supports sustainable electronics development
- Commercially viable for integration into emerging green tech markets



Industry

ICT

Potential Applications

- Next-generation biodegradable electronics and memory devices
- Flexible and transparent electronic systems
- Sustainable consumer electronics manufacturing
- Green IoT and wearable technology platforms

Creators

Ananthakri Srinivasan

Sreedevi Vallabhapurapu

Vijaya Vallabhapurapu

Stage of Development

Prototype

Intellectual Property

Patent Protection

Desired Relationship

Co-development investor

BioReRAM™

Non-volatile resistive random-access memory and a manufacturing method

“Memory made green.”

Technology

BioReRAM™ is a novel non-volatile Resistive Random-Access Memory (ReRAM) technology that utilises a bio-based switching/active layer made from milk or a milk-based emulsion. The resistive switching layer, located between two electrodes, contains lactose, fat, protein, and water - components naturally present in cow milk. This bio-based layer enables data storage by switching between high and low resistance states under applied voltage, functioning similarly to traditional ReRAM devices but with eco-friendly and cost-effective materials. The technology leverages the intrinsic electrical properties of milk constituents to facilitate resistive switching, offering a sustainable alternative to conventional ReRAM materials.

Market need

Conventional ReRAM devices rely on expensive, complex, or environmentally challenging materials for the switching layer, limiting scalability and sustainability. With increasing global demand for green electronics, flexible devices, and cost-effective memory solutions, there is a growing market need for non-volatile memory systems that are high-performance, sustainable, and affordable. BioReRAM™ addresses this need by providing a bio-based, low-cost alternative suitable for next-generation consumer electronics, IoT devices, wearable technology, and flexible electronics.



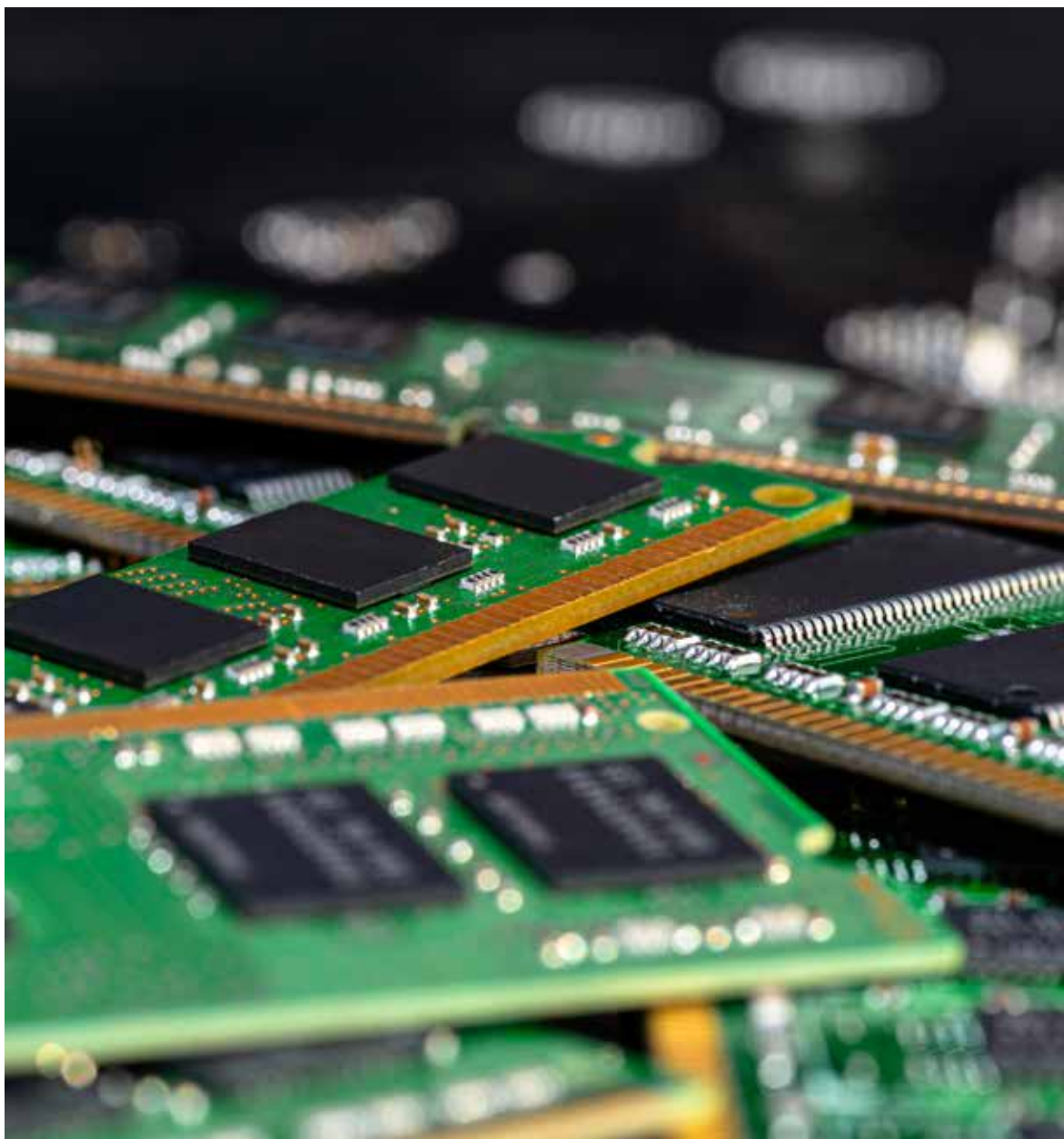
Features

- Uses bio-based materials (milk) as the resistive switching layer.
- Low-cost raw materials compared to traditional inorganic or synthetic ReRAM layers.
- Reduces reliance on rare or environmentally harmful materials.
- Versatile fabrication.



Benefits

- Minimises environmental impact by utilising milk-based biomaterials.
- Reduces material costs, making non-volatile memory more accessible for diverse applications.
- Retains resistive switching capabilities comparable to conventional ReRAM devices.
- Applicable in consumer electronics, IoT, flexible displays, wearable electronics, and other memory-intensive applications.



Industry

ICT

Potential applications

- Next-generation memory devices for consumer electronics, IoT systems, and wearable technology.
- Eco-friendly and flexible electronics requiring sustainable and biodegradable components.
- Data storage in low-power devices such as sensors, smart textiles, and medical wearables.
- Green semiconductor manufacturing reducing reliance on rare or toxic materials.
- Educational and research tools for exploring bio-based computing and sustainable electronics.

Creators

Mr Zolile Wiseman Dlamini

Prof Vijaya Srinivasu Vallabhapurapu

Dr Sreedevi Vallabhapurapu

Stage of development

Early stage

Intellectual property

Patent Protection

Desired relationship

Co-development, Investors

FemtoFab™

Automated Femtosecond Laser Fabrication of Nano-Structured Superconductors

“Precision Nanofabrication for Next-Generation Quantum Devices”

Technology

FemtoFab™ introduces an automated femtosecond laser-based process for the fabrication of micro- and nano-constriction structures on high-temperature superconducting (HTS) thin films such as $\text{YBa}_2\text{Cu}_3\text{O}_{7-x}$. The technique enables the precise and reproducible formation of superconducting nano- and micro-patterns used in quantum interference devices (SQUIDs) and other high-performance electronic systems.

This method represents a significant advancement in superconductor manufacturing, overcoming the cost, complexity, and scalability barriers associated with traditional lithographic techniques. By employing programmable, automated laser control, FemtoFab™ allows the rapid, low-cost, and high-fidelity fabrication of arrays of superconducting nano-structures suitable for research and commercial applications.

Market need

Today, reliable and stable thin-film Josephson circuits can be manufactured in large quantities. However, the production process of good-quality SQUIDs is not that simple. The main challenge lies in the technically demanding fabrication process of reliable high-temperature superconductors. Most well-established fabrication technologies fail, particularly at the nanoscale. Even extremely sensitive SQUIDs present challenges when it comes to manufacturing.



Features

- Automated manufacturing process of high-temperature superconductors
- Produces perfect interfaces and uniform barriers, which ensures good reproducibility
- Improved signal-to-noise ratio and increased strength and performance of the SQUID



Benefits

- Automated femtosecond laser system for precision nanofabrication
- High reproducibility and scalability for industrial use
- Reduced cost and complexity compared to conventional lithography
- Compatible with multiple superconducting materials
- Enables customisable, programmable pattern design for nano-arrays



Industry

Manufacturing

Possible Applications

- Quantum sensors and SQUID devices
- High-temperature superconductor (HTS) fabrication
- Advanced electronic and photonic device manufacturing
- Research in quantum materials and cryogenic systems

Creators

Vijaya VS Vallabhapurapu

Patrice Umeme

Stage of Development

Prototype

Intellectual Property

Patent Protection

Desired Relationship

Co-development; investor

MagNanoClean™

Nanoscience-Based Fluid Treatment System

“Smart Magnetic Nanotechnology for Efficient Fluid Purification.”

Technology

MagNanoClean™ is an innovative method and apparatus for fluid treatment that leverages charged nanoparticles and a moving magnetic system to remove impurities efficiently and sustainably. In this process, contaminants are trapped by the charged nanoparticles suspended in a reactor. When activated, the magnetic field excites and mobilises only the nanoparticles, which in turn capture and isolate impurities from the fluid.

Unlike traditional filtration systems, MagNanoClean™ operates without moving mechanical parts, significantly reducing energy consumption and maintenance costs. The system's design allows for customisation to specific contaminants or fluid types, offering a flexible, energy-efficient, and low-maintenance solution for water, industrial, or chemical fluid purification.

Market need

The challenge of removing particles after purification inspired the concept of using nanoparticles with a magnetic core. Magnetic nanoparticles have been explored for some time, and various removal techniques have been developed and studied to enhance efficiency. However, existing systems often rely on mechanical excitation methods involving nanoparticles, which results in wear and tear of moving components. This project aims to develop a next-generation prototype that employs a moving electromagnet to manipulate charged nanoparticles within a fluid. Laboratory tests have demonstrated the system's effectiveness in removing specific impurities from water, highlighting the need to scale it up for broader application.



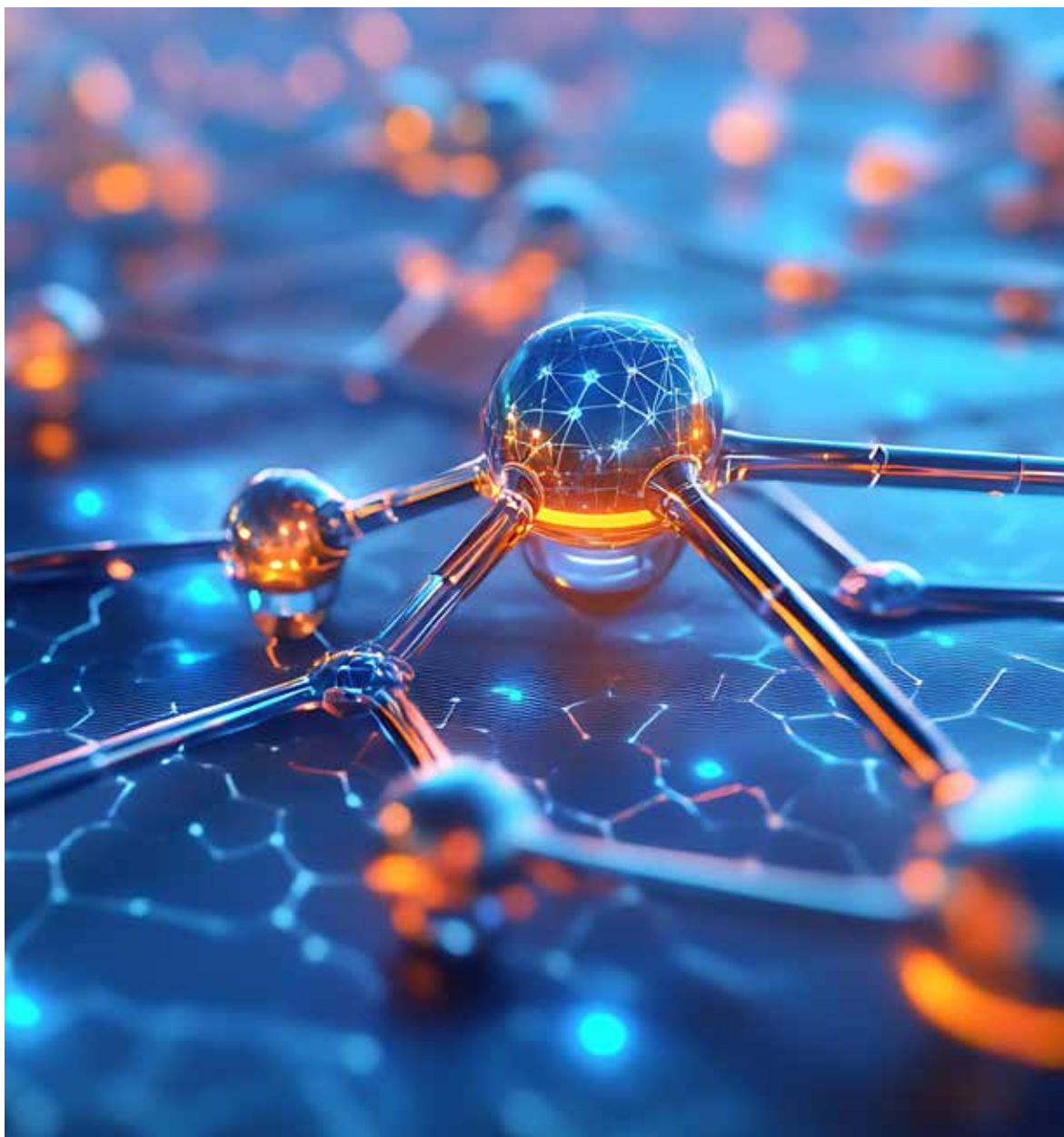
Features

- Nanoparticle-based treatment process designed for efficient purification, separation, or enhancement of fluid properties.
- Magnetically responsive or functionalized nanoparticles enable selective targeting and removal of contaminants.
- Integrated regeneration mechanism allowing repeated reuse of nanoparticles, reducing operational costs and waste.
- Scalable and adaptable system design suitable for industrial, environmental, and laboratory fluid treatment applications.
- Low energy consumption compared to conventional mechanical or chemical treatment methods.
- Environmentally friendly process, minimizing secondary pollution and chemical additive use.



Benefits

- No moving parts, resulting in low maintenance and longer operational life
- Magnetic nanoparticle activation for targeted impurity removal
- Reduced energy requirements through selective excitation of particles
- Highly adaptable system for different fluids and contaminants
- Scalable, compact, and environmentally friendly design



Industry

Water

Possible Applications

- Industrial wastewater and chemical effluent treatment
- Purification of drinking and process water
- Oil and gas fluid separation systems
- Pharmaceutical and bioprocessing applications

Creator

Vijaya VS Vallabhapurapu

Stage of Development

Prototype

Intellectual Property

Patent Protection

Desired Relationship

Co-development investor

SpillGuard™

Recovery of crude oil from crude oil adsorbent

“Recover. Reuse. Restore.”

Technology

The technology is a membrane-based system developed from waste expanded polystyrene (EPS) using electrospinning to create a nanofibrous material with superhydrophobic (water-repelling) and superoleophilic (oil-attracting) properties. It enables crude oil adsorption, recovery, and membrane regeneration, allowing spilled oil to be efficiently removed from water and recovered for reuse while the membrane is regenerated for multiple cycles. This approach offers a sustainable solution that tackles both oil spill pollution and plastic waste through circular material use.

Market need

There is a strong market need for eco-friendly, cost-effective technologies that address marine oil spills and industrial water contamination without causing further environmental harm. Existing methods are often inefficient, non-reusable, or rely on harmful chemicals. This invention meets growing demand from the oil and gas, environmental cleanup, and wastewater treatment sectors for green, reusable, and high-performance oil recovery solutions that align with sustainability and regulatory goals.



Features

- Superhydrophobic and super oleophilic surface enabling selective oil adsorption.
- Simultaneous oil recovery and membrane regeneration capability.
- Reusable and durable.
- Lightweight, flexible, and easy to deploy in marine and industrial environments.
- Environmentally friendly, chemical-free process.



Benefits

- Effective oil spill remediation, reducing environmental and ecological damage.
- Recoverable oil can be reused or refined.
- Reduces plastic waste, supporting circular economy principles.
- Lower operational costs due to membrane reusability.
- Minimises water pollution, improving environmental compliance for industries.



Industry

Water

Potential applications

- Marine oil spill cleanup with efficient oil adsorption and recovery.
- Industrial wastewater treatment to remove oil contaminants from process water.
- Oil recovery and recycling in refineries and petrochemical facilities.
- Sustainable environmental remediation by using recyclable membranes and minimizing chemical usage.
- Plastic waste valorisation through the conversion of waste EPS into functional nanofibrous membranes.

Creators

Prof Titus Msagati
Samson Alayande
Enock Dare
Kehinde Akinlabi

Stage of development

Early stage

Intellectual property

Patent Protection

Desired relationship

Co-development, Investors

BrewCycle™

Waste beer recovery

“No Drop Wasted.”

Technology

During beer production, around 2–4% excess yeast is generated and removed, causing significant beer loss of up to 400 mL for every litre of yeast discarded. Since beer production is highly water-intensive (about 3.5 L of water per litre of beer), this loss also represents substantial wasted water and resources. With growing concerns about water scarcity, breweries face increasing pressure to reduce waste and improve resource efficiency. The invention introduces UV sterilisation as a solution to recover and reuse beer lost during yeast removal. UV treatment permanently inactivates microorganisms without affecting the beer’s taste, colour, or texture, allowing the recovered beer to be safely reintroduced into production. This environmentally friendly, low-maintenance method supports sustainability goals, reduces costs, and minimises water waste in the brewing process.

Market need

The brewing industry faces growing pressure to improve water efficiency and reduce product losses due to rising water scarcity, stricter environmental regulations, and increasing production costs. A significant volume of beer and water is wasted during the yeast removal process, resulting in both economic and environmental inefficiencies. Breweries need a practical, low-cost solution that enables recovery and reuse of beer without compromising its quality or safety. Technologies that promote water and resource conservation while maintaining product integrity have strong commercial potential in both large-scale and craft breweries.



Features

- UV Sterilisation System designed to disinfect and recover beer lost during yeast removal.
- Uses ultraviolet light to inactivate microorganisms by damaging their DNA.
- Preserves beer quality, ensuring no change in taste, colour, or texture.
- Environmentally friendly and low maintenance compared to other methods.
- Easily integrated into existing brewery processes for continuous or batch operation.



Benefits

- Reduces beer and water waste, directly lowering production costs.
- Conserves water and minimises wastewater discharge.
- Eliminates chemical disinfectants.
- Supports regulatory compliance and improves brand reputation through responsible waste management.
- Increases profitability by recovering beer that would otherwise be lost.



Industry

Manufacturing

Potential applications

- Beer recovery and reuse during yeast removal in large-scale and craft breweries.
- Water conservation by reducing water loss associated with discarded beer.
- Sustainability initiatives for breweries aiming to meet environmental regulations and reduce operational costs.
- Quality-preserving process integration ensuring recovered beer maintains taste, color, and texture.
- Resource-efficient production supporting circular economy practices within the brewing industry.

Creator

Dr JBJ Dewar

Stage of development

Prototype

Intellectual property

Patent Protection

Desired relationship

Co-development, Investors

Sprinkler Guard

Adjustable and Modular Protection System for Sprinklers

“Protect. Adjust. Perfect.”

Technology

The Sprinkler Guard is an innovative irrigation sprinkler riser technology designed to overcome the limitations of conventional above-ground sprinklers, which are often prone to mechanical damage, disorientation, and poor aesthetics. Traditional rigid riser pipes not only shorten the lifespan of irrigation systems but also compromise optimal water distribution and disrupt landscape design. This technology introduces a protective and flexible fixture that joins the lateral water supply pipe to the sprinkler head, incorporating a tubular body with an adjustable knob that allows for angle, directional, and height adjustments. The riser can collapse when not in use, protecting the sprinkler from damage while maintaining a neat, uniform appearance that complements landscape aesthetics. By combining durability, adaptability, and design appeal, the Sprinkler Guard provides a cost-effective, efficient, and visually pleasing solution for irrigation systems.

Market need

Traditional sprinkler systems are often limited by fixed angles, rigid installation, and vulnerability to external damage. Landscaping, agriculture, and turf management industries require more adaptable, durable, and cost-efficient solutions that can adjust to varied terrain, be easily retrofitted, and provide precision watering. This technology offers a solution that protects sprinklers from avoidable damage, thereby enhancing the efficiency and lifespan of irrigation systems while creating visually appealing landscapes.



Features

- Angular adjustment (tilting base for uneven terrain).
- Retrofit riser integration (easy installation into existing systems).
- 360° spherical nozzle adjustment (precise water direction).
- Leak-proof sealing and weather-resistant materials (enhanced durability).
- Flexible external conduit system (simplified water routing).
- Telescopic or incremental height adjustment (adaptable spray coverage)



Benefits

- Reduced water wastage through precision targeting.
- Cost-effective retrofitting without major redesigns.
- Greater flexibility for diverse environments (lawns, golf courses, farms).
- Extended product life through modular design and durable materials.
- Licensing opportunities across different user segments.
- Competitive advantage via a multi-patent portfolio.



Industry

Water

Potential application

- Residential landscaping: protects home garden and lawn sprinklers while allowing precise watering and aesthetic integration.
- Golf courses and sports fields: ensure uniform irrigation coverage and prevent damage from maintenance equipment or foot traffic.
- Agriculture and horticulture: durable, adjustable sprinklers for uneven terrain and variable crop layouts.
- Public parks and urban green spaces: protect sprinklers from vandalism and environmental wear while maintaining efficient irrigation.
- Irrigation system retrofitting: easily integrates into existing sprinkler networks to improve longevity and performance.
- Commercial landscaping services: cost-effective solution for maintaining large-scale, adaptable watering systems.

Creator

Prof Hennie Stoffberg

Stage of development

Prototype

Intellectual property

Patent Protection

Desired relationship

Co-development, Investors

Floatation Device

“Stay Safe Above the Flood.”

Technology

The flotation device is an engineered support system designed to protect mobile structures from flood-related damage. Mobile structures such as temporary housing units, construction site offices, or warehouse equipment are highly vulnerable in flood-prone areas. This technology addresses that vulnerability by providing a base platform that both stabilises and elevates structures during flood events. The device consists of interlocking modular units made from durable, high-strength plastic materials. These units are assembled to form a solid base, which can be anchored securely into the ground using support poles. Under normal conditions, the device functions as a stable foundation. However, in the event of rising water levels, the flotation base lifts, causing the supported structure to rise above the floodwaters. The anchoring system ensures that the elevated structure remains balanced, stable, and in place.

Market need

Climate change and rapid urbanisation have led to more frequent and severe floods worldwide. Many communities, especially in developing areas, depend on mobile or semi-permanent housing and facilities. Flooding can damage these structures, force families to evacuate, disrupt supply chains, and result in significant economic losses. There is an urgent need for affordable, effective, and scalable flood protection methods that can protect both people and property.



Features

- Interlocking modular design for easy assembly and scalability.
- Robust plastic construction, resistant to corrosion, wear, and water damage.
- Ground anchoring system to ensure stability during elevation.
- Automatic buoyancy response, lifting structures without manual intervention.
- Customisable size and load capacity to support different types of structures and equipment



Benefits

- Reduces damage and loss caused by flooding.
- Enhances security for residents and workers in flood-prone environments.
- Provides an alternative to costly permanent flood defenses.
- Can be adapted for small-scale residential or large-scale industrial use.
- Extends the lifespan of mobile structures and reduces the need for post-flood reconstruction or replacement.
- Ideal for emergency relief operations where time-sensitive solutions are required.



Industry

Manufacturing

Potential applications

- Elevates homes, shelters, and disaster-relief units during floods.
- Safeguards mobile structures and machinery from flood damage.
- Protects inventory and critical equipment in flood-prone areas.
- Provides rapidly deployable flood protection for vulnerable communities.
- Supports schools, clinics, or other semi-permanent buildings in flood-risk regions.
- Enables safe, elevated structures in areas prone to rising water levels.

Creator

Patricia PM Gouws

Stage of development

Lab-scale prototype

Intellectual property

Patent Protection

Desired relationship

Co-development, Investors

CloudHarvest™

Cloud Seeding/Magnesium Carbonate Ice Nucleating Agent

“Seeding the Future with Rain.”

Technology

CloudHarvest™ is an innovative solution that tackles the rising frequency of droughts and water shortages caused by climate change. It offers a sustainable way to influence weather patterns and water availability in vulnerable regions. During severe droughts, cloud seeding has been proven as an effective method to fight water scarcity by artificially inducing rainfall, especially in arid areas or coastal regions with limited natural precipitation.

The process begins with a solution containing magnesium ions that absorb CO₂, followed by the introduction of magnesium carbonate (MgCO₃) particles into the atmosphere, which may serve as ice nucleating agents to enhance precipitation and rainfall.

Market need

The rising frequency and severity of droughts caused by climate change have increased global demand for sustainable water generation technologies. Traditional cloud-seeding materials like silver iodide pose environmental concerns due to their toxicity, which impacts soil and water systems. Consequently, traditional cloud seeding fails to meet sustainability standards. The CloudHarvest™ technology using MgCO₃ is environmentally friendly and non-toxic to animals, making it a better alternative to conventional cloud seeding materials.



Features

- Uses bi-engineered or naturally sourced MgCO₃ nanoparticles as the nucleating agent.
- Likely effective across various atmospheric conditions, not limited to specific cloud types.
- Potential uses in artificial rain, snow creation, and ice recovery systems.



Benefits

- The CloudHarvest™ offers an environmentally friendly, non-toxic materials solution, coupled with the potential to enhance precipitation.
- Demonstrates strong ice nucleation performance with reproducibility.
- Can be mass-produced using bioengineering or mineral-based synthesis methods
- Offers a lower-cost alternative to AgI and dry ice.
- Supports global climate adaptation strategies particularly in drought-affected, coastal, or agriculturally stressed regions.



Industry

Water

Potential applications

- Drought mitigation: inducing rainfall in arid and drought-prone regions to replenish water resources.
- Agricultural support: enhancing precipitation to sustain crops and reduce irrigation dependency.
- Water resource management: improving reservoir levels and groundwater recharge in water-scarce areas.
- Climate adaptation programs: supporting regional and national initiatives aimed at combating the effects of climate change.
- Snow and ice generation: creating artificial snow for water storage, ski resorts, or glacial restoration projects.
- Environmental protection: replacing toxic cloud-seeding agents with an eco-friendly, non-toxic alternative.

Creators

Prof Malek Maaza

Prof Khosroshahi Shafiei Shiva

Dr Meisam Aligholami

Dr Razieh Morad

Dr Mahmood Akbari

Stage of development

Early stage

Intellectual property

Patent Protection

Desired relationship

Co-development, Investors

PureLite Reactor™

LED-based batch photoreactor for advanced oxidation processes

“Light-Powered Precision.”

Technology

The PureLite Reactor™ provides a highly efficient and customisable platform for various applications. Its energy-efficient LED light sources, advanced control systems, and versatile design give researchers precise control over photochemical reactions, making it a vital tool in environmental science, water treatment, photocatalysis, and chemical synthesis. The reactor's advanced features, such as flow-through systems, automation, and real-time monitoring, improve both the accuracy and efficiency of experiments, enabling a deeper understanding of complex chemical processes and supporting the development of sustainable technologies.

Market need

There is a growing global demand for cleaner, more efficient, and precise methods to address environmental pollution, especially in water and wastewater treatment. Traditional photochemical reactors often depend on mercury lamps, which are energy-consuming, environmentally hazardous, and provide limited control over reaction parameters. Researchers and industry professionals increasingly seek scalable, sustainable, and high-precision systems to investigate advanced oxidation processes (AOPs), photocatalysis, and synthetic chemistry for environmental remediation and material development.



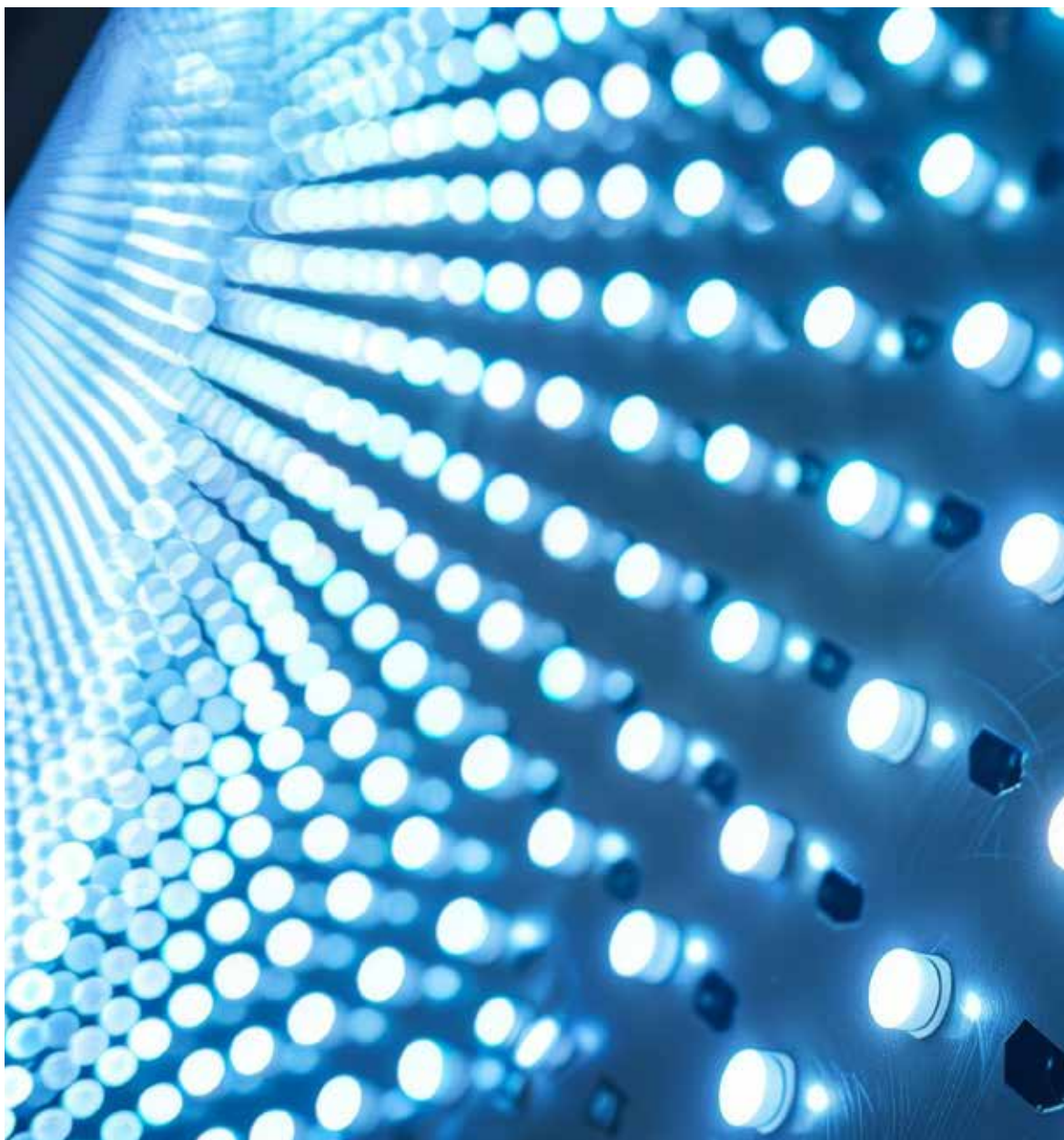
Features

- LED Light Sources (UV, Vis, IR)
- Reactor Design
- Control System



Benefits

- Precise control over reaction conditions ensures more reliable and repeatable experimental results.
- LED lighting significantly reduces operational costs and carbon footprint.
- Suitable for photocatalysis, AOPs, environmental science, synthetic chemistry, and materials research.
- Easily integrated into academic labs, industrial pilot setups, or portable testing kits for fieldwork.



Industry

Manufacturing

Potential applications

- Water and wastewater treatment: degradation of pollutants and testing of advanced oxidation processes.
- Environmental remediation: photocatalytic removal of hazardous air, soil, and water contaminants.
- Photocatalysis research: evaluation and optimization of new photocatalytic materials.
- Chemical synthesis: controlled photochemical reactions for organic and material synthesis.
- Green chemistry and renewable energy: research toward sustainable, low-energy chemical processes.

Creator

Prof Alex Kuvarega

Stage of development

Early stage

Intellectual property

Patent Protection

Desired relationship

Co-development partner, Investors

DarkLight™ Catalyst

Process for producing bio-engineered black TiO₂ photocatalyst

“The Catalyst That Works Beyond Light”

Technology

The DarkLight™ Catalyst is an advanced, bio-synthesised titanium dioxide (TiO₂) photocatalyst that functions efficiently without the need for visible or ultraviolet light. Developed through a green synthesis process using natural extracts from *Hibiscus sabdariffa*, the material features an oxygen-deficient “black” TiO₂ structure capable of photocatalytic activity under near-infrared and even dark conditions.

This breakthrough enables pollutant degradation and environmental purification in enclosed or low-light environments, eliminating the dependence on artificial light sources. By fine-tuning the material’s electronic bandgap, the process enhances its performance across the visible and infrared spectra, significantly expanding the operational range of photocatalysis.

The DarkLight™ Catalyst represents a sustainable and energy-independent innovation for next-generation water treatment, air purification, and self-cleaning applications, combining green chemistry, high efficiency, and environmental adaptability.

Market need

Current photocatalytic materials face several limitations, including their reliance on UV light for activation, low quantum efficiency due to rapid charge carrier recombination, and the use of energy-intensive, chemically hazardous synthesis methods. Additionally, their effectiveness is often restricted in dark or indoor environments, limiting their use in applications such as wastewater treatment in low-light conditions, indoor air purification systems, off-grid or energy-scarce areas, and affordable water decontamination in developing regions. In response to increasing global demands for sustainable environmental remediation, green chemistry, and energy-efficient technologies, the development of dark-active, bio-engineered TiO₂ offers a crucial solution that provides a light-independent, eco-friendly, and scalable approach to pollutant degradation across diverse settings.



Features

- Light-Independent Photocatalytic Activity
- Bio-Synthesised Oxygen-Deficient TiO₂, derived from natural *Hibiscus sabdariffa* extracts for eco-friendly, sustainable synthesis.
- Enhanced Bandgap Engineering
- Green, Scalable Manufacturing Process
- Versatile Application Potential



Benefits

- Operates without visible or UV light, enabling purification in dark or enclosed environments.
- Eco-friendly and sustainable synthesis using renewable plant-based extracts.
- High efficiency and energy independence reduce operational costs and carbon footprint.
- Broad-spectrum photocatalysis extends performance beyond traditional TiO₂ materials.
- Scalable, low-cost manufacturing for diverse environmental and industrial markets.



Industry

Manufacturing

Potential Applications

- Water Treatment: Photocatalytic degradation of organic pollutants and dyes in low-light settings.
- Air Purification: Continuous pollutant removal in indoor or low-illumination environments.
- Self-Cleaning Surfaces: Energy-independent coatings for glass, textiles, and construction materials.
- Industrial Waste Remediation: Treatment of chemical effluents and contaminated sites.
- Healthcare and Sanitation: Antimicrobial coatings for sterile and enclosed facilities.

Creators

Prof Malek Maaza

Adama Fall

Stage of development

Early stage

Intellectual Property

Patent protection

Desired relationship

Co-development, Investors

Meet the DITTC team



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Director: Innovation, Technology
Transfer and Commercialisation

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- Commercialisation



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Notes

Notes

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