DST AMRITA

TECHNOLOGY ENABLING CENTRE

विज्ञान एवं प्रौद्योगिकी मंत्रालय
MINISTRY OF SCIENCE AND TECHNOLOGY
सत्यमेव जयते

DST-AMRITA TECHNOLOGY ENABLING CENTRE

HALF YEARLY REPORT

January - June 2024

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Kerala 690546

“Today, universities are ranked mainly based on funding, the number of papers they publish and their intellectual caliber, but we should also consider how much their research can serve the lowest and most vulnerable strata of society. Only by strengthening the base of the society does the entire edifice grow healthy and strong”

- Sri Mata Amritanandamayi Devi, Chancellor,
Amrita Vishwa Vidyapeetham at United Nations Academic Impact.

Amrita - Technology Enabling Centre

The Technology Enabling Centre (TEC) at Amrita Vishwa Vidyapeetham, supported by the Department of Science and Technology, Govt. of India, fosters an innovation ecosystem by connecting researchers, institutes, labs, and industry. TEC ensures market-ready technologies through collaboration and technology transfer. With a focus on bridging research and industry, TEC aligns interests to create sustainable partnerships.

Our Mission & Vision

Mission

To create an ecosystem that contributes to empowering the scientific and business community and enhancing the innovation potential of both - the state and the country as a whole.

Vision

To emerge as the academic hub for innovation by providing synergy and support to other academic institutions and MSMEs.

Our Objectives

- Enabling innovators through its network of partners. & Augment innovators with an ecosystem of resources.
- Awareness creation for solutions based on needs assessment.
- Creating platforms for exhibition and showcasing of technology products and services.
- Advisory/facilitating role towards technology commercialization and transfer.

Our Services

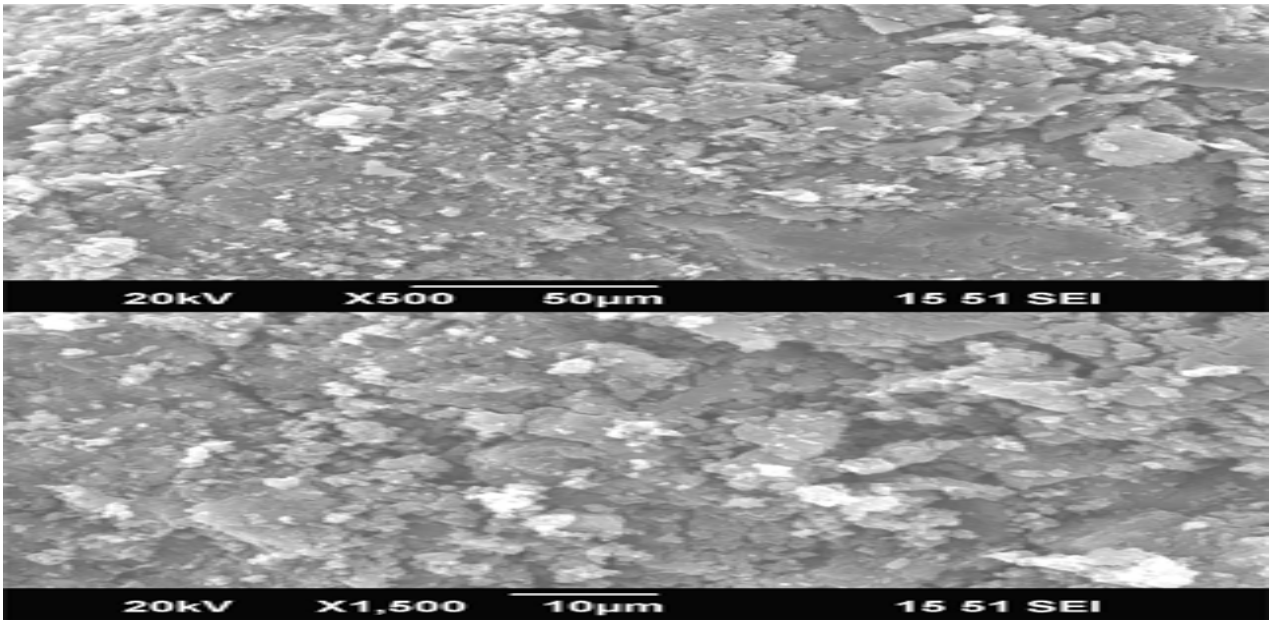
The Technology Enabling Centre (TEC) at Amrita Vishwa Vidyapeetham provides a comprehensive range of services tailored to meet the needs of MSMEs, industries, and academia. For MSMEs, TEC offers technology consultancy, assessment of technology

readiness,emerging technology training, and workshops,technology transfer, funding and IP facilitation. Industries benefit from technology transfer, customized product and solution development, connections to national and scientific laboratories, technology licensing, and problem-solving, Academia receives support in technology commercialization, pilot deployment, industry connections, consultancy, development assistance, and IP facilitation, ensuring a holistic approach to bridging the gap between research and market needs.

Technologies Developed

1.Effective EMI shielding materials.

An economical and effortless method for the production of flexible shielding material for feasible application has gained remarkable attention since the massive spread of technologies has notably marked up the electromagnetic pollution, which will cause interference or malfunctioning of electronic devices.Traditionally Electromagnetic Interference (EMI) shielding is achieved by using a metal screen to absorb it. But metals have low impact resistance, high density and are susceptible to corrosion, polymer nanocomposites with magnetic nanofillers become a radical alternative to this. Rubber based nanocomposites have considerable importance since they bear excellent multifunctional applications. The conductive fillers incorporated in the polymer matrix give out the advance functions like light weight, corrosion resistance and tailored coefficient of thermal expansion and ease of processing. In the class of magnetic materials that possess broad applications in technology, Polyaniline (PAni) gain much attention and cannot be replaced by any other magnetic material because they are less expensive, stable and widely used in high-frequency applications. Ferrites, belonging to ferromagnetic material which cannot be easily replaced by any other material as they are economic for a wide range of applications and ease of fabrication into complex shapes. Thus the use of hybrid fillers based on various combinations will be a possible solution for improved shielding effectiveness as well as the mechanical properties of nanocomposites.

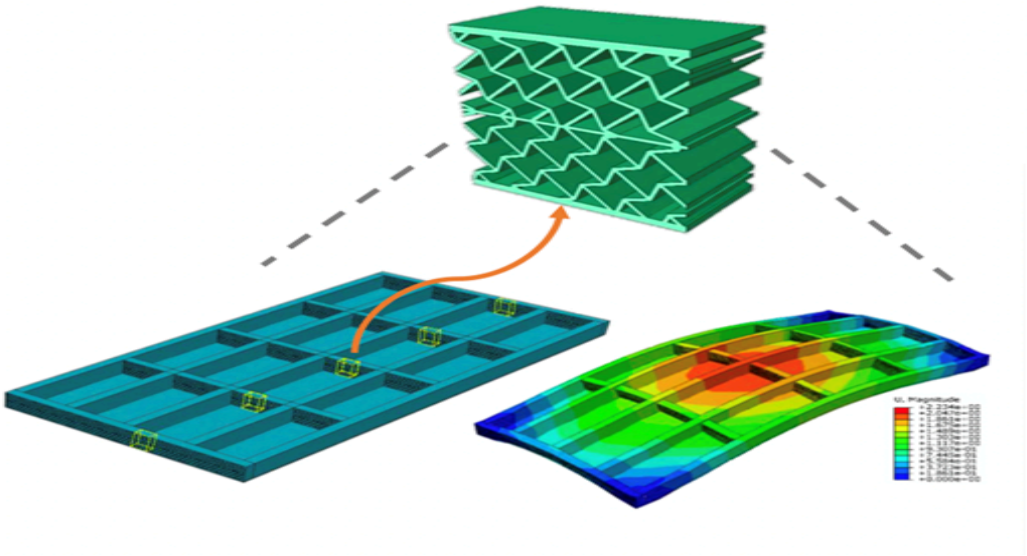


SEM micrographs of polyaniline at two different dimensions.

Polymeric magnetic nanocomposites play a vital role as scientist and engineers find possible exploitation of several industrial applications. Rubber nanocomposites prepared successfully with excellent shielding effectiveness and dielectric property. The shielding effectiveness is measured in X band region and found gradually increases with increase in filler loading. A gradual increase in EMI shielding effectiveness with hybrid PAni/Ferrite composite is observed. The effective shielding property is due to dispersibility of filler, filler loading levels, size of filler etc. Effective shielding is due to both magnetic and dielectric losses shown by Ferrites/PAni combinations and can be a desirable choice for EMI shielding applications. The addition of ferrites gives a synergistic effect to the shielding effectiveness of PAni based nanocomposites.

2.Advanced Auxetic Structures

Auxetic structures, a fascinating subset of mechanical metamaterials, have been garnering significant attention due to their unique geometries and remarkable mechanical properties. Characterized by their negative Poisson's ratio, these structures exhibit unconventional attributes such as negative thermal expansion, enhanced energy harvesting capabilities, and superior load-bearing capacities.



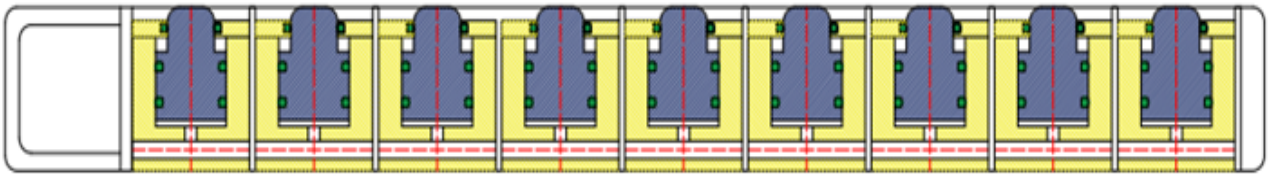
We have achieved groundbreaking advancements in this field. Recently, we developed high-strength engineering load-bearing auxetic members with an outstanding load-to-weight ratio, achieved through the strategic organization of auxetic clusters within a confined structural frame, demonstrating a 65% reduction in material usage compared to conventional beams while maintaining remarkable load-bearing capacities. These properties open up a plethora of applications, from shape-morphing skins and programmable auxetics used in aerospace and automotive industries, to acoustic and optical wave guidance and cloaking in advanced communication systems and stealth technologies, impact attenuation in protective gear, and crash protection systems in automotive and aerospace sectors.

Auxetic textiles offer improved flexibility, durability, and comfort, ideal for sportswear and high-performance clothing. In the biomedical field, auxetic structures are used to create advanced nano-scale devices and systems, significantly enhancing the bio-mechanical properties of bone implants, ensuring sustainable implantation with easier post-operative recovery. These advancements represent a significant milestone in material science and engineering, paving the way for innovative applications and sustainable solutions. The continuous exploration and development of auxetic structures hold promise for even broader applications, with future research likely focusing on optimising these materials for specific industrial applications, enhancing their properties

further, and integrating them into commercial products, highlighting the immense potential for innovation in this field enabled by the Amrita Technology Enabling Centre.

3.Vibrating Frequency Granite Breaker

The present invention is a vibrating frequency granite breaker powered by hydraulic energy and a variable frequency generator. It provides a massive splitting force of up to 600 tons with minimal noise, dust, and vibration. The breaker allows for adjustable splitting direction, making it ideal for confined spaces. Its user-friendly design, ease of transportation, and versatility for various environments make it an excellent tool for controlled demolition applications.



Hydraulic Spliter 10 Piston Model
Size110 x 1000

Technical Description

The vibrating frequency granite breaker offers a revolutionary solution for controlled demolition of granite and similar materials. Key features and functionalities include:

- **Drilling Specifications**: Diameter: 110 mm, Depth: 1000 mm, Number of Pistons: 10, Split Force: 600 tons.
- **Hydraulic Power and Variable Frequency Generator**: Provides reliable force and precise control over the vibrating frequency.
- **Enormous Splitting Force**: Generates up to 600 tons of splitting force for efficient granite breaking.
- **Nearly Noise-Free Operation**: Minimal noise, ensuring a disturbance-free environment.

- **Low Dust and Vibration**: Produces minimal dust and low vibration, enhancing safety and comfort.
- **Adjustable Splitting Direction**: Suitable for confined spaces and complex scenarios.
- **User-Friendly Design**: Intuitive controls and ergonomic features for operator comfort and efficiency.
- **Easy to Transport**: Compact and portable design for flexibility and convenience.
- **Versatile Application**: Suitable for both indoor and outdoor demolition projects, capable of splitting granite in seconds.
- **Controlled Demolition**: Precise control with the variable frequency generator ensures minimal collateral damage and safety.

Advantages Over Other Systems

- **No Vibration, Impact, Noise, Dust**: Operates without affecting the surrounding environment.
- **Usable in Densely Populated Areas**: Can work near precision equipment and in indoor settings without interference.
- **Flexible Splitting**: Can split granite in any size and direction in mines.

Commercial Application

The splitter is customized for granite breaking and is ideal for granite mines, the granite stone processing industry, and granite quarries.

In conclusion, the vibrating frequency granite breaker offers an efficient, versatile, and environmentally friendly solution for controlled demolition applications. Its innovative design and advanced features make it a valuable tool for construction and demolition professionals.

Technologies Commercialised

1. A revolutionary innovation groundbreaking composite material

A groundbreaking composite material developed by a professor from the Amrita Technology Enabling Centre in Coimbatore promises to revolutionize defense technology. This innovative material, impervious to bullets, resistant to explosions, and fireproof, is projected to save India approximately Rs 20,000 crore annually by reducing reliance on imported defense materials. It aims to enhance the safety of soldiers and paramilitary personnel significantly. Rigorous tests confirmed its resilience to explosions and its lightweight nature compared to armored steel, with field trials in the Siachen Glacier proving its effectiveness, marking a game-changer for defense and paramilitary forces, anticipating substantial savings and honoring national heroes through dedicated applications in various defense scenarios.

2. Flood Warning System

തോടുകളിലെ വെള്ളപ്പൊക്കം മുന്നറിയിപ്പു സംവിധാനം വരുന്നു

റഡാർ അധിഷ്ഠിത സെൻസറുകൾ സ്ഥാപിക്കും

വിവേക് ആർ.ചന്ദ്രൻ

തിരുവനന്തപുരം

ദുരിതരാത്രി

കഴക്കൂട്ടം സബ്വേയിൽ വെള്ളം കയറി; ഗതാഗതം തടസ്സപ്പെട്ടു

വെള്ളപ്പൊക്ക മുന്നറിയിപ്പു സംവിധാനം വരുന്നത്

- പട്ടം
- ഉള്ളൂർ
- പാറ്റാണ്ടി
- കണ്ണമ്മൂല
- ആഴയിഴഞ്ചാൻ
- തെറ്റിയാർ
- തക്കാനകര കനാൽ
- പാർവതീപുത്തനാർ (രണ്ടെണ്ണം)
- വേളി കായൽ (പൊഴിക്കു സമീപം)

ഗൗരീപട്ടത്ത് മിതിയുടെ രാവ്

In efforts to improve public safety and mitigate the impact of past flooding events, Thiruvananthapuram, Kerala is implementing a new flood warning system developed by Amrita Technology Enabling Centre (Amrita TEC). This system, a key component of the Thiruvananthapuram Smart City project, utilizes radar-based sensors strategically placed within canals to monitor water levels in real-time. The collected data will be transmitted to a central control center, allowing for timely warnings to be issued to residents through multiple channels including sirens, text messages, and social media. This early notification system empowers residents to take preventative measures, such as evacuating their homes or securing property, to minimize damage and ensure their safety during potential flooding events.

Problem Statements

1.Intervention Requirements for MSME Sector

MSME, which stands for Micro, Small, and Medium Enterprises, was introduced by the Government of India through the MSMED Act of 2006. Governed by the Ministry of MSME, MSME encompasses entities involved in the manufacturing, production, processing, and preservation of goods and commodities. There are a total of 633.9 lakh MSMEs in India. In India, over 99% of total MSMEs qualify as micro-enterprises that make up to 630.5 lakh enterprises. A total of 3.3 lakh businesses qualify as small businesses, i.e. 0.5% of all MSMEs, and just 0.05 lakh qualify as medium businesses, a sum of 0.01% of all MSMEs. The rural areas consist of 324.9 lakh businesses, while urban areas have 309 lakh businesses. Medium businesses, small companies and corporations are the spine of the Indian economy, employing 12.36 million people and contributing significantly to economic activities and job generation. Among the key states in India with significant contributions to the Micro, Small, and Medium Enterprises (MSME) sector, Maharashtra leads with a substantial 17.74% share, followed by Tamil Nadu at 10.20%, Uttar Pradesh at 9.34%, Gujarat at 7.43%, and Rajasthan at 7.38%. These states play a crucial role in the overall MSME landscape. The share of MSME-related products in all India exports stood at 45.56 per cent as of September in the current financial year 23-24. By 2028, India is expected to reach 1 trillion in manufacturing exports. Manufacturing's share of GDP in India is estimated to increase from 15.6% to 21% by 2031.

On the other hand, the challenges that need to be addressed include that 38 Indian cities appear on the list of the world's 50 most polluted cities. If this continues, it could threaten the very bastions of our growth. The European Union has launched the world's first system to impose CO2 emissions tariffs on imports (steel, cement, etc) to stop "more polluting foreign goods" from undermining its green transition. The European Union introduced the Carbon Border Adjustment Mechanism (CBAM) on October 1, 2023. The CBAM would result in a 20-35 per cent tax on selected imports into the EU from January 1, 2026. Domestic companies from seven carbon-intensive sectors, including steel, cement, fertiliser,

aluminium, and hydrocarbon products, will have to seek compliance certificates from EU authorities to comply with the CBAM norms.

It is high time for the MSME sector to adapt to green manufacturing and technology; financing, policy-making and Governmental support are necessary to address these challenges. The various MSME industries that need to be addressed in this regard include Coir, Dyes and Intermediates, Electrical machinery, Electroplating, Light engineering and auto parts, Food and beverage units, Foundries, Machinery and equipment, Metalworking, Pulp/ Paper, Recycling, Sponge iron plants, Textiles, Brick tiles manufacturing, Ceramic and glass industries, Construction, Chemicals and chemical products, Distilleries, Drugs & pharmaceutical. The issues to be addressed include supply chain, water usage, energy usage, waste disposal and impact on the environment.

To accelerate adaptation planning and achieve India's emission targets for 2030 and 2070, key stakeholders such as the government, industry associations, and the private sector should collaborate to boost MSMEs' resilience; the key driver remains the technology.

Industry Requirements

Smart sensors for integration into production processes to continuously monitor product quality, ensuring that only products meeting predefined standards reach the market. Automated Guided vehicles for material handling within the production facility to transport raw materials, semi-finished goods, and finished products, optimizing logistics and reducing manual labour.

Cost-effective barcode and RFID systems for inventory tracking and management help reduce errors, improve traceability, and optimise stock levels on the production floor. Augmented Reality (AR) is for maintenance technicians with real-time information and guidance, overlaying digital data on physical equipment to enhance maintenance efficiency and reduce downtime.

2.Intervention requirements for Rice Mill

Background

Rice is a staple food for 65 % of the Indian population, with India being the second-largest producer of rice in the world after China. India is also the world's biggest rice exporter, with a turnover of more than Rs. 36,500 crores per annum. Indian rice mills process about 85 million tonnes of paddy annually, using conventional and modern rice milling processes. The major rice-growing states include Tamil Nadu, West Bengal, Uttar Pradesh, Andhra Pradesh, Punjab, Orissa, Chhattisgarh, and Bihar. Only one-third of India's wastewater is currently treated, resulting in raw sewage flowing into rivers, lakes and ponds, eventually polluting the groundwater. The health costs relating to water pollution are estimated at about INR 470-610 billion ($6.7-8.7 billion) per year. Nearly 70% of India's water is contaminated, impacting three in four Indians and contributing to 20% of the country's disease burden. Rice mill effluents are potential sources for recovery of value-added resources and viable generation of energy. There is huge potential for generating viable energy sources from wastewater generated in these plants as well as bringing down the water footprint in this sector.

The wastewater generated from a rice mill contains a wide range of organic and inorganic contaminants. The effluent is typically dark-coloured and foul-smelling. An extensive analysis of physical and chemical wastewater characterization is to be carried out to identify the appropriate treatment system for the removal of specific contaminants.

A medium-scale parboiled rice mill generates 27.5 million litres of wastewater per year. The rice mill effluent contains soluble starches, sugars from the grain starch, polyphenolics, lignin, tannins and volatile fatty acids with COD ranging from 2000 to 5000 mg/l. The proposed solutions should be scalable to meet this requirement.

Waste to wealth technology proposals to utilise rice husk and rice husk ash.

3.Intervention Requirements for Coir Industry

COIR is a versatile natural fibre extracted from mesocarp tissue or the husk of the coconut fruit. Generally, fibre is of a golden colour when cleaned after removing from the coconut husk; hence the name ” The Golden Fibre”. It contributes significantly to the economy of the country’s major coconut-producing states, i.e., Maharashtra, Karnataka, Andhra Pradesh, Kerala, Tamil Nadu, Goa, Assam, Orissa, Andaman & Nicobar, Pondicherry, Lakshadweep, etc. India, the major global coconut producer, accounts for more than two-thirds of the world’s coir and coir products production. India and Sri Lanka account for about 90% of the total global coir fibre production. India produces about 280,000 metric tonnes (MT) of coir fibre annually. The coir industry employs about 5.5 lakh (0.55 million) people in the country. Kerala accounts for about 61% of India’s coconut and 85% of coir products. The industry is a good source of employment in the country’s rural economy, especially for the women population. The coir industry, renowned for its eco-friendly attributes, encounters environmental challenges primarily linked to water pollution during washing.

While coir and its products are generally considered environmentally sustainable, the identified issue poses a threat to this sustainability. Technologies are required to address environmental problems, particularly water pollution, associated with coir production processes and effective solutions that uphold the industry's commitment to eco-friendliness and environmental sustainability. Coco pith uses waste products from the coconut industry and creates water pollution, greenhouse gas emissions, air pollution, soil pollution, marine pollution, and ethical work practice issues. There are over 7,000 coir pith units in Tamilnadu and 2,000 in Coimbatore.

The retting of coconut husks is brought about by the pectinolytic activity of microorganisms, especially bacteria, fungi, and yeasts, degrading the fibre-binding materials of the husk and liberating large quantities of organic matter and chemicals into the environment, including pectin, pentosan, tannins, polyphenols, etc. Washing one cubic meter of coir pith takes 300 to 600 litres of water. The result is polluted water that impacts the environment. They require so much water to rinse the fibres to get out any accumulated salts. Consequently, hydrogen

sulphide, phosphate, and nitrate contents increase while dissolved oxygen and community diversity of plankton decrease in the ambient waters during the retting process.

Industry Requirements

- Achieve a Pollution-free coir industry with technological advancement.
- Production of high-value customer-oriented products.
- Technologies for mechanical drying options are required.
- Advanced technology for quicker and eco-friendly retting.
- Wastewater rated from the units should be recycled using effluent treatment plants.

4.Disaster Alert System for Kerala Government

India is highly vulnerable to floods. Out of the total geographical area of 329 million hectares (MHA), more than 40 MHA is flood-prone. Floods are a recurrent phenomenon which cause huge loss of lives and damage livelihood systems, property, infrastructure and public utilities. Urban flooding is significantly different from rural flooding as urbanization leads to developed catchments, which increases the flood peaks from 1.8 to 8 times and flood volumes by up to 6 times. Consequently, flooding occurs quickly due to faster flow times (in minutes). Urban areas are densely populated, and people living in vulnerable areas suffer due to flooding, sometimes resulting in loss of life. It is not only the event of flooding but also the secondary effect of exposure to infection, which has its toll in terms of human suffering, loss of livelihood, and, in extreme cases, loss of life.

Also, India, with its diverse geological landscapes and monsoon climate, grapples with a significant landslide hazard. 412 socio-economically significant landslides from the year 1868 to 2022 have adversely affected human lives, livelihood, living places, livestock, resources, economy, infrastructure, and the ecosystem with different degrees of severity. 183 landslides fall under the low socio-economic significance category while 89 are in the moderate category, and 140 landslides fall in the high socio-economically significant category. The Geological Survey of India (GSI) offers detailed maps outlining the susceptibility of different regions in India to landslides. Approximately 15% of India's

landmass, covering around 0.49 million sq. km, is deemed prone to landslides, according to GSI estimates. National Disaster Management Authority (NDMA) reports data on an average of over 2,500 landslides occurring annually in India. GSI maps highlight specific regions with high susceptibility, mainly in the Himalayas, Nilgiris, Ranchi Plateau, Eastern Ghats, and Western Ghats. These regions account for approximately 80% of the total landslide-prone areas in the country.

Kerala, the lush green state on India's southwestern coast, is unfortunately well-acquainted with floods and landslides. These natural disasters pose a significant threat to the lives and livelihoods of millions of people living in the state.

Panchayat Requirements

There is a need for a reservoir water level monitoring system integrated with weather prediction to give warnings, water management and decision-making for preventing calamities.

To develop new sensors that can predict landslides and monitor necessary parameters to aid decision-making.

To develop sensors and technologies to monitor the structural health of the transportation infrastructure in disaster-prone areas.

Cluster-specific plans can be developed to encourage resource efficiency and adaptation practices. Moreover, large corporate houses, of which MSMEs are suppliers, can encourage resilient practices by aligning their policies with national climate goals.

5. Waste to Wealth products from Water Hyacinth

Water Hyacinth (Eichhornia crassipes) from South America has become a notorious invasive aquatic plant, spreading across tropical and subtropical regions globally. Recognized for its rapid growth, the plant forms dense floating mats in freshwater ecosystems, impacting biodiversity and hindering water transportation. Characterized by

slender rootstocks, feathery roots, and vibrant flowers, water hyacinth reproduces prolifically, doubling its population every 5-15 days. While considered a serious waterway weed, it exhibits phytoremediation potential by absorbing harmful substances such as heavy metals, ammonia, and phosphorus from water bodies. Despite this benefit, the environmental repercussions of water hyacinth necessitate rigorous control measures, including mechanical removal, biological control, and herbicide application. Balancing its invasive nature with its phytoremediation capabilities poses a challenge, requiring integrated management approaches and technological interventions to mitigate its impact on aquatic ecosystems. Can form dense mats that block waterways, hindering navigation, reducing oxygen levels, and harming native plants and animals. Disrupts fishing, tourism, and water transportation. Dense hyacinth mats can provide breeding grounds for mosquitoes and other disease vectors. Rapid growth consumes large amounts of water, potentially impacting surrounding areas from water depletion.

The Kerala local self-government department has been spending a substantial amount of money for efforts to remove aquatic plants from water bodies every year. Yet, the spread of weeds has been creating difficulties for the residents as it affects different activities in the region, including agriculture, fishing, inland navigation and tourism. Vietnam and Cambodia have been manufacturing water hyacinth products for over four decades. With several countries turning towards sustainable products, there are good opportunities in the global market.

Municipal Requirements

Sustainable technologies to harvest the stems of the water hyacinth.

Technologies for creating value-added products from water hyacinth in areas of Phytoremediation, Biogas Production, Biomass for Composting, Fibre Extraction for Textiles, Floating Gardens and Agriculture, Animal Feed Production, Paper and Pulp Production, Bio-Filtration for Aquaculture and others.

Innovation and technologies for the Handicrafts and Artisanal Products

Detailed Report on Water Hyacinth Menace

Abstract

Clean water is the elixir of life. Pure water is essential for public health, energy, and agricultural production.

Unfortunately, water scarcity is seen worldwide, particularly due to serious problems like water pollution Conservation of natural water resources and restoring the water ecosystem is the need of the hour. In India, many programs and campaigns like Swachh Bharat Abhiyaan, Clean India campaign, and River water cleanliness programs like Namami Gange are working to conserve water bodies that sustain human and aquatic lives. Water hyacinth plants have covered most water bodies, forming green mats spread over a large surface area. They are free-floating aquatic plants that live in water. Due to their rapid growth, these plants have become a weed. The growth of water hyacinth reaches more than 200 tonnes wet weight/1 ha area within one year under normal conditions. It can double its size within five days, and more than a million plants of medium size form a large mat per hectare of area It reproduces both sexually and asexually, making it difficult to control, and its seeds remain dormant for more than 20 years in water bodies.

Introduction

The water hyacinth is categorized among the world's top ten worst invasive plant species of aquatic ecosystems.

Interestingly, the Water Hyacinth was a gift of the British to India, introduced towards the end of the 18th century. Lady Hastings, the wife of the First British Governor-General, who was enchanted by the beauty of the flowers, brought it to India, which has now spread to most water bodies. Water Hyacinth (Eichhornia crassipes) from South America has become a notorious invasive aquatic plant, spreading globally across tropical and subtropical regions.

Invasive aquatic plants are non-indigenous or non-native to the habitat which they have invaded. In the new habitat, the invasive aquatic plants lack natural enemies threaten the habitat and can harm or displace native species. The invasive aquatic plants become established because they possess the following traits:

- Rapid growth
- High reproductive potential
- Highly efficient dispersal mechanisms
- Ability to alter growth in response to environmental conditions
- Capacity to tolerate a wide range of environmental conditions

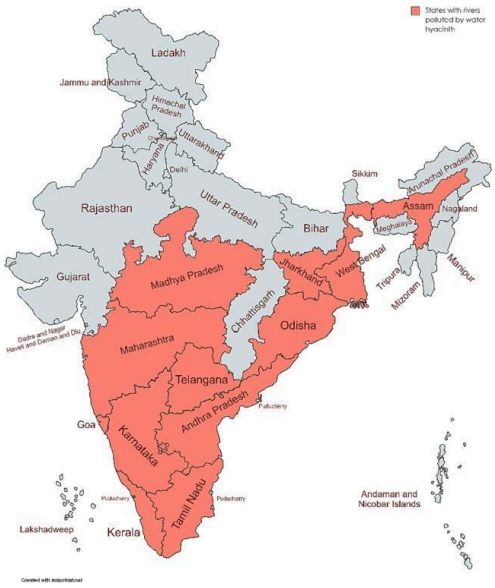


Figure 1: Indian States affected by Water Hyacinth

While considered a serious waterway weed, it exhibits phytoremediation potential by absorbing harmful substances such as heavy metals, ammonia, and phosphorous from water bodies. Despite this benefit, the environmental repercussions of water hyacinth necessitate rigorous control measures, including mechanical removal, biological control, and herbicide application. Balancing its invasive nature with its phytoremediation capabilities poses a challenge, requiring integrated management approaches and technological interventions to mitigate its impact on aquatic ecosystems. They can form dense mats that block waterways, hindering navigation, reducing oxygen levels, and harming native plants and animals. Disrupts fishing, tourism, and water transportation. Dense hyacinth mats can

provide breeding grounds for mosquitoes and other disease vectors. Rapid growth consumes large amounts of water, potentially impacting surrounding areas from water depletion. The physical removal of the water hyacinth is laborious, and subsequent disposal and decomposition pose serious environmental health concerns. Water hyacinth needs a sustainable strategy for its uncontrolled growth and management, and preventing sewage from entering water bodies is the best and single most permanent solution to prevent it from invading water bodies.

Impact of Water hyacinth

> Unsurprisingly, water hyacinth has spread to more than 80 countries over the past century with its remarkable ability to multiply. Ten water hyacinth plants can reproduce into 655,360 plants, covering approximately half a hectare in 8 months.

- It enhances water loss by 2.5 to 3 times due to evaporation.
- Reduction of Bio-diversity: Other aquatic plants have difficulty surviving.
- The proliferation of water hyacinths often affects the diversity of fish stocks.
- Sediment level increases with the increase of water hyacinth.
- Source of breeding ground for mosquitoes and other parasites.
- Hindrance to water transport.

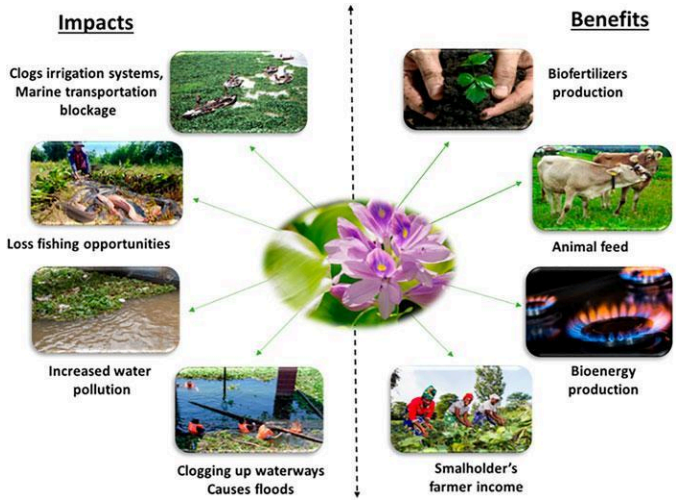


Figure 2: Impact and Benefits of Water Hyacinth

Solutions

The Biochemical composition of the water hyacinth plant is shown in Table 1. Several value-added products can be produced from water hyacinth residue. Various research has been conducted, and value products that can be produced with water hyacinth include different enzymes, cellulose xanthogenate, levulinic acid, shikimic acid, biogas, bioethanol, biohydrogen, biopolymer, biobutanol, composites, biofertilizers, fish feed, high calorific value fuel, fuel briquette, superabsorbent polymer and xylitol. In addition, water hyacinth can also be used as a substrate for mushroom cultivation and for the treatment of various industrial effluents for the removal of heavy metals.

Parameter	Value (%)	Parameter	Value (%)
pH	5.5––6.5	Carbon	11–50
Water content	65–90	Nitrogen	1.1–3
Cellulose	17–35	Oxygen	30–50
Hemicellulose	17–45	Hydrogen	5–6
LigninAsh	1.1–15 1.5––30	SulphurPhosphorous	0.1–1.5 0.2–0.7
Crude Protein	5–20	Calcium	0.5–5
		Magnesium	0.1–2
		Potassium	2.5–8

Table 1: Biochemical composition of water hyacinth plant

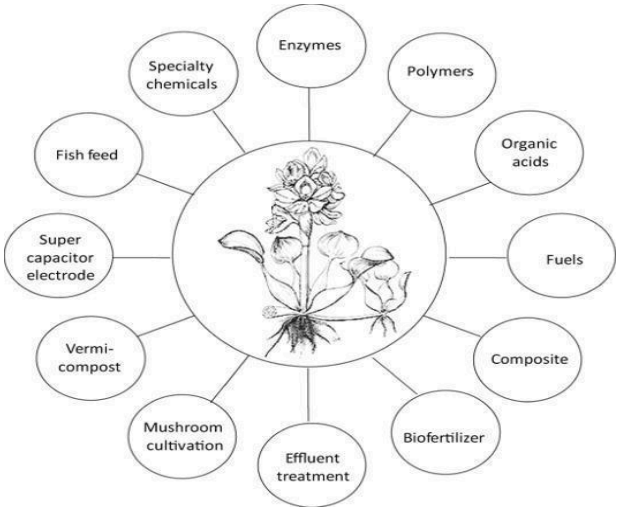


Figure 3: Waste to Value Products using Water Hyacinth.

Need for Water Hyacinth Craft

Although water hyacinth holds potential for diverse product development, including enzymes, cellulose xanthogenate, levulinic acid, shikimic acid, biogas, bioethanol, biohydrogen, biopolymer, and biobutanol, these technologies remain in early research stages. However, various consumer goods derived from water hyacinths, such as composites, biofertilizers, fish feed, high-calorific value fuel, fuel briquettes, and substrates for mushroom cultivation, offer immediate economic opportunities. Water hyacinth crafts involve local workforces, providing economic value to communities and controlling water hyacinth growth. These initiatives demonstrate the potential for sustainable economic development while addressing environmental challenges. The following are the advantages of the water hyacinth craft.

- Its removal helps to conserve water and rejuvenate the environment.
- Sustainable Livelihood & Inclusive Growth in Rural Areas.
- Opportunity to earn as per the skill level of the artisan: Semi Skilled:- Braid & Rope: Rs. 2 to 3.5 per meter -Skilled: Finished Products with value from Rs. 40 in a coin purse to Rs. 30,000/- in furniture set.
- Raw Material is free and abundant.
- An eco-friendly product for consumers.
- Empowering women in rural India.

Government and NGOs have spearheaded numerous initiatives like capacity building programs, R&D projects, financial support and grants to transform water hyacinth waste into valuable products, resulting in varying degrees of success. However, beneficiaries often struggle to establish market linkages and adopt sophisticated technologies to standardize and scale up production. Some of the initiatives implemented by states and NGOs include:

Water hyacinth craft activities in Assam state

- Manufacture of paper and paper boards from water hyacinth plant, Hyderabad.
- Production of organic fertilizers from water hyacinth plants, Jharkhand.
- Biodegradable products from water hyacinth stem, West Bengal.
- Biodegradable products from water hyacinth pulp, Centre for research on aquatic Resources, Kerala

Both government bodies and NGOs are actively exploring the potential of leveraging this seemingly problematic plant to create value from waste. Instead of resorting to costly and potentially harmful eradication methods, the focus has shifted towards sustainable harvesting and utilizing water hyacinths to craft eco-friendly handicraft products. Water hyacinth boasts remarkable qualities that render it ideal for such endeavours: its sturdy fibres make it well-suited for crafting durable bags, baskets, and other utilitarian items. Moreover, its utilization promotes the adoption of a readily available, renewable resource, reducing reliance on virgin materials and minimizing environmental impact. Additionally, water hyacinth crafts are biodegradable, contributing to waste reduction efforts by decomposing naturally over time. This shift in approach yields many benefits: it fosters economic activity within local communities, offering new opportunities for income generation through harvesting, processing, and crafting activities. Furthermore, sustainable harvesting helps manage the spread of water hyacinths, facilitating the restoration of natural ecosystems and enhancing water quality. Additionally, by utilizing water hyacinths, governments can significantly reduce spending on traditional eradication methods, reallocating resources towards other critical environmental and social initiatives. Ultimately, the transition towards a circular economy centred around water hyacinth represents a win-win scenario. By harnessing the potential of this abundant resource, we can create environmentally friendly products, empower local communities, and pave the way for a more sustainable future. Let's embrace innovation and transform what was once perceived as an environmental challenge into an economic and environmental well-being opportunity.

Challenges and Technology Development

Harvesting water hyacinth demands a meticulous approach, emphasizing the importance of stem size, quality, and processing techniques, particularly when targeting the stems for handicraft items. Unlike simply clearing away the plants, harvesting for stem utilization necessitates careful selection and handling. The size and condition of the stems significantly impact the final product's quality, requiring precision during harvesting and subsequent processing. By prioritizing these factors, we ensure the production of high-quality handicraft items from water hyacinth, highlighting the importance of a thoughtful and methodical approach to harvesting.

1. Harvesting: Employ a systematic approach to harvest the plants, ensuring thorough area coverage. Employ tools such as nets or rakes to gather water hyacinth efficiently, minimizing disturbance to the surrounding ecosystem.
2. Cleaning: Employ a high-pressure water spray or agitation method to dislodge dirt and debris from the water hyacinth. Implement a rinsing process to ensure thorough cleaning, utilizing clean water sources to prevent contamination.
3. Separation: Employ sharp cutting tools such as knives or shears to separate water hyacinth meticulously stems from leaves. Execute precise cuts to facilitate optimal separation and subsequent processing. Implement proper handling techniques to avoid damage to the plant material.
4. Transportation Challenges: Address logistical challenges associated with transporting harvested water hyacinth, including the bulkiness of the plant material.
5. Quality Control: Implement stringent quality control measures to assess the cleanliness and condition of harvested water hyacinth. Conduct regular inspections to identify contaminants or bug attacks that may compromise product quality.
6. Preservation Techniques: Employ preservation techniques to extend the shelf life of harvested water hyacinth during transportation and storage. Utilize methods such as drying, curing, or chemical treatment to prevent spoilage or degradation. Implement proper packaging and storage practices to protect the plant material from environmental factors and pests.

Figure 4: Manually Cultivated Water Hyacinth Stem (Left) Water Hyachinth Stem dried in a solar dryer facility.

Figure 5: Dried stem using solar dryer.

Further, there are various gaps in the technology requirements to bring the full potential of water hyacinth, and the technology needs are listed below.

- Sustainable technologies to harvest the water hyacinth stems by minimising manpower requirements.
- Innovation and technologies for the Handicrafts and Artisanal Products.
- Technologies for creating value-added products from water hyacinth in Biomass for Composting, Fibre Extraction for Textiles, Floating Gardens and Agriculture, Animal Feed Production, Paper and Pulp Production, Biofiltration for Aquaculture and others.

Conclusion

The future scope of the study lies in exploring advanced techniques and technologies for managing and utilizing water hyacinths effectively. This can be done by integrating artificial intelligence and remote sensing to enhance management methods. Evaluating the success of current management policies in Indian states and identifying areas for improvement is crucial. Utilizing water hyacinth for fuel and value-added products can mitigate socio-economic issues linked to its proliferation. Globally, research focuses on converting water hyacinth waste into wealth for sustainable management of this invasive weed.

Industry Interactions for Technology Enablement through TEC

1. Industry Interactions with Wipro Team

Dr. Krishnashree Achuthan, Director of Amrita Technology Enabling Center (TEC), facilitated a strategic interaction with senior leaders from Wipro, including the Senior Partner and the Senior Consultant of the Skilling Team, to discuss potential collaboration in cyber technologies. The discussions aimed to establish a Wipro-Amrita Center of Excellence in Cyber Security, focusing on several key initiatives. These include developing academic programs to enhance the skills of Wipro employees, organizing industry-academic exchange events such as talks, conferences, and joint research projects to advance cybersecurity technologies. Additionally, the collaboration will implement nationwide cybersecurity outreach programs to identify and nurture talent, conduct social outreach for cybersecurity awareness, and promote innovation and technology transfer in the field. These initiatives are expected to significantly contribute to the advancement of cybersecurity expertise and innovation, benefiting both Wipro and the broader technological ecosystem.

2. Interaction with Jai Krishna Metals for developing Paddy Dryer

Amritra TEC, with Mr. Surendran at the helm, recently visited Jaikrishna Metals in Coimbatore to join forces on developing a low-cost paddy dryer for farmers.

The team, which also included Mr. Mahesh Mohan, Deputy General Manager, and Mr. Premkumar, Liaison Associate, discussed design specifics, explored cost-effective materials and fabrication methods with the aim of finalising the design and establishing a production plan with Jaikrishna Metals. This collaboration has the potential to significantly impact farmers by providing them with an accessible solution for drying their paddy rice.

3. Assessing Coir pot Product Potential with SKS Hydraulics

A team from Amrita Vishwa Vidyapeetham's Technology Enabling Centre (TEC) visited SKS Hydraulics to assess the potential of their coir pot-making machine for producing a variety of coir products by our Amrita TEC. Discussions centered around project needs, followed by a demonstration highlighting the machine's vertical design and adjustable stroke capabilities. Hands-on trials with the machine yielded promising outputs, suggesting its suitability for the

project. The team toured the facility, gaining insights into SKS Hydraulics' manufacturing and quality control processes. Next steps involve evaluating them for technology enhancement. This visit proved valuable, providing not only machine specifications (80-ton capacity, EN 8 steel die, 1000 pots/day production) but also insights into the machine's potential for diversifying coir product creation.

4. Collaboration on Automated Cashew Grading Technology

A grand meeting was held at the Amrita Technology Enabling Centre to discuss the cashew grading technology requested by the Desingnad Cashew Producers Association. Attendees included key representatives from both the association and the technology center. The association's president, highlighted challenges with the current manual grading process, including labor intensity, inconsistency, and high costs. Amrita TEC team proposed an automated grading system. The benefits discussed included increased accuracy, reduced costs, and improved product quality. An action plan was agreed upon, consisting of three phases: research and prototype development, pilot testing and refinement, and full-scale implementation with ongoing support.

The meeting concluded with a commitment to collaborate, and a follow-up meeting was scheduled.

5. Fostering Innovation: Amrita TEC and COSIEMA Collaboration

Amrita Vishwa Vidyapeetham's Technology Enabling Centre (TEC) met with prominent figures from the Coimbatore SIDCO Industrial Estate Manufacturers' Association (COSIEMA) on a visit to the SIDCO Industrial Estate in Eachaneri, Coimbatore. Mr. M.

Premkumar, Liaison Associate at Amrita TEC, led the discussions with Mr. Natarajan, President of COSIEMA, and Mr. Navaneethan Krishnan, CEO of Omegatube Dynamics and a key member of the association.

The insightful meeting explored potential collaborations between Amrita TEC and COSIEMA member companies. Discussions centered on fostering technology transfer, problem-solving solutions for industries, and collaboratively driving innovation within the Coimbatore's manufacturing sector. This collaboration has the potential to establish a strong link between academia and industry, with Amrita TEC gaining valuable insights into industry needs and tailoring its services to address challenges and support technological advancements for Coimbatore's businesses.

6. Amrita TEC Collaborates with Bio Gardener a coir Industry

Amrita TEC's meeting with coir industry leaders like Mr. Kannan (TANCOIR), Er. Gowthaman (Bio Gardener), and Mr. Muruganandham (COCOMANS) yielded valuable insights into the industry, potential government research grants for the COCONUS project, and opportunities for collaboration on technical expertise, joint research initiatives, or pilot project implementation. This paves the way for a deeper understanding of industry needs,

securing project funding, and driving advancements in the coir industry through collaborative research and development.

7. Discussion with Essar engineers,Coimbatore

Amrita TEC achieved a significant milestone by securing commitments from Essar Engineers, a leading coir machinery manufacturing company in Coimbatore, to develop custom machinery tailored to our specific needs.The Amrita TEC team explored various advanced coir machinery technologies available as ready-to-use products with Essar Engineers. Discussions focused on automated systems, IoT integration for real-time monitoring, energy-efficient solutions, and advanced robotics, all aimed at enhancing industrial efficiency. Essar Engineers committed to designing and developing bespoke machinery that aligns precisely with our project requirements, addressing technical specifications, customization capabilities, timelines, and cost-effectiveness.This strategic collaboration positions Amrita TEC to deliver cutting-edge technological solutions to industries, ensuring enhanced competitiveness and sustainability.

This partnership underscores our commitment to innovation and excellence in technology implementation, poised to drive transformative advancements in the industrial sector.

8. Interaction with Unitek Hydraulics, Coimbatore

The Amrita TEC team's visit to Unitek Hydraulics in Coimbatore provided crucial insights into pot-making machinery options, significantly aiding in equipment selection. The discussions also focused on the customization of various coir product machines, such as coir packaging machines and coir root runner machines. This collaboration will enhance faster technology transfers to the industry through TEC, improving our capabilities in producing specialized coir products efficiently.

9. Interaction with NN Engineering, Coimbatore

Amrita TEC team visited NN Engineering in Coimbatore to explore their range of rice dryer technologies, with the objective of collaborating to bring these technologies to our industry partners in need of efficient drying solutions. NN Engineering showcased various models, including batch dryers, continuous flow dryers each with distinct features such as high energy efficiency, advanced automation, and uniform drying capabilities.The demonstrations emphasized the ease of operation and quality of output. Detailed discussions covered technical specifications, customization options, and potential collaboration frameworks, including technology transfer and training programs.

10. Interaction with Hydro Constructions, Coimbatore

The Amrita TEC team visited Hydro Constructions, a coir machinery manufacturing company in Coimbatore, to discuss potential collaboration on coir manufacturing technologies for upcoming projects. During the visit, detailed discussions were held on integrating advanced technologies to enhance coir production processes. Both teams explored various innovative solutions and agreed on the benefits of combining their expertise.

11. Collaboration talk with Medsby Healthcare & Engineering Solutions

A visit to Medsby proved to be fruitful, with discussions centering around 3D printing and its applications in biomedical devices. The potential for collaboration in this domain emerged as a key takeaway from the meeting. The talks delved into the exciting prospect of utilizing 3D printing technology to create intricate, previously difficult-to-manufacture biomedical parts. Furthermore, Medsby's insights into cutting-edge advancements within the biomedical field laid a strong foundation for future collaborative efforts between Amrita TEC and Medsby.

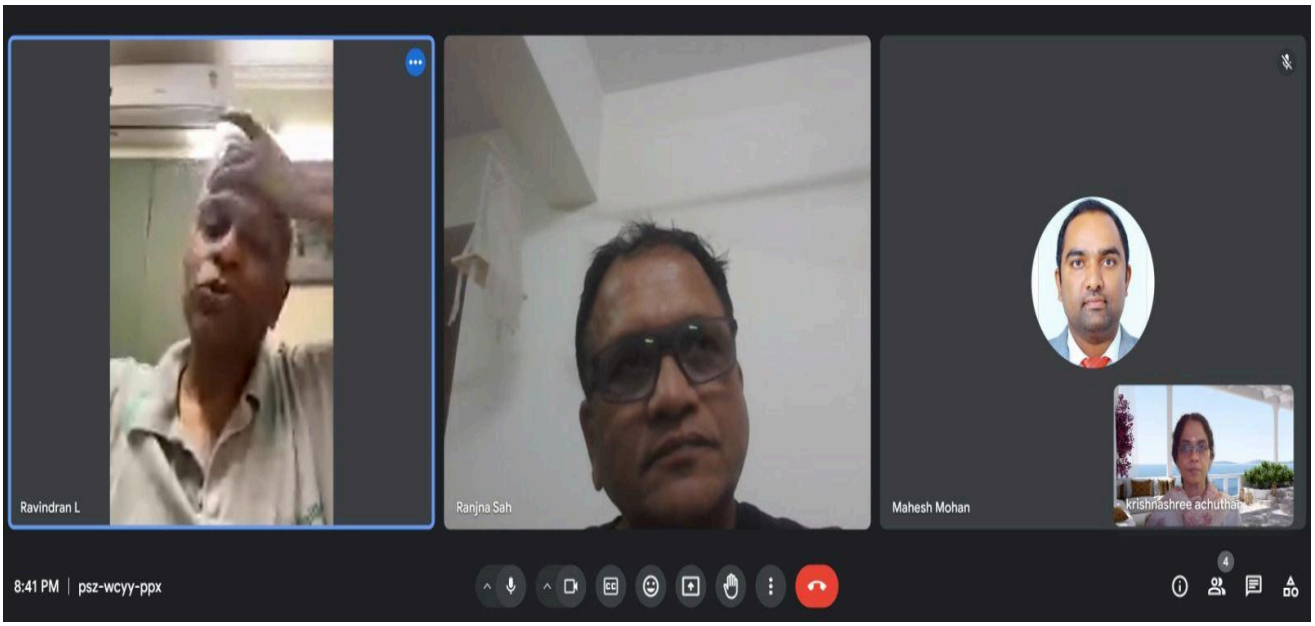
12. Amrita TEC Explores Coir Root Trainer Unit at Pollachi Forest Department

Amrita TEC ventured to Pollachi to visit the Coir Root Trainer Unit Augmentation Project at the Parambikkulam Tiger Conservation Foundation. At the Coir Root Trainer Unit, Amrita TEC representatives delved into the operational aspects of the project. Discussions focused on manpower requirements for efficient production, explored the sourcing of raw materials, and examined potential marketing strategies for the coir root trainer pots. Additionally, samples were collected for further analysis and evaluation.This on-site exploration provided Amrita TEC with valuable insights into the coir industry's capabilities and potential, particularly its role in sustainable development.

13. Interaction Self Help Group (SHG) for Waste to Wealth generation from Water Hyacinth

A team from Amrita Technology Enabling Center visited to identify the challenges faced by the Self Help Group (SHG) in the value addition of water hyacinth. The team interacted to identify the technology intervention required for the SHG to convert the waste to wealth from water hyacinth with affordable advanced technology. The visit was also aimed to identify various other possible value added products from water hyacinth.

14. Amrita TEC and BCIC Plan Future AR/VR Training and Autonomous Vehicle Collaboration



Dr.Krishnashree Achuthan, Director Amrita TEC with Dr.L.Ravindran Past President BCIC, and Mr.Rabindra Sha, BCIC had a discussion for a plan of action for the future event. Discussion was on organising AR/ VR training programs, collaboration for autonomous vehicle and a conference were discussed. TEC is in continuous engagements with BCIC team for collaborating for future events.

Training program & Webinars Organised

S.No	Date	Title	Speaker
1	February 13th, 2024	Expert Talk: Cyber Defence, career in cyber security	Shanavas Chemmamkuzhi, Senior Partner & Head of Cyber Defense Center, Cybersecurity & Risk Services at Wipro Ltd
2	March 22nd, 2024	Security and Trust in Edge Network Environments	Prof. Prasad Calyam, Professor, University of Missouri-Columbia
3	March 26, 2024	Evolution of Research Opportunities in the Aerospace Sector	Dr. J. Venkatramani
4	March 27, 2024	Research Opportunities in the Department of Mathematics.	Dr. K. Somasundaram
5	April 4, 2024	Deterministic Low Latency Communications for Real-time IoT Applications	Dr. Subhasri Duttagupta
6	April 18, 2024	Research Trends in e-Mobility	Dr. K. Deepa
7	April 19, 2024	Electric Vehicles and their impact in Transportation	Dr. S. Sampath Kumar
8	April 19, 2024	AI, IoT and Cyber Security in Smart Grid	Dr. S. Balamurugan
9	April 24, 2024	Exploring the Spectrum: Cutting-Edge Insights into Hyperspectral Imaging and its Diverse Applications	Dr. Anand R

10	April 25, 2024	A Declarative Approach To Detecting Design Patterns From Object Oriented Software	Dr. Swaminathan. J
11	April 26, 2024	Graph Theory and its Applications	Dr. K. Somasundaram
12	May 13, 2024	Research in the Ph.D. Program is an art rather than science	Dr. Amitava Mukherjee
13	May 4th, 2024	Artificial Intelligence for Healthcare Data Analysis	Dr. V. Sowmya
14	May 25th, 2024	Implications of Artificial Intelligence in Biomarker Prediction	Dr. Harishchander Anandaram
15	June 6th, 2024	Water-Energy Nexus: Sustainable Technologies for Real-Time Sensors & Hydrogen Production	Dr. Murali Rangarajan
16	June 19th, 2024	Synergistic Integration and Emerging Trends in Multiscale Filler Reinforcement for Smart Hybrid Polymer Composites	Dr. K Jayanarayanan, Dr. Rasana Nanoth
17	June 22nd, 2024	Materials for Solid State Hydrogen Storage	Dr. Thirugnasambandam G. M.


AMRITA VISHWA VIDYAPEETHAM
SCHOOL OF COMPUTING
DST-AMRITA TECHNOLOGY ENABLING CENTRE
A Declarative Approach To Detecting Design Patterns From Object Oriented Software
Topics of discussion
Gang-of-four patterns
Design pattern detection
Declarative specification
Translation to SQL queries
Handling variants
Experimental results
Speaker:
Dr. Swaminathan. J
Associate Professor, Chairperson,
Department of CSE, School of Computing,
Amritapuri
Registration link
25 APRIL, 2024 | THURSDAY | 5:00 PM TO 6.00 PM
NAAC A++ ACCREDITED
nirf GOVT OF INDIA
7TH BEST 2023 UNIVERSITY IN INDIA
No.1 IN INDIA
THE IMPACT RANKINGS 2023


AMRITA VISHWA VIDYAPEETHAM
DST-AMRITA TECHNOLOGY ENABLING CENTRE
EXPLORING THE SPECTRUM: CUTTING-EDGE INSIGHTS INTO HYPERSPECTRAL IMAGING AND ITS DIVERSE APPLICATIONS
WEBINAR
Dr. Anand R
Assistant Professor
Department of Electrical and Electronics Engineering,
School of Engineering, Coimbatore.
24-4-2024
6.00PM
Topics of discussion
Signal and image analysis
Real time implementation of satellite images
Open source platforms to develop the satellite models
AI in Satellite images
NAAC A++ ACCREDITED
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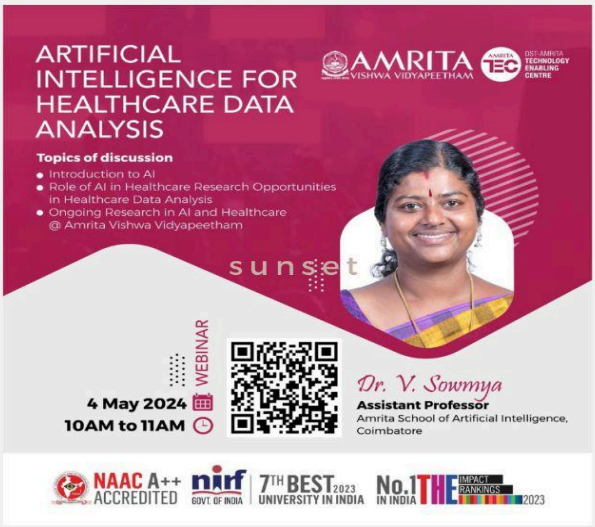
7TH BEST 2023 UNIVERSITY IN INDIA
No.1 IN INDIA
THE IMPACT RANKINGS 2023


ARTIFICIAL INTELLIGENCE FOR HEALTHCARE DATA ANALYSIS
AMRITA VISHWA VIDYAPEETHAM
DST-AMRITA TECHNOLOGY ENABLING CENTRE
Topics of discussion
Introduction to AI
Role of AI in Healthcare Research Opportunities in Healthcare Data Analysis
Ongoing Research in AI and Healthcare @ Amrita Vishwa Vidyapeetham
sunset
WEBINAR
4 May 2024
10AM to 11AM
Dr. V. Sowmya
Assistant Professor
Amrita School of Artificial Intelligence,
Coimbatore
NAAC A++ ACCREDITED
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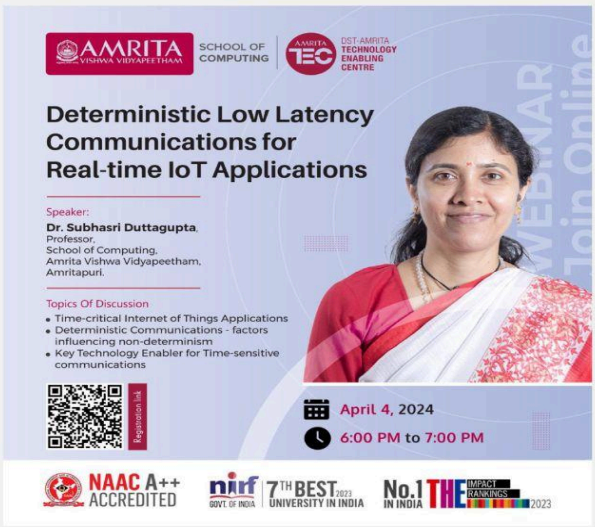
AMRITA VISHWA VIDYAPEETHAM
DST-AMRITA TECHNOLOGY ENABLING CENTRE
Research Trends in e-Mobility
Speaker:
Dr. K. Deepa,
Associate Professor,
Electrical and Electronics Engineering,
School of Engineering, Bengaluru.
Topics Of Discussion
Electric vehicle charging and balancing techniques
On board and off board chargers
V2G, G2V,V2V, V2H, H2V...etc
Battery management systems
WEBINAR
Join Online
Registration link
April 18, 2024
6:00 PM to 7:30 PM
NAAC A++ ACCREDITED
nirf GOVT OF INDIA
7TH BEST 2023 UNIVERSITY IN INDIA
No.1 IN INDIA
THE IMPACT RANKINGS 2023


AMRITA VISHWA VIDYAPEETHAM
SCHOOL OF COMPUTING
DST-AMRITA TECHNOLOGY ENABLING CENTRE
Deterministic Low Latency Communications for Real-time IoT Applications
Speaker:
Dr. Subhasri Duttagupta,
Professor,
School of Computing,
Amrita Vishwa Vidyapeetham,
Amritapuri.
Topics Of Discussion
Time-critical Internet of Things Applications
Deterministic Communications - factors influencing non-determinism
Key Technology Enabler for Time-sensitive communications
WEBINAR
Join Online
Registration link
April 4, 2024
6:00 PM to 7:00 PM
NAAC A++ ACCREDITED
nirf GOVT OF INDIA
7TH BEST 2023 UNIVERSITY IN INDIA
No.1 IN INDIA
THE IMPACT RANKINGS 2023


AMRITA VISHWA VIDYAPEETHAM
DST-AMRITA TECHNOLOGY ENABLING CENTRE
AI, IOT AND CYBER SECURITY IN SMART GRID
Topics of discussion
Smart Grid Facilities available in EEE department
Cloud Based monitoring of Power System
Self Healing capability to Smart Grid
mood
Dr. S. Balamurugan
Professor & Chairperson - EEE
Amrita School of Engineering,
Coimbatore,
19 April 2024
5PM to 5:30PM
NAAC A++ ACCREDITED
nirf GOVT OF INDIA
7TH BEST 2023 UNIVERSITY IN INDIA
No.1 IN INDIA
THE IMPACT RANKINGS 2023


Electric Vehicles and their impact in Transportation
Speaker:
Dr. S. Sampath Kumar,
Assistant Professor (Selection Grade),
Department of Electrical and Electronics Engineering, School of Engineering,
Amrita Vishwa Vidyapeetham,
Coimbatore Campus.
April 19, 2024
5:30 PM to 6:00 PM
Registration link
Topics
Power Electronics
Electric Vehicle
Soft Computing
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No.1 IN INDIA
Graph Theory and its Applications
Topics of discussion
Graph Theory (Graph Colorings, Graph Indices and Graph Domination)
Graph based Deep Learning models in Data Science
Graph Theory and Networks
Speaker:
Dr. K. Somasundaram
Professor and Chairperson
Department of Mathematics
Amrita Vishwa Vidyapeetham
Coimbatore.
26 APRIL, 2024 FRIDAY 11.00 AM
WEBINAR
Join Online
Registration link
Research in the Ph D Program is an art rather than science!
Topics of discussion
What is the motivation for defining a problem in your research interest?
How to solve this problem in a path-breaking way in your Ph D program
How to write a paper with 100% clarity, 0% ambiguity for your final manuscript to be submitted in a Tier 1 Journal/ Conference
Speaker:
Dr. Amitava Mukherjee
Professor, School of Computing, Amritapuri
13 MAY, 2024
7:00 PM to 8:00 PM
MONDAY
WEBINAR
Join Online
Registration link
Expert Talk
Cyber Defence
Career in Cyber Security
Date: 13th February, 2024.
Venue: Sreekrishna Hall, Amrita School of Business, Amritapuri.
Time: 3.15 - 4.30 P.M
Meeting Link
https://bit.ly/42Dugpb
Scan Here ->
Shanavas Chemmamkuzhi
Senior Partner & Head of Cyber Defense Center
Cybersecurity & Risk Services at Wipro Ltd
Materials for Solid State Hydrogen Storage
Free Webinar
Date June 22nd 2024
Time 11.00 AM - 12.00 PM
Topics of Discussion :
Hydrogen, as an energy carrier.
Hydrogen production and storage
The major challenges in developing the hydrogen-based economy.
Various physical and chemical methods of hydrogen storage.
Competent high-capacity metal hydrides for hydrogen storage.
Register Here:
Speaker :
Dr. Thirugnasambandam G. M
Associate Professor,
Department of Chemical Engineering and Materials Science,
Amrita Vishwa Vidyapeetham, Coimbatore
Synergistic Integration and Emerging Trends in Multiscale Filler Reinforcement for Smart Hybrid Polymer Composites
Speakers
TOPICS OF DISCUSSION
Processing technologies: Commodity and high-performance thermoplastics and thermoset composites
Reinforcements in multiscale polymer composites
Multiscale composites manufacturing
Exploration of the synergy between micron, 0D, 1D, 2D nano fillers
Evolving strategies and challenges for performance improvement
Dr. K Jayanarayanan
Professor, Department of Chemical Engineering and Materials Science
Amrita Vishwa Vidyapeetham
Coimbatore
Dr. Rasana Nanoth
Assistant Professor, Department of Chemical Engineering and Materials Science, Amrita Vishwa Vidyapeetham Coimbatore
Date & Time
WEDNESDAY/19 JUN 2024
10:00 AM TO 11:00 AM
Registration Link:
FREE WEBINAR

Amrita Technology Enabling Centre (TEC) sparks a passion for innovation in students and developers through captivating webinars. These sessions bridge the gap between theory and the cutting edge of engineering.

TEC's diverse curriculum empowers participants with the latest knowledge. From mastering cybersecurity best practices to understanding the transformative impact of electric vehicles, students stay ahead of the curve. Webinars delve into AI's potential in healthcare and delve into the role of AI, IoT, and cybersecurity in securing smart grids.

For those seeking deeper dives, TEC offers specialized topics. participants can explore real-time communication for IoT and software design patterns. Budding mathematicians and aerospace engineers can discover research opportunities and Ph.D. programs.

TEC fosters innovation across all engineering disciplines. By equipping students with knowledge and igniting their curiosity, TEC paves the way for future advancements and groundbreaking discoveries in the ever-evolving world of engineering.

These programs cater to students, faculties, researchers, and industrialists, providing them with valuable skill development opportunities and promoting a culture of continuous learning. Moreover, these training programs also create awareness about the Technology Readiness Level (TRL) and the activities of the technology-enabling center.These programs not only address industry needs but also facilitate networking, knowledge dissemination, and the transformation of creative ideas into practical applications, contributing to the overall growth and advancement of the community.

Industry-Academia Meet

1. Innovation Seminar for National Technology Day Celebrations at Jansons Institute of Technology, Coimbatore

Dr. Prashanth R. Nair, from the Amrita Technology Enabling Centre (TEC), was invited to participate in a webinar hosted by the Jansons Institute of Technology's Institution's Innovation Council (IIC) and National Digital Library (NDL) Club. The event coincided with National Technology Day and aimed to ignite young minds with a passion for innovation and startups.

2. Panelist for Conclave on Transforming Businesses in Digital India of CODISSIA

Dr. Prashant R. Nair, DST-Amrita Technology Enabling Centre (TEC) fellow and Head, IQAC, Amrita Vishwa Vidyapeetham Coimbatore campus, was a panelist for a conclave on Transforming Businesses in Digital India organized by Coimbatore District Small Industries Association (CODISSIA) at Kumaraguru College of Liberal Arts & Science, Coimbatore on 25th March 2024.

Other distinguished panelists included Dr. Deepak Mishra, Director and Chief Executive of ICRIER thinktank; Mr. V. Thirugnanam, President of CODISSIA, and Mr. B. Raghava Srinivasan, Associate Vice-President, of ICT Academy of Tamil Nadu. Dr. Prashant actively contributed to a panel that delved into assessing infrastructure, literacy, and innovation for Digital India as also traversed shifts in consumer behavior, AI integration, and the imperative for responsible data utilization.

3. Solarisation Of Kerala

Amrita Vishwa Vidyapeetham's Technology Enabling Centre (TEC) actively participated in a week-long exploration of Kerala's renewable energy initiatives (April 22nd-25th, 2024). The centrepiece was the "Awareness Workshop on SOLARISATION OF KERALA " held in Cochin. TEC aimed to foster collaboration and exchange knowledge to advance solar energy adoption in the state.The workshop provided valuable insights.

Discussions focused on reducing electricity bills, environmental protection, and widespread installation strategies for rooftop and ground-mounted solar systems. Recognizing the challenges and opportunities present, TEC explored potential areas for collaboration with Kerala's renewable energy stakeholders.

Technical aspects of the solar system and charging station installation were covered, equipping TEC with the practicalities involved. Additionally, the "Surya Ghar Muft Bijli Yojana" scheme provided a platform for potential collaboration to raise awareness and facilitate scheme utilization. Discussions around Electric Vehicles (EVs) and charging infrastructure highlighted the potential for a comprehensive renewable energy ecosystem, another area where TEC seeks collaborative opportunities.

This visit served as a springboard for TEC to forge connections and identify potential areas of collaboration in Kerala's renewable energy sector. Amrita TEC, with its expertise, is poised to contribute significantly to the state's solarisation goals and the development of a robust renewable energy ecosystem through collaborative efforts.

4. Empowering MSMEs for Sustainable Growth

The Amrita Technology Enabling Centre (ATEC) recently participated in the Federation of Indian Chambers of Commerce and Industry's (FICCI) "Empowering MSMEs for Sustainable Growth" initiative. This participation likely involved presenting their work in empowering MSMEs through technology solutions, showcasing products or services, and networking with stakeholders. By engaging with FICCI, ATEC not only raised awareness of their solutions but also gained valuable insights into the current needs of MSMEs in the technological landscape, allowing them to tailor their offerings for maximum impact on sustainable growth.

Events

1. Technology demonstration at Wipro, info Park, Cochin.

A team from Amrita Vishwa Vidyapeetham's Technology Enabling Centre (TEC) visited Wipro's Kochi office located in Infopark. The purpose of the visit was to discuss advancements in technology development and explore potential collaborations. The TEC team highlighted the Centre's significant role in fostering innovation and driving technological advancements across various sectors. Wipro offered a dedicated booth for Amrita Vishwa Vidyapeetham to showcase its research projects, innovations, and collaborations in the field of technology. The visit further included a presentation on their latest AI innovations, showcasing their cutting-edge technologies designed to revolutionize artificial intelligence and its applications. This visit fostered valuable discussions and opened doors for future collaboration in technology development.

2. Amrita Research & Innovation Symposium for Excellence (ARISE) 2024

The Amrita Technology Enabling Centre has demonstrated profound commitment to innovation, sustainability, and societal impact through various initiatives, notably our participation in the Amrita Research & Innovation Symposium for Excellence (ARISE) 2024. This event highlighted Amrita TEC's dedication to transcending disciplinary boundaries and addressing global challenges with sustainable solutions. Our interdisciplinary projects, which combine cutting-edge technology with practical applications, have significantly impacted various sectors, emphasizing environmentally friendly technologies, public health improvements, and enhanced quality of life for communities. Additionally, Amrita TEC's involvement in the Faculty Hackathon further exemplifies our innovative approach and commitment to excellence, encouraging faculty members to engage in creative problem-solving and technological advancements.

3. A Call to Action for Youth: Human Trafficking and the Role of Youth in Prevention

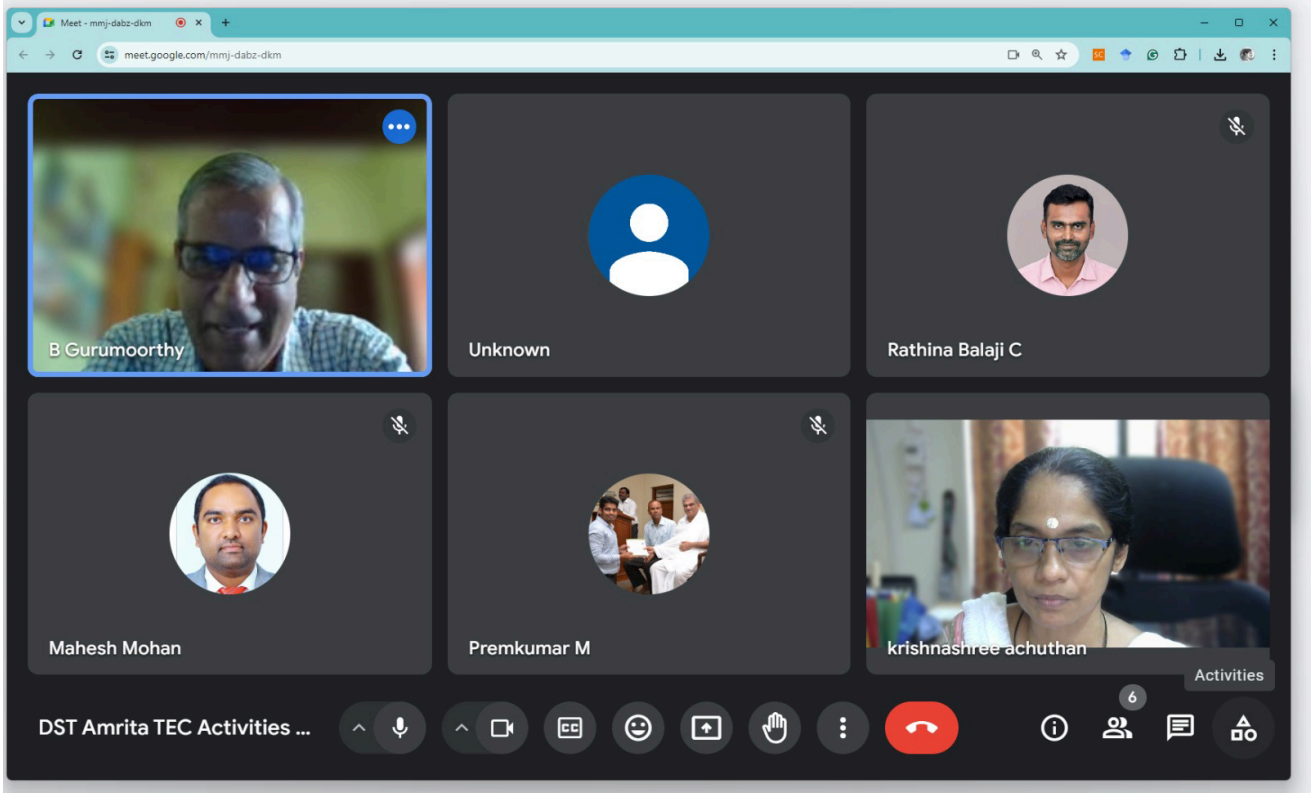
Amrita Vishwa Vidyapeetham hosted an impactful talk titled "A Call to Action for Youth: Human Trafficking and the Role of Youth in Prevention" by Dr. P.M. Nair, a distinguished retired law enforcement official. Organized by the Amrita Technology Enabling Centre, which is keen on combating human trafficking through technological developments, the event

addressed the pervasive nature of human trafficking, its impact on children, women, and labor sectors, and highlighted preventative measures. Dr. Nair emphasized a multi-faceted approach involving government, law enforcement, NGOs, and the community, stressing the importance of strengthening laws, enhancing law enforcement capabilities, and increasing public awareness. He passionately called on young people to be proactive in their communities by raising awareness, volunteering, using social media to spread information, and participating in advocacy and policy-making processes. Based on the talk, recommendations include implementing educational programs in institutions, fostering partnerships between educational institutions, law enforcement, and NGOs

4. DST TEC Conclave 2024: Reviewing Achievements

The Department of Science and Technology (DST) organised the 'TEC Conclave 2024' on March 14, 2024 at DELNET, New Delhi. The conclave object was to review the TEC activities, network with peer TECs for collaborations. Co-ordinators from 22 TECs presented the accomplishments of their centres. Dr. Krishnashree Achuthan, Director DST-Amrita TEC demonstrated the success story of the DST Amrita Technology Enabling Center. The feedback from The Expert Advisory Group (EAG) were noted for incorporation into the future plans.

5. Interaction with Prof.B.Gurumoorthy TEC Mentor



Amrita TEC interacted with Prof. B.Gurumoorthy to discuss their activities and challenges. Prof. Gurumoorthy recommended expanding their network to attract more partners and projects. Funding strategies were also discussed, including faculty involvement in negotiations, industry co-funding requirements, and faculty incentives for industry-funded projects. Prof.B.Gurumoorthy suggested leveraging alumni for CSR grants to support technology development. Amrita TEC will implement these suggestions moving forward.

Awards

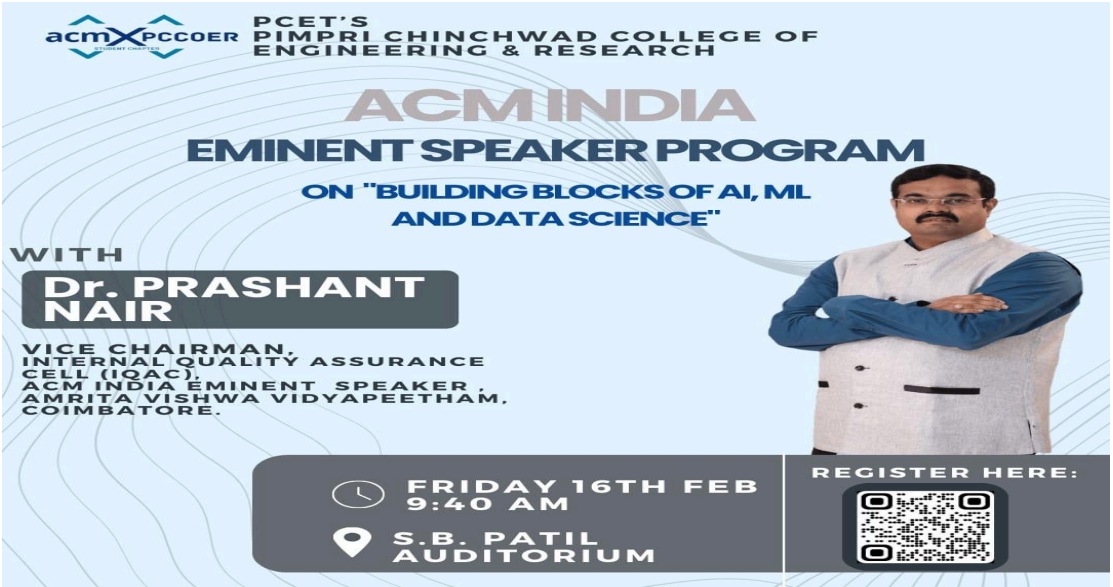
1. Smart India Hackathon 2023 Expert Evaluator Recognition for DST-Amrita TEC Fellow

Dr. Prashant R. Nair, DST-Amrita Technology Enabling Centre (TEC fellow) was an expert evaluator for the Smart India Hackathon (SIH) 2023. He evaluated problem statements of the Ministry of Housing and Urban Affairs, Government of India at the nodal center, Forge Incubator, Coimbatore at the SIH2023 grand finale from 19 to 23 December 2023. Prime Minister of India, Shri Narendra Modi interacted with the participants of the Grand Finale on 19th December 2023 via video conferencing. In line with the Prime Minister's vision of youth-led development, SIH is a nationwide initiative to provide students a platform to solve the pressing problems of Ministries and Departments of the Government, industries, and other organizations. Launched in 2017, the Smart India Hackathon has gained massive popularity among young innovators. In the last five editions, many innovative solutions have emerged in different domains and stand out as established startups. In SIH 2023, more than 50,000 ideas were received from 44,000 teams, which is almost a seven-fold increase compared to the first edition of SIH.

2. DST-Amrita TEC Academic Partnership Program

As part of the DST-Amrita Technology Enabling Center (TEC)'s academic partnership program, Dr. Prashant R. Nair, DST-Amrita TEC fellow, and Head - Internal Quality Assurance Cell (IQAC), Amrita Vishwa Vidyapeetham, Coimbatore campus delivered the following talks for various academic institutions

- Innovation & Technology Readiness Levels for Kumaraguru School of Business (KSB), Coimbatore on 14 February 2024
- Building Blocks of AI, ML, and Data Science for International Institute of Information Technology (I2IT), Pune on 16 February 2024
- Building Blocks of AI, ML, and Data Science for Pimpri Chinchwad College of Engineering (PCCOE), Pune on 16 February 2024
- Building Blocks of AI, ML, and Data Science for Pimpri Chinchwad College of Engineering & Research (PCCOER), Pune on 16 February 2024



3. AIC Raise Edu Bridge Summit 2024 Panelist

Dr. Prashant R. Nair, DST-Amrita Technology Enabling Centre (TEC) fellow and Head, IQAC, Amrita Vishwa Vidyapeetham Coimbatore campus, was a panelist for the Edu Bridge Summit 2024 organized by and held at Atal Incubation Centre (AIC) Raise, Coimbatore, on 6 January, 2024. Other

distinguished panelists included Mr. Sujith Kumar, Associate Vice-President of Infosys, and Ms. Rufina Tresa Mendez, project coordinator at NASSCOM. 150+ ecosystem enablers and professionals attended the panel discussion, which focused on the need for design thinking, innovation, and entrepreneurship for 21st-century skilling.

4. Consolation Prize at IMTEX, 2024

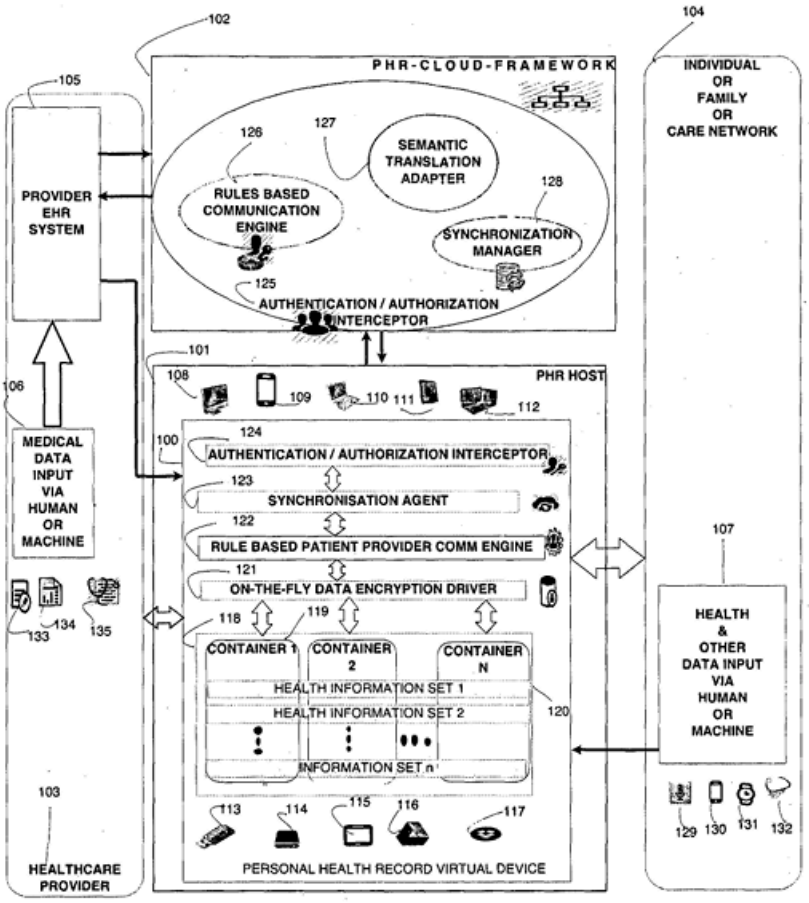
Amrita TEC impressed at IMTEX FORMING 2024, the International Forming Technology Exhibition held in Bengaluru. Our research on "Humanoid Mobile Robots for Multipurpose Societal Applications" in metal forming earned them a consolation prize from the Indian Machine Tool Manufacturers' Association (IMTMA). This recognition underscores our dedication to developing innovative robotic solutions with real-world applications in the industry.

Patents & Designs Granted through TEC

S.No	Patent name	Title	Year
1	Indian Patent 503394	Portable secure health record device & system for patient-provider communication granted on January 25, 2024	2024
2	Indian Patent 501351	System And Method For Synthesizing, Preserving Consistent Relative Neighborhood Positions In Multiperspective Multipoint Tele-Immersive Environment granted on January 19, 2024	2024
3	Indian Patent 498460	Balance Monitoring and Training System granted on January 12, 2024	2024I
4	Indian Patent 500165	Hand Orthosis Control Using Electrooculography granted on January 17, 2024	2024
5	Indian Patent 461661	An automatic pancake PREPARING MACHINE	2024
6	Indian Patent 537200	Wearable Wireless Tongue Controlled Devices	2024
7	Indian patent 509445	Using CPS enabled microgrid system for optimal power utilization and supply strategy"	2024
8	Indian Patent	SYSTEM FOR SELF DRIVING WHEELCHAIR AND THE METHOD THEREOF	2024
9	Indian Patent 501351	System And Method For Synthesizing, Preserving Consistent Relative Neighborhood Positions In Multi-Perspective Multi-Point Tele-Immersive Environment	2024
10	Indian Patent 500165	HAND ORTHOSIS CONTROL USING ELECTROOCULOGRAPHY	2024

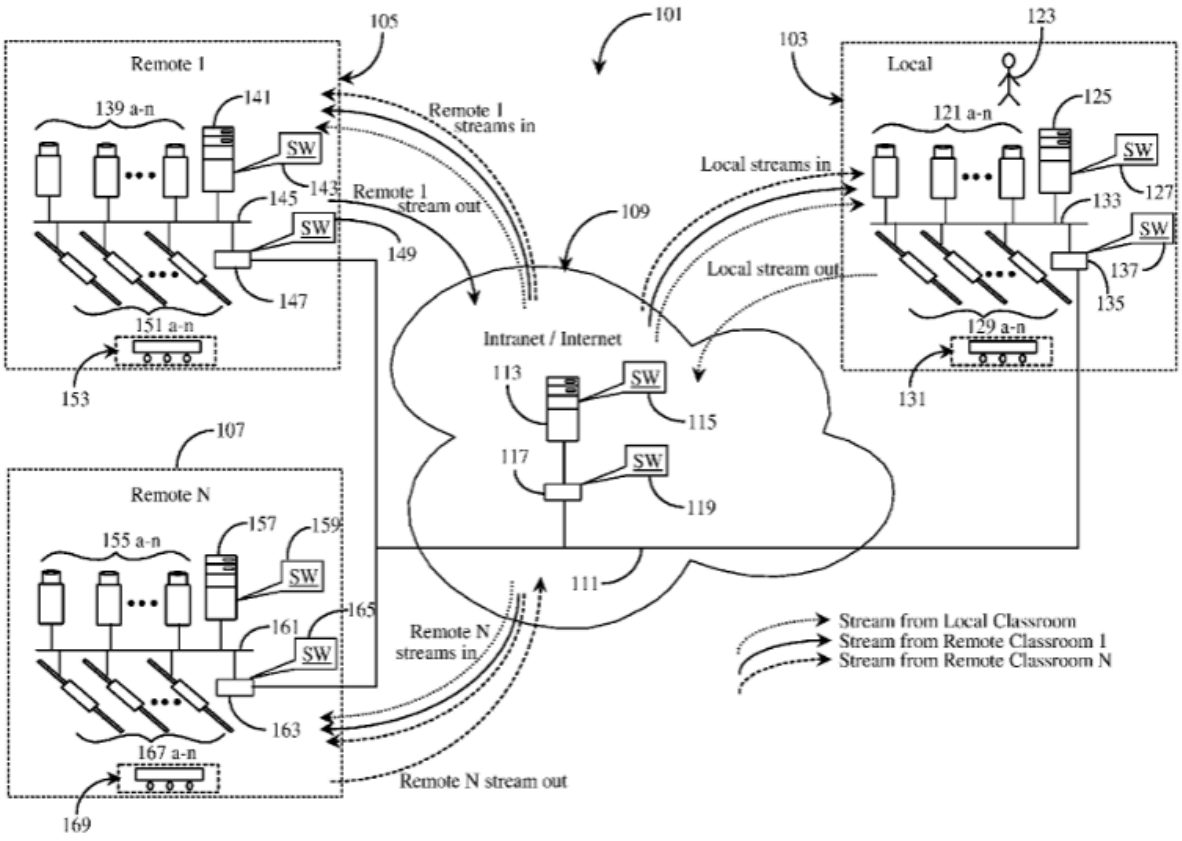
1. Indian Patent 503394 - Portable secure health record device & system for patient-provider communication granted on January 25, 2024

The present invention relates to portable secure health system. The portable secure health system provides communication of a person's personal health record between at least one patient and at least one service provider or among at least two service providers in a secure environment. The system comprises of unique portable personal health record (PHR) device (100), PHR Host (101) and patient provider communication system. The PHR device may be a physical storage device such as USB flash drive or SD card, or a virtual device entirely contained in a single file system file or cloud drive. The communication systems are also synchronized in a secure environment between PHR device (100) and patient provider communication system (102, 105).



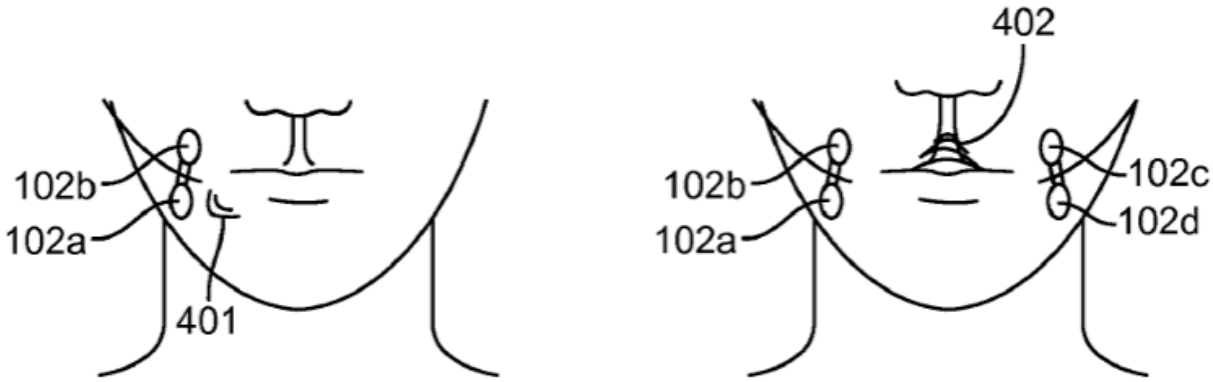
2. Indian Patent 501351 System And Method For Synthesizing, Preserving Consistent Relative Neighborhood Positions In Multiperspective Multipoint Tele-Immersive Environment granted on January 19, 2024

An e-learning system has a local classroom with an instructor station and a microphone and a local student station with a microphone, a plurality of remote classrooms with an instructor display and a student station with a microphone, and planar displays and video cameras in each of the classrooms, the remote and local classrooms connected over a network, with a server monitoring feeds and enforcing exclusive states, with sets of video displays, each set dedicated to a remote classroom, arrayed along a line orthogonal to a line between the instructor station and the local student station, with one display in each set facing toward the instructor station, and one display in each set facing toward the local student station.



3. Indian patent **537200-** Wearable Wireless Tongue Controlled Devices

A wearable device and a system to provide an input for a computing device are disclosed. The device comprises a sensing unit to deliver infrared signals to the facial region of a user and to receive transmitted or reflected signals therefrom, and a processing unit to determine the position or movement of the tongue of the user based on the received infrared signals. The processing unit is configured to provide an input to a computing device based on the determined position or movement of the tongue. The system further comprises a transmitter for wirelessly transmitting the input from the processing unit to the computing device



4. Indian patent 509445 “Using CPS enabled microgrid system for optimal power utilization and supply strategy"

The power grid experiences dynamic variations in energy generation and demand, inclusion of renewable energy alone will not assure self-sustainability of the grid system. Energy sustainability can be achieved by developing Cyber Physical System enabled smart buildings capable of dynamic energy management. In this research work, we propose the architecture for CPS enabled sustainable buildings integrated with Distributed Energy Generators (DEG). We have developed three algorithms, namely, Equipment Classification Algorithm (ECA), Context Aware Room Energy Utilization (CAREU), and Availability based Management Algorithm (AMA), for dynamic energy management to attain energy sustainability of smart buildings, and optimization models for profit maximization in smart buildings. Prototype of the smart buildings are developed with features such as realtime energy monitoring, renewable energy integration, dynamic rescheduling and reallocation of

energy utilization of equipments to attain energy sustainability. The results show that the proposed method provides energy sustainability compared to the current state-of-the-art methods.

5. System For Self Driving Wheelchair And The Method Thereof

The present invention relates to a system for self-driving wheelchair that provides navigational assistance in both indoor and outdoor environments. More particularly, the present invention relates to software 5 enabled self-driving wheelchair with single LiDAR (Light Detection And Ranging) sensor without the need of internet or GPS. The present invention also provides a method for operating self-driving wheelchair. This was successfully tested with patients having mobility issues (stroke patients, spinal cord injury patients etc.) at the Dept. of Rehabilitation and Physical Medicine, Amrita Institute of Medical Sciences, Kochi, Kerala, India.