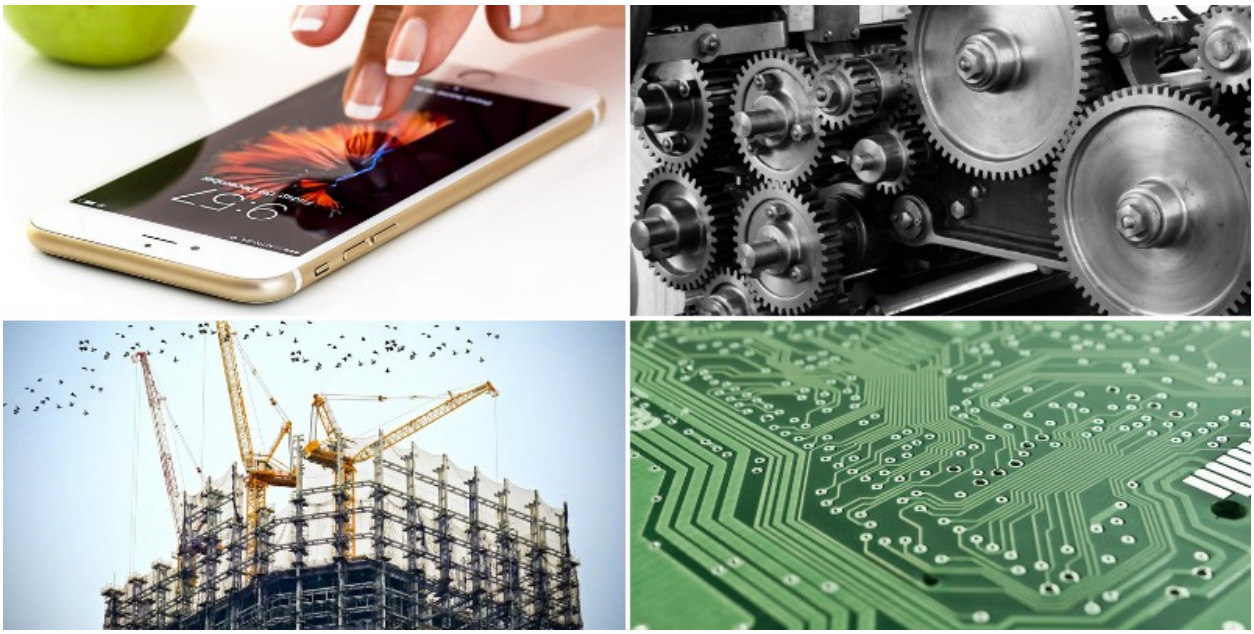


DST-Amrita TEC Centre

Six Monthly Update

June 30 2022

Dr. Krishnashree Achuthan

Amrita Vishwa Vidyapeetham

Amritapuri

Kollam, Kerala - 690546

Overview

This report has the following sections:

- Technologies Mined - TEC team assessed individual patented and funded projects to assess the TRL levels and interacted with the inventors to discuss way forward
- Technologies in Development - A set of technologies under development were shortlisted and their market studies were completed
- Technologies Commercialised - TEC Team helped with securing of funds to scale innovations towards commercialization.
- Technologies Transferred
- Industry Interactions
- MSME Interactions & Discovery of Issues
- Events & Webinars
- Outcomes

Quick Reference of the Technologies

Technologies in Pipeline	Braking of wind mill Goa Shipyard - Smart weighing system Router
Technologies under Development	Bar bending technology Cashew nut shelling Automation of Plywood curing process Universal Measuring Machine Water treatment Dr.Meera Mam project Oxygen concentrator
Technologies transferred	Rural projects by Dr.Manisha Brazing of dissimilar metal
Technologies commercialised	Smart Foundry 5 in 1 ECG

Snapshot Summary

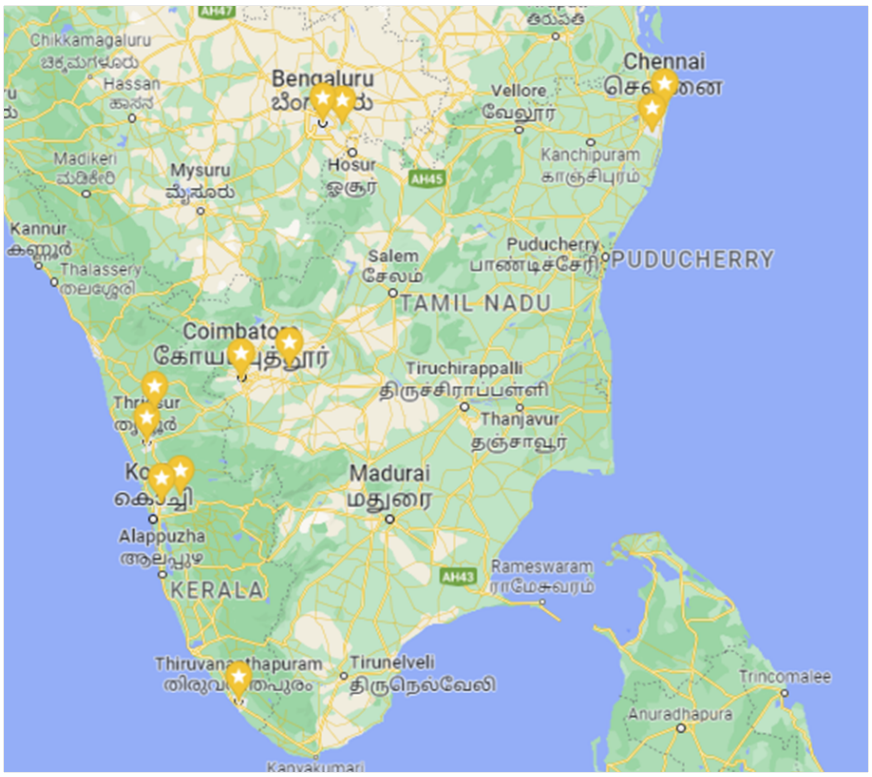
1. Technologies Mined - 105
2. Technologies in Development - 6
3. Technologies Commercialised - 2
4. Technologies Transferred - 3
5. Industry Interactions and MoUs
6. MSME Problem Identification - 15
7. Events
8. Webinars -
9. No. of faculty involved

Summary

It has been 2 years since the Technology Enabling Centre was established in Amrita. The TEC has become the hub of the Research and Development activities at Amrita, and it is the nodal point for Researchers, MSMEs and Government Agencies for Assessment, Enabling, Co-Development, Transfer and Commercialization of Technologies.

TEC was involved in mining of Technologies, inside Amrita and outside of Amrita too and there have been approximately 100+ technologies mined and now they are at different stages of TRLs. The last six months saw a few MOUs signed, for Co-Creation of technologies, Technology Transfer and Product Development.

TEC team visited a number of MSMEs in Kerala and Tamil Nadu for a tie up for technology enablement and TEC will be signing a few MOUs with industrial associations in next weeks. Here is the report of the activities done by Amrita TEC during the last six months.



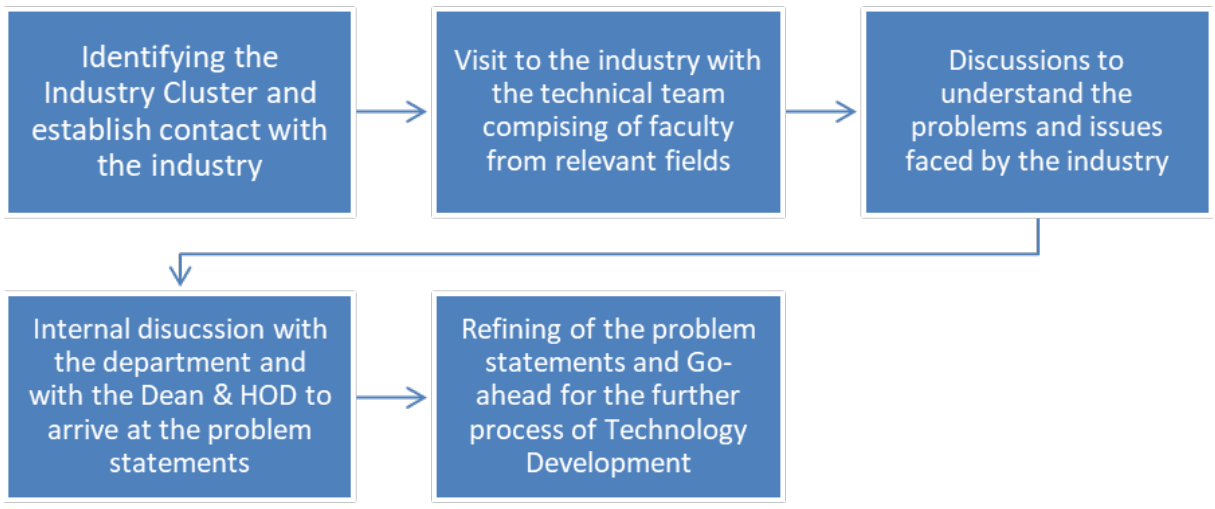
List of Regions DST-Amrita TEC has reached out to.

Technologies Mined

Technology Mining is an important activity of the Technology Enabling Centre and TEC at Amrita was able to mine about 105 technologies within Amrita and also externally. Majority of the technologies mined externally are from DST - AMT funded projects. Here is a brief summary of the same.

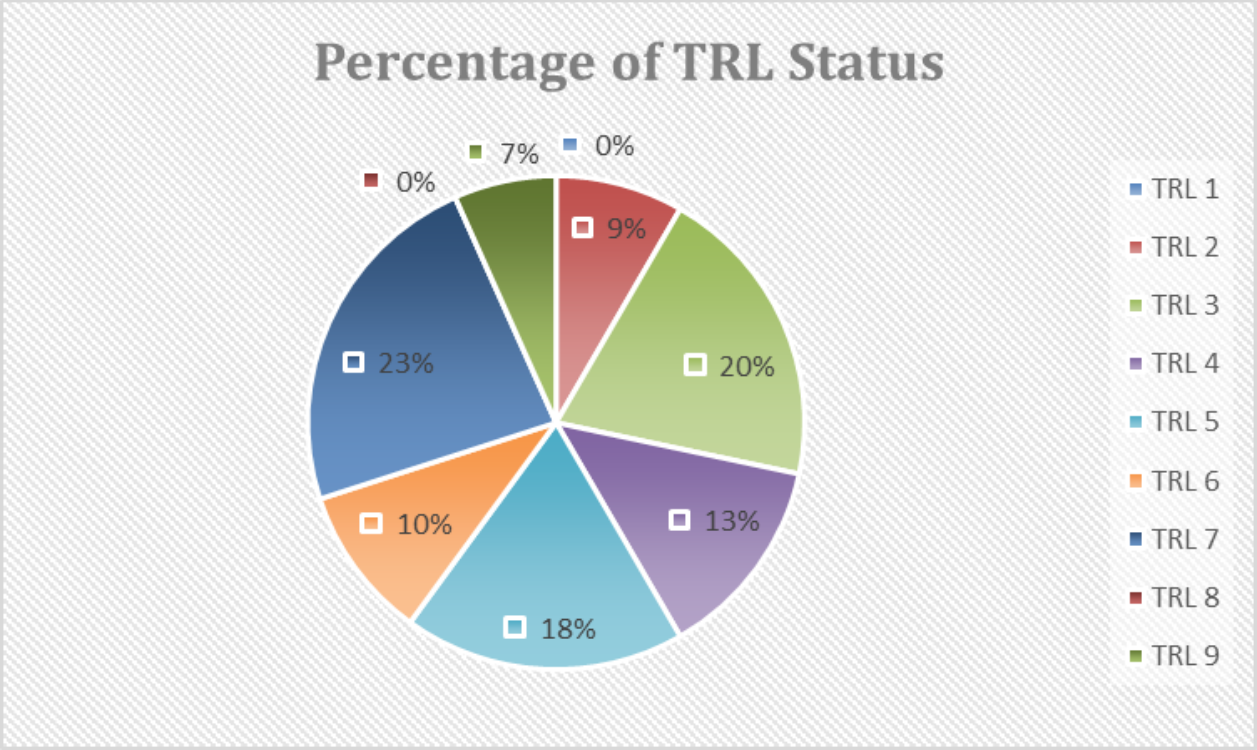
Source	Number of Technologies	Current Status
Amrita Vishwa Vidyapeetham & Others (GoI, Research Institutes such as IIT Kanpur, VIT, CSIR, Nodal Centres)	About 120 technologies are mined within Amrita and external agencies.	About 30 of them are selected for the next stage and they are under various stages of research and development and some of these projects are funded by the Govt. Agencies and CSR activities

I. Process of Technology Mining at Amrita TEC



Format used for Technology Mining Process at Amrita

Graphical Representation of TRL Level computation by Amrita TEC team



Few of the technologies mined and shortlisted to assist with technology enablement

Projects	Source
Washable adhesive and related products	DST - Compendium
Development of Supply Market Intelligence System with supplier selection and performance monitoring for auto ancillary industry	DST - Compendium
Agarose based wound dressing material	DST - Compendium
SMART Foundry 2020	DST - Compendium
Additive Manufacturing, Coating and Lasers	DST - Compendium
Development and Prototyping of ICT enabled Smart Charging Network Components	Amrita

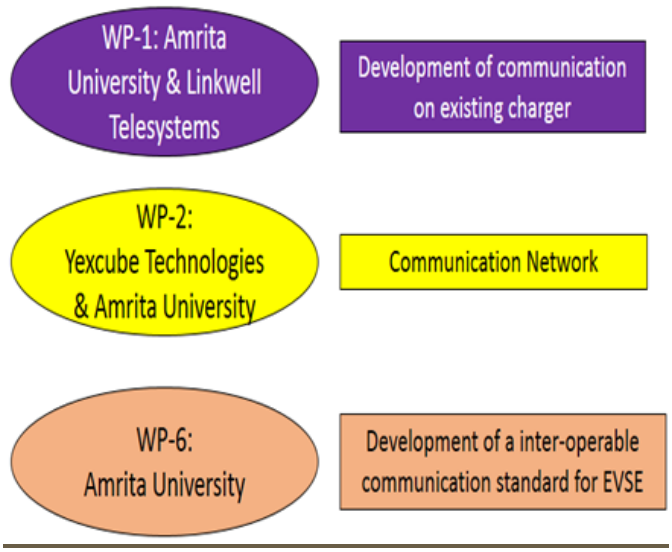
Automation of Transport and Building Feature Extraction using deep learning with Super - Resolution Enhancement of Satellite Imagery-reg	Amrita
Fabrication of a lab-on -a-chip device for the point of care testing of haemoglobin	Amrita
Amrita Pranavayu - A Portable Oxygen Concentrator for Medical and Defence Applications	Dept. of Chemical Engg. and Material Science, Amrita

These projects are at various stages of discussion to take it to the next level. The project from NIT, Tiruchirapalli, the Prototype is ready and TEC team isin discussion with the Aerospace Connector Manufacturers to commercialise the product.

Technologies Developed

II. Development and Prototyping of ICT enabled Smart Charging Network Components

Specific Objectives



1. To design a bidirectional Electric Vehicle Supply Equipment for residential and public charging stations as per ARAI standards.

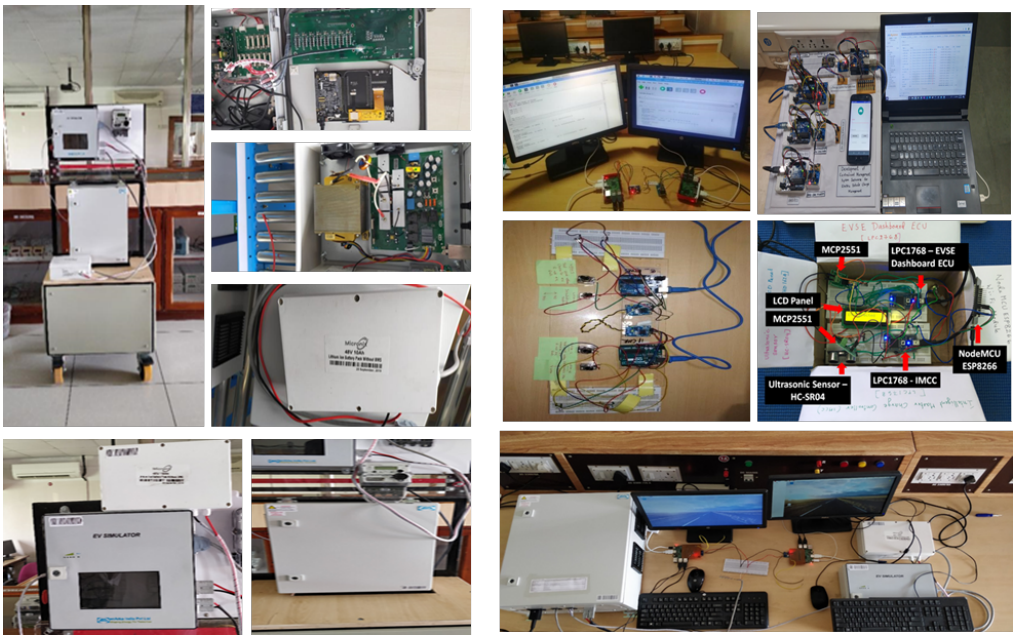
2. Development of control algorithms to limit the introduction of harmonics, dc and non-sinusoidal currents.

3. To develop a net-meter following IEC 62056 (DLMS/COSEM) communication standard for monitoring, supervisory control and data storage in V2G environment.

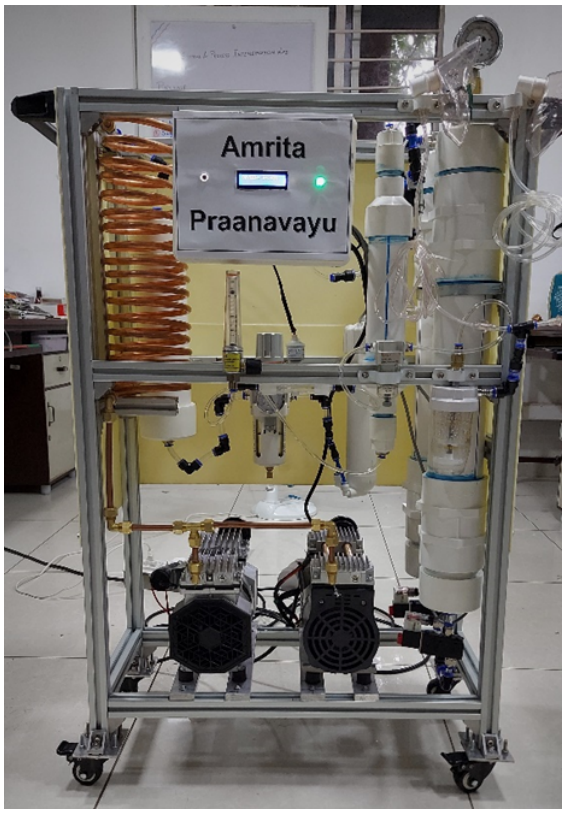
4. Development of communication architecture integrating consumers, vehicles (as load or source), and utility (electrical and infrastructure)

Status - **Completed. Attained TRL-4 (Amrita).**

- Development of EV charging emulators
- Implementation of GB/T and OCPP messages in EV charging emulators
- Implementation of GB/T, CHAdeMO and OCPP messages in MATLAB for HIL system development
- Development of BMS simulator in MATLAB for HIL system development
- Development of CMS services like end user Android apps, Web apps, server-side apps and cloud algorithms
- Development of chargers in MATLAB and in hardware with different specifications
- Implementation of algorithms and smart models for SoC, SoH, slot booking, charging station recommendation, grid integration etc.

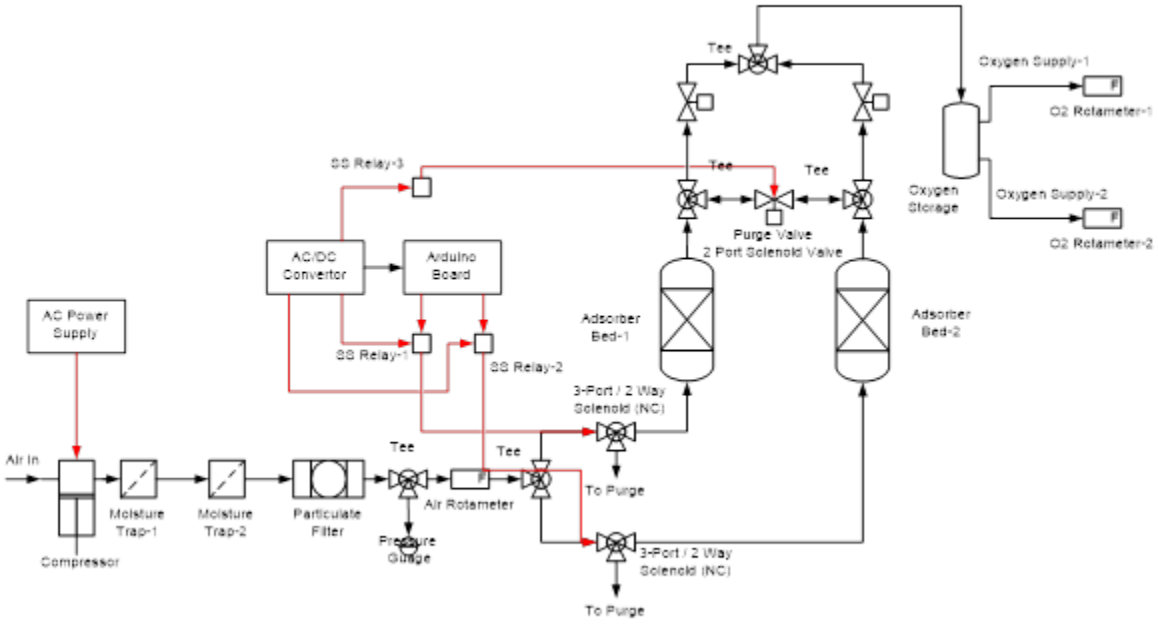


III. Amrita Pranvayu - A Portable Oxygen Concentrator for Medical and Defence Applications



COVID-19 pandemic has truly exposed the lack of preparedness of humanity in the face of a large-scale disaster. The most unfortunate part was the lack of medical equipment to assist patients with breathing. Oxygen concentrators had to be flown from foreign countries to overcome the shortage of oxygen concentrators in India.

The key component is the zeolite material used in the oxygen concentrator. Dr. Udaya Bhaskar Reddy Ragula, Professor, and Dr. Thirugnasambandam G.M, Associate Professor, Department of Chemical Engineering & Materials Science, Amrita School of Engineering, Amrita Vishwa Vidyapeetham, Coimbatore, came up with an idea that in the case of disruption of supply chain for any reason, the oxygen concentrator is required to function at the desired productivity and purity of oxygen. The proposed oxygen concentrator would work irrespective of the material used through a model predictive control algorithm that is in build as part of the microcontroller (Arduino board).



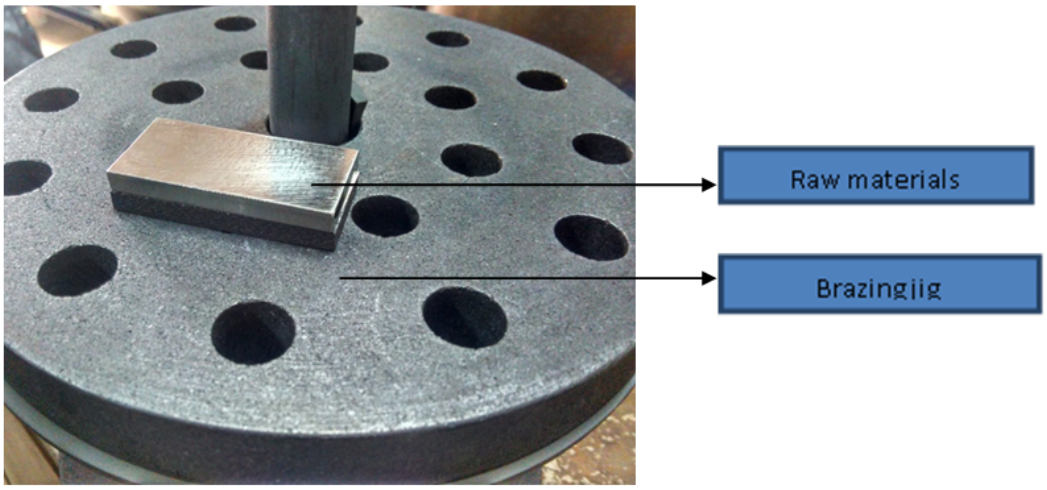
The Prototype of the product is ready and the product has been tested in the lab environment and achieved the **Technology Readiness Level (TRL) 4.** The project is funded by Indian Navy and The oxygen concentrator can be deployed in the following cases:

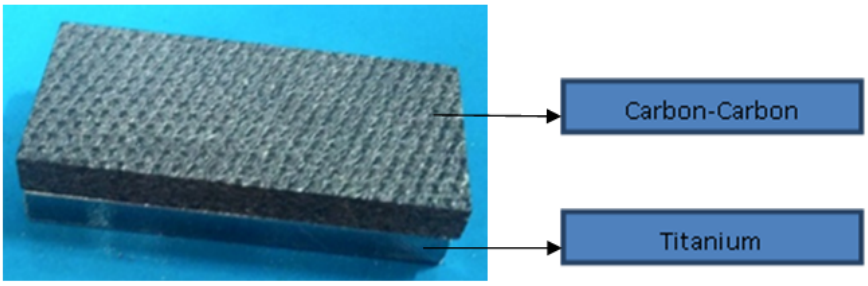
- Hospitals
- Portables units for patients with breathing difficulties
- High altitude oxygen supply

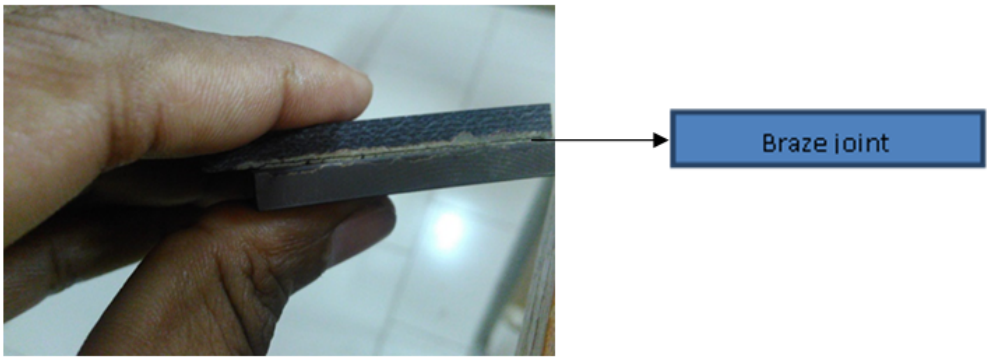
The unique selling point of Amrita Pranavaayu is that it can work with any zeolite materials among many available with an inbuilt model predictive control algorithm

IV. Development of Braze Joint between Carbon-Carbon Composites and Titanium Alloy - In partnership with Indian Space Program

This project involves development of suitable Brazing Technology between advanced aerospace carbon-carbon composite and titanium alloy, which comes under *ceramic to metal sealing* domain of material science. (Braze joint is a type of welding, in which two vastly different difficult to weld materials are welded with carefully carved process)







Ceramic to metal sealing technology, though it was more than 1000 years old, is still a technological wonder for researchers and manufacturers. Among many types of ceramic to metal seals, high temperature seals between carbons -carbon (ceramic) composite to titanium alloy for space application is one of the most critical parts to do.

Amrita has solved technical issues arising from the braing by (1)optimising brazing cycle, (2) " metal OUT-ceramic IN" design, (3) successfully using copper based active brazing alloy which has potential for **aerospace , high temperature** application.

The Prototype of the project and la testing is completed and achieved the TRL level of 5. Amrita Team is exploring the opportunities for technology transfer.

Technologies in the Pipeline

V. The Technologies in pipeline and are various phases of development

The TEC department at Amrita has identified some of the technologies which are taken up for development and in various stages of Development

Technology	Department
Cashew Nut Cutting – Fine tuning the technology to reduce the wastage and labour cost	Mechanical Engineering
Bricks from plywood ash	Civil Department, Cbe
Development of field trial, pilot production and technology demonstration of sintered brake pads with improved performance for wind turbine applications suitable to India specific wind characteristics	Mechanical Engineering

A. Development of field trial, pilot production and technology demonstration of sintered brake pads with improved performance for wind turbine applications suitable to India specific wind characteristics

Currently used brake pad assembly

brake pad assembly - aimed bythis project

In a major stride towards indigenization, researchers at Amrita are involved in development of critical and complicated components for the energy sector. Wind turbine brake pad assembly is one of the

components, for which Amrita is aiming for an End *to End solution* (Raw materials, process know-how, more importantly the process equipment). This project is aimed at technology transfer and establishment of local manufacturing.

As the process equipment is a critical bottleneck & gap for establishment of advanced manufacturing technology in India, it is addressed in the project and technology will be developed along with equipment.

By incorporating two major scientific inventions (1) functionally graded materials and (2) advanced joining technologies, substantial enhancement of properties & performance of brake pad assembly is expected at the end of the project as early as 2023.

Technologies Commercialised

VI. Powered Air Purifying Respirator

Low cost Powered Air Purifying Respirator (PAPR) for frontline medical workers for Covid-19 response and during any other pandemics was developed by the Ammachi Labs and Amrita Institute of Medical Sciences. The PAPR kit has been successfully commercialised and it is available at the some of the Medical Equipment Agencies in the Country.

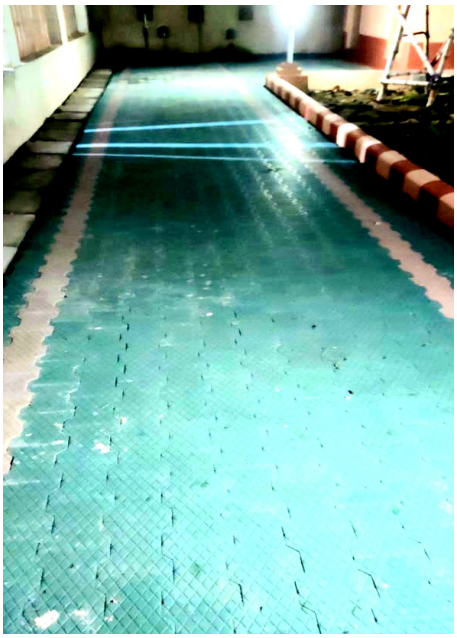
Technologies Transferred

VII. Waste Water Treatment Technology with Ruhvenile Biomedical OPC Pvt Ltd, New Delhi

Bio-Sciences process for treatment of wastewater was developed by Amrita Bio Sciences scientists and the technology was transferred to Rhunville closely held Indian company for development of vertical gardening in urban areas. The technology was implemented in phases for the waste water treatment in Delhi. TEC team helped secure CSR grants and facilitated technology transfer.

VIII. Agreement with R-Cube Plastics, Coimbatore

Students of Aerospace Department at Amrita ably guided by Dr. Santanu Bhowmick, developed a Technology to Convert Single Use Plastics (bags and bottles) into useful products like Pavement Tiles and for Window Coverings. The product is developed and the Technology is transferred to the R-Cube Plastics, Coimbatore at a Royalty of 5%. The tiles developed are successfully installed at Ramakrishna Mission, Narendrapur, Kolkata and Dashagram HIgh School, West Midnapur, West Bengal.



IX. Technology Transfer to Midgard Electric

Midgard Electric is bringing a new concept to our Electric Vehicle Charging Station (EVCS) networks known as HAAS-'HARDWARE-AS-A-SERVICE'. EVCS's are bottlenecks for EV adoption & Midgard Electric is installing EVCS on pay-per-use model through our EVCS network.

X. Technology Transfer to Purnam Bitoech

The product transferred was developed for wastewater treatment with capacity of 500 liters per day. By using layers of biofilter made of phages, microbes, algae, plants. The solution is most economic & aspirational solution for decentralized sanitation needs. The plants/algae/microbes growing can be used in agriculture (animal feed, fertilizer). The system can be adapted for both grey & blackwater (with faecal contaminants), fully automated, monitored over mobile network.

XI. Technology Transfer to Ayurarogya Foundation

Automating banana fiber extraction and sheet making processes. Made reusable menstrual pads from banana fiber. The key to scaling is to have automated processes for extracting, cleaning, and setting the banana fiber. We will build/enhance three machines for this.

XII. Technology Transfer to Haksh-E Robotics

Haksh-E Robotics is a startup that intends to develop minimalist low-cost interactive social robots that could instil positive habits in children from a very young age. Our robots feature artificial intelligence which can facilitate intelligent conversations and provide feedback based on autonomous action recognition systems. We also intend to develop affective computing capabilities in our robots.

XIII. Technology Transfer to Guru Kripa Electrolyzers

Guru Kripa Electrolyzers is building prototypes of indigenous, high-surface-area, anion exchange membrane water electrolyzer for hydrogen and oxygen production. The prototype will involve novel IP on incorporation of nanostructured catalysts on high-surface-area substrates, designs of electrolyzer and optimum conditions for maximum hydrogen production rate and yield. Guru Kripa Electrolyzers' novel technology is expected to be a major indigenous solution in Atmanirbhar Bharat's move towards net-zero-emissions and sustainable development.

Industry & Academia Interactions and MOUs

XIV. MOU with Gururaj Deshpande Center - IIT, Chennai

Amrita TEC and GDC – IIT signed an MOU to collaborate in assisting researchers in customer discovery, customer development, Commercialisation of academic research and to train and facilitate researchers. It was further agreed to leverage their strengths to collaborate on projects to solve societal and humanitarian issues.

XV. Agreement with Traboda

Amrita TEC signed an agreement with Traboda for framing of process for Cyber Security and Development. Bond on a portal which focuses on the preparedness for Cyber Security.

XVI. Non-Disclosure Agreement with BPL- Pharma

Amrita TEC signed a Non-Disclosure Agreement with BPL for exchange of knowledge, information and Co-Creating and development of products and processes related to Medical Devices.

Agreement Signing with BPL and Amrita at ASE Coimbatore

XVII. MSME Interactions

Amrita TEC team is visiting the MSME clusters in Ernakulam, Kottayam, Thiruvananthapuram and other locations in Kerala to identify and understand their products, processes and issues. Prof. Surendran has visited more than 30 units so far to assess their needs and their Technology Readiness Level. Amrita TEC is offering the services like – Technology Development, Prototyping, Testing and Commercialization. Amrita TEC also arranges Training Programs and Skill Development Workshops.

Amrita TEC team is visiting the Special Economic processing Zone, Kakkanad, Kochi

XVIII. Engagement with Cashew Nut MSME Cluster

A seven member faculty team from Amrita along with Mr. Surendran visited two factories in Kayankulam, Kerala to understand the process and the issues in the Cashew Nut Factory.

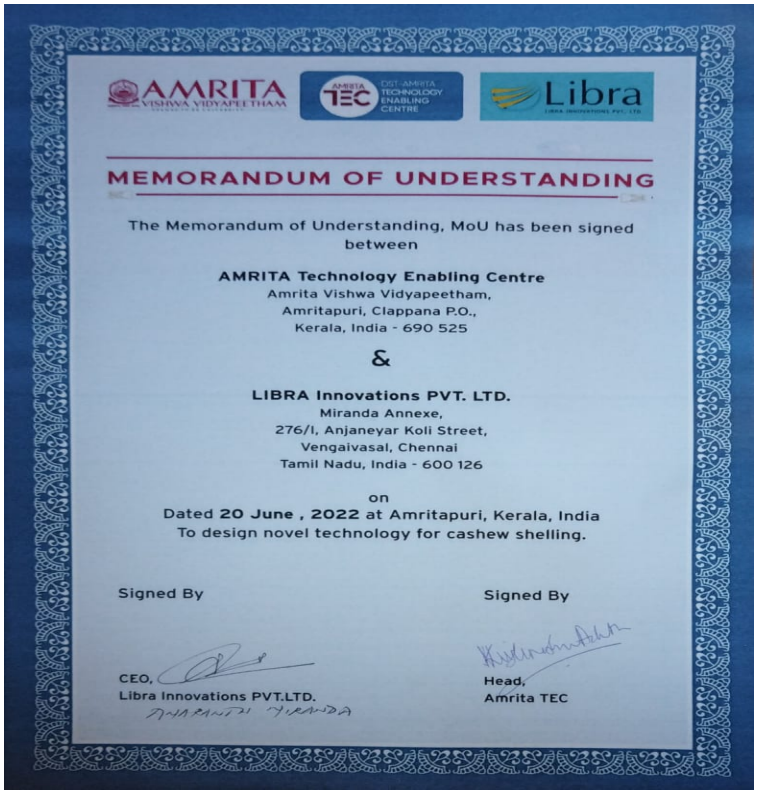
The entire process involves Roasting, Shelling, Drying, Peeling, Grading, Quality Controls, Fumigation and Packaging, which is a very labour-intensive process and takes about 10 days to complete. Industry has mechanised some of the process to reduce the cost incurred and increase productivity.

Further, to the discussion with the Consortium of the Cashew Nut Industry in Kollam and Libra Industries Pvt. Ltd. Chennai, Amrita team was entrusted with the task of solving the technical issue to increase the productivity, thereby lowering the cost incurred. An EOI is signed between Amrita TEC and Libra Industries Pvt. Ltd for Research and Development on 20-Jun-2022.

After multiple interactions with the stake holders involved - Libra Industries Pvt. Ltd., Cashew Nut Industry Consortium and Amrita Team and , it was agreed that the Amrita will take up the issue for research and development

and fine tuning of the technology to achieve the desired results. An EOI is signed by Amrita TEC team and Libra Industries Pvt. Ltd to take it ahead. Mr.Surendran K N from Amrita TEC played a major role in this and Dr. Pramod from Mechanical Engg Dept. will be leading the research efforts to resolve the issues.

Discussion of MOU with Amrita TEC and M/S Libra Innovations Pvt. Ltd, Chennai At Amritapuri



AMRITA VISHWA VIDYAPEETHAM

AMRITA TEC DST-AMRITA TECHNOLOGY ENABLING CENTRE

Libra

MEMORANDUM OF UNDERSTANDING

The Memorandum of Understanding, MoU has been signed between

AMRITA Technology Enabling Centre
Amrita Vishwa Vidyapeetham,
Amritapuri, Clappana P.O.,
Kerala, India - 690 525

&

LIBRA Innovations PVT. LTD.
Miranda Annexe,
276/1, Anjaneyar Koli Street,
Vengaivasal, Chennai
Tamil Nadu, India - 600 126

on
Dated **20 June , 2022** at Amritapuri, Kerala, India
To design novel technology for cashew shelling.

Signed By

CEO,
Libra Innovations PVT.LTD.

Signed By

Head,
Amrita TEC

Signing of MOU with Amrita TEC and M/S Libra Innovations Pvt. Ltd, Chennai At Amritapuri

XIX. Collaboration with Plywood Consortium

Amrita TEC team is visiting the Plywood Cluster Consortium, Angamaly, Kerala

XX. Amrita TEC Participation in Government of Tamil Nadu's Naan Mudhalvan initiative meeting

Naan Mudhalvan meeting held at government secretariat complex at Chennai on 18 June, 2022 presided by Mr. Udhayachandran T, IAS, Principal Secretary to the Chief Minister of Tamil Nadu. This is a pet initiative of the Tamil Nadu government and is in collaboration with NASSCOM & Tamil Nadu Skill Development Corporation.

- Amrita TEC representation in its committee for:
- Evolving a comprehensive plan of action to address employability and skill gaps existing in the state of Tamil Nadu
- White paper on above-mentioned area and fostering innovation in academia
- Structured program for capacity building of manpower for industry and MSME clusters
- Support in solving the problems faced by industry and MSME clusters through technology enablement in universities and colleges
- Strengthen the enabling eco-system with active participation of higher educational institutions with special programs and incentives
- Thrust sectors of the government announced as:
    - Semiconductor
    - Fintech & BFSI
    - Electric Vehicles (EV)
- Priority for thrust sectors in technology development support such as patenting, assessment, mining and market study from the government

XXI. Machinery Expo Expo 2022 Kerala

The Machinery Expo 2022 Kerala was organised by Department of Industries & Commerce, Govt. of Kerala between 24th – 27th Jan 2022 at JLN International Stadium Ground, Ernakulam

Shri G. S. Prakash, Joint Director and Head of office of MSME DI Thrissur visits Amrita TEC Stall at Machinery Expo 2022 at Ernakulam, Kerala

Amrita TEC participated under the technical Institutions category. Amrita showcased the products developed in house – N96 masks, PAPR kit, E-Wheel Chair, UV Sanitzer, Solar driven vehicle and IIOT Sensor products and the visuals were displayed in the stall.

Stall attracted a good number of visitors and there were few genuine queries regarding the Armita TEC who wanted to take their technology to the next level and to the market. The following brochure was distributed to the visitors.

AMRITA VISHWA VIDYAPEETHAM

DST-AMRITA TECHNOLOGY ENABLING CENTRE

DEPARTMENT OF SCIENCE & TECHNOLOGY

DST - TECHNOLOGY ENABLING CENTRE (TEC) @ AMRITA

MISSION

To create an eco-system 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.

PROFILE

DST – Amrita TEC was established with the support of Department of Science and Technology, Govt. of India. Our mandate is to create an Ecosystem for Technology Development in the state and in the country by networking with Researchers, Institutes, National Laboratories and Industry.

The focus of TEC will be on providing an innovation ecosystem, process and support system to ensure the technologies/innovations developed reach the market through market driven technology transfer & research

OBJECTIVES

- Technology Mining and Commercialisation
- Market Mining & Market Study
- R&D Reports in Industry clusters
- Technology Enablement
- Creating Ecosystem

DRIVERS

- Translate technologies and discoveries to market, bridge gap between research and industry, ensuring a Win-Win situation for all the stakeholders.
- Product development by supporting setting up of projects for validation or prototyping of technologies
- Assessment of technology readiness level (TRL) of the technologies developed at MSMEs

PRODUCTS FOR COMMERCIALIZATION

Nano Masks | Powered Air Purifier Respirator Kit

UV Sanitizers | Self Driving E Wheel Chair

CONTACT US

Technology Enabling Centre (TEC),
Amrita Vishwa Vidyapeetham,
Amritapuri, Clappana P. O.,
Kerala, India – 690 525.

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+91 8921434611
+91 9500696677
tec@amrita.edu

SCAN ME

XXII. Issue Identification Central Coir Research Institute, Alappuzha, Kerala.

Amrita TEC team is visiting the Central Coir Research Institute,Alappuzha, Kerala

Sri. Radhakrishnan A. Asst. Director i/c explaining to Amrita TEC team during their visit to the Central Coir Research Institute,Alappuzha, Kerala

AMRITA TEC team Mr. K.N.Surendaran, Mr.R.Venkatesh and Mr.C.Rathina Balaji visited Coir Research Institute and ‘Enterprise India National Coir Conclave at Coimbatore to identify the opportunities in COIR Industry. Following insights and opportunities were identified.

Amrita TEC team at "Enterprise India National Coir Conclave "at Coimbatore

The global coco coir market stood at a value of around USD 304.8 million in 2020. The market is expected to grow at a CAGR of 8.1% in the forecast period of 2022-2027 to attain a value of around USD 485.9 million by 2026. An optimistic growth rate of 13.35% CAGR is also possible and to reach USD 948.69 million by 2027. However, new technology and innovative products have to be developed to achieve this growth. Globally Over 30 countries in Asia, East Africa and America grow coconut. Only India and Sri Lanka do value addition to this natural fibre. India commands monopoly with 80% world trade in coir yarn and coir products. Though more than 30 countries spread over the tropical belt in the regions of Asia, East Africa, and America grow coconut, the economic utilisation of coconut husk, which otherwise is a waste material, is made only in Asian countries that too on a significant commercial scale in India and Sri Lanka. In India Kerala, Tamil Nadu, Karnataka, Andhra Pradesh, Odisha, Puducherry, Maharashtra, West Bengal, Gujarat, Assam, Tripura, Lakshadweep, and Andaman and Nicobar Islands

- To identify and transfer existing technologies and promote the use of coir fibre products currently on the market to compete with substitutes
- To mine new technologies and identify innovative products in which natural fibres have advantages over synthetics.

XXIII. Visit to MECON Engineering Consortium Centre, Manjeri, Kerala

Amrita TEC team is visiting the MECON Fabrication common Facility Centre,Manjeri,Kerala

Amrita TEC team is visiting the MECON Fabrication common Facility Centre,Manjeri,Kerala

As a part Technology mining Amrita TEC team visited the common facility centre of steel fabrication cluster “ MECON CFC '' at Manjeri. The CFC is equipped with Machines like Lath, Milling, Drilling,Grinding , Welding, Bending ,Painting and Powder coatingAnd also having a Classroom.

Currently the CFC is utilised by more than 100 fabrication units in Manjeri and nearby.

XXIV. Visit to TINTEX 2022, Handicrafts Exhibition , Thrissur, Kerala

Amrita TEC team is visiting the MECON Fabrication common Facility Centre,Manjeri,Kerala

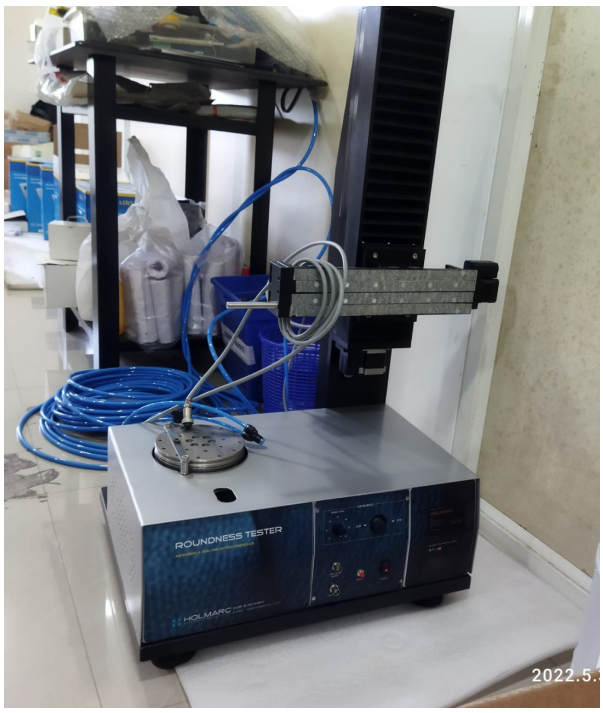
https://youtu.be/lVchLZXbYDo

Tindex **2022** -**Thrissur** Industrial **Exhibition** is an Exhibition of products of Small and Medium Scale industries. About 60 participants were participated. Mainly from Handicrafts sector. The visit help us to identify various needs of cottage industries in Kerala.

XXV. Prototyping and Commercialisation discussion with M/S Holmarc Opto Mechatronics, Kalamassery, Kerala.

Presentation of advantages of Universal Measuring Machine to M/S Holmarc by Mr.K.N.Surendrar, TEC Amrita.

AMRITA-TEC team made its discussions with M/s Holmarc Opto Mechatronics Pvt Ltd to prototype and commercial manufacturing of Universal Measuring Machine. Mr.K.N.Surendran, Liaison Executive, MSME Technology Enabling Centre explained the distinctive advantages of the Universal Measuring Machine that it has high accuracy of 0.0001 mm. The patency of the product will be with Amrita School of Engineering and the manufacturing and marketing will be done by M/S Holmarc Opto Mechatronics Pvt Ltd. A one time Technology Transfer Fee and a royalty on sales is to be paid by M/S Holmarc Mechatronics Pvt Ltd.



Universal Measuring Machine (UMM), Developed by Amrita School of Engineering Amritapuri, CMTI Bangalore and Holmarc Opto-Mechatronics Ltd,Kerala

XXVI. Meeting with CSEZ Members, Kerala for Technology Transfer & Innovation for MSMEs

Amrita TEC participated in the meeting with Cochin Special Economic Zone Members for the Technology Transfer and Innovation in Technology to boost productivity, an DST, GOI and Amrita TEC initiative.

Mr. Surendran and Dr. Shiju Sathyadevan participated in the event and addressed the consortium members and briefed about the activities of the TEC. The TEC team will be visiting the consortium members to try and understand the issues faced by them.

Sri. K K Pillai, President SEZ, Kochi, introducing Amrita TEC team

XXVII. Meeting with Agri Implements Consortium, Shornur , Kerala

Agri tools manufactured at Shornur Agri Impliments Consortium

Amrita TEC Team Visited The Agri Implements Consortium at Shoranur, Kerala.

The Consortium Chairman Mr. Purushothaman discussed various problems, challenges and opportunities facing the industry. The TEC team visited the following units.

1. M/S PARASAKTHI Tools and Impliments, Shoranur.
2. M/S Gayathri Tools, Shoranur.
3. M/S Universal Agrico, Shoranur

The issues face by the industry are

- Availability of quality raw material
- Upgradation of process for Zero defect
- Marketing strategies

XXVIII. Visit to KERALA POTTERY, Thrissur, Kerala

<TEXT Required>

XXIX. Visits to Industry and Industrial Associations in Coimbatore, Tamilnadu

Amrita TEC team visited various associations on the advise of Mr. Karthigai Vasan, GM / Dy. Director, Dept. of Industries and Commerce/MSME Dept. met with number of industrial associations to address the needs of the MSMEs. Some of the associations visited were - CODISSIA, Indian Institute of Foundrymen (IIF), Coimbatore Tirupur District Micro and Cottage Entrepreneurs Association (COTMA),The South India Engineering Manufacturers' Association (Siema), Tamilnadu Association of Cottage and Micro Enterprises (TACT), Coimbatore SIDCO Industrial Estate Manufacturers' Association, Tamilnadu Small and Tiny Industries Association (TANSTIA), The South India Spinners Association (SISPA), Foundries Development Foundation (FDF)

Amrita TEC team visited the IIF and met with the Chairman Mr. Balraj to understand the problems faced by the Foundry Industry. The Amrita Team also met with Dr. Bhagayanathan, Faculty at SREC, Dr. Nithianandam, Sr. General Manager, Barani Ferrocast Pvt. Ltd. The problem statements were arrived at after the meeting with the industry experts. The problem statements were then sent to DST with possible solutions and benefits to the stake holders and society at large.

Meeting with South India Spinners' Association officer bearers - President, Vice-President, Treasurer for an opportunity to address the association members to explain the activities of TEC and tie-up for technology development. The discussion are in initial stages and the followup meetings are expected to happen during the first week of July 2022.

Mr. Sureshkumar P, Operational Head, Foundries Development Foundation (FDF) visited Amrita Campus and met with Dr. Sasangan R, Dean Engineering and Dr. Govindaraju, Faculty in Mechanical Dept. A first of its kind initiative in the country FDF was keen on signing the MOU with Amrita for Research and Skill Development. The facility is coming up near Coimbatore and can be utilised by the Research Scholars, Faculty and Students for Research & Development.

Discussions are underway to sign MOU Amrita TEC & FDF for Research and Skill Development

Dr. B Vinodh Kumar, General Manager, CODISSIA Defence Innovation and Atal Incubation Centre (CDIIC) visited the campus and met with Dean. Engineering,

Dr. Sasangan R and Dr. Prashant Nair, Vice-Chariman, IAQC and discussion is in progress to sign an MOU with CDIIC for Research and Product Development.

Amrita Team – Dr. Prashant Nair, Vice-Chariman IQAC, Dr. Sivakumar, Faculty Aeronautics, Dr. Govindaraju, Faculty Dept of Mechanical Engineering and Mr. Venkatesh R visited the 5 BRD, AFS, Sulur, on the invitation of Dr. Vinodkumar, GM, CDIIC.

The Symposium was to indigenize the spares required for repairs of the aircrafts and other equipments

5 BRD team made the presentation on the requirements and how industry and academia can partner to indigenize the spare parts

5 BRD is looking at academia for Reverse Engineering, Research and Product Development

5 BRD team has invited the Amrita team to visit the AFS again for a detailed discussion and further association.

Meeting with President and Vice-President of SIDCO, Coimbatore for exploring the opportunities to address the association members and possible tie-up for Technology Development, Training and Skill Development. The Amrita TEC made a presentation to the association members about the activities of TEC and how Amrita TEC can help the MSMEs to grow.

XXX. Industry Visits & Arriving at Problem Statements

Amrita TEC team and Faculty team from Coimbatore campus, visited about 35 MSMEs in Coimbatore and Kerala for defining the problem statements as required by DST. Some of the industries visited were Barani Ferrocast Pvt. Ltd., Bright Castings Pvt. Ltd., RSM Autokast PVt. Ltd., Universal Iron Traders, Gokul Metals & Alloys etc., The problem statements were arrived based on the guidance received from DST and the same has been submitted to DST for further action the problem statements are listed below:

1. **Waste Management Technologies – Theme – Recycling of Scrap**

An effective and scalable technology for recycling, re-using of the waste sand coming out of the foundries and disposal of the Carbon wastes to reduce the pollution it is causing.

Project Summary

Foundries are one of the oldest industries surviving in the world today. Though newer technologies have come there still the problem of adapting to the changes and disposal or reusing of the industrial waste. One of the main ingredients required for foundry is the silica sand. After the use the sand is dumped laced with chemicals in the old wells or near to the water bodies or open lands. This is causing groundwater poisoning and depletion of soil fertility. Approximately 3000 tons of waste is being dumped in Coimbatore alone. Thus, prompting to find a solution for recycling and reusing the waste sand coming out of the foundries. As of now the sand cannot be reused as it would not give desired results.

The aim of the project is to find a technology solution to recycle and reuse the sand, thereby reducing the pollution caused by the waste sand from the Foundries.

1) Recycling and reusing of the Waste Foundry Sand (WFS) in foundry industry
2) Treating and using the WFS in construction materials when it is not fit to be reused in the casting industry;
3) Using the WFS in construction materials applying nanotechnology to arrest the toxic content leaching away on interaction with water.

Expected Outcome

- Reusing of the waste sand in the foundries there by reducing the excavation of sand from the sea shores
- Silica sand is a natural resource and with the reuse of the sand in the Foundries this natural resource can be conserved
- Reduction in water / soil contamination

- Reduction in fuel consumption since the sand is transported from far off places
- Reduction in air pollution
- Reuse of the sand means reduction on the quantity of the material required and thereby savings to the company.
- Improvement of health of the people as the ground water contamination can be reduced or stopped.
- Moving towards the environmental sustainability both at local level and global level.

2. **Waste Management Technologies – Theme – Process Automation for Effective Recycling of Scraps**

   Automation of fettling with AI and machine vision to be developed with a focus of reclaiming the material, protecting workmen from occupational hazards and eliminating environmental degradation.

   Project Summary

   After the casting is completed the fettling process is done to remove the unwanted metals from the casting which are currently being dumped as the waste. The excess parts such as die's parting lines, runners, risers, sprue, chills etc are unavoidable in casting process, but needs to be cut and removed when final product is to be made ready. The process is currently manual and labour intensive, which is an occupational hazard for the people and time consuming. Even after the this process, the unwanted materials will still be on the castings due to the human error. Another problem which is imminent is these wastes are collected by the scrap dealers and dumped indiscriminately all over the place, after removing the metal parts from the waste. The same metal is being mixed with other scrap material and resold to the Foundries for processing and this is causing a lot of wastage as the castings are developing during the process and large quantities of fine dust is produced which causes health hazards.

Hence, the need of the hour is to find a solution to reclaim the metal parts completely before dumping the waste. The industry is looking for an AI solution with machine vision which can reclaim the material completely before dumping the waste. A filing process can be adopted which can eliminate the dust produced as a by-product of the process.

Expected Outcome

- ★ Recovery of the material upto 95% - 98%
- ★ Safe working environment for the workmen – which is dust and pollution free
- ★ Recycling of the waste material upto 90%
- ★ Reduction /elimination of the occupation hazards
- ★ Protecting the earth from pollution and contamination thereby reducing the imminent health issues
- ★ Elimination of dust resulting clean working environment

3. Waste Management Technologies – Theme – CCUS

An effective and scalable technology for capturing, storing and reusing Carbon (CCUS) emitted from the industries and vehicles.

Project Summary

There is lot of carbon emission from the industries and emission from vehicles. This is causing air pollution and quality of breathable air has worsened in the cities. While there is immediate need to reduce the carbon emission from the industries and vehicles, another way is to capture the emitted carbon, storing and reusing the same to produce carbon related products. As of now the technology to Capture and Storing, Reusing the carbon is very expensive. As of now very few and big industries may be using this technology in other countries and yet to catch up in India.

There is a big and immediate need to find a cost effective and scalable solution to capture, store and use the carbon emission from the industries and vehicles.

Expected Outcome

- ➔ Reduction in the pollution levels in the country
- ➔ Increased air quality
- ➔ Improved health and living conditions
- ➔ Increased productivity

4. **Waste Management Technologies – Theme – Effective Recycling of Non-Ferrous Scrap Materials**

An effective and efficient scalable technology for reusing the Aluminum Scrap and reducing the pollution and contamination in the environment

Project Summary

Aluminium is one most recycled metal, but the metallurgical difficulty is significantly higher than the steel recycling. The difficulty arises due to a complicated sorting procedure of the collected scrap, 9 different alloys make the composition control and extraction of pure aluminium very difficult. There are a lot of hazardous emissions and metal oxides which need to be effectively disposed of or captured for reusage. The challenges are metal oxides during the melting process, evaporation of hazardous emissions such as carbon monoxide, lead etc, sorting of aluminium scrap, separation of ferrous scrap from aluminium scrap are most crucial.

But, aluminium and aluminium alloys being low melting metallic materials, has enormous scope for MSMEs to establish local recycling units if the following issues are sorted out.

- ➢ An innovative simplified method for sorting of aluminium scrap
- ➢ An innovative simplified method for separation if ferrous scrap and impurities from aluminium scrap
- ➢ Metallurgy for real time composition control

- ➢ Metallurgy for property enhancement of recycled aluminium alloys
- ➢ Control of emissions and solid contaminants

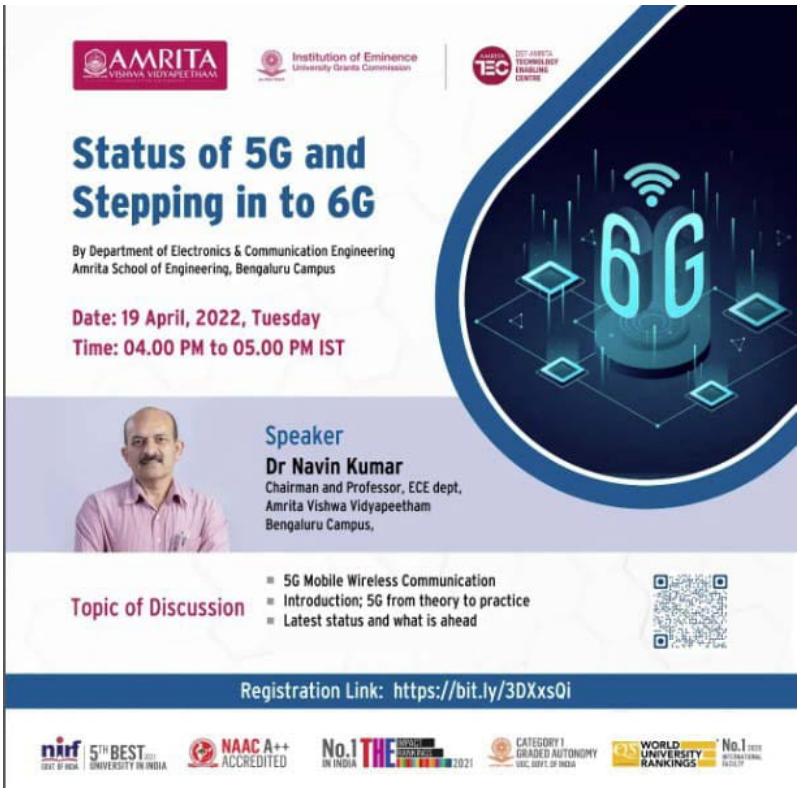
Expected Outcome

- Increased yield and productivity
- Better and safe working conditions
- Capturing, Storing Re-Usage of emitted carbon emitted during the melting process
- Eliminating indiscriminate dumping and pollution of environment

Webinars

XXXI. List of Webinars conducted

SI No	Title	Number of Attendees
1.	Status of 5G and Stepping in to 6G	165
2.	Blockchain Beyond the Hype: The Real Use Cases in Energy Sector	116
3.	Supply Chain Management	17
4.	The New Age Robotics - A multidisciplinary outlook	28
5.	Energy Storage Devices	21
6.	Camera Captured Document Processing	69
7.	Integrated Machine Health Monitoring	40
8.	Impact of Attitude, Values and Beliefs on Human Behaviour	16
9.	Industry 4.0 – An overview and challenges	46
10.	Biotechnology: The Future is Now	30
11.	AI for Natural Language Processing (NLP)	29
12.	Nudge Marketing and GenZ customers	36


AMRITA
VISHWA VIDYAPEETHAM
Institution of Eminence
University Grants Commission
Status of 5G and Stepping in to 6G
By Department of Electronics & Communication Engineering
Amrita School of Engineering, Bengaluru Campus
Date: 19 April, 2022, Tuesday
Time: 04.00 PM to 05.00 PM IST
6G
Speaker
Dr Navin Kumar
Chairman and Professor, ECE dept,
Amrita Vishwa Vidyapeetham
Bengaluru Campus,
Topic of Discussion
5G Mobile Wireless Communication
Introduction; 5G from theory to practice
Latest status and what is ahead
Registration Link: https://bit.ly/3DXxsQi
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AMRITA
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University Grants Commission
BLOCKCHAIN BEYOND THE HYPE: THE REAL USE CASES IN ENERGY SECTOR
By Department of Electrical & Electronics Engineering
Amrita School of Engineering, Bengaluru Campus
DATE: 21 APRIL, 2022, THURSDAY | TIME: 02.00 PM TO 03.00 PM IST
Speaker ▸ Dr. Anand. R
Assistant Professor,
Department of Electrical and Electronics Engineering
Amrita Vishwa Vidyapeetham, Bengaluru Campus,
Topic of Discussion
Introduction to Blockchain
Peer-to-Peer Energy Trading
Blockchain Enabled Smart Grid
Registration Link : : bit.ly/3xw6cHu
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SUPPLY CHAIN MANAGEMENT
By Department of Mechanical Engineering,
Amrita School of Engineering, Bengaluru Campus
25 April 2022, Monday
03:30 pm to 04.30 pm IST
Speaker
Dr. T. Srinivas Rao
Associate Professor
Department of Mechanical Engineering,
Amrita School of Engineering, Bengaluru
Topic of Discussion
Solving Supply Chain issues through evolutionary algorithms
Registration Link : bit.ly/3KR1uYt
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THE NEW AGE ROBOTICS - A MULTIDISCIPLINARY OUTLOOK
By Department of Electronics and Communication Engineering,
Amrita School of Engineering, Bengaluru Campus
27 April 2022, Wednesday | 03:30 pm to 04.30 pm IST
Speaker
Dr. Sreeja Kochuvila
Assistant Professor and Vice-Chair
Department of Electronics and Communication Engineering,
Amrita School of Engineering, Bengaluru Campus
Topic of Discussion
The current/emerging trends in robotics research
Registration Link: https://bit.ly/3uDKrUr
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AMRITA VISHWA VIDYAPEETHAM
Institution of Eminence
University Grants Commission
Webinar
Energy Storage Devices
by Department of Science and Humanities
Amrita School of Engineering, Chennai Campus.
April 29 2022 (Friday)
04:30 PM to 05:30 PM IST
Topic of Discussion
Energy storage devices
REGISTER NOW
bit.ly/3xFYhqX
SPEAKER
Dr Sarathchandran C
Asst. Professor
Department of Science and Humanities,
School of Engineering, Amrita Vishwa
Vidyapeetham, Chennai Campus.
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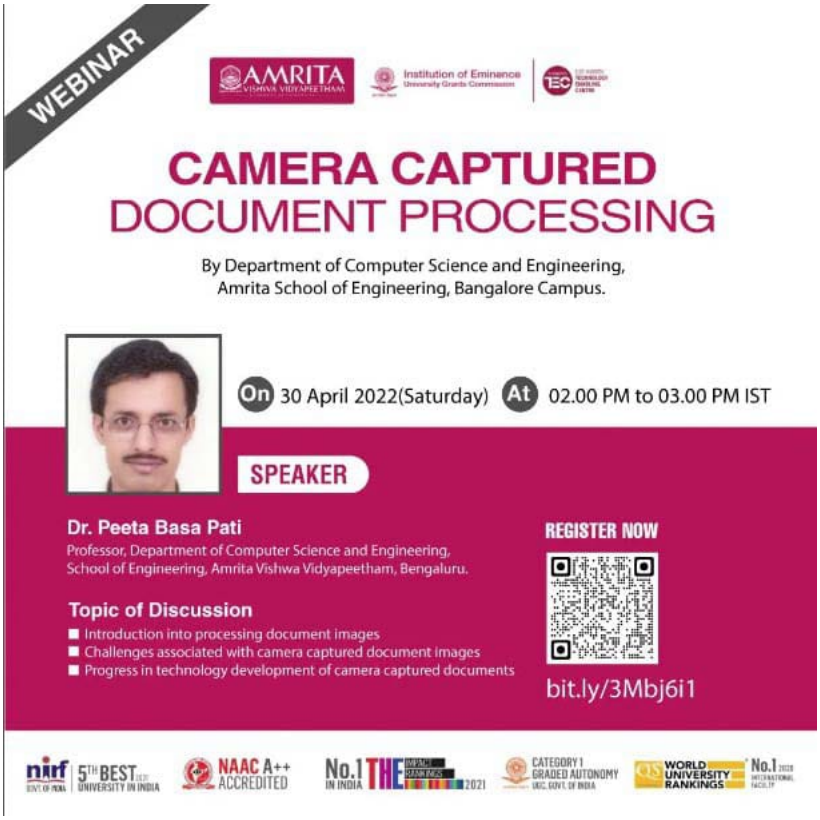
WEBINAR
AMRITA VISHWA VIDYAPEETHAM
Institution of Eminence
University Grants Commission
CAMERA CAPTURED
DOCUMENT PROCESSING
By Department of Computer Science and Engineering,
Amrita School of Engineering, Bangalore Campus.
On 30 April 2022(Saturday) At 02.00 PM to 03.00 PM IST
SPEAKER
Dr. Peeta Basa Pati
Professor, Department of Computer Science and Engineering,
School of Engineering, Amrita Vishwa Vidyapeetham, Bengaluru.
Topic of Discussion
Introduction into processing document images
Challenges associated with camera captured document images
Progress in technology development of camera captured documents
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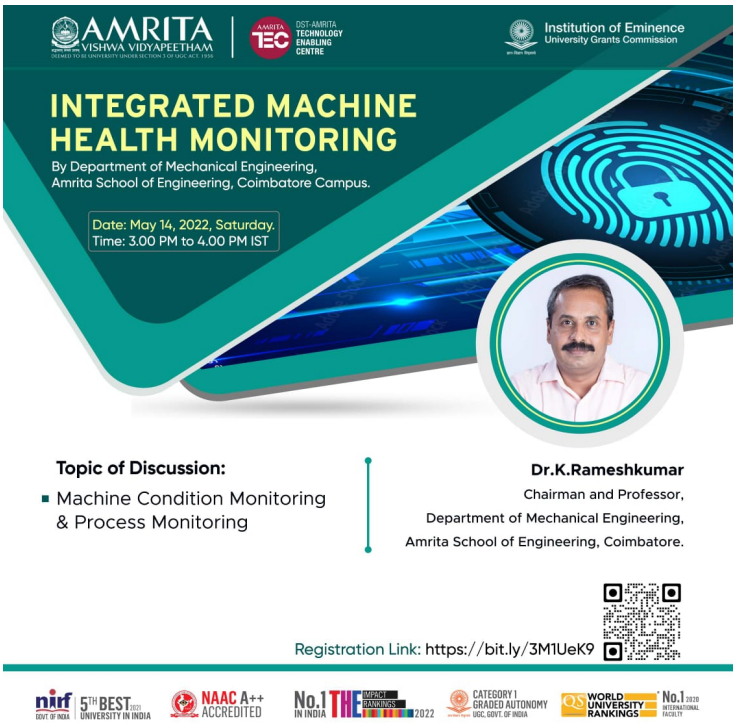
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Institution of Eminence
University Grants Commission
INTEGRATED MACHINE HEALTH MONITORING
By Department of Mechanical Engineering,
Amrita School of Engineering, Coimbatore Campus.
Date: May 14, 2022, Saturday.
Time: 3.00 PM to 4.00 PM IST
Topic of Discussion:
Machine Condition Monitoring & Process Monitoring
Dr.K.Rameshkumar
Chairman and Professor,
Department of Mechanical Engineering,
Amrita School of Engineering, Coimbatore.
Registration Link: https://bit.ly/3M1UeK9
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University Grants Commission
IMPACT OF ATTITUDE, VALUES AND BELIEFS ON HUMAN BEHAVIOUR
By Department of Management and Commerce,
Amrita School of Arts and Sciences,
Mysore Campus.
Date: May 18, 2022, Wednesday
Time: 11.00 AM to 12.00 PM IST
Topics of Discussions:
Basic aspects of human behaviour and how a person's attitudes, values, and beliefs influence his behaviour.
What type of human being is needed for the organization, and whowill be left behind in the race.
Speaker: Dr. Sriranjini.S
Assistant Professor,
Department of Management and Commerce,
Amrita School of Arts and Sciences,
Mysuru Campus.
Registration Link: https://bit.ly/3vVu5ql
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INDUSTRY 4.0
AN OVERVIEW AND SOME CHALLENGES
By Department of Computer Science and Engineering,
Amrita School of Engineering,
Bangalore Campus.
Topic of Discussion
A brief overview of Industry 4.0
Associated research challenges in Computing,
Communication, and Control/Monitoring.
Dr. B. Hariram Satheesh
R&D manager,
ABB Technology, Bangalore
Registration Link:
https://bit.ly/3Mhefwv
Date: May 21, 2022, Saturday
Time: 10.00 AM to 11.00 AM IST
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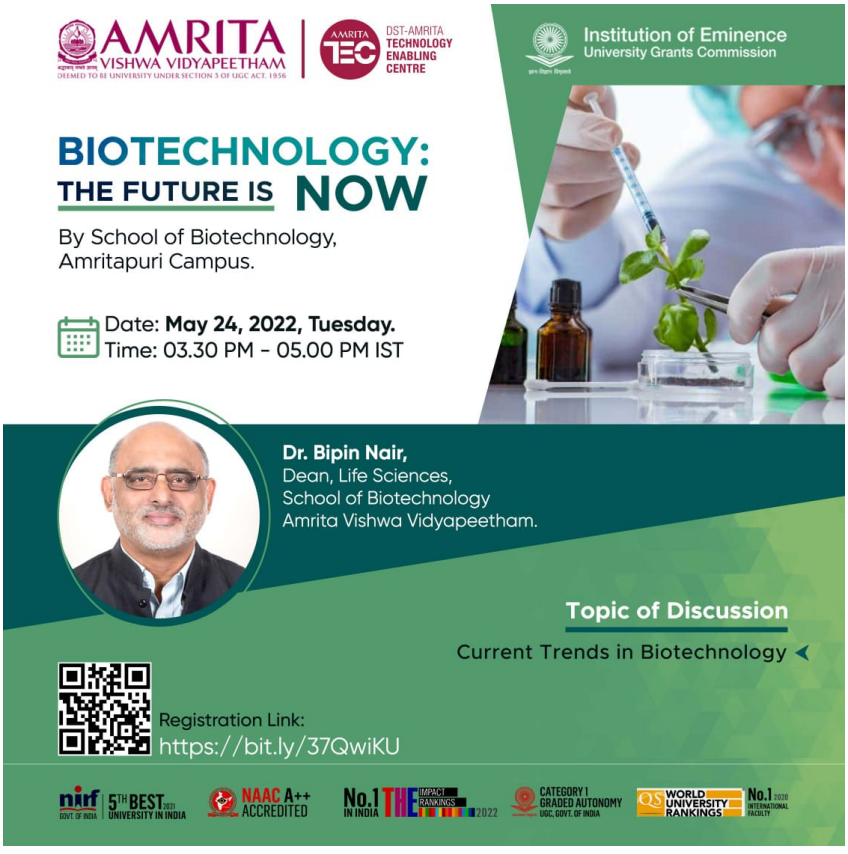
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University Grants Commission
BIOTECHNOLOGY:
THE FUTURE IS NOW
By School of Biotechnology,
Amritapuri Campus.
Date: May 24, 2022, Tuesday.
Time: 03.30 PM - 05.00 PM IST
Dr. Bipin Nair,
Dean, Life Sciences,
School of Biotechnology
Amrita Vishwa Vidyapeetham.
Topic of Discussion
Current Trends in Biotechnology
Registration Link:
https://bit.ly/37QwiKU
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Institution of Eminence
University Grants Commission
AI for Natural Language Processing (NLP)
By Center for Computational Engineering and Networking (CEN)
Amrita School of Computing,
Amrita Vishwa Vidyapeetham,
Coimbatore Campus.
Date: May 27, 2022, Friday.
Time: 05.00 PM - 06.00 PM IST
NLP
Dr. Premjith B,
Assistant Professor,
Center for Computational Engineering and Networking (CEN)
Amrita School of Computing,
Amrita Vishwa Vidyapeetham,
Coimbatore Campus.
The topics of Discussion:
Introduction to NLP
Recent Trends in NLP, Important Algorithms in NLP
Research problems in NLP
Registration Link: https://bit.ly/3LmZ1Vq
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AMRITA VISHWA VIDYAPEETHAM
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Institution of Eminence
University Grants Commission
Nudge Marketing and GenZ customers
By Department of Commerce and Management,
Amrita School of Arts & Science,
Amritapuri Campus
Date: May 27, 2022, Friday.
Time: 07.00 PM - 08.00 PM IST
The topics of Discussion:
How small attractions give great results in the market.
How to communicate with your customers when they are focused
Dr. SHEEJA.R
Assistant Professor,
Commerce and Management,
Amrita School of Arts & Science,
Amritapuri Campus
Registration Link: bit.ly/39sBXqW
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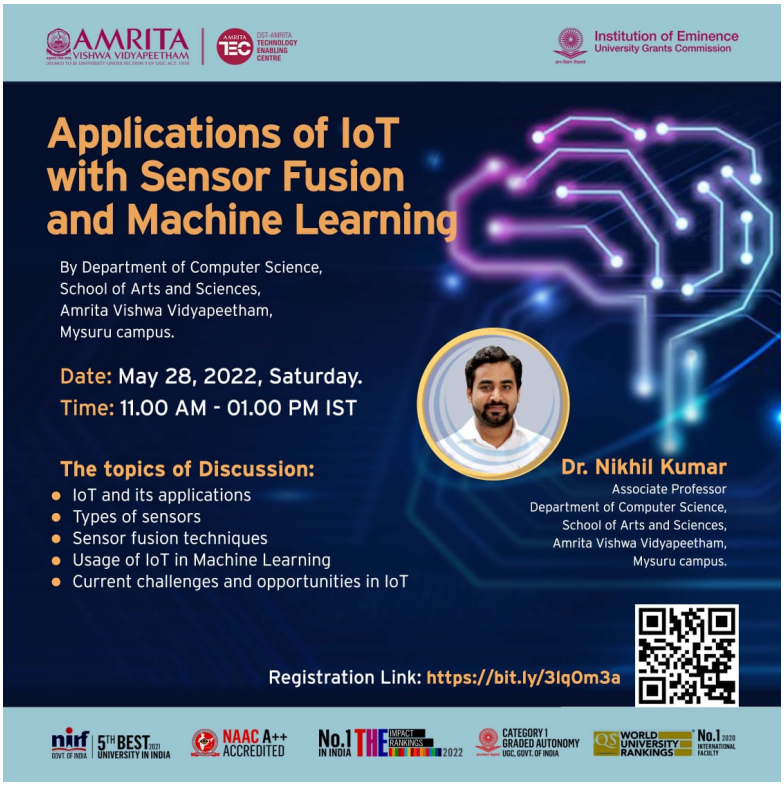
AMRITA VISHWA VIDYAPEETHAM
DST-AMRITA TECHNOLOGY ENABLING CENTRE
Institution of Eminence
University Grants Commission
Applications of IoT with Sensor Fusion and Machine Learning
By Department of Computer Science,
School of Arts and Sciences,
Amrita Vishwa Vidyapeetham,
Mysuru campus.
Date: May 28, 2022, Saturday.
Time: 11.00 AM - 01.00 PM IST
The topics of Discussion:
IoT and its applications
Types of sensors
Sensor fusion techniques
Usage of IoT in Machine Learning
Current challenges and opportunities in IoT
Dr. Nikhil Kumar
Associate Professor
Department of Computer Science,
School of Arts and Sciences,
Amrita Vishwa Vidyapeetham,
Mysuru campus.
Registration Link: https://bit.ly/3lqOm3a
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AMRITA VISHWA VIDYAPEETHAM
DST-AMRITA TECHNOLOGY ENABLING CENTRE
Institution of Eminence
University Grants Commission
Advanced Materials for the removal of Inorganic Contaminants from Wastewater
By Department of Chemical Engineering and Materials Science,
Amrita School of Engineering,
Coimbatore Campus
Date: Jun 04, 2022, Saturday
Time: 10.00 AM - 11.00 AM IST
The topic of Discussion:
Water and Wastewater treatment using nanomaterials and biochar
Dr. Nithya K.
Assistant Professor
Department of Chemical Engineering and Material Sciences,
Amrita School of Engineering,
Coimbatore Campus.
Registration Link: bit.ly/3IYQ4aw
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AMRITA VISHWA VIDYAPEETHAM
DST-AMRITA TECHNOLOGY ENABLING CENTRE
Institution of Eminence
University Grants Commission
AUTONOMOUS VEHICLES:
THE ROLES OF COMMUNICATION,
NETWORKING AND COMPUTING
By Department of Electronics and Communication Engineering,
Amrita School of Engineering,
Bengaluru Campus.
Date: June 08, 2022, Wednesday
Time: 04.00 PM - 05.00 PM IST
The topic of Discussion:
Technologies that pave the way for autonomous vehicles, emphasizing the roles of communication, networking and computing.
Dr. Manoj Kumar Panda
Associate Professor,
Department of Electronics and Communication Engineering,
Amrita School of Engineering,
Bengaluru Campus.
Registration Link:
bit.ly/3Q4QxWy
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AMRITA VISHWA VIDYAPEETHAM
DST-AMRITA TECHNOLOGY ENABLING CENTRE
Institution of Eminence
University Grants Commission
BIGDATA ANALYTICS AND AI IN
CLINICAL TRIALS-AN OVERVIEW
By Department of Computer Science and Engineering,
Amrita School of Engineering,
Bengaluru Campus.
DATE: JUNE 09, 2022, THURSDAY
TIME: 03.00 PM- 04.00 PM IST
Ms. Uma Kattil Sadasivan,
Senior Bigdata engineer,
IQVIA Research and Development India Pvt Ltd,
Bangalore.
Topics of Discussion:
What is Clinical Trial?
How does BigData Analytics make clinical trials simpler?
Importance of AI in Clinical Trial
Registration Link:
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Future Plans

XXXII. Technology Day

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XXXIII. MSME Specific Webinar

AMRITA TEC through its visits through various industries has identified some common problems that the MSME sector is currently facing. The problems include productivity issues and adaptation to digital technology. A series of webinars is to be organised to create awareness and a simple & cost effective solution to address these issues is to be organised in association with MSME DI in Kerala and Tamilnadu.

XXXIV. MSME Skill Development Training

AMRITA TEC has identified the following areas where a skill enhancement program is required for MSME to improve their performance.

- Training of 5S implementation for productivity improvement.
- Sales Training Program.
- Digital Marketing Training program.
- ERP Implementation training program.

Market Studies

XXXV. Cashew Industry: An Overview

The Cashew (Anacardium Occidentale) was introduced in India by the Portuguese in the 16th Century. Over the years, cashew became a crop with high economic value and attained the status of an export–oriented commodity, earning considerable foreign exchange for the country. India exports cashew kernels to over 60 countries. Its major markets are US, Japan, Spain, France, Germany, UK as well as Middle East countries such as UAE and Saudi Arabia. In India, cashew is cultivated across 1.2 million hectares of land, with a productivity of 706 kg per hectare, according to 2020 government data. Maharashtra, Andhra Pradesh, Orissa, Kerala, Karnataka and West Bengal are among the major producers. India has around 1600 cashew nut processing industry out of which 840 cashew industries are situated in Kerala and is mainly concentrated in Kollam district.

List of Governing bodies and Associations

Directorate of Cashewnut and Cocoa Development,
Ministry of Agriculture and Farmers Welfare,
Kera Bhavan, Kochi-682011.

Kerala Cashew Board Limited
TC No. 29/4016,
Women's College – Bakery Junction Road,
Vazhuthacaud,
Thiruvananthapuram – 695 014, Kerala, India.

Demand & Supply

Export of Cashew Kernel, CNSL and Import of Raw Cashewnut in India for the past 20 years

Year	Cashew Kernel Export from India		CNSL Export from India		RCN import into India	
	Quantity (MT)	Value (Rs. Cr.)	Quantity (MT)	Value (Rs. Cr.)	Quantity (MT)	Value (Rs. Cr.)
1998-1999	77,076	1630.00	1912	4.21	2,41,161	958.00
1999-2000	96,805	2569.00	1930	3.74	2,53,577	1186.00
2000-2001	89,155	2049.00	2246	3.89	2,49,318	961.00
2001-2002	98,203	1789.00	4178	5.93	3,55,556	950.00
2002-2003	1,04,137	1933.00	7215	9.26	4,00,659	1237.00
2003-2004	1,00,828	1804.00	6926	7.03	4,52,399	1401.00
2004-2005	1,26,667	2709.00	7474	7.91	5,78,884	2191.00
2005-2006	1,14,143	2515.00	6405	7.09	5,65,400	2163.00
2006-2007	1,18,540	2455.15	6139	10.29	5,92,604	1811.62
2007-2008	1,14,340	2289.02	7813	11.98	6,05,970	1746.80
2008-2009	1,09,522	2988.40	9099	26.06	6,0,5850	2632.41
2009-2010	1,17,991	2801.60	11227	27.62	7,52806	3037.09
2010-2011	1,05,755	2819.39	12051	33.77	5,29,730	2649.56
2011-2012	1,31,760	4390.68	13575	59.46	8,09,825	5338.64
2012-2013	1,00,105	4067.21	9192	29.84	8,92,365	5331.74
2013-2014	1,14,791	5058.73	9480	38.61	7,71,356	4563.99
2014-2015	1,18,952	5432.85	10938	55.81	9,39,912	6570.93
2015-2016	96,346	4952.12	11677	57.59	9,58,339	8561.01
2016-2017	82,302	5168.78	11422	44.00	7,70,446	8839.42
2017-2018	84,353	5870.97	8325	32.63	6,49,050	8850.03
2018-2019	66,693	4433.99	5300	26.85	8,35,463	10929.00
2019-2020	67,647	3867.165	4605	23.093	9,38,038	8861.58

Source: CEPCI

India started importing raw cashew nut kernel in the 1960s to meet its growing processing demands. India's raw cashew production in the 20 years—between 1995 and 2015—grew at a compound annual growth rate (CAGR) of 3.1 per cent, while its domestic demand grew at CAGR 5.3 per cent, according to the Cashew Export Promotion Council of India (CEPCI). To bridge the gap, India imports from over 15 African and Asian countries.

The problem started in 2006 when the Centre introduced a 9.4 per cent import duty on raw cashew. It intensified in 2016 when the price of raw cashew increased from US$800 to US$1,800 per tonne in the international market primarily due to the growth of cashew processing industries in Vietnam and China, which are more mechanised and efficient than India. India's import of raw cashew declined from 0.96 million tonnes (MT) in 2015-16 to 0.65 MT in 2017-18, according to the Directorate General of Commercial Intelligence and Statistics, Kolkata. Several African countries are now planning to process about 50 per cent of their cashew in-house and enter the world market in a big way. Cashew industry in our country is facing a stiff competition from countries like Vietnam, Brazil, Mozambique and Tanzania. India stands 2nd in the export of cashew kernels in the world. Kerala state stood 1st in the extent of area under cashew during 1970s. But with the expansion of area under rubber, major areas under cashew of the state were converted to rubber plantation. At present Kerala stands 6th position in area and 5th position in production among other states viz Maharashtra, Andhra Pradesh, Odisha, Tamil Nadu and Karnataka. Kerala's contribution to the Indian cashew industry is remarkable in the processing and exporting sectors Kerala has 840 registered cashew factories, almost all of them in Kollam. And over 80 per cent have shut shop in the past few years due to huge operational costs that eventually led to accrued loss of these firms. The closures have rendered many people jobless; mainly women.

Strength	Weakness
· A large pool of experienced and skilled labours available. · Favourable climatic condition gives high quality cashew kernels. · Higher output per hectare of cultivation compared to other countries.	· High processing cost. · Lack of process mechanisation and automation. · Dependence of Raw Cashew Nuts (RCN).
Opportunities	**Threats**
· Favourable Government policies can revive the industry. · The industry is having a global growth rate of 4.8% CAGR.	· Heavily dependence of RCN which may attract duty. · The RCN exporters may start processing unit in their home country.

Problem statement

· High operating cost is involved in processing due to manual operations.

· A huge volume of standard quality at standard price is the need rather of the global market.

· A processed food product that is untouched by hand is required for global market and perceived to be hygienic.

· Automation and novel processes are required for reducing the processing cost of the Industry.

- Shelling is the process where more manual operations are involved which is to be automated with high efficiency to bring the manual operations to nil.

List of Cashew Industries Visited:

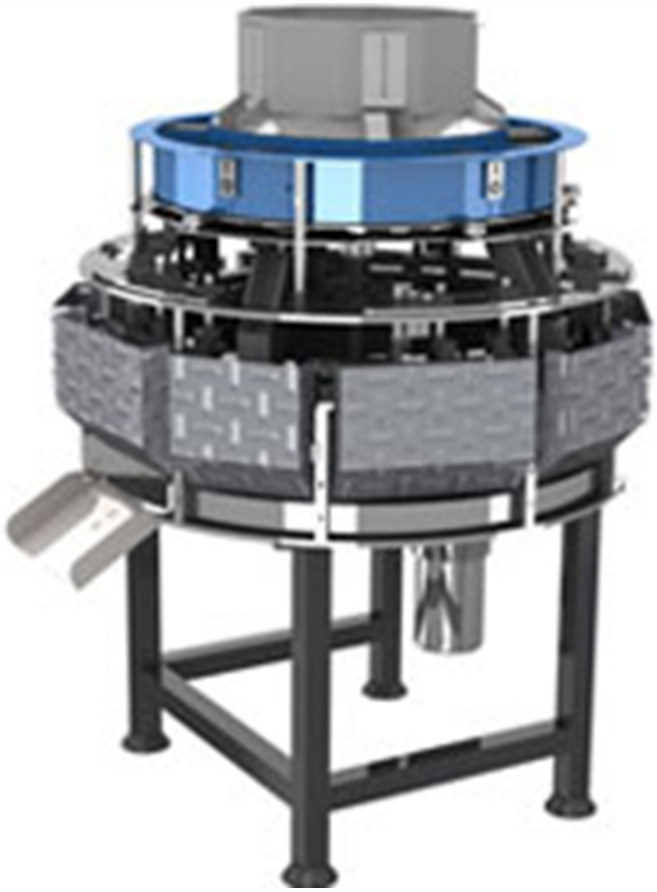
1. Latha Cashews, Vallikummam, Kayamkulam.
2. Sainel Cashews, Padayanivattom, Kayamkulam.

Name of the Company with whom Technology is developed

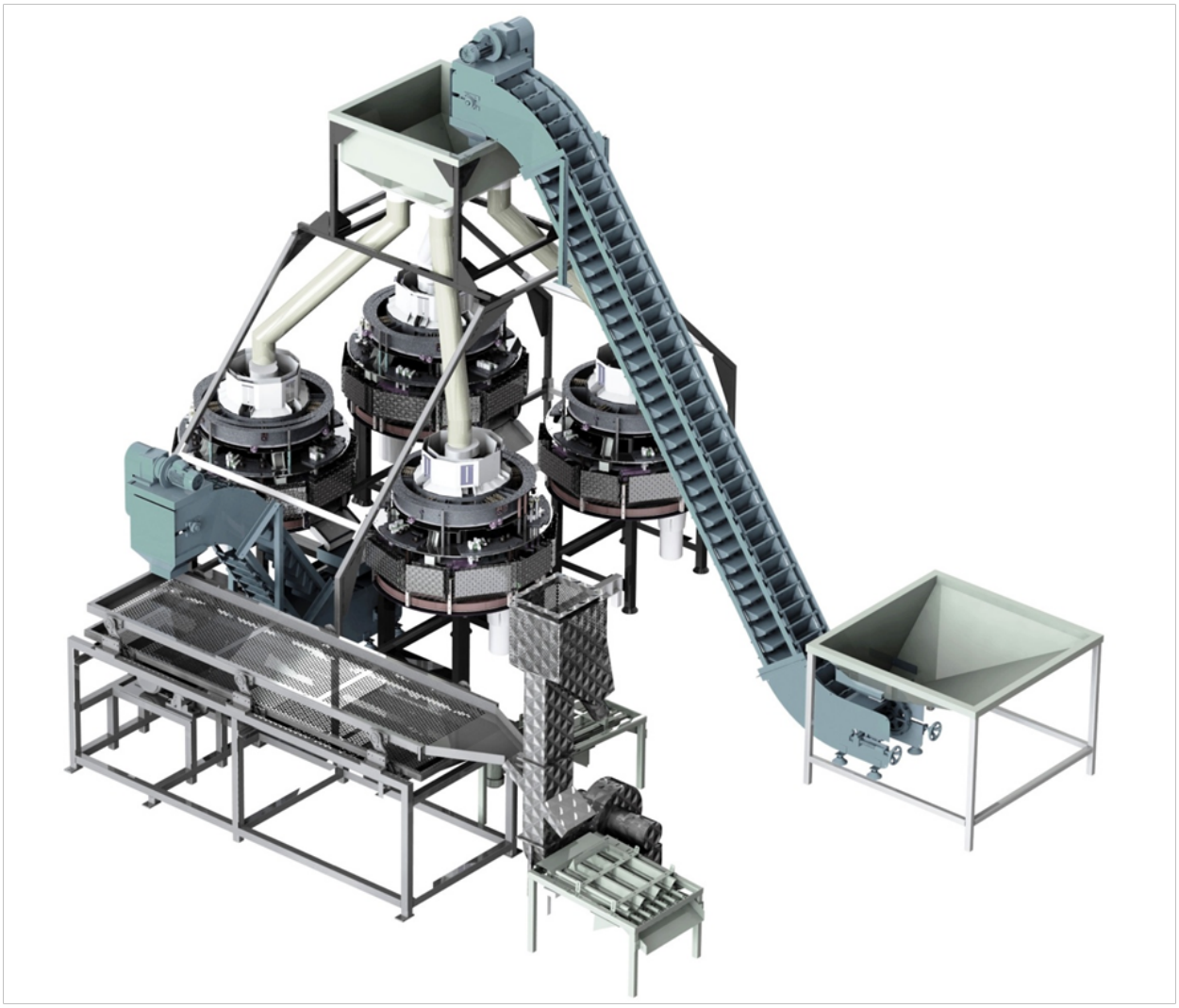
Libra Innovations Pvt. Ltd.,

Chennai: Miranda Annexe,
276, Anjaneyar Kovil Street, Vengaivasal,
Chennai – 600126.

Circular Shelling Machine



Multi-Grade shelling machine



XXXVI. Plywood Industry: An Overview

History of Plywood

Plywood is made of three or more thin layers of wood bonded together with an adhesive. Each layer of wood, or ply, is usually oriented with its grain running at right angles to the adjacent layer in order to reduce the shrinkage and improve the strength of the finished piece. Most plywood is pressed into large, flat sheets used in building construction. Other plywood pieces may be formed into simple or compound curves for use in furniture, boats, and aircraft.

In 1797, Englishman Sir Samuel Bentham applied for patents covering several machines to produce veneers. In his patent applications, he described the concept of laminating several layers of veneer with glue to form a thicker piece—the first description of what we now call plywood.In about 1890, laminated woods were first used to build doors. As the demand grew, several companies began producing sheets of multiple-ply laminated wood, not only for doors, but also for use in railroad cars, busses, and airplanes.

In 1928, the first standard-sized 4 ft by 8 ft (1.2 m by 2.4 m) plywood sheets were introduced in the United States for use as a general building material. In the following decades, improved adhesives and new methods of production allowed plywood to be used for a wide variety of applications.

Today, plywood has replaced cut lumber for many construction purposes, and plywood manufacturing has become a multi-billion dollar, worldwide industry.

Indian Plywood Industry

The India plywood market reached a value of INR 195.8 Billion in FY 2021-22. Looking forward, the industry is expected to reach INR 297.2 Billion by 2027-28, exhibiting a CAGR of 7.4% during 2022-23 to 2027-28.

The India plywood market is primarily driven by the growing demand for plywood from the residential sector in the country. This is facilitated by the increasing population, shifting lifestyle patterns and the increasing number of nuclear families across India. In line with this, there has been a considerable increase in the refurbishment and renovation of existing residential areas, supported by rapid urbanization, inflating disposable incomes and improving living standards of the working population. A majority of the population prefers apartments that are semi-furnished or fully furnished, owing to the associated convenience, which, in turn, is propelling the demand for plywood in the Indian market.

Key players are collaborating and entering into joint ventures with regional plywood manufacturers based across India. The majority of these manufacturers are based out of areas that have an abundance of raw material supply, which ensures an assured supply of finished products at competitive prices.

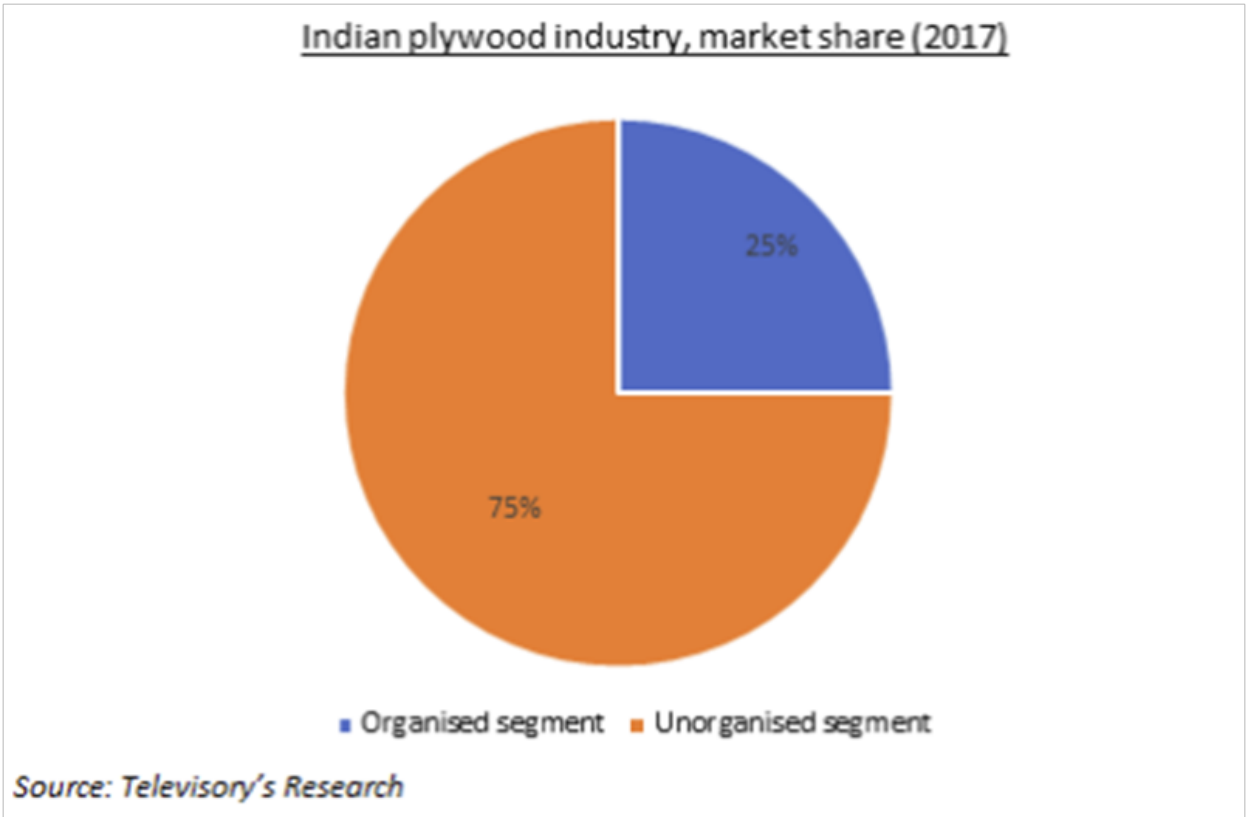
Plywood Industry in Kerala

Plywood industry is one of the most promising and developing industry in Kerala. The industry makes an enormous contribution to the economy of the state.

According to Sawmill owner and Plywood Manufacturers Association (SOPMA), Kerala has 600plywood manufacturers and around 450 of them are based out in Perumbavoor and

nearby villages. Most of the units started out as Sawmill and moved into the Plywood 20years ago.

Currently the industry is dominated by unorganised segment; however there is a shift for Unorganised segment to Semi Organised and Organised segment. Hence there is a need for affordable technology for these companies to upgrade to the need of the market to produce a higher quality with lesser production cost.



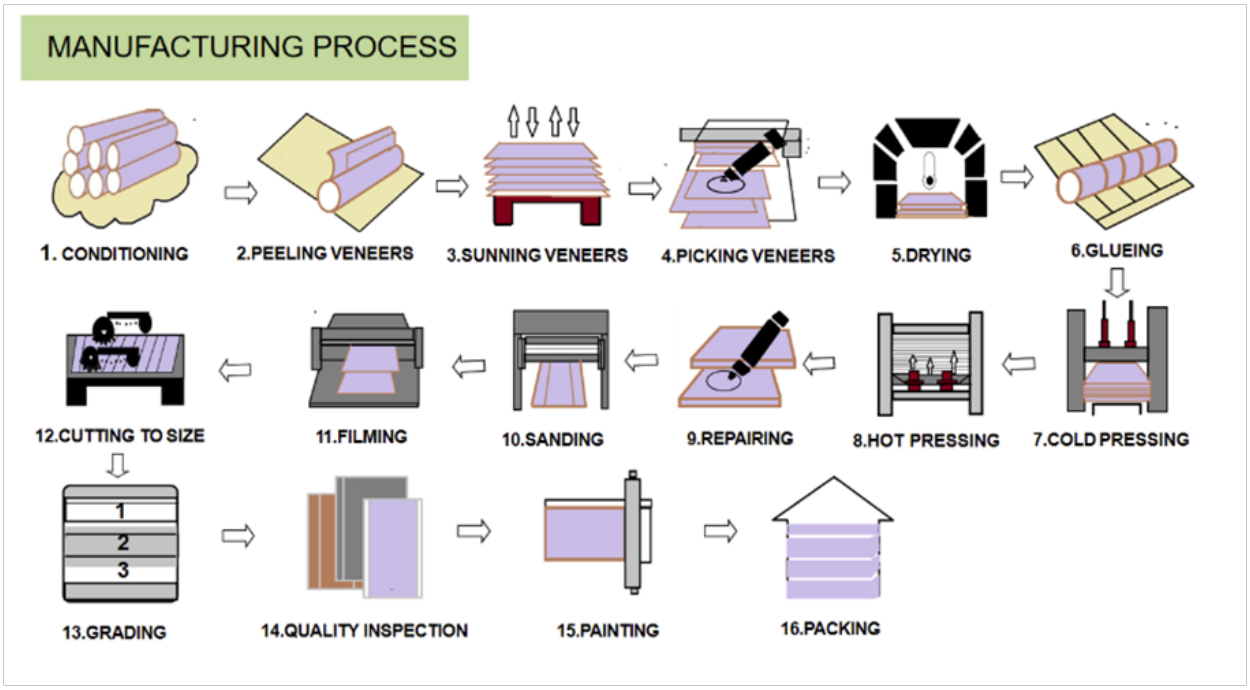
The Approach:

The manufacturing process was studied by visiting the industries to give suitable technology for overcoming their problems.


PERUMBAVOOR PLYWOOD
MANUFACTURERS CONSORTIUM PVT. LTD.
2022.1.7 14:42


2022.1.7 14:32

An Overview of the Manufacturing Process



List of Problems Identified

Major Problem:

Upon studying the manufacturing process, the hot pressing stage plays a critical role in the bringing out a quality product. Hence standardization, automation with control and monitoring has to be employed at this stage of the process. The Perumbavoor Plywood Consortium has agreed to have technology transfer for the automation of the hot pressing process through TEC. The parameters that are to be controlled and monitored are

- Curing temperature maintained in the process.
- Thickness of the veneer.
- Curing time per lot of the production.

Latest sensors and IoT devices are being deployed and a dashboard to monitor these parameters is being developed and is to be transferred to the industry through AMRITA Technology Enabling Center (AMRITA TEC) through Tranquility IoT & Big Data Solutions.

Other problem includes the following

- Air pollution from the industry due to chemicals involved.
- Deforestation and soil degradation as the raw materials are the trees that have been cut down.

A strategic alliance is being established with AMRITA TEC to provide a long term solution for the above stated problems.

Expected Outcome of Technology Transfer

- A consistent quality at affordable cost can be produced.
- As the industry becomes more organised, the government tax collections improves.
- The work environment improves for the man power involved and the manpower challenge the industry facing will get solved.
- This will provide an opportunity to work on solving the air pollution problem due to the industry.

PAPR Kit

Powered Air Purifying Respirator (PAPR) is a protection equipment technology used to supply purified air to medical professionals working in infection-prone areas such as COVID wards, to prevent infection and disease from the aerosolized virus particles. It is also gaining its importance as a kind of personal protective equipment (PPE) which is used by workers in an atmosphere where the air is contaminated by fumes, dusts, fumes, harmful gases or vapors. An air purifying respirator market provides clean and breathable air through face mask, and hoods which helps to remove air pollutants. The global powered air purifying respirators market size is anticipated to reach USD 3.81 billion by 2030, registering a CAGR of 6.1%

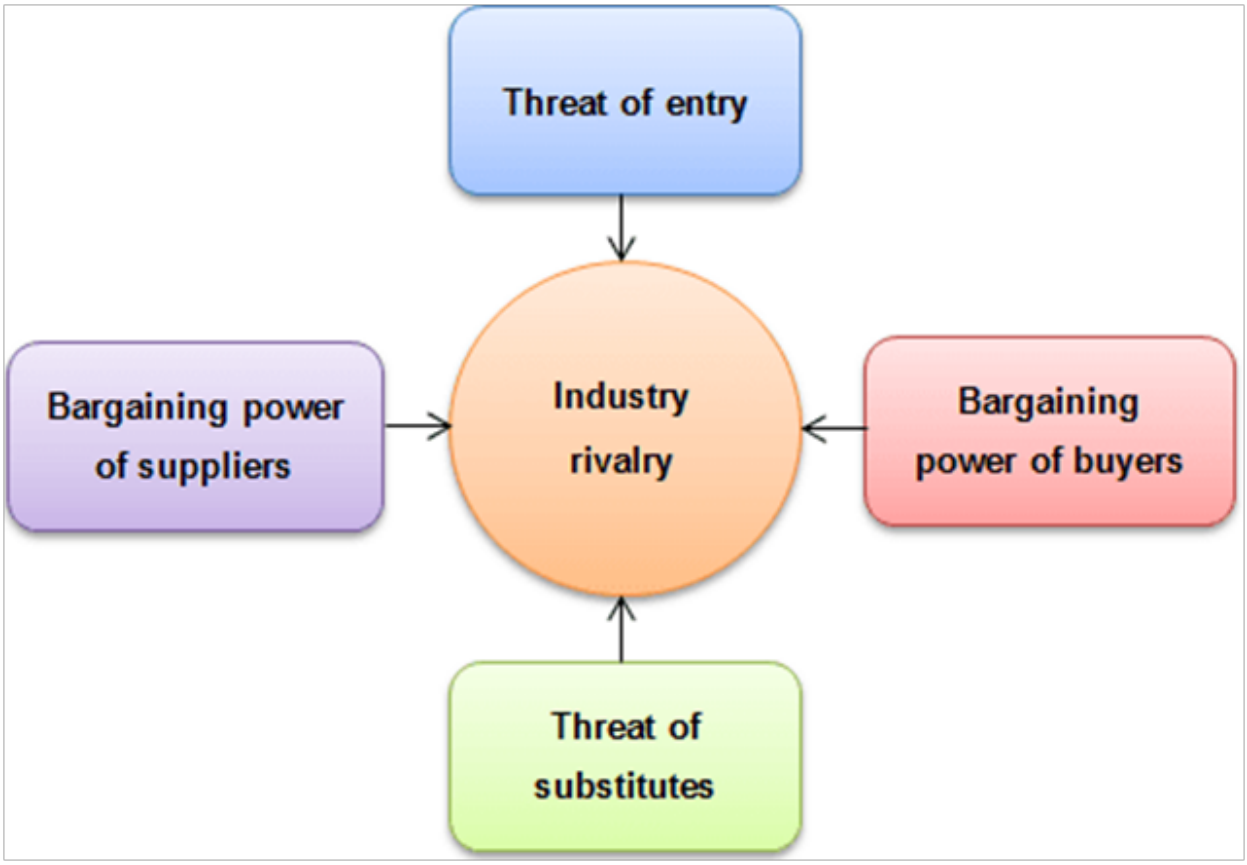
Factors contributing to growth

1. Increasing pollution and number of airborne disease is increasing the demand for air purifying respirator in the global market.

2. Increasing awareness about the importance of worker safety at workplace leads to increase in demand for air purifying respirator market.

3. Increasing usage of Air purifying Respirators in the field where a worker needs to be protected from chemicals, toxic gases, radiological, and nuclear hazards.

Porter's Five Force Analysis



Threat of Entry:

The treat to new entrants is low as the medical equipment business is a capital and R&D intense business. Hence the possibility for competition from the new entrant is very low.

Bargaining power of suppliers:

The components of the PAPR kits do not have any raw materials that are scarce, and have high fluctuation in price. Also there is no raw material that has a monopoly with suppliers through market share or technology or patents. Hence the bargaining power of the supplier is significantly low.

Bargaining Power of the Buyer:

The PAPR is a protective wearable medical device. Hence the willingness to pay for a proven product is high. However a volume based pricing is to be adapted to different institutions based on their buying volume and frequency.

Threat from Substitute:

There is no close substitute that currently exists as an alternative for the product.

Industry Rivalry:

Every industry looking to improve its net profitability through high profit margin or huge market share with penetrating pricing we strive to serve the lowest and most vulnerable starta of the society. Also the cost of the imported kits is more than Rs 1,00,000/- and now the cost of the indigenously developed PAPR kit is less than Rs 30,000/- per kit even making the cost competence by a big margin that the commercial manufactures who are selling it around Rs 70,000/-

Competitive Advantages

- Safer Breathing with 99.995% Virus Filtration
- Easy to Wear <1.5 Kgs.
- Feel calm – Lesser Noise Level <68 dB.
- Airflow > 10CFM.