# RES NOVAE



### **CURIN Research and Development News**

Volume 2023, Issue 3 R&D Activities During July - September 2023



# CHITKARA UNIVERSITY

### HIGHLIGHTS

- CoE of Cyber Security and Artificial Intelligence Received Worldwide Recognition for their Work
- Recognition from 'India Today-MDRA Best Universities Survey 2023' for Filing Most Number of Patents
- Several Individual Recognitions for CURIN Researchers

CURIN Celebrated its 9<sup>th</sup> Annual Day

(September 15)



181 Research Publications



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### Editorial

Chitkara University Research and Innovation Network (CURIN) celebrated its 9th Annual Day on September 15, 2023. It has been a phenomenal journey of carrying out impactful research, developing innovative solutions for solving countless technological and societal problems, inventing newer technologies, promoting entrepreneurship, and building meaningful collaborations with industry, research labs, government agencies, etc. I congratulate all the CURIN faculty members and students as well as our collaborators for being part of this journey, and for making their significant contributions. I also express my gratitude to the leadership team of CURIN for their vision, direction and support. In the current issue of Res Novae, which covers the activities of CURIN from July to September 2023, you will find reflections of CURIN's constant endeavors to achieve excellence. We had the unique privilege of organizing a prestigious G20/S20 outreach event in Q3, 2023 that was attended by close to 1000 delegates. In addition, different research groups of CURIN organized a large number of activities that benefitted not only the students and faculty members of our university, but these activities also benefited the science community of the entire region. You will find details of all those activities in this issue. Additionally, many of the CURIN faculty members received awards and recognition for their contribution to education and research. You will find details of their contributions in this issue. Finally, you will find in this issue, the glimpses of key contributions in research, innovation, entrepreneurship, and IPR by CURIN faculty members and scholars in Q3, 2023. I hope you will find this issue resourceful. Please do write to us with your feedback.

Happy Reading!

Sagar Juneja, PhD Editor, Res Novae Assistant Dean, CURIN

# CURIN organized a G2O/S2O Outreach Event

#### Attended by Close to 1000 Delegates | Held on July 31, 2023

By: Dr. Sagar Juneja – Assistant Dean, CURIN

Science 20 or S20 is one of the working groups of G20 which aims to bring together national science academies to engage in fruitful scientific conversations for addressing global issues including energy, healthcare, well-being, and integrating science into society. To mark the celebrations of India's G20 Presidency in 2023, CURIN, Chitkara University, Rajpura, Punjab, conducted a one-day S20 outreach event on July 31 that was attended by close to 1000 delegates. The Chair of S20 India Engagement Group, Prof. (Dr.) Ashutosh Sharma - Institute Chair Professor, Indian Institute of Technology, Kanpur was the Chief Guest of the event, which was attended by the stalwarts and flagbearers of science and technology of the region including Dr. Madhu Chitkara – Pro-Chancellor, Chitkara University, Dr. Anita Aggarwal and Dr. Pratishtha Pandey (Scientists, Department of Science and Technology, New Delhi), Dr. Jatinder Kaur Arora (Exec. Director, PSCST), Mr. Vivek Bhushan (CTO, Jio), Prof. J Gowrishankar (Director, IISER, Mohali), Dr. Susheel Mittal (VC, I. K. Gujral PTU), Dr. Baldev Setia (Director, PEC Chandigarh), and Prof. Arun Grover (Ex. VC, PU, Chandigarh).



It was an inquiry-based event on the theme Science, Technology and Society, and in the inauguration ceremony that was hosted by Dr. Archana Mantri – VC, Chitkara University, Punjab, young science enthusiasts from schools, colleges, and research labs asked inquisitive questions to these stalwarts. A school student asked Prof.

Sharma "You are the chair of S-20, Can you explain to the audience here – what it means to be in hold the G-20 presidency; What are the objectives, what are the outcome expected?" A researcher from biotechnology asked Prof. Gowrishankar "Research in biological sciences requires maintenance of cold chain for perishable chemicals and biomaterials. What sustainable steps are being taken or should be taken in this field?" A student from college asked Dr. Jatinder Kaur, "Punjab region is known for its agriculture stint. Do you think there are enough advancements in agriculture science and technology in the region?" Similarly, each of the nine above mentioned dignitaries answered one question each from the delegates. The delegates had sent their questions one day in advance, and the most relevant and interesting questions were chosen for the inauguration ceremony. Dr. Madhu Chitkara – Pro Chancellor, Chitkara University presented the mementos to the dignitaries, which marked the conclusion of the inauguration ceremony.



This outreach event was attended by over 450 school students from the Punjab region as well as Panchkula (Haryana). They comprised of a good mix of private and government school students. As many as 200 UG/PG students and 200 scholars from different universities, colleges and research labs attended the event. Finally, there were close to 50 industry professionals who participated. Exclusive inquiry-based sessions were conducted for school students, UG/PG students and researchers. There were six science champions in each of these sessions who answered the questions of the participants.



Theme of the session meant for school students was 'Clean Energy for Better Future' and the science champions were Dr. Reena Chadha (General Manager, Indian Pollution Control Association), Dr. Tharamani C.N. (Associate Professor, IIT Ropar), Mr. Ajay Sharma (Research Comm), Mr. Kartik Pal, (Sunny Engineering Works, Patiala), Ms. Mahak Hira (Academic Head, ENTECRES Labs Pvt. Ltd.) and Dr. Vijay Kumar Jadon (Evangelist and Dean Academic Affairs, Chitkara University). Each of these experts answered questions of the school students related to the theme of the session.



The session for the UG/PG students was titled 'Creating Impact in a Science Driven World: Start-up Stories.' The science champions of this session were, Dr. Sameer Panda (CEO and Founder, TJ Tyres), Mr. Jainul Abedin (Founder, Abyom SpaceTech and Defence Pvt. Ltd.), Mr. Harinder S. Lamba (Founder, WheaFree, Chierz Foods & Beverages Pvt. Ltd.), Mr. J. P. Kundra (Head-Research Division, Cheema Boilers Pvt. Ltd.), Dr. Ritu Kulshreshtha (Professor and Head, Dept. of Pathology, Vallabhbhai Patel Chest Institute, New Delhi), and Dr. Suphiya Khan (Founder, Drumlins Water Technologies Pvt. Ltd. and Associate Professor, Banasthali Vidyapith, Rajasthan).



Finally, the session for researchers was titled 'Academic Research Vs Industrial Research' and the science champions of the session were Dr. Ashutosh Sharma (Chair, S20 India Engagement Group), Dr. Pratishtha Pandey (Head R&D Infrastructure Division, DST), Dr. Anita Aggarwal (Head Technology Development Transfer Division, DST), Dr. Rajendra Pratap (Fellow and Tech. Head, Arrow Electronics Inc., Noida Design Center), Dr. Sanjai Saxena (Founder, Agpharm Bioinnovations and Professor, Thapar University Patiala), and Dr. PK Khosla (Pro Vice Chancellor, Research, Chitkara University).



The event successfully achieved some of the objectives of the S20/G20 and it benefitted a large number of stakeholders. It was convened by Dr. Archana Mantri – VC, Chitkara University, Punjab. Dr. Nitin Saluja (Associate Director, Research) and Dr. Sagar Juneja (Assistant Dean, CURIN) were the co-conveners.

Chitkara University takes keen interest in organizing such meaningful events that can have very good societal impact. The university has a strong focus on applied research and innovation, and most of our research efforts, innovations, and inventions are directed toward solving societal problems. The university has published more than 4500 research papers so far in the world leadings journals and conferences, filed close to 2000 patents of which about 500 have been granted, received more than INR 50 crores worth of government projects, and supported over 150 start-ups till date. All these efforts are resulting in the significant impact that science and technology can have in the society.

#### 9th CURIN Day Celebrated on September 15, 2023

Chitkara University Research and Innovation Network (CURIN) celebrated its 9th Annual Day on September 15, 2023. A get-together of all CURIN members including the research scholars as well as faculty members was organised that featured captivating array of cultural performances, skits, fun games, amazing dance numbers and song numbers. Dr. S.N. Panda – Director, Executive Research, Chitkara University, Punjab delivered a welcome address and he reflected on the journey of CURIN from 2014 to 2023 under the wise leadership of Dr. Archana Mantri – Vice Chancellor, Chitkara University, Punjab. He narrated a story from 'The Upanishads', and encouraged us to remain grounded and focussed. Dr. Archana Mantri madam in her discourse applauded the efforts of all the performers and the organizing team comprising of Dr. Satyam Agrawal, Dr. Himanshi Babbar, and Dr. Amanpreet Kaur for putting together a great show. Madam showed us the vision for the coming years as well as the path of reaching even higher goals for CURIN. The program was concluded in a cake cutting ceremony, followed by a hearty lunch. Close to 100 members from CURIN attended the event.



# Activities under Three Funded Projects from NCSTC Division of DST

STEM awareness and popularization programs for schools

CURIN has three funded projects from the National Council for Science and Technology Communication (NCSTC) division of the Department of Science and Technology (DST), Gol, for Science, Technology, Engineering and Mathematics (STEM) demonstration and popularization among schools. A large number of activities were conducted under each of these three projects during July – September 2023.

Dr. Deeptiprit Kaur – Assistant Professor, ECE and Dr. Bhanu Sharma – Assistant Professor, CURIN, are the respective PI and Co-PI of one of the three projects, which is titled Parivartan. The details of activities conducted by them in their project are as follows –

Two hands-on workshops titled 'Exploring the World of Science: Tinkercad Circuits and Arduino' and 'Learn to Code: My First Step using SCRATCH' were conducted on July 25, 2023. More than 150 students and teachers from different government schools in the region benefited from these workshops that were held at Chitkara University. These workshops were delivered by Dr. Naveen Kumar (Director, Sensor Mind Pvt. Ltd., Haryana, India), Dr.



Harsimranjit Kaur (Co-Founder, Techliasioning Services Pvt. Ltd., Himachal Pradesh, India) Dr. Shanky Kansal (Assistant Professor, CSE, Chitkara University), and Dr. Rubina Dutta, Dr. Priyanka Malhotra, Dr. Amanpreet

Sandhu and Dr. Rashpinder Kaur (Assistant Professors, ECE, Chitkara University, Punjab).

 On August 8, a hands-on workshop titled 'Learn to Code: My First Step using SCRATCH' and an expert session titled 'Interactive and Smart Teaching - Learning Inside and Outside of the Classroom' were conducted that benefitted 100 students and teachers. These sessions



were delivered by Dr. Swati Singh (Assistant Professor, ECE, University Institute of Technology, Himachal Pradesh University, Shimla), Dr. Amit Kumar (Co-Founder, Techliasioning Services Pvt. Ltd., Himachal Pradesh), Dr. Nidhi Garg (Associate Professor, ECE, UIET, Panjab University, Chandigarh), and Dr. Rubina Dutta (Assistant Professor, ECE, Chitkara University, Punjab).

One August 9, two handson workshops and a projectdisplay program titled 'Vigyan Pradarshani: Science Projects and Model-based Exhibition' for the school students of Grade 9 and Grade 10 were conducted. A total of 27 projects were showcased by around 70 students along with their teachers. The projects were evaluated on the use of science and technology, innovation, and presentation by the participating teams. The workshops were delivered by Dr. Swati Singh, Dr. Nidhi Garg, Dr. Rubina Dutta and Dr. Mamatha Sandhu (Associate Professor, Department of Applied Engineering, Chitkara University, Punjab).



Dr. Archana Mantri – VC, Chitkara University, Punjab and Dr. Sagar Juneja – Assistant Dean, CURIN, are the respective PI and Co-PI of the NCSTC funded project titled "Science Fest and Fair on Design, Development and Implementation of a Sustainable Program/Model for the Skill Development of School Children in the Field of Science, Technology, Engineering and Mathematics (STEM)". This two-year project commenced in December 2021 and is in its final stage. During July – September 2023, science exhibitions were held in some of the participating schools, wherein school students demonstrated their learning, which they got after participating in this NCSTC funded project.

On July 29, two schools of Rajpura, Angels Valley School and Aadharshila – The Foundation International School, organized Science Exhibitions. In these exhibitions, students from classes 6 to 12 displayed working models and prototypes of the projects they developed as their learning outcome. Following faculty members of Chitkara University, who had trained students from these two schools under this NCSTC funded project, were invited to witness the exhibitions and interact with the participating students - Dr. Satyam K. Agrawal (Professor, CURIN), Dr. Payal Sachdeva (Assistant Professor, Applied Engineering), Dr. Bhanu Sharma (Assistant Professor, CURIN), and Dr. Sagar Juneja (Assistant Dean, CURIN).



- On August 4, a Science Exhibition was organized by Baby Convent School, Banur in which school students displayed their projects and working models. Dr. Jyotsna Kaushal (Professor, CURIN), Dr. Varsha Singh (Assistant Professor, CURIN), and Dr. Sagar Juneja from Chitkara University visited this exhibition and interacted with the participating students.
- On August 5, AC National Public Sen. Sec. School, Zirakpur, conducted a similar Science Exhibition that was attended by Dr. Reetu Malhotra (Professor, Applied Sciences) and Dr. Sagar Juneja from Chitkara Univeristy.
- St. Attri's Public Sen. Sec. School, Lalru Mandi, organized their Science Exhibition with support from Chitkara University under this funded project on September 25. Students from Classes 9 to 12 showcased 15 working models and project prototypes. Dr. Pooja Mahajan (Associate Professor, Applied Sciences) and Dr. Sagar Juneja from Chitkara University were invited by the school management in the inaugural ceremony of the exhibition.



Dr. Kalpna Guleria – Professor, CURIN, is the PI of a NCSTC funded project titled 'Awareness and Training Program for Teachers on Teaching Mathematics through Origami'. Four skill development programs were conducted under this project during July – September 2023.

The 2nd Skill Development Program under this project was conducted during August 17-19, 2023. It was inaugurated by Sh. V.S.S. Sastry (India's renowned Origamist, Maths, and Science Communicator), in the presence of Dr. S. N. Panda (Executive Director – Research, Chitkara University), Dr. Kalpna Guleria, Dr. Ashutosh Mishra (Dean, CSMC, Chitkara University), and Dr. Gurjinder Singh (Assistant Professor, CURIN). Sh. Ashwani Kumar Dutta (District Education Officer, Mohali), was the Guest of Honour and he appreciated the efforts made by Chitkara University, Punjab, to enhance the skills of teachers for the benefit of academia. Participating teachers from schools went through the basics of Origami and its potential to simplify complex mathematical concepts. They were introduced to the history of Origami

and its relevance in modern education. The sessions were designed to acquaint teachers with foundational Origami folds and shapes that could be used to represent geometric figures, fractions, and symmetry (that are the essential elements of mathematics curricula). The teachers were engaged in hands-on workshops where they learned how to craft Origami models that visually elucidate mathematical principles. From constructing interactive polygons to showcasing the Pythagorean Theorem using folded paper, participants gained valuable skills to create engaging and interactive learning experiences for their students. During the valedictory function, Dr. S.N.Panda, Dr. Nitin Saluja (Associate Director,



Research, CURIN), Dr. Kalpna Guleria felicitated Sh. V.S.S. Sastry ji, and presented awards of appreciation to the winners of the mathematics Origami model-making competition. More than 50+ teachers from the Mohali and Patiala districts of Punjab participated in this program.

• The 3rd Skill Development Program was conducted during August 24-26 and it also introduced educators to the captivating world of Origami. Throughout the workshop, teachers were immersed in a series of enlightening sessions by the honourable resource person, Sh. V.S.S Sastry. They were introduced to the historical context and relevance

of Origami in modern education, emphasizing its potential to foster conceptualization and analytical skills. The hands-on sessions took teachers on a journey through foundational Origami folds and shapes, clearly illustrating geometric figures, fractions, and symmetry - key components of the basic mathematics curriculum. In the beginning of the program, during their respective addresses, Dr. Kalpana Guleria highlighted the objectives of this funded project, Dr. S.N. Panda emphasized that the program is aimed to equip teachers with innovative Origami techniques



to simplify complex mathematical concepts to benefit academia, and Dr. Nitin Saluja apprised about the NCSTC and DST, Govt. of India's initiatives for the skill enhancements of school teachers. On Day 3, Sh. Satinder Singh - Block Education Officer, Banur, was the guest of the day, and he appreciated the efforts made by Chitkara University to benefit the academia. The program concluded with the felicitation of the winners of the mathematics Origami model-making competition. The program was attended by 50 school teachers from Mohali District.

Similarly, the 4th and 5th Skill Development Programs were conducted along the same lines during September 12-14, 2023 and September 20-22, 2023, respectively and were delivered by Sh. V.S.S Sastry. These workshops provided insights into using Origami as a powerful tool to revolutionize educational techniques, emphasizing its capacity to augment conceptualization and analytical abilities. The hands-on segments skilfully guided teachers through fundamental Origami techniques, vividly demonstrating geometric shapes, fractions, and symmetry—integral elements of the mathematics curriculum. During the 5th Skill Development Program, Mrs. Jasbir Kaur (Block Education Officer Derabassi) and Mr. Jatin Miglani (Block Education Officer Kharar) visited and interacted with the participants of the workshop. They also congratulated Chitkara University for their efforts for the benefits of school education.



### Filing Patents is an Integral Part of Nurturing Research-driven Culture in Academic Ecosystem

Recently, in the India Today-MDRA Best Universities Survey 2023, Chitkara University bagged the 1st position in the category of 'Private Universities with the Highest Number of Patents Filed in the Past Three Years'. In the category of 'Top Private Universities for Patents Granted', Chitkara University stood fifth. Additionally, our university secured a remarkable 15th position in the 'General (Private)' Category. On the occasion of such important accomplishments, I conducted an interview with Dr. S.N. Panda, who heads the Office of Patent Facilitation at Chitkara University. The excerpts from the interview are presented here.

Dr. S.N. Panda, you are heading the Office of Patent Facilitation at Chitkara University that encourages both students and faculty members of the university to file patents. Why do you think it is important for the students, faculty members and educational institutions to file patents?

Filing patents is important for the students, faculty members, and educational institutions because it protects intellectual property, enhances recognition and prestige, and opens up financial opportunities through licensing and partnerships. It encourages innovation and research, disseminates knowledge, provides a competitive edge by showcasing innovative capabilities, and enhances job prospects for students by showcasing experience in innovation and intellectual property management. Overall, filing patents is an integral part of nurturing a research-driven culture and securing intellectual property rights in academic ecosystem.



**Dr. S.N. Panda** Executive Director (Research), Chitkara University, Punjab

Dr. Panda, how many patents have been filed by Chitkara University till date (September 30) and what is the current status of these filed patents? Like for instance, how many patents have been granted, how many have been commercialized, etc.

To date, we have filed a total of 3,047 patents. Of these, 1,690 patents have been published, 676 patents have been granted, and 47 patents have been commercialized.

Having such a vast patent portfolio is a commendable achievement! What does this achievement mean to you, being the head of the Office of Patent Facilitation at Chitkara University, and what does it mean to the organization? How your patent portfolio is contributing in motivating both the faculty members and students of the university?

As the head of the Office of Patent Facilitation at Chitkara University, I am extremely proud of our extensive intellectual property portfolio, which reflects our university's commitment to research, innovation, and real-world impact. This achievement signifies our position as a leader in academic research and innovation, contributing to our reputation among students, faculty, and industry/international university partners. The portfolio inspires faculty and students by providing recognition, collaboration opportunities, and avenues for further research and practical innovative work. Overall, it underscores our commitment to knowledge creation and is a driving force behind our culture of creativity and problem-solving.

### What do you think it takes for an organization like Chitkara University to build such an ecosystem where students and faculty members are inventing newer technologies and products, and protecting their IPRs?

Chitkara University has a culture of creativity, robust support infrastructure, intellectual property management, collaboration with industry, funding for research and development, mentorship programs, startup incubation and acceleration, continuous IPR education, international collaborations, recognition of achievements, etc. All these elements

contribute toward building an ecosystem that is needed for building newer technologies.

Chitkara University is one of the top educational institutions in the country in terms of filing patents. We have already won so many accolades and laurels for this achievement. What according to you is the next phase of this journey and what are the key steps your office is taking in this direction?

The next phase for Chitkara University, as a leader in patent filing, should be to focus more on commercialization, industry collaboration, research funding, startup incubation, and international partnerships. The Office of Patent Facilitation is taking key steps in these directions by actively working on commercializing patented technologies, fostering collaborations with industry, seeking external funding, supporting startup growth, and exploring more and more opportunities for international collaborations. The goal is to enhance the impact of the patent portfolio and further strengthen the University's position as an innovation hub of international level.

How do you reach out to students and faculty members and encourage them to file patents for their novel ideas? Also, at what stage do you start orienting students toward IPR?

We reach out to our students and faculty members through awareness workshops, seminars, ideathons, hackathons and mentorship programs, emphasizing the importance of protecting intellectual property. Research and innovation societies of the different departments of the university also foster a culture of creativity and patent filing. In future, it is envisioned to integrate IPR concepts into the UG curriculum so as to establish an understanding of intellectual property rights from the beginning of the academic journey of the students.

### Does the Office of Patent Facilitation also conduct programs to spread awareness about IPRs outside the university, for instance, at other educational institutions and in industry? If yes, can you throw some light on it?

Yes, the Office of Patent Facilitation at Chitkara University conducts programs to spread awareness about intellectual property rights outside the university, including other educational institutions and industry. These programs often include workshops, seminars, and training sessions on IPR, patent filing, and innovation protection. The office collaborates with various organizations and institutions to organize these events, sharing knowledge and expertise to promote a culture of innovation and intellectual property protection across different sectors.

### I am sure, students who file patents through your office gain a lot of insights about IPR and IPR related issues. Why do you think it is important for the students to have knowledge of IPR? How can this knowledge benefit them?

Knowledge of IPR is crucial for the students as it helps protect their creative works, inventions, and innovations. Understanding IPR can provide legal exclusivity, foster a culture of innovation, and enhance employability by equipping students with skills valued by the employers. Additionally, it encourages ethical practices and fosters a sense of ownership and responsibility towards one's creations.

### Any message you wish to give to the young innovators who either have filed patents through your office or aspire to file patents?

To young innovators who have filed patents or aspire to do so, my message is:

Congratulations on taking the first steps towards innovation and intellectual property protection! Your creativity and hard work are commendable. Continue to explore, learn, and innovate. Remember that your ideas have value, and protecting them through patents is a smart way to secure your intellectual property rights. The journey of innovation is challenging but rewarding, and your contributions can have a lasting impact. Always 'Explore your Potential' and keep pushing boundaries to make a difference.

### Finally, for the benefit of our readers, can you share the process, starting from idea generation by an inventor to the filing of a patent through the Office of Patent Facilitation?

When an inventor, be it a student, faculty, or a group of students or faculties, develops an innovative idea, they are required to complete a form known as the Patent Information Extraction (PIE) form. This form must be uploaded to our portal through the Chalkpad ERP system. Once submitted, the PIE form is received by our Patent Portal 1, where our team evaluates the submission by conducting prior art searches. We may suggest changes to the innovator based on the findings. If no changes are required, the proposal moves to Patent Portal 2, where it undergoes another evaluation before being sent to an attorney for final prior art searching, document preparation, and filing. During this phase, the attorney continuously corresponds with the inventors, gathers their feedback and refines the documents. Ultimately, the attorney files the patent and notifies the inventor and the Office of Patent Facilitations, providing receipts and other relevant documents for our records.

#### Conducted By: Dr. Sagar Juneja – Editor, Res Novae

## CoE of Cyber Security and Artificial Intelligence Received Worldwide Recognition for their Work

The Center of Excellence (CoE) of Cybersecurity and Artificial Intelligence, CURIN, Chitkara University, which is headed by Dr. Ramkumar Ketti Ramachandran (Professor, CURIN), is dedicated to advancing research in key areas of Artificial Intelligence and Cryptography. Their research group is actively engaged in the creation of cutting-edge post quantum cryptography algorithms, coupled with their hardware implementations. This endeavor is of utmost importance in light of the imminent threat posed by quantum computers, which have the potential to compromise the existing security standards, as being tendered by the National Institute of Standards and Technology (NIST).

() JULY 19, 2023

JEditors' notes

Predicting pandemics with machine learning



Credit: Pixabay/CC0 Public Domain

Research in the International Journal of Electronic Security and Digital Forensics, investigates the potential for machine learning models to predict the occurrence of disease pandemics with greater accuracy than other approaches. The ability to quickly identify the spread of an emergent pathogen and determine whether or not it will lead to a global pandemic could allow policymakers and health care professionals to develop more effective planning, response, and containment strategies during a global health crisis.

Soni Singh, K.R. Ramkumar, and Ashima Kukkar of Chitkara University in Punjab, India, have taken a novel approach to improving the parameters of existing machine learning models using the Ant Colony Optimization (ACO) algorithm, which they say helped them surpassed the accuracy of previous prediction models.

This research group is currently working on a funded project sanctioned by DRDO through the ER & IPR scheme, aimed at safeguarding their voice communication against potential adversaries.

In addition to their primary focus on cybersecurity, this group also works on providing crucial AI support to core domains, such as agritech, biomass energy, life insurance, and pandemic predictions. Notably, one of our recently published articles titled 'Pandemic outbreak prediction with an enhanced parameter optimisation algorithm using machine learning models', which was published in the International Journal of Electronic Security and Digital Forensics (Inderscience), has garnered a worldwide recognition and acclaim. It was penned by David Bradley of Inderscience on the prestigious Medical Xpress portal. This paper was authored by Dr. Ramkumar Ketti Ramachandran, Dr. Ashima Kakkar, and Dr. Soni Singh from the Center of Excellence of Cyber Security and Artificial Intelligence, CURIN, Chitkara University, Punjab.

Medical Xpress portal is a part of Science X network, which has a massive online community of science enthusiasts with a global reach of 10 million monthly readers. It is indeed a moment of pride for this research group of Chitkara University to receive global recognition through the Science X network. The Science X network, with its large readership, provides an excellent platform to disseminate their findings to a wide audience. Its rigorous fact-checking process and publication of content from highly trusted sources make this accomplishment even more noteworthy. This, not only highlights the expertise of this research group, but it also showcases their dedication to making meaningful contributions to the scientific and medical research community.

It is important to highlight that the merit and reputation of the Center of Excellence of Cybersecurity and Artificial Intelligence, CURIN, are on a steady rise, which is evidenced from their consistently high-quality research papers, successful funded projects, patents, and the increasing number of scholars associated with their work. This CoE is actively working in the diverse subject areas including ad hoc networks, vehicle adhoc networks, post quantum cryptography, homomorphic encryption, network security, artificial intelligence for earth, biomass energy prediction models, FPGAs, and cryptocurrencies.

# Individual Contributions of CURIN Faculty Members

*Invited Speakers, Session Chairs, Guest Editors, Reviewers, etc. | Key Achievements and Recognitions* 

#### **Key Achievements and Recognitions**

 Dr. Archana Mantri – Vice Chancellor, Chitkara University, was honoured with the Institution Builder Award by the Top Rankers Management Club in New Delhi. Additionally, Dr. Deepali Gupta - Professor, CURIN, received recognition for Academic Research in Technology in the same summit that was held during September 15-16. The Club, comprised of eminent industrialists and policy advocates, serves as a prominent think tank and policy group. In a cohort of 32 distinguished awardees representing leading industries, both Dr. Mantri and Dr. Gupta stood out for their exceptional contributions. The awards were presented by Arun Kumar Bajoria – President, J K Tyres and Industries Ltd., along with several other notable industrialists.



 Dr. Ishu Sharma - Assistant Professor, CURIN participated in a four-week Technology-based Entrepreneurship Development Program (TEDP) focused on Bio-Entrepreneurship Sponsored by the Department of Science & Technology, Govt. of India, held from July 5 to 28. This TEDP was organized by the Institute's Innovation Council, School of Biomedical Sciences and School of Business, Galgotias University. This team from Chitkara University comprising Jagdeep Sharma and Dr. Ishu Sharma secured 3rd position



in the Market Survey and PPR Presentation Competition among all TEDP participants. They presented their innovation idea, market survey report, and future roadmap during the competition.

- Dr. Anoop Kumar Singh Professor, CURIN and Dr. Ankit Sharma Assistant Professor, CURIN, have successfully qualified Non-Destructive Testing (NDT) Level-II proficiency certificate in the domains of Radiography, Ultrasonic, Eddy Current, Magnetic Particle, Liquid Penetrant, and Visual Inspection Testing. The certification has been sanctioned by the Institute of Material Testing & Evaluation (ISO 9001-2015 certified) on August 31, 2023.
- Dr. Ayush Dogra Assistant Professor, CURIN, has been selected as an editorial board member of several journals, including Plos One, Plos Complex Systems, Frontiers in Neuroanatomy, Journal of Computer Science, BMC Biomedical Engineering, Biomedical Reports, and Medicine International. One of his seminal articles titled 'A Constructive Algorithm for Low Dose Computed Tomography Denoising with Morphological Residual Processing' has been published in Plos One, the journal that holds a prestigious position as a Q1 Journal with an astounding H-index of 404 and Impact Factor of 3.7.

Dr. Dogra has also been chosen as a member of prestigious societies working in the domain of imaging, namely the Society for Advanced Body Imaging, Texas Academy of Science as well as 16 societies under the umbrella of the International Association of Engineers (IAENG), covering fields such as Artificial Intelligence, Bioinformatics, Chemical Engineering, Computer Science, Data Mining, Electrical Engineering, Internet Computing and Web Services, Imaging Engineering, Industrial Engineering, Information System Engineering.

#### Participation in External Events, both as Resource Persons and Attendees

- Dr. Manish Sharma Professor, CURIN, delivered an invited talk on July 3 in the five-day Faculty Development Program (FDP) titled Antennas for 5G Communications & Beyond, that was organized by Aditya Engineering College, Andhra Pradesh, India, during July 3-8 and was attended by 162 delegates. The workshop demonstrated the design and calculation of parameters for microstrip antennas for 5G communication with HFSS electromagnetic simulator. Parminder Kaur – PhD Scholar, working under the guidance of Dr. Manish Sharma attended this FDP.
- Dr. S.N. Panda Executive Director (Research), CURIN delivered an invited talk on the topic of Artificial Intelligence in Healthcare for a delegation of doctors from the Nepal Medical Association. The event was hosted by the International Public Health Management Development Program, Post Graduate Institute of Medical Education and Research (PGIMER), Chandigarh on July 27.
- Puneet Bawa from CURIN was recently honoured with an invitation to serve as one of the evaluators at the prestigious DBT-sponsored one-day National Conference on Pharmaceutical Biotechnology: Global Opportunities &





Latest Developments (PBGOLD 2k23). The event, held on August 19, witnessed an assembly of some of the brightest minds in the field, coming together to discuss and explore the latest breakthroughs, opportunities, and challenges in the ever-evolving world of biotechnology.

- A National Workshop on Clean and Green Solutions for Rice Straw Management was organized by the Confederation of Indian Industry (CII) in association with the Ministry of Agriculture on September 29 in New Delhi. Dr. Nitin Saluja - Associate Director (Research), along with this team comprising of Varinder Singh and Maninder Singh, were invited in this event to showcase their DST funded project titled MOKSH: A tractormounted machine to convert rice stubble to useful powder.
- Demonstration of excellent traditional teaching to engage the audience for more than two hours for each class and the importance of books were well experienced and realized during the National Instructional Workshop on Cryptology (NIWC): Codebased Cryptography at IIT (BHU), Varanasi, from 5-7 July 2023 attended by Dr. K. R. Ramkumar Professor and Dr. Amanpreet Kaur -Assistant Professor, CURIN, Chitkara University, Punjab. The informative sessions included coding theory, syndrome encoding, post-quantum cryptography and other important aspects of security algorithms.
- Dr. Mudita Assistant Professor, CURIN, attended a ten-day skill development course organized by the Department of Computer Science and Applications, Panjab University, Chandigarh, from August 24 to September 4. She has also participated in a one-day workshop on Deep Learning Techniques organized by the Department of CSE, Chitkara University, Punjab on September 12.
- Shivani PhD Scholar, working in the VLSI Center of Excellence under the guidance of Dr. Jaya Madan - Assistant Professor, CURIN, participated in the prestigious twoday workshop organized by IIT Delhi, during September 23-24. The aim of this workshop was to delve deep into the nuances of nanotechnology fabrication techniques and the advanced tools that drive innovation in this field. Additionally, the workshop provided a unique opportunity for attendees to visit the state-of-the-art clean







room facilities used in the fabrication of semiconductor devices, offering valuable hands-on insights into the practical aspects of nanotechnology.

- Dr. Rajesh Kumar Kaushal Associate Professor, CURIN was invited to deliver an expert session on July 6 by the CSI Student Chapter, Department of Computer Applications. The agenda of his talk was to share a comprehensive guide for developing Web Applications using the MERN Stack. The other resource person of the program was Mr. Sandeep Gokhale - CEO, TechVito. The event was attended by over 70 students and faculty members of the Department of Computer Applications.
- Dr. Bhanu Sharma Assistant Professor, Immersive and Interactive Technology Lab (IITL), CURIN, delivered a talk on How a Mobile Tower Works! An Expert Session on Exploring Wireless and Satellite Communication on July 31 under the auspices of the Academy for Edge Networking. The purpose of the event was to give computer science and engineering students, knowledge regarding mobile communication. The event was convened by Dr. Vidhu Bhaggan from the Department of Computer Science and Engineering, and was attended by more than 150 students.
- Dr. Sagar Juneja Assistant Dean, CURIN, was nominated to deliver orientation sessions for the first-year engineering students of Chitkara University, and inform them about CURIN and the research ecosystem of Chitkara University. He delivered three sessions, on August 18 for the students of Department of Electronics & Communication Engineering, on August 19 for the students of Applied Engineering and Computer Applications, and on September 6 for the students of Computer Science and Engineering.
- Dr. Amanpreet Kaur was invited to deliver an expert talk on Skill Development using MEMS Sensors to the 2nd year students of the CSE Department on September 21. Students gained insights into miniaturization, sensor integration, and data processing. This knowledge would help them in designing innovative applications in the fields of IoT, Robotics, and Healthcare with the help of advanced sensor technologies. The session was convened by Dr. Shikha of CSE Department, Chitkara University.



#### **Paper Presentations and Participation in External Conferences**

• M.E. Scholars, Savita Rawat and Vishal Yadav, working under the guidance of Dr. Jaya Madan and Dr. Rahul Pandey - Assistant Professors, CURIN, showcased their research findings in two prestigious conferences, namely, IEEE International Conference on Smart Systems for Applications in Electrical Sciences (ICSSES 2023)

that was held during July 7-8, and IEEE International Conference on Sustainable Emerging Innovations in Engineering and Technology (ICSEIET 2023) that was held during September 14 - 15.

 Sheena Angra - PhD Scholar, working in the Immersive and Interactive Technology Lab (IITL) under the guidance of Dr. Bhanu Sharma - Assistant Professor, CURIN, presented a paper titled 'One-Stop Solution for Education: An Immersive Perspective' at the National Symposium on Innovations in Teaching and Learning Practices in Higher Education held on July 7. She also presented a paper titled 'Interactivity Development using Unity 3D Software and C# Programing' at the 14th International Conference on Computing Communication and Networking Technologies 2023, held in July 2023.



- A team from IITL headed by Dr. Bhanu Sharma and Dr. Amanpreet Kaur Assistant Professors, won the second prize in a role-play on the theme of Aadhunik Shiksha: Aatam Nirbhar Bharat in the National Symposium on Innovations in Teaching and Learning Practices in Higher Education held on July 7.
- Monica Dutta Ph.D. Scholar, working under the guidance of Dr. Deepali Gupta Professor, CURIN, presented a research article titled 'Analyzing the Employee Attrition Rate: A Comparative Study of Various Machine Learning Approaches to Foresee Employee Attrition' in the International Conference on Artificial and Business Intelligence, Quantum and Machine Learning: Trends, Perspectives, and Prospects (COM-IT-CON 2023) held during July 14-15. She presented another paper titled 'Automation of Hotel Inventory Management using RPA' in the 2nd International Conference on Edge Computing and Applications (ICECAA-2023) that was held during July 19-21. Additionally, she presented a paper titled 'Analyzing the Fluctuations in Commodity Prices and Forecasting the Future Directions using Machine Learning Techniques' in the International Conference on Futuristic Trends in Networks and Computing Technologies (FTNCT-2023) that was held during July 29-30.
- Dr. Sonam Mittal Assistant Professor, CURIN, received appreciation for her contribution as a reviewer in two different IEEE supported conferences, including, 1st International Conference on Data Science and Network Security (ICDSNS-2023) that was held during July 28-29, and International Conference on Networks, Multimedia and Information Technology (NMITCON-23) held during September 1-2.

She also presented a paper titled 'Data Analytics over Encrypted Data from Fully Homomorphic Encryption' in the IEEE INDISCON-2023 that was organized by GSSS Institute of Engineering & Technology for Women during August 5-7, 2023, in association with IEEE India Council and IEEE Bangalore Section.

 Dr. Vatsala Anand - Assistant Professor, CURIN, presented two papers at the International Conference on Circuit Power and Computing Technologies (ICCPCT-2023) that was held during August 10-11, 2023. These papers were titled 'A Proficient Framework for Coronary Artery Disease Prediction using Logistic Regression' and 'Ensemble Model for Seven-class Categorization of Skin Disease using Dermoscopy Images'.

In the same conference, a B.Tech student working under the guidance of Dr. Sonam Mittal, Vansh Aggarwal, presented his paper titled 'A Comparative Study of Directory Fuzzing Tools'.

Dr. Vatsala presented another paper in the 3rd International Conference on Innovative Sustainable Computational Technologies (CISCT 2023) that was held during September 8-9, 2023. The paper was titled 'Hemorrhage Classification in Head Computed Tomography Images using Convolution Neural Network Model'.

 Dr. Kalpna Guleria – Professor, CURIN, chaired a paper presentation session on August 25 in the 4th International Conference on Mobile Radio Communications & 5G Networks (MRCN-2023), sponsored by Springer and held at Kurukshetra University, Haryana, India. During this session, various researchers presented papers on optimization techniques in machine learning, deep learning, and recent research trends in artificial intelligence, and machine intelligence.



Seema Gulati - PhD Scholar, working under the

supervision of Dr. Kalpna Guleria, presented a paper titled 'Classification of Diabetic Retinopathy using Deep Learning Model- DenseNet 121' in the International Conference on Computing, Communication and Networking Technologies (ICCCNT-2023), which was a premier conference held at IIT Delhi during July 6 - 8, 2023.

Somya Srivastav and Archana Saini – M.E. Scholars, working under Dr. Kalpna Guleria presented their papers titled 'Brain Stroke Prognosis Using Machine Learning Techniques' and 'Machine Learning Approaches for Early Identification of Thyroid Disease: A Predictive Study', respectively, at the 2023 World Conference on Communication and Computing (WCONF-2023) organized by Kalinga University, Raipur, Madhya Pradesh during July 14-16, 2023. Somya and Archana presented several other papers, including 'Lung Cancer Detection using Deep Learning-based Convolutional Neural Networks' and 'Multiclass Classification of Rice Leaf Disease using Deep Learning based Model', respectively, in the 2023 3rd Asian Conference on Innovation in Technology (ASIANCON 2023) organized by Pimpri Chinchwad College of Engineering & Research during August 25-27; and 'A Convolution Neural Network-based System for Licensed Number Plate Recognition' and 'Deep Learning based Model for Malaria Disease Detection using Convolution Neural Network', respectively, in the 2023 IEEE International Conference on Networks, Multimedia and Information Technology

(NMITCON 2025) organized by NITTE Meenakshi Institute of Technology, during Sept 1-2, 2023. Finally, Somya presented a paper titled 'Tea Leaf Disease Detection using Deep Learning based Convolutional Neural Networks' in the 2023 IEEE World Conference on Applied Intelligence and Computing (AIC 2023) jointly organized by Rajkiya Engineering College, Sonbhadra, India and Ashoka Institute of Technology & Management, Varanasi, India during July 29-30, 2023.

- Dr. Manish Sharma Professor, CURIN, chaired a paper presentation session at the 1st International Conference on Sustainable Emerging Innovations in Engineering and Technology that was held at ABES Engineering College, Ghaziabad during September 14-15. Additionally, his research group presented nine research papers in this conference.
- Dr. Arun Upmanyu (Professor), Dr. Rakesh Goyal (Associate Professor), and Dr. Harjeet Singh (Assistant Professor) from CURIN presented their paper titled 'Automatic Liquid Flow Management using Internet of Things (IoT) Technology' in the International Conference on Sustainable Emerging Innovations in Engineering and Technology that was held during September 14-15, 2023.
- Dr. Ishu Sharma Assistant Professor, CURIN, presented her paper titled 'Investigating Patterns of UAV Attacks for Building Secure UAV Network' at the 6th International Conference on Contemporary Computing and Informatics (IC3I-2023) that was held at Amity University, U.P., during September 14-16. Vanshika Pahuja - B.E. (CSE) student working under the guidance of Dr. Ishu presented her paper titled 'Employing Convolutional Neural Network for IoT Healthcare Attack Detection in Intensive Care Unit' at the same conference.



Atul Kumar – M.E. Scholar, working under the guidance of Dr. Ishu Sharma

presented a paper titled 'Performance Evaluation of Machine Learning Algorithms for Website Defacement Attack Detection' in the International Conference on Smart Systems for Applications in Electrical Sciences (ICSSES) that was organized by Siddaganga Institute of Technology Tumakuru, Karnataka, during July 7- 8, 2023. He also presented a paper titled 'Detection of Smartphone Permissioned Security Breaches using Machine Learning Techniques' at the 2nd World Conference on Communication and Computing that was organized by Kalinga University, Raipur, India during July 14-15.

• Dr. Rajesh Kumar Kaushal - Associate Professor, CURIN, presented a research paper titled 'Demystifying Hyperledger Fabric Framework for Distributed Ledgers and Approach to Evaluate Its Performance' at the International Conference on Sustainable Emerging Innovations in Engineering and Technology (ICSEIET) on September 15.

#### MoU Signing between Chitkara University and Adamson University, Philippines

Chitkara University, India and Adamson University, Philippines entered into a formal agreement through a MoU in August 2023 to foster collaboration in the areas of research and academic endeavours. CURIN is going to drive this collaboration initiative at Chitkara University. The MoU seeks to facilitate collaboration between the two educational institutions in the domains of research, pedagogy, and student mobility. The two universities will engage in collaborative research initiatives, facilitate resource sharing,



and promote staff and student exchange programs. The MoU delineates the overarching concepts and provisions governing our collaborative endeavours. These encompass the extent of our work, the respective obligations of each party, the allocation of intellectual property rights, the maintenance of confidentiality, the guidelines for publication, and the conditions for termination. It additionally incorporates a stipulation for the creation of a collaborative research centre between the two academic institutions.

# Chitkara Xcelerator 2023 Program Inaugurated on September 21, 2023

By Chitkara Innovation Incubator Foundation (CIIF)

The inaugural session of the Chitkara Xceleartor 2023 program that was organized by the Chitkara Innovation Incubator Foundation (CIIF) on September 21, marked the commencement of an extraordinary journey for 40 carefully selected seed-stage start-ups. These start-ups have been chosen after a rigorous screening process that drew more than 500 applicants from all corners of the country. The program aimed to propel these start-ups into the dynamic realms of entrepreneurship, innovation, and collaboration. The program kicked-off with a great enthusiasm and sense of purpose, thanks to the inaugural address by Dr. Archana Mantri - CEO, CIIF. Her words injected a strong sense of dynamism and resolute passion into the proceedings, thereby setting the tone for the day ahead. One of the highlights of the event was a thought-provoking panel discussion titled "Investments from an Investors Perspective," which was moderated by Dr. Adarsh Aggarwal - Vice President, CIIF.

The panel brought together esteemed individuals from the start-up industry, each with a wealth of experience and knowledge. The panel Included, Dr. H.K. Mittal (Chairman of SISF), Dr. Archana Mantri (CEO, CIIF), Mandar Joshi (Angel Investor, Media Producer, and Theatre Actor), Ashank Singh (VP, Venture Catalyst), Bhavish Sood (General Partner, Modulor Capital), CA Sahil Makkar (Managing Director, Punjab Angels Network), and Anmol Jamwal (Angel Investor, Soonicorn Ventures). These seasoned panellists shared inspiring success stories and invaluable insights from their own entrepreneurial journeys. Their wisdom served as a guiding light for the budding entrepreneurs in attendance, providing them with the motivation and knowledge needed to navigate the challenging start-up landscape.



The event also featured an interactive Q&A session that allowed attendees to seek mentorship directly from these start-up legends. This direct engagement provided a unique opportunity for aspiring entrepreneurs to receive personalized guidance and advice.

Post the inauguration of the Xcelerator 2023 Program, following three exciting sessions were conducted -

#### "Ask Me Anything" Session by Mandar Joshi (Director, Horses Productions Pvt. Ltd.)

Mandar Joshi shared his vast knowledge and insights into the start-up and investment landscape, offering attendees a unique opportunity to gain in-depth understanding and clarity on various aspects of entrepreneurship, venture capital, and start-up investments. One of the session's primary features was the open and candid discussion format. Attendees were encouraged to submit their questions in advance or ask them during the live session. Mr. Joshi responded to a wide array of questions with depth and transparency, providing attendees with valuable insights and suggestions. Several key topics were explored during the session such as start-up fundraising,



venture capital, entrepreneurship and navigating challenges as a start-up founder.

#### "Investment through the Lens of an Investor" by Ashank Singh (Vice President, Venture Catalyst)

This session provided a unique opportunity for entrepreneurs, start-ups, and aspiring investors to gain valuable insights into the world of start-up investments. Mr. Singh's extensive experience in the field offered attendees a deep understanding of the investors' perspective and the key to successful fundraising. He provided practical tips on creating compelling pitch decks and engaging in productive meetings and negotiations with the potential investors. Attendees gained an overview of the various investment options available to start-ups, including, angel investments and venture capital. Mr. Singh explained the implications and benefits of each, helping attendees make informed decisions about their fundraising paths. The



event concluded in a networking session, allowing attendees to connect with one another, share experiences, and build valuable relationships within the start-up ecosystem. This facilitated the exchange of ideas and potential collaborations.

#### Workshop on "Idea to IPO" by CA Sahil Makkar (Manager Director - Punjab Angels Network)

The workshop served as a comprehensive guide for the aspiring entrepreneurs and early-stage start-ups on navigating the entrepreneurial journey, from conceiving innovative ideas to reaching the pinnacle of success through an Initial

Public Offering (IPO). The workshop provided a deep dive into establishing a solid business foundation. Attendees received valuable guidance on structuring their businesses and navigating the intricate web of legal and compliance considerations, ensuring a sturdy launchpad for their entrepreneurial ventures. There was a detailed exploration of the IPO process. Attendees gained a comprehensive understanding of the steps involved, the potential benefits, and the challenges of taking a company public. This workshop demystified the IPO journey, making it more accessible to the ambitious entrepreneurs.



# **NOVATE+ 2023**

16 teams won prototype development funding from NewGen IEDC

NOVATE+ is an annual flagship hackathon of CURIN, Chitkara University, in which innovative project ideas are invited, and shortlisted ideas receive prototype funding for their implementations. NOVATE+ 2023 has been the 5th edition of the hackathon that was organized with support from Department of Science and Technology (DST) funded centers at Chitkara University, namely, Chitkara University NewGen IEDC and Chitkara University Technology Enabling Centre (CU-TEC). Over the years, NOVATE+ has given many significant technologies and products. Over 75 projects have been supported through NOVATE+ in these five years (including 16 in 2023) and several projects have been converted into successful technologies. NOVATE+ not only provides



funding support to worthy project ideas, but it also provides mentoring, technical support, fabrication support, and helps the teams in building traction for their project ideas.

NOVATE+ 2023 aimed at supporting joint industry-academia projects for solving the real-world problems, projects that are inline with the Government of India schemes, projects targeting social and local problems, etc. It was announced on March 4, 2023, during the CU-TEC industry-academia conclave, with a theme 'Biggest Confluence of Academia and Industry for Building Market-Ready Products' and the submissions were due by May 15, 2023.

Over the course of these two days, a jury comprising of experts from both industry and academia with first-hand experience of developing products for end use evaluated



the presentations made by 38 finalists. The jury included, Mr. Harpreet Singh – Director (Eon Infotech Ltd., Punjab), Mr. Rama Kant (Director, EPIC Ambala), Dr. P.K. Khosla (PVC, CURIN, Chitkara University, Punjab), Dr. S.N. Panda (Executive Director, Research, Chitkara University, Punjab), Mr. Sanjay Bhatnagar (Visiting Faculty, Chitkara University, Punjab), and Dr. Rakesh Goyal (Professor, Research, Chitkara University, Punjab). Based on the comments of the jury, 16 teams were shortlisted and awarded prototype development funding. Total funding of INR 32 lakhs was sanctioned from NewGen IEDC.

Dr. Sagar Juneja (Assistant Dean, CURIN), who is the convener of NOVATE+ since 2020 and the Coordinator of Chitkara University NewGen IEDC and TEC, guided the teams in executing their projects by connecting them with the vendors, helping them obtain quotations from the vendors, planning milestones, supporting them in finalizing their budgets, etc. Both student applicants, as well as faculty mentors of these 16 teams, attended the session. Below is the list of 16 shortlisted projects.

Dr. Sagar Juneja was ably supported by his team in executing NOVATE+ 2023, including Mr. Chanpreet Singh (Project Manager, CURIN), Mr. Parul Chawla (Assistant Manager, CURIN), and Mr. Lovit Kumar (Senior Office Executive, CURIN).



#### List of NOVATE+ 2023 Winners

S.No.	Project Title	Team Details
1	Automatically Staircase Climbing Wheelchair with Robotic Arms	Vanshika Garg, Dr. Gurpreet Singh
2	CancerScreen- A Cutting Edge Urine-based Cancer Detection Device	Divya Kanwar, Bhavesh Dharmani, Dr. Sanjana, Dr. Pooja Mittal, Bhavesh Dharmani, Dr. Thakur Gurjeet Singh
3	Community Based Plastic Pyrolysis by Plasma	Rishiv Kalia, Dr. Arrik Khanna
4	Design and Development of Novel Geothermal Heat Exchanger to Provide Drinking Water at a Drinkable Temperature in Rural Indian Schools	Rishab Thakur, Ipshita Ramdaik, Gurleen Kaur, Dr. Rajesh Kumar
5	Development of a Prototype of an Affordable Thermoelectric Chiller to Quickly Cool Down the Water Temperature and Eliminate Harmful Emissions	Khyath Thakur, Rishab Thakur, Lovepreet Singh, Dr. Rajesh Kumar
6	Development of a Simplified Nano-Enabled Nitrate and Arsenic Removal Water Purifier	Pramit Kumar Bhunia, Dr. Amulya Prasad Panda, Prof. Sudesh Kumar Mittal
7	Fabrication and Testing of Hypoxia Flask for in Vitro Use	Pooja Kumari, Monika Sharma, Dr. Satyam Kumar Agrawal
8	GAM Illuminating Urinary Bladder Catheter	Prachi Mittal, Prof. Keerti Bhusan Pradhan and Dr. Girija Shankar Mohanty
9	GREENLEAF: Generating Renewable Energy and Enhancing Nature through Liquid Plant-Based Air Filtration	Navdeep Singh, Anmol Nangla, Dr. Ajay Goyal, Mr. S.K. Rana
10	Multipurpose Herbal Oil Processing Machine	Soumarshi Das, Ravi Goyal, Dr. Deepinder Singh
11	Problem Solving Approach for the Post-Surgical related Bedding Problem for Rodents	Kartik Vats, Vaibhav Sapra, Dr. Onkar Bedi, Dr. Thakur Gurjeet Singh
12	Pyrolysis Reactor for Extracting Oil from Plastic Waste	Dhawal Goyal, Sukhdev Singh, Punam, Vikas Chadha, Dr. Rakesh Goyal
13	Solar Power Refrigeration System	Ashutosh Sharma, Ayush Sharma, Shiivam Ashutosh, Dr. Rajesh Kumar
14	Smart Pour	Lovleen Kala, Kartik Sangwan, Dr. Deepti Prit Kaur, Dr. Priyanka Malhotra
15	WATERSHIFT: Water-Based Approach for Turbine Energy Recovery and Sustainable Hydrology Implementation for Future Transformation	Navdeep Singh, Anmol Nangla, Dr. Ajay Goyal, Mr. S.K. Rana
16	Wheelchair Cycle	Parth Bansal, Anurag Sokhal, Krish Aggarwal, Gaurav, Dr. Kulwinder Singh, Dr. Gurdyal Singh

#### Other Activities of NewGen IEDC and CU-TEC

- On June 28, Dr. Sagar Juneja (Assistant Dean, CURIN) was invited to attend a brainstorming meeting at the office of Innovation Mission Punjab in Mohali for the setting up of a Maker Space and Skilling Centre in the state of Punjab. The meeting was also attended by representatives from Punjab Government and from different academic institutions of the state.
- On July 28, Chitkara University NewGen IEDC organized a Faculty Development Program titled 'Rapid Prototyping: Become an Expert of 3D Printing Technology through Hands-on Experience'. The session was delivered by an industry expert from Divide by Zero Company on their Accucraft i250D 3D Printer. A total of 10 faculty members participated in this session and learned on how to use this new 3D printer. On July 29, Mr. Chanpreet Singh, Project Manager, CURIN, who is an expert in 3D printing, conducted a hands-on session for the participants where they printed some 3D models on this 3D printer. They learned to setup multiple 3D printers in the printing manager software, i.e., CURA. They also learned about various printing time.
- During August 7-11, NewGen IEDC organized a Fiveday Hands-on Workshop on 3D Design and 3D Printing. The session commenced with an inaugural address by Dr. Sagar Juneja (Assistant Dean, CURIN), wherein he discussed how rapid prototyping techniques like 3D printing is shaping the whole concept of building academia projects. He also discussed how students can get funding from NewGen IEDC for developing projects. The hands-on sessions were delivered by Mr. Chanpreet Singh, in which he trained students on designing mechanical components, such as connecting rod, piston, and gudgeon pin. These designed parts were 3D printed and assembled together to make a functional prototype. In addition, 26 students who attended the workshop learned to configure 3D printer machine settings in the printing manager software. They also learned various advanced 3D printing parameters to optimize the time and output quality of the parts depending on the end applications.
- On August 17, Dr. Sagar Juneja and Dr. Amit Kumar (Assistant Professor, ECE), visited Modern Business Equipment and Services Pvt. Ltd., Mohali and met Mr. Amandeep Singh Virk (Director Marketing) to discuss an opportunity of a joint project on Indigenization of Intelligent Weight Indicator Instrument. His team explained to us the working of the weight indicator instruments and their requirements for developing this product locally, which is targeted for pharma industry.
- On September 2, two top officials from the MSME Development Institute of Ludhiana, Mr. Virinder







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Sharma (Director) and Mr. Kundan Lal Sharma (Assistant Director) visited Chitkara University, Punjab, to evaluate the innovation and start-up ecosystem of Chitkara University, Punjab for the setting up of a Ministry of MSME supported incubation centre at Chitkara University. This visit was facilitated by CU-TEC, and during this visit both officials visited our research labs and met faculty innovators and entrepreneurs.

- On September 8, NewGen IEDC conducted an interactive mentoring session on 'Start-up Creation and Different Types of Business Ownership'. Chitkara University NewGen IEDC has been supporting a large number of student projects with prototype grants. To motivate the student beneficiaries of NewGen IEDC funding to start their ventures and become entrepreneurs, this session was convened by Dr. Sagar Juneja. It was delivered by Piyush Garg - Vice President, CEED, and his team. They showed students the entrepreneurial path and answered tons of questions from student innovators. Dr. Archana Mantri -VC, Chitkara University, and Chief Coordinator, NewGen IEDC, presided over the session and highlighted the importance as well as benefits of converting quality projects into start-ups.
- Dr. Archana Mantri Vice Chancellor, Chitkara University, Punjab, was invited as DST nominee to the 1st PAG meeting of University of Ladakh - Technology Enabling Centre (DST funded) that was held on September 26, 2023. The two Technology Enabling Centres (TECs) - Chitkara





University and University of Ladakh agreed to work together on technologies useful for the Ladakh region.

She was also invited as one of the keynote speakers to the 'National Workshop cum Conference on Bio-diversity and Conservation in Himalayan Region' that was organized by University of Ladakh during September 25-26, 2023. He delivered a talk on "Technology in Livestock and Agriculture: A Boon to Sustainability and Biodiversity".

## Key Activities of Doctoral Research Centre - Chitkara Business School in Q3, 2023

FDPs, Workshops, Seminars and Participation as Resource Persons in External Events

### • Six-day Faculty Development Program (FDP) on Understanding the Roots of Good Research: From Research Problem to Hypotheses Development

A six-day online FDP was organized by Doctoral Research Centre - Chitkara Business School (DRC-CBS) covering the basics of research during July-August 2023, and it was delivered by Dr. Niti Chatterji and Dr. Urvashi Tandon (Associate Professors, DRC-CBS). The resource persons discussed the usage and implication of research process and research design methods in this FDP that was attended by 80 participants. They gained insights about combining quantitative and qualitative approaches, research design along with sampling design, and how to balance out the limitations of each method. Deep insights were provided into the identification of a research problem, formulation of hypotheses, selection of adequate sample size and sampling design, conducting a systematic literature review, data collection methods, questionnaire design and report writing. This FDP helped the participating faculty and scholars to improve the ability to conduct ethical and collaborative research.

#### Seven-day Hands-on FDP on Research and Analytics

In the age of big data, research and analytics increasingly play a fundamental role in business decision making. Research and analytics enhance the quality of business decision making by helping organizations better understand customers and competitors. The unprecedented growth and availability of customer data, both structured and unstructured, has engendered many challenges that include data acquisition, management, visualization, and analysis. To understand the intricacies of data collection, a seven-day FDP was organized by DRC-CBS during 21-27 August, 2023. This FDP was attended by 35 faculty members and research scholars. Resource persons of this FDP were Dr. Arun Aggarwal (Assistant Professor, Doctoral Research Centre,



CBS) and Dr. Sridhar Manohar (Assistant Professor, Doctoral Research Centre, CBS). The FDP was a combination of lectures, workshop, discussions, exercises, and case analyses. Various research related topics, like scale development, identification of latent variables, factor analysis, regression, etc., were discussed with relevant examples and case studies.

#### • Two-day Workshop on Financial and Time-Series Data Analysis

A two-day workshop on Financial and Time-Series Data Analysis was organized during 22-23 August, 2023. The workshop was attended by 91 faculty members and research scholars of Chitkara University and was delivered by Dr. Dhaval Mehta - Professor, Veer Narmad South Gujrat University, Surat. He acquainted the participants about time-series analysis using EViews and R softwares. The workshop trained the participants on data analysis, econometric

modelling, and statistical programming using EViews and R software.

#### One-day Seminar on Systematic Literature Review through Bibliometric Analysis using VOSviewer

A one-day seminar on Systematic Literature Review through Bibliometric Analysis using VOSviewer was organized on 22 August 2023. The resource person for this seminar was Dr. Meenal Arora (Assistant Professor, DRC-CBS) and it was attended by 48 research scholars and faculty members. The aim of this seminar was to give participants a sound overview of bibliometric methods, performance indicators and tools & techniques related to bibliometric analysis and mapping order. Participants were provided training on how to interpret data while structuring it into a format that is easy to understand and applicable in real-world situations. In the beginning, various concepts and terms, such as citations, h-index, and impact factor were discussed. This was followed by a discussion on procedure to



retrieve data from Scopus database. Participants received knowledge about the various themes and sub-themes like co-occurrence analysis, co-citation analysis, bibliometric coupling, etc.

#### Four- day Workshop on Practical Insights into a Journey of a Research Scholar

Doctoral Concentration Seminar (DCS) and Research Proposal (RP) writing are the foundation of any PhD program. The effective preparation and delivery of the same certainly help the research scholars in their research journeys. To make the process easier and understandable for the research scholars, this workshop was organized during 23-26 August, 2023 and attended by 45 research scholars. The resource persons of the workshop were Isha Nag, Ishani, and Namita (Research Scholars, DRC-CBS), who have already gone through the stages of DCS and RP writing. The program aimed at helping the new research scholars on preparing DCS and RP documents and presentations through a peer learning process.



#### Individual Contributions and Achievements of the Faculty Members of DRC-CBS

A lecture on Entrepreneurship Development for Commerce/Management/Tourism/ Economics/Mass Communication
and Media Technology was delivered by Dr. Amit Mittal (Pro-Vice Chancellor, Research Programs, Chitkara University
and Head, DRC-CBS) at the Institute of Management Studies, Kurukshetra University (KU), Haryana during a two
week online refresher course organized by KU in collaboration with the UGC-Human Resource Development
Centre from September 18 to 30, 2023. The purpose of this FDP was to inspire and motivate teachers to enhance
their professional performance and engage more proactively in their roles. Dr. Amit Mittal delivered an insightful
presentation that shed light on the significance of entrepreneurship in the field of commerce and its relevance in
shaping the future of education. He discussed how entrepreneurship skills empower students to be more adaptable,
innovative, and prepared for the evolving job market. He also discussed the strategies of instilling an entrepreneurial
mind-set among the students. Following the lecture, a lively Q&A session allowed the 35 participants to engage with

Dr. Mittal. The lecture served as a valuable resource in motivating faculty participants in enhancing their professional performance, and providing an inspiring and informative platform for the exchange of ideas.

- Dr. Amit Mittal acted as a resource person in the workshop on Strategies to Get Published in High Impact Factor Journals on September 26, with the primary motive of enlightening scholars and faculty participants in helping them navigate the intricacies of academic publishing. This workshop was organized by the Central University of Himachal Pradesh, Dharamshala, India. Dr. Amit Mittal provided an overview of high-impact factor journals, explaining their significance in academia and research. The entire publishing process, from selecting the right journal to manuscript preparation and submission was also covered in this session.
- Dr. Amit Mittal was selected as a part of the Jury Panel for the prestigious QS Reimagine-the Oscars of Education. QS Quacquarelli Symonds is a globally recognized organization specializing in the analysis of higher education institutions all over the world. This appointment represents a significant milestone in recognizing Dr. Mittal's expertise and contributions to the field of education and innovation.
- Dr. Sridhar Manohar (Assistant Professor, DRC) was invited to conduct a two-hour workshop on Qualitative Research for the students of Loyala Institute of Business Administration (LIBA), Chennai, India. The event was held on August 14.

Dr. Manohar also co-authored and presented a paper titled 'Omni Channelling Healthcare: Chaining Details, information and Predictions for Extemporize Service Delivery' in the 7th International Conference on Computing, Communication, Control, and Automation held on August 17 at Pimpri Chinchwad College of Engineering Pune, India. He co-authored and presented another paper titled 'Enhancing Customer Experience with Teleportation Technology: The Future of Travel and Tourism Industry' in an International Conference on Smart Technologies for Smart Nations (SmartTechCon) that was held during August 18-19 and organized by Amity Global Institute, Singapore. Another paper titled, "Revolutionizing Tourism and Hospitality Services: Integrated AI in the Metaverse" was presented by Dr. Manohar in the 6th International Conference on Contemporary Computing and Informatics (IC3I-2023) that was held during September 14-16 at Amity University, Greater Noida, Uttar Pradesh, India.

- Dr. Niti Chatterji (Associate Professor, DRC-CBS) has been appointed as an external expert in the DRC meeting of research scholars held on September 1 at Parul University, Vadodara, India. She evaluated the research proposals of the scholars and provided feedback for improvement.
- Dr. Urvashi Tandon (Associate Professor, DRC) won an Outstanding Reviewer Award in the 2023 Emerald Literati Awards. The selection was made by the editorial team of Global Knowledge Memory and Communication Journal. Further, she also delivered an expert talk on Research Methodology during a two-day National Level Virtual FDP organized by IOT Academy, Tamil Nadu, India, during September 29-30.

# 112 scholars received their doctoral degrees in the PhD Convocation 2023

The PhD Convocation is a significant event that marks the culmination of years of committed study, labour, and academic success for doctoral candidates. It is a celebration of their academic success and the formal awarding of the highest degree. A total of 67 scholars from PhD Registry-1 and 45 scholars from Registry-2 were awarded degrees in the PhD Convocation 2023 that was held on September 16. Across various disciplines within Registry-1, 27 scholars were from Computer Science and Engineering, 16 from Electronics and Communication Engineering, 8 from Applied Sciences, 1 from Mass Communications, and 15 from Pharmaceutical Sciences. Similarly, in



Registry-2, from Architecture school, there were 3 scholars, from Art and Design - 9, from Health Sciences – 8, and from Management Sciences – 25, who received their doctoral degrees.

# A Solution for Reducing Harmful Gases in the Exhaust Outlet of a Vehicle

Developed by Nanomaterials Research Laboratory of CURIN has received widespread recognition

The Nanomaterials Research laboratory, CURIN, Chitkara University, led by Dr. Mansi Chitkara (Professor, Research) along with her team member, Dr. Aashish Kumar (Assistant Professor) has achieved a significant breakthrough in the production of a catalytic converter for four-wheeler automobiles. This accomplishment involved a successful utilization of doped Zinc-Oxide nanoparticles. The supposed effectiveness of this discovery is said to surpass that of the converters currently installed in automobiles by manufacturers, particularly in terms of cost and pollution reduction. The research team is presently involved in examining alternate and economically viable alternatives to the traditional catalytic converter. One of the prominent newspapers of the country, "Dainik Bhaskar", provided coverage of this noteworthy accomplishment.

The efficacy of this discovery is purportedly superior in terms of cost and pollution reduction compared to the existing converters placed in automobiles by automobile manufacturers. This catalytic converter utilizes Zinc-Oxide nanoparticles that have



में जितने लोग, उतनी ही कारें। ही नहीं बाकी बड़े शहरों में यह बनता जा रहा है। इससे प्रदूषण तो रहा है, कैंसर कारक कार्सिनोजेनिक त्र तो स्वा हो, चरता चतरा चतारा कार्याचाया हो। सिंभी बढ़ती जा रही हैं। इस इसका हल कितला चाह रहे थे। इसी दिशा में काम करते हुए कैटालिस्टिक कन्बर्टर बनाया।' ये कुहना है चितकारा यूनिव्वसिंटी की कहना है चितकारा नैनोमटीरियल रिसर्च के डॉ. निकल इंजीनियरिंग दिपार्टमेंट की • क्या है कैटालिस्टिक कन्वर्टर ...

गाड़ी से निकलने वाली जहरीली गैसों

कैटालिस्टिक कन्बर्टर ऐसी डिवाइस है जो जहरीली गैसों और पॉल्यूटेंट्स को इंटरनल कंब्रचन इंजन से निकलने के प्रक्रिया में कम जहरीली कर देता है। 19वीं सदी में पहल भार सुरसको डिजाइन किया गया जबा कुछ ही करों रेथे पर होती थी। 1975 से युएस में इसका उपयोग किया जा रहा है। भारत सरकार ने भी बीएस-2 जेनरेशन में इसको जरूरी किया है। इसकी कीमत 4500 रुपए से शुरू होती है।

• ये हैं स्थितियां... एन्वायर्नमेंटल प्रोटेक्शन एजेंसियों का कहना है कि शहरों में 95 फीसदी कार्बन मोनोऑक्साइड मोटर वहीकरस से आती है। कारों से कार्बन मोनोऑक्साइड, नाइट्रोजन ऑक्साइड, फोटोकेमिकल ऑक्सीडेंट्स, एयर टॉक्सि जैसे कि बेंजीन, एल्डीहाइड्स, सल्फर भी निकलते हैं। ऑक्सीडेंट्स, एयर टॉक्सिंस

तैयार किया है और तकनीक का घेंटेर भी प्राव्हल कर दिया है। इस कन्दर्य में आम कैटाईपिटक कन्दर्य को अवसाधित (एकावेंग) करेगा ही, कार्डमेनोबॉन्क मैसों को भी यह हवा से साफ कर देशा जिंक ऑक्साइट नौवारिडल आवासीद झा कन्दर्य को सरते और बोड़ रतरा पर तैयार करने के लिए बज डों. आशीभ ने बताया- इस समय करों में जो कन्दर लगते हैं वह सिर्फ कार्बन के लिए हैं। हम ऐस प्रोडण्ट बनाना पाले थे जो बाकी नुकतान्द्रफल सेती पर भी काम करो. पाले ने को पार्टिकस्त तैयार किए, फिर बेटरलिस्टिक कन्दरी। ये गड़ियों के समसे मुली पुरी में से एक है। प्रोडाव्ट्रस की टीरटंग के दौरान 70 से 30 जमेरवी का इस प्रथिशियों. इंडस्ट्री के संपर्क में भी हैं। इस कन्वर्टर से कार्बन मोनोऑक्सइड, सल्फर, मर्करी, आई है। अब टेक्नोलॉजी ट्रांसफर की दिशा में हैं, ताकि इसे कम कीमत में तैयार किया जा ाइट्स कंपाउंड, क्लोरीन आदि को भी साप सके। इसके लिए हमारी लैब काम कर रही है, इंडस्टी से भी बातचीत जारी है।

चंडीगढ

been doped with a combination of graphene, biochar, activated carbon, graphene quantum dots. The resulting catalytic converter has been successfully patented.

The automobile industry is currently confronted with formidable obstacles due to the implementation of more stringent emissions standards. These regulations aim to mitigate the release of detrimental air pollutants from vehicles. The utilization of rare-earth elements is necessary in the operation of contemporary catalytic converters. These elements are not only

characterized by their high cost, but also necessitate importation and have a very limited lifespan. The presence of these high-value metals contributes to the catalytic converters being one of the most expensive components of a car, with prices ranging from INR 80,000 to 100,000 INR or more.

This research group of CURIN is actively engaged in the investigation of alternative and cost-effective options for the conventional catalytic converter.

The proposed filter contains the coated layer of ZnO2 doped with graphene/ biochar/activated carbon/ graphene quantum

dots. The dopant not only improves the sensing and adsorption characteristics but also enhances the conductivity. Moreover, thermal stability is also important to balance. The graphene/ biochar/activated carbon/ graphene quantum dots doped ZnO2 is synthesized by Sol-Gel and chemical co-precipitation technique.

The major components of a diesel exhaust are: Carbon monoxide (100-10000 ppm), HC (50-500 ppm), NOx (30-1000 ppm), PM soot (20-200 mg/m3), Ammonia (2 mg/mile), Cyanides (1 mg/mile), Benzene (6 mg/mile), toluene (2 mg/mile), and PAH (0.3 mg/mile). The ZnO2 based filter not only absorb carbon monoxide, but also the doping with graphene/ biochar/ activated carbon/ graphene quantum dots make it possible to adsorb cyanides, benzene, toluene and PAH which are exhausted by the vehicles and are extremely carcinogenic.



# Research@CURIN

Top Research Papers of the Quarter by CURIN (Published during July – September 2023)

Faculty members and research scholars from CURIN publish high-quality research articles in top peer-reviewed journals and conferences. In this section of the newsletter, we select high impact research papers from CURIN and attempt to discuss them in the form of short summaries.

The research papers discussed in this issue are the ones that were published during July – September 2023. A complete list of publications by CURIN faculty members and scholars during this period is available in a separate section.

#### A multi-criteria decision-making (MCDM) model of tourism for the senior citizens

#### By: Dr. Arun Aggarwal - Assistant Professor, Doctoral Research Centre (CURIN), Chitkara Business School

This article is based on the research paper titled 'Senior Tourism: Travel Motivators and Perceived Constraints and Risks for the Elderly' published by Dr. Arun Aggarwal, Ms. Vandita Hajra and Dr. Vinay Kukreja from Chitkara University, Punjab in Emerald journal entitled Tourism Review.

This research proposes a multicriteria decision-making (MCDM) model targeting the senior tourist market. The model is built on four pillars: push and pull factors, perceived travel risk (PTR) factors, and perceived travel constraint (PTC) factors. By employing the decision-making trial and evaluation laboratory (DEMATEL) and Fuzzy TOPSIS methods, the study investigates the interplay and significance of various sub-factors within these pillars.

#### **Key Contributions:**

- 1. Gap in Existing Literature: While some research has studied senior citizens' travel intentions, the interrelationships between push factors, pull factors, PTRs, and PTCs remain unexplored. This study fills this gap, offering insights into senior citizens' destination choice intentions and the relative priorities of factors influencing these intentions.
- 2. Innovative Approach: Diverging from past research that focused solely on senior citizens' perspectives, this study incorporates views from industry experts and leaders. These include executives, government officials, and academicians with significant experience in senior citizens' leisure and travel behavior.
- 3. Distinctive Analysis Methods: The study employs MCDM methods (DEMATEL and Fuzzy TOPSIS) which, to the authors' knowledge, haven't been applied in senior tourism research before.
- 4. Focus on Indian Senior Tourists: Although research on senior travel is extensive, Indian senior travellers are underrepresented in the literature. The findings provide recommendations for stakeholders aiming to penetrate the Indian senior tourist market.

#### **Data Collection:**

With India's growing outbound tourism market and an aging population, senior tourism from the country holds significant potential. Yet, it has received limited academic focus. The research used the Delphi technique to select experts and employed judgmental sampling for its sample size of 48. Data was collected from diverse industry and academic professionals across India. Data analysis was carried out using Python programming.

#### Findings:

- PTRs impact PTCs, push factors, and pull factors for senior tourists.
- PTCs also influence push and pull factors.

- Among push factors, "improving health and wellness" and "self-fulfilment and spirituality" are most important for seniors.
- For pull factors, the safety and security quotient of a destination is vital.
- Health risks dominate PTRs, and interpersonal constraints are most impactful among PTCs.

These findings reveal that senior tourists' perception of risks, especially health risks, play a significant role in their travel decisions. This aligns with previous research suggesting older tourists' travel intentions decrease during health crises. The emphasis on health and wellness also underscores the appeal of wellness tourism to older adults.

#### **Theoretical Implications:**

- This study advances understanding of the interplay between the push and pull factors, PTRs, and PTCs. It posits PTR as a primary influencer, affecting PTCs and indirectly the push and pull factors.
- The distinction between PTRs and PTCs is further established.
- The research identifies key sub-factors within the primary four pillars that significantly influence seniors' destination choices.

#### **Practical Implications:**

- Wellness tourism offerings, catering to health and spiritual needs, are essential for attracting senior tourists.
- Destinations should be prepared for health crises and emphasize their safety measures, especially post-COVID-19.
- To cater to interpersonal constraints (most significant PTC), tour operators should create specialized tour groups for seniors, ensuring continuous support and care.

#### **Conclusion:**

This paper provides a comprehensive perspective on senior tourism by examining push and pull factors, PTRs, and PTCs. Unique in its approach, it combines expert opinions with analytical methods to shed light on the aging Asian tourism market, with a focus on India. In the post-COVID-19 landscape, the findings underscore the importance of not sidelining the elderly tourist market. By adhering to the insights and recommendations of this study, destinations can enhance their competitiveness, promote equality, and align with the 2030 UN Agenda.



Illustration is borrowed from the published paper

#### Improving quality control in casting through deep learning-based defect detection

#### By: Dr. Vatsala Anand - Assistant Professor, CURIN

This article is based on the research paper titled 'Deep Learning Model for Defect Analysis in Industry using Casting Images' published by Dr. Rupesh Gupta, Dr. Vatsala Anand and Dr. Sheifali Gupta from CURIN, Chitkara University, Punjab in Elsevier journal entitled Expert Systems with Applications.

Casting is a manufacturing method that involves pouring a liquid material, which is most commonly a metal or alloy, into a mold cavity so that the material can solidify and take on the shape of the mold. The manufacturing industry makes extensive use of this method to generate a diverse range of goods and components, with shapes ranging from the simplest to the most complicated.

The authors of this paper proposed an ensemble model for casting defect analysis, which combines transfer learning with a ResNet50 model and a custom Convolutional Neural Network (CNN). The authors selected ResNet50 for transfer learning after comparing its performance with the other three pre-trained models. They extracted feature maps from both the ResNet50 and custom CNN and combined them using a weighted ensemble approach, with weights assigned to each model. This hybrid feature map aims to leverage the knowledge of multiple models trained on different data portions and mitigate overfitting. The ensemble model is implemented using the Kaggle dataset containing 7348 images of two casting classes: defective and non-defective and the research explores three hyper-parameters namely

optimizers, batch size, and epochs. The results show that the proposed ensemble model outperforms individual models when using the Adam optimizer, a batch size of 32, and training for 30 epochs. The ensemble model achieves impressive precision and accuracy values of 99.89% and 98.18%, respectively. To summarize, the paper introduces an ensemble model for casting defect analysis, combining transfer learning and a custom CNN. Through experiments and optimization, the proposed model demonstrates superior performance, achieving high precision and accuracy in identifying casting defects.



Illustration is borrowed from the published paper

## Influence of pricing and engagement models on firm performance – A multi-faceted business strategy framework

#### By: Dr. Sukhpreet Kaur - Chitkara Business School, Chitkara University, Punjab

This article is based on the research paper titled 'Pricing Model, Engagement Model and Firm Performance: Evidence from Indian Data Science Industry' published by Dr. Deepika Jhamb, Dr. Sukhpreet Kaur, Dr. Saurabh Pandey and Dr. Amit Mittal from Chitkara University, Punjab in Emerald journal entitled Benchmarking: An International Journal.

India has experienced rapid growth in the Data Science industry over recent years. Data Science is of higher-value competence in the IT services value chain. Many data science firms have established themselves and are growing in the same way that the IT sector did in previous decades. Firms are attempting to modify the form of contracts for sharing more risks and benefits with service providers, both in terms of engagement and cost. Vendors continuously strive for opportunities to increase the value of their work and increase their profit margins. Businesses must negotiate the most profitable price models with suppliers to save money. Thus, the present study aims to understand the influence of pricing and engagement models on firm performance. This study focuses on two broad classifications- pricing models and engagement models. The pricing model further encompasses- cost-based, competition-based and value-based pricing models. Engagement models on the other hand, include staff augmentation model and engagement services. The findings of the study suggested the positive and significant impact of pricing models and engagement models on firm performance. Value-based pricing strategies have the maximum impact on firm performance. On the other hand, managed services have a higher influence than engagement models on firm performance. The present study has several practical implications. First, the service provider must establish distinct strategies and tactics for different models to manage service and efficiency goals. The transition from one kind of engagement and pricing model to another involves not only a shift in mathematical modelling but also a shift in the operational risk-sharing model between the client and the vendor. Second, adopting value-based pricing, the value of the product/services needs to be quantified. People differ in their values and perceptions of things. Value-based pricing is widely regarded as a better strategy that enables businesses to obtain a competitive edge by creating customer value and profitably collecting a portion of that value. This improved understanding will not only aid in determining the pricing, but it will also aid in providing better service and, in turn, contribute to increased profit margins. Third, from an engagement model perspective, it has been established that a service provider's effectiveness in planning activities (demand forecasting, staffing, staff scheduling, and real-time management) is critical in delivering consistent service performance and maximizing resource and asset utilization (seats/desks and people). Fourth, vendors with visibility into their clients' end-to-end demands strive to build products based on the business objectives of client initiatives. They have qualified project management and execution of employees to break the job down into tiny chunks and get the work done by the most qualified staff to deliver the project and fulfill end objectives. Fifth, to decrease attrition, customers must empower suppliers to manage workers locally. Training local team leaders and empowering them to run projects on their own are all instances of this. Thus, by developing a multi-faceted framework, this study is a novel contribution to the field of business strategy, especially for the data science industry.

# Wireless localization and ubiquitous communication in IoT networks powered by 6G wireless technology

#### By: Dr. Ashu Taneja - Assistant Professor, CURIN

This article is based on the research paper titled 'An Improved WiFi Sensing Based Indoor Navigation with Reconfigurable Intelligent Surfaces for 6G enabled IoT Network and AI Explainable Use Case' published by Dr. Ashu Taneja and Dr. Shalli Rani from CURIN, Chitkara University, Punjab in Elsevier journal entitled Future Generation Computer Systems.

The ubiquitous interconnection of several devices around for a variety of uses is what powers the IoT ecosystem. In a number of IoT application areas, such as industrial IoT, smart healthcare, environmental monitoring, intelligent transportation, and personal navigation, communication exchange is crucial. Sensing device localization is essential in ensuring proper information flow between the connected nodes and creation of an intelligent, context-aware IoT network. For many settings, the location information is the most crucial context-sensing attribute.

Accurate geolocation information is required for ubiquitous communication, which is the goal of 6G wireless technology, which is intended for the next generation of IoT networks with enormous numbers of linked devices. Wireless localization is emerging for various sensor nodes, and location-based applications and it depends upon precise and trustworthy location data. It is a technique for finding the sensing node or device's position within a wireless network. Angle of arrival (AoA), time of arrival (ToA), received signal strength (RSS), angle of departure (AoD), phase difference, and fingerprint-based techniques are the different categories into which wireless localization techniques fall. Long Range (LoRa) technology is also used for object tracking in interior environments. The localization of an object depends on several aspects, such as the position of the node, the configuration of the LoRa signal, and the kind of indoor environment. Intelligent reflecting surfaces, also known as reconfigurable intelligent surfaces (RISs), is another exciting technology that is anticipated to play a significant part in the extended IoT networks enabled by 6G.

This research paper describes a node localization technique by employing energy-efficient RISs for the IoT network powered by 6G. Through controlled reflection, RISs allow smart radio propagation. It provides optimal phase shifts and an optimal number of reflecting elements for effective node localization. It is suggested to deploy RISs in an indoor communication network to assist in determining the locations of communicating nodes as shown in the illustration. The suggested method makes use of the channel information to track the node's location from various angles with the least amount of localization error. With a minimum NMSE, known training signals are used to estimate the channel. Additionally, a comparison with flawless CSI is shown. It is found that when the received SNR increases, the localization error reduces. When comparing the optimized RISs to non-optimal RISs, the average inaccuracy in estimating the user position improves by 33.3% at SNR of 0 dB. The use case scenario for AI-enabled indoor localization is presented at the conclusion. A variety of machine learning classifiers are used, including bagging, random forests (RF), gradient boosting decision trees (GBDT), neural networks (NN), and decision trees (DT). With a mean error of 1.399, the GBDT method performs exceptionally well, achieving 100% floor accuracy and 78.52% point accuracy.



Illustration is borrowed from the published paper

# Science Kunj Skilling Program for Young Professionals

by Chitkara University Central Instrumentation (CUCIF)

- CUCIF organized a session on the topic of 3D Designing and Printing Applications in Pharmaceutical on September 14. The session was delivered by the students' design team of CUCIF and was attended by 16 students. The session featured hands-on exercises using a Shaperjet 3D printer.
- On September 19, a session on Creating Vibrant Vistas in the Virtual World using VR was organized, which was delivered by Shinnu Jangra – Assistant Professor, CURIN. Close to 20 students attended the session to learn the fundamentals of virtual reality (VR) and game development. They learned to design VR applications using Unity and C# Language, and did hands-on practice with VR Headsets and Oculus Quest.
- A session titled Recognition of Human Emotions using EEG Signals was organized by CUCIF on September 20 and it was attended by 15 students of different engineering departments. They learned about the fundamentals of EEG signals, electrical activities of the brain, and different applications in the field of EEG.
- CUCIF organized a session on the topic Give Shape to your Ideas with 3D Designing on September 26 and it was delivered by Sahil Mehta of CURIN. A total of 15 students from different departments attended the session and learned the basics of 3D designing through hands-on experience with AutoCAD and Autodesk Fusion 360.









# **Events Organized by CURIN**

FDPs, Workshops, Seminars, etc.

- A two-day Faculty Development Program (FDP) on Intellectual Property Rights to Consultancy was organized by the Office of Patent Facilitation Licensing and Consultancy (OPFLC), CURIN, during July 1-2, 2023. Mr. Varinder Singh - Project Manager, CURIN, was the resource person of the program. He explained the process of consultancy and its benefits to the university, industry, and the consultant. He discussed about the consultancy policy and encouraged attendees to convert their research and innovation into consultancy.
- A one-day FDP on Connect and Test Your Networks using Packet Tracer was organised on July 3. Packet Tracer is a simulation software developed by Cisco Systems that allows users to simulate network scenarios. It is used to design, configure, and troubleshoot computer networks. The workshop was delivered by Dr. Naveen Kumar – Associate Professor, CURIN, and convened by Dr. Manish Sharma (Professor) and Dr. Bhanu Sharma (Assistant Professor), CURIN.
- Embarking on the exciting frontier of 5G: Embracing the New Era of Global Connectivity, Dr. P.K. Khosla - Pro Vice-Chancellor, Chitkara University, Punjab, delivered an enlightening lecture on July 19. Highlighting the



intense technological rivalry between numerous nations, he illuminated how this competition is shaping the landscape of a transformative new world order. Dr. Khosla delved deeper, unravelling the intricate web of compelling research challenges and the potential applications that India holds in the dynamic realm of 5G technology. His insights not only

shed light on the current state of global connectivity but also hinted at India's pivotal role in charting the course for the future of technological innovation. His session was attended by close to 50 faculty members of different academic institutions.

- A five-day FDP on Intellectual Property Rights and Technology Transfer, was organized by the OPFLC from July 29 to August 2. Mr. Sanjay Bhatnagar - Visiting Professor, CURIN, was the resource person for this fiveday event, and Dr. SN Panda -Executive Director, Research and Head, OPFLC, was the convener. On day-one, Mr. Bhatnagar delivered his talk on Technology Transfer and its Processes to the participating faculty members of different departments of the university. On day-two and three, he elaborated on the role of intellectual property rights in technology transfer and the common challenges faced in transferring the technology. The theme of day-four was Licensing and Monetization, and dayfive was Market Diffusion and Commercialization Processes. Overall, this event was helpful for the faculty members and scholars to understand the role of intellectual property rights in technology transfer and common obstacles faced by academic institutions and start-ups during the technology transfer and commercialization processes.
- A one-day FDP titled Ethereum Blockchain and Smart Contracts was conducted on August 5, 2023 and it provided a dynamic platform for individuals to delve into the transformative potential of Blockchain technology. It was delivered by Dr. Rajesh Kaushal – Professor, CURIN and Dr. Shanthi Makka – Professor, Vardhaman College of Engineering. The workshop was organized by Dr. Manish Sharma and Dr. Naveen Sharma.
- A one-day workshop on XLSCOUT: Leverage AI to Innovate Faster was organized by the OPFLC on September 2. The objective of



the workshop was to give a demo of XLSCOUT, which is an AI-based software used to produce accurate and comprehensive data for research publications and patents. The event began with an address by Dr. S. N. Panda, wherein he welcomed the resource persons from Xlscout, Evenpreet Singh -Product Marketing Manager and Prateek Kanaujia - Product Consultant. Mr. Prateek gave a demo of the XIscout software and explained various features of the portal using step-by-



step approach. Mr. Evenpreet discussed the application of the software with the help of several case studies.

- A five-day FDP on Innovation, IPR, and Prior Art Technique was organized by the OPFLC from August 19 to September 23. On day-one, Dr. S. N. Panda, delivered his talk on Intellectual Property Rights (IPR) and discussed the different aspects of innovation and IPR. On day-two, he discussed about the recent innovations and inventions with the help of Gartner Hype Cycle. Day-three and four were meant for hands-on sessions on drafting of patents and prior art searching. On day-five, Dr. Panda explained the process of prior art technique by taking case studies of the prior art searches done by the participants on the previous two days.
- CURIN, Chitkara University organized the Internal Smart India Hackathon on September 26. More than 120 teams, comprised of 6 members each in each team, participated in the hackathon and presented their ideas based on the problem statements given by the Institution's Innovation Council-Ministry of Education Innovation Cell. A total of 68 teams have been shortlisted who will compete in the Smart India Hackathon, which will be organized by the Ministry of Education Innovation Cell later this year. This internal hackathon was convened by Dr. Manish Sharma Professor, CURIN. He was supported by Dr. Bhanu Sharma Assistant Professor, CURIN, Parminder Kaur and Lovish Matta Ph.D.Scholars, CURIN.





### 60 Patents Filed by CURIN Faculty Members and Scholars in Q3

The Patent Office has Granted **27 Patents** to Chitkara University in Q3, 2023.

A total of 184 patents (including industrial designs) have been filed by different departments of Chitkara University during July - September 2023, out of which 60 have been filed by CURIN faculty members and researchers. The details of these 60 patents are given below:

S. No.	Title	Inventors	Application Number
1	A Multi-Functional Mobile Phone Holder	Pranav, Pranav Garg, Mansi Chitkara, Gulshan Dhillon	202311054435
2	A Multi-Functional Removable Battery Enclosure for Electric Vehicles	Arjun J Nair, Sridhar Manohar, Amit Mittal	202311060774
3	A Sensor-based Room Heater and a Method for Detecting Emission of Carbon Monoxide	Savita Rawat, Jaya Madan, Rahul Pandey	202311054091
4	A Shoe Cleaning Device	Shinnu Jangra, Gurjinder Singh, Archana Mantri	202311057469
5	A Smart pH Monitoring and Regulating Device	Maninderjeet Singh, Chanpreet Singh, Navdeep Singh, Nitin Kumar Saluja, Varinder Singh	202311060786
6	A Smart Waste Collection Product	Kamini, Chirag Kumar, Shalli Rani	202311048187
7	AI Enabled Smart Tab for Medical Prescription and Assistance	Bhisham Sharma, Manoj Gaur	202311060778
8	An Antenna Structure and a Method of Fabricating the Same	Manish Sharma	202311053178
9	An Environment for Managing Employee Related Information and a Method Thereof	Rajesh Kumar Kaushal, Naveen Kumar, Shilpi Garg, Ekkarat Boonchieng	202311054436
10	Angle Adjustable Multiple Solar Panel System with Auto Sensor Rotator Holder and Expandable Solar Panel	Arjun J Nair, Sridhar Manohar, Amit Mittal	202311060777
11	Approaches for Biometric-based Authentication of a User, over Blockchain, for Authorizing a Transaction	Devang Khurana, Amanpreet Kaur	202311045883
12	Audio Translator on Phone	Rinku, Ashu Taneja, Arun Lal Srivastav, Dolly Gupta, Ananya Verma	202311059373
13	Automated Faucet and Method to Control Flow of Liquid Therethrough	Syna, Vinay Kukreja	202311051025
14	Automatic Water Level Monitoring	Leema Nelson, Vettivel SC, Mukesh Kumar, Rajat Tripathi, Kritika Bhatt, Drishti Gupta, Shagun Jaswal, Ahila SC	202311054088
15	Autonomous Power Cleaning System	Ayush Dogra, Archana Mantri	202311054432

16	Biocompatible Nanostrip for Quantitative and Qualitative Evaluation of Tears	Mansi Chitkara, Renu Thakur, Aashish Kumar	202311054434
17	Blockchain based Security Framework for Internet of Vehicles through Game-Theory Authentication	Shaily Jain, Manik Gupta, Bhisham Sharma, RB Patel	202311057150
18	Card Reading Device for Public Transport	Sanya Kalra, Shalini Rana, Muskan Chawla	202311051534
19	Chip-based Chatbot System for Retrieving Information	Pranav, Pranav Garg, Mansi Chitkara, Gulshan Dhillon	202311054433
20	Conformal Ultra-Compact Narrowband	Manish Sharma, Nitin Goyal, Ashwni Kumar, Vaishali Kikan, Gaurika Jaitly, Siddhi Bhardwaj, Neha, Takshish Bano	202311053323
21	Current Detection Glove	Shinnu Jangra, Anjali, Gurjinder Singh	202311059640
22	Device and Method for Detecting and Quantifying Strabismus in an Eye	Debarshi Ghosh, Nitin Kumar Saluja, Mukul Goyal, Nayan Gupta, Kunaal Kiran Kumar, Rishabh Tandon, Gurjinder Singh	202311048191
23	Device to Measure Parameters of Stored Water	Varun Jindal, Vinay Kukreja	202311065481
24	Diode-Connected Current Source based Flipped Voltage Follower Low Pass Filter	Diksha Thakur, Kulbhushan Sharma	202311051536
25	Edible Ayurvedic Composition	Mansi Chitkara, Arvind Kumar, Chef Rohit Agnish, Chef Naresh Kumar, Rajwinder Kaur, Diksha Choudhary	202311060782
26	Efficient Fluoride Sorption from Wastewater on Bryophyllum Pinnatum Activated Biochar Embedded in Funnel for Earthen Pots	Jyotsna Kaushal, Pooja Kashyap	202311048195
27	Enhanced Flipped Source Follower Filter	Diksha Thakur, Kulbhushan Sharma	202311065207
28	Herbal Antirash Cream and Preparation Method Thereof	Varsha Singh, Neha Dahiya, Manpreet Kaur	202311060812
29	Herbal Composition of Hair Dye and Method for the Preparation Thereof	Varsha Singh, Manpreet Kaur, Neha Dahiya	202311060811
30	Intelligent and Internet Connected Speed Limited for Vehicles	Sakhshra Monga, Nitin Kumar Saluja, Lokesh Garg	202311047244
31	Light Weight Dust and Litter Collector	Ayush Dogra, Sonam Mittal	202311054431
32	Massager Assembly	Kanwarpartap Singh Gill, Vatsala Anand, Rupesh Gupta, Sheifali Gupta	202311053606
33	Microwave-assisted Crop Waste Powder Making Machine	Maninderjeet Singh, Nitin Kumar Saluja, Varinder Singh, Chanpreet Singh	202311061205
34	Multifunctional Ruler	Ashu Taneja, Rinku, Arun Lal Srivastav	202311053322
35	Nanostructured Perovskite Solar Cell with MGF2 Textured Surface for Enhanced Light Trapping and Absorption	Savita Kashyap, Rahul Pandey, Jaya Madan	202311064000
36	Non-Invasive Body Constituents Monitoring System	Ayush Dogra, Archana Mantri	202311060785
37	Non-Invasive Neuro-Stimulation Device for Detecting Cognitive and Neurological Disorders	Puneet Bawa, Virender Kadyan, Saurabh Gupta, Sahil Mehta	202311055736
38	Panic Button System for Vehicles	Sakhshra Monga, Nitin Kumar Saluja, Ashu Taneja, Lokesh Garg, Kheyanshu Garg, Lovish Bansal	202311051252

39	QOE-Optimized Content Caching and Delivery System	Divya Gupta, Shalli Rani	202311063484
40	Real-Time Queue Management System with Enhanced Privacy	Aashish Kumar, Krish Chaudhary	202311048194
41	Recommendation Model for Monitoring of Devices in IOT Enabled Daycare	Sheetal Sharma, Kamali Gupta, Deepali Gupta	202311053879
42	Secure Plug-in Device for Enabling Charging Devices without Data Theft	Parveen Kumar Khosla, Bhanu Sharma, Manish Sharma	202311054815
43	Sensor based Pressure Probe to Enhance the Efficacy of Kegel Exercises	Amandeep Singh, Bhanu Sharma, Arushi Mishra, Naveen, Kanika, Renu Thakur, Adarsh Aggarwal	202311051256
44	Sensor Enabled Smart Trash Collection System	Ayush Dogra, Archana Mantri	202311060780
45	Smart Hydra-Bottle with Advanced Cooling System	Kamini, Chirag Kumar, Shalli Rani	202311051250
46	Smart IOT based Product Surveillance System	Shubham, Swapnil Tayal, Sudeep, Shubham Kumar Sehgal, Muskan Chawla	202311054075
47	Squatting Exercise Support Belt for Pregnancy	Gurpreet Kaur, Neha Rana, Amanpreet Kaur	202311060776
48	Synthesizer to Process Different Agriculture Biowaste under the Predefined Process Parameters	Chanpreet Singh, Maninderjeet Singh, Nitika Dhingra, Nitin Kumar Saluja	202311051254
49	System and Method for Kitchen Safety	Meenu Garg, Sheifali Gupta, Hitesh Gupta, Isha Gupta, Gurjinder Kaur, Rubina Dutta	202311054322
50	System and Method for Water Resource Management through Integration of Federated Learning and Distributed Ledger	Ishu Sharma, Arshnoor Kaur, Tushar Khanna	202311060816
51	System for Safeguarding Wireless Sensor Networks from Code Injection Attacks	Ishu Sharma, Vanshika Pahuja	202311060815
52	System for Secure and Traceable Communication System	Ishu Sharma, Arshnoor Kaur	202311060813
53	System for Securing Registry Files of Operating System	Ishu Sharma	202311055737
54	System for Smart Route Planning Process for Heavy Good Road Vehicles	Ishu Sharma	202311060814
55	System to Deactivate Alarm	Vinay Kukreja, Varun Jindal	202311065158
56	Voice Assessment Device for Assessing Speech Articulation and Vocal Fold Function	Puneet Bawa, Shirvi Verma, Virender Kadyan	202311054442

#### **INDUSTRIAL DESIGN REGISTRATIONS**

#### 57. Portable Luggage-Carrying Device

**By**: Naveen Kumar, Rajesh Kr. Kaushal, Sanjeev Verma, Karan Kapoor

Application No. 393657-001





58. Stand for Upright Holding of Three Round Bottom Flasks

**By**: Satyam Kumar Agrawal, Monika Sharma, Madhunika Agrawal

Application No. 394840-001





#### 60. Universal Microtip Box

**By**: Satyam Kumar Agrawal, Monika Sharma, Madhunika Agrawal

Application No. 394841-001



# List of Publications

181 publications by CURIN researchers and scholars that were indexed in SCI and Scopus Journals and Conferences in Q3, 2023

- A. Aggarwal, V. Hajra, and V. Kukreja, "Senior Tourism: Travel Motivators and Perceived Constraints and Risks for the Elderly," *Tourism Review*, 2023.
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- [3] A. Arya, D. Gupta, U. Sharma, M. Dutta, and S. Juneja, "Automation of Hotel Inventory Management System for Online Travel Agency using RPA," in 2<sup>nd</sup> International Conference on Edge Computing and Applications (ICE-CAA), IEEE, 2023, pp. 442–449.
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