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CURIN Research and Development News

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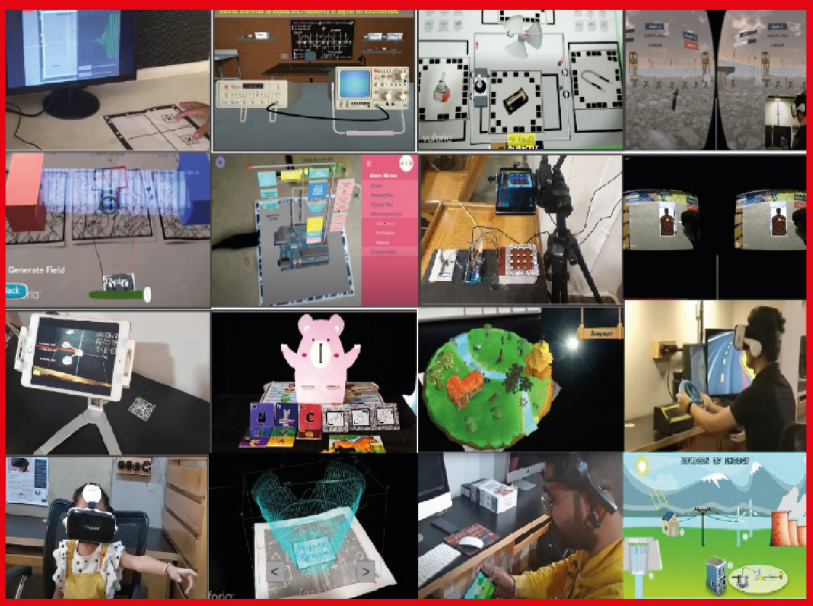
Glimpses of Innovations at Immersive and Interactive Technology Lab (IITL)



Vol. 2022, Issue 1
R&D Activities
During Jan – Mar 2022

COVER STORY

RESEARCH @ CURIN
Summaries on High-impact Research Papers Published by CURIN in Q1 2022

HIGHLIGHTS

- 76 Research Publications
- 66 Patent Filings
- Joint Project with C-DAC Mohali
- NOVATE+ 2022 : 4th Annual Hackathon Announced

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EXPLORE YOUR POTENTIAL

RESEARCH @ CURIN

Ayurvedic Medicine is More Effective in Diabetes Management - A Study by Chitkara University Reveals

Phase IV clinical trials on a group of 100 diabetic patients conducted by the Chitkara University team for this study.

In a recent study conducted by Chitkara University, Punjab, it was found that Ayurvedic medicine is highly effective in treating diabetes, and therefore it could be a better treatment method for the same. This research, which was published in the latest edition ofthe Serbian Journal of Experimental and Clinical Research, revealed that Ayurvedic medicine will not just reduce diabetes, but also repair the damaged cells in the body.

Generally, it is considered very difficult to control diabetes, and hence people are very particular about the treatment method chosen for them. Additionally, not a lot of research work is done on the use of Ayurvedic medicines for treating diabetes, so their effectiveness is less known.

A research group from Chitkara University headed by Dr. Thakur Gurjeet Singh and Dr. Ravinder Singh conducted Phase IV clinical trials on a group of 100 diabetic patients. The patients were divided into two groups, and double-blind trials were conducted for this study, meaning that the patients were not informed about the medicine that would be administered to them. The first group was given the allopathic medicine Sitagliptinand, while the second group was given Ayurvedic medicine BGR-34. BGR-34 is an Ayurvedic formulation that has been developed by scientists from the Council of Scientific and Industrial Research (CSIR) Labs including National Botanical Research Institute (NBRI) and Central Institute of Medicinal and Aromatic Plants (CIMAP) and is marketed by AIMIL Pharmaceuticals.

After monitoring for a few days, the results showed that the Ayurvedic medicine proved to be very effective in treating diabetes. The study has found that the Ayurvedic medicine not only lowered the sugar levels but also improved the functioning of Beta cells in the pancreas. The first round of results showed a decline in the baseline level of glycated hemoglobin (HbA1c), and the medicine was found effective even in the Random Blood Sugar Test. The baseline value of HbA1c in patients at the start of the trial was 8.499%, but after four weeks of taking Ayurvedic medicine, the value reduced to 8.061%. Moreover, after eight weeks the value came down to 6.56%, and to 6.27% after twelve weeks.

This study has been published in the Volume 22, Issue 4 of the Serbian Journal of Experimental and Clinical Research in an open access mode and can accessed from https://doi.org/10.2478/sjecr-2021-0057.

High Impact Research Papers Published by CURIN during January - March 2022

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 five highly impactful research papers from CURIN and attempt to discuss them in the form of short summaries or articles.

The researcher papers, discussed in this issue are the ones that were published during January- March 2022. A complete list of publications by CURIN faculty members and scholars during this period is available in a separate section.

A CNN Based Sentiments Detection Model

By: Dr. Shalli Rani, Associate Professor, CURIN

This article is based on the research paper titled "An Efficient CNN-LSTM model for sentiment detection in Black Lives Matter" published by Ankita and Dr. Shalli Rani from Chitkara University in Elsevier journal entitled Expert Systems with Applications.

Imagining things without mixed emotions is next to impossible in today's scenario. Whether it is news or any online movement started on social media applications. One of the social media applications i.e Twitter started a movement known as #BlackLivesMatter. Black Lives Matter formed in 2013 in the United States indicated the unjust killings by police of the black people. It was the online movement started. The reaction to this is positive as well as negative. Black Lives Matter is the protest against the brutal police incidents and also racist violence against African-American people. This study attempts to work on the data collected from the Kaggle. As the advancements can be seen in the deep learning text-based approach such as BERT in which based on tweets of the people the sentiments attached to the texts can be classified. People from all over the world displayed mixed emotions such as expressing trust in the movement, giving negative feedback, feeling disgusted and angry. Machine and Deep Learning techniques along with advances taking place in computing are responsible to take out the information from the data available. As a result, deep learning is a powerful technique in dealing with social media analytics. The approach to reach the topic in many ways from pure ordered based to the more serious deep learning's neural network. To train the model using deep learning classifier's algorithms, the relevant tweets can be labeled based on emotional polarity. In this study, a deep learning classifier Convolutional Neural Network (CNN) and Long Short-term Memory (LSTM) is used to detect the sentiments and emotions of the people based on the tweets of the two provinces of the USA (Minnesota and Washington D.C.). The proposed hybrid model is validated over Random Forest, Convolutional Neural Network, LSTM and Bidirectional LSTM. This study contains the steps for loading the dataset namely the data collection, pre-processing of data, data analytics, sentiment analysis, data annotation and then the desired results takes place. It is really surprising to see the results as in both the provinces people showing interest as they are trusting the movement with 48% in Minnesota and 54% in Washington D.C. Our proposed model CNN-LSTM is 94% accurate in detecting the various sentiments based on the hyper-parameters such as epoch, filter size, pooling, activation function, dropout, stride, padding, and number of filters.

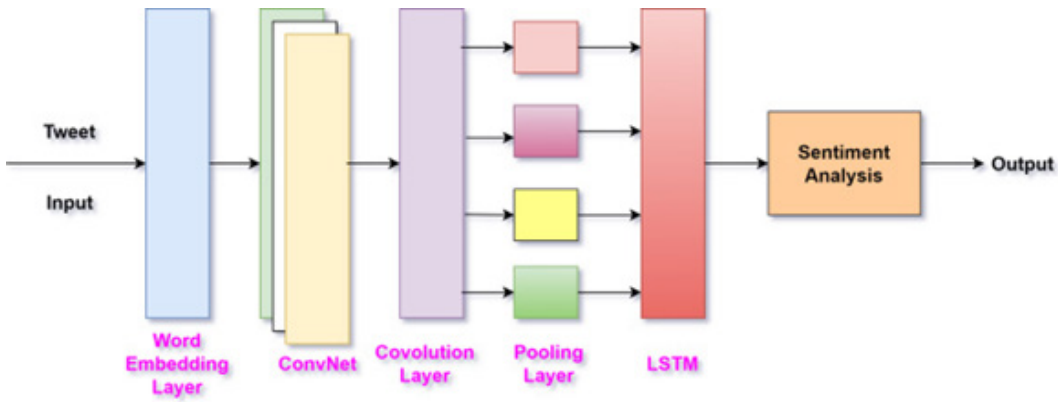


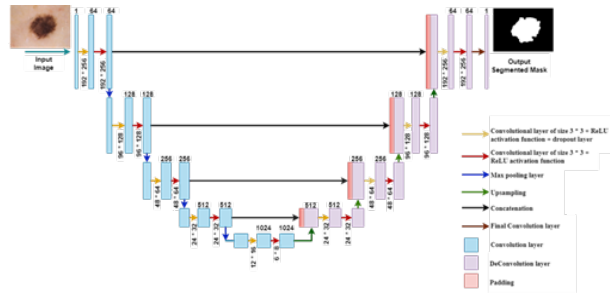
Illustration is borrowed from the published paper

An Early Diagnosis of Skin Disease Using Segmentation Method on Dermoscopic Images

By: Dr. Sheifali Gupta - Professor, CURIN

This article is based on the research paper titled "Modified U-NET Architecture for Segmentation of Skin Lesion" published by Vatsala Anand and Dr. Sheifali Gupta from Chitkara University in MDPI journal entitled Sensors.

A modified U-Net architecture is proposed by modifying the feature map's dimension for an accurate and automatic segmentation of skin lesion in dermoscopic images. The proposed model is simulated by considering several hyper parameters such as epochs, batch size, and the types of optimizers. The U-Net architecture consists of two paths, the first one is the contraction path, also known as the encoder, and the second one is the symmetric expanding path, also known as the decoder. Encoder is used to capture the image context, whereas decoder uses transposed convolutions to enable precise localization. The proposed architecture localizes and distinguishes borders by classifying every pixel. In the encoder part, the convolution layer and the max-pooling layer are applied. In the decoder part, the transposed convolution layer and the simple convolution layer are applied.



Proposed U-Net architecture.
(Illustration is borrowed from the published paper)

The proposed model is validated with different optimizers, batch sizes, and epochs for better accuracy. The three different optimizers are Adam, Adadelta and SGD, the values of batch size are 8, 18, 32, and the epoch values are 25, 50, 75 and 100. The proposed model has been analyzed with various performance parameters such as Jac card Index, Dice Coefficient, Precision, Recall, Accuracy and Loss. The result analysis is performed in three steps.

First result analysis was performed for different optimizers. The Adam and SGD optimizers produced nearly identical results with a batch size of 18 and 100 epochs, respectively. The Adadelta optimizer does not follow the profile of the skin lesion, rather it extracts a whole skin section and therefore it is not suitable for skin lesion segmentation. The Adam optimizer outperforms the SGD and Adadelta optimizer in terms of training loss and training accuracy. The value of loss is much lower in the case of the Adam optimizer.

Second result analysis was performed using different batch size values and batch sizes 8 and 18 show almost similar results with the Adam optimizer and 100 epochs, whereas batch size 32 does not perform well, since it is not extracting only the lesion part but also the outer part. Therefore, batch size 32 cannot be recommended for skin lesion segmentation. The batch size 8 has shown the best results on the validation dataset.

Third result analysis was performed using different epoch values. Adam optimizer and batch size 8 produced nearly identical results for 25, 50, and 75 epochs, however the results for 100 epochs are not good. An analysis of these epochs was done by utilizing confusion matrix parameters to see the top performing epochs between 25, 50, and 75. On 75 epochs, the best accuracy was obtained with a substantially lower loss.

The proposed model can be used for early diagnosis of skin disease and it can act as a second opinion tool for dermatologists.

An Effective Green Communication Routing Protocol for Intelligent Transportation Systems

By: Dr. Himanshi Babbar - Assistant Professor, CURIN

This article is based on the research paper titled "DCGCR: Dynamic Clustering Green Communication Routing for Intelligent Transportation Systems" published by Roopali Dogra, Dr. Himanshi Babbar and Dr. Shalli Rani from Chitkara University in IEEE journal entitled Transactions on Intelligent Transportation Systems.

For effective green communications amongst the vehicles, the energy-efficient routing protocol for intelligent transportation system (ITS) is essential. Due to the high speed and recurring topological variations of Vehicular sensor Networks, identifying a connected route with a sufficient latency is a difficult task with many constraints and obstacles. Therefore, to overcome this, we developed the statistical approach to theoretically determine the load congestion and consumption of energy during the lifetime of the sensor network for ITS. Hence, dynamic clustering green communication

routing (DCGCR) protocol is proposed for vehicular communication. To manage energy consumption and enhance the lifetime of the network deployed on the roadside units (RSU), we have analyzed the evolution of energy holes and applied our analytical conclusions for ITS with WSN routing. The proposed routing protocol considers various metrics: i) energy consumption of vehicular sensor nodes, ii) network stability, iii) reliability and iv) amount of data exchange among vehicles. The efficiency of the proposed computational model in calculating the lifetime of the vehicular network and energy hole evolution process is demonstrated through extensive computation results. DCGCR approach is compared with the various energy aware routing algorithms namely, Dynamic Energy Balanced Routing (DEBR), Geographic Greedy Routing (GGR), double cost function-based routing (DCFR) and found that proposed approach achieves more accuracy with 7% less failure rate.

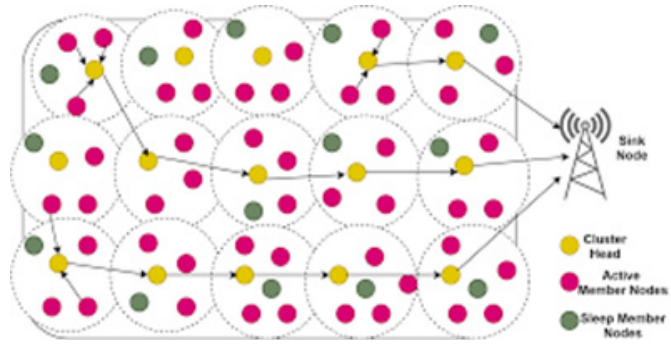


Illustration is borrowed from the published paper

We have proposed a statistical approach for ITS to improve the parameters of load congestion, consumption of energy and lifetime of the network of the sensor nodes based on the theoretical and computational analysis. Our statistical conclusions for ITS ensure the sustainability and lifetime of the network behind a particular proportion of dead nodes, as well as the network's residual energy. Extensive computations show that the suggested mathematical method can predict the lifetime of the ITS network with a 7 percent failure rate.

The energy hole evolution in ITS environment is analyzed based on the lifetime of the network for the sensor nodes which avoid the mitigation or energy hole in the ITS communication for the efficient delivery and reception of the data. We represent lifetime of the network as total available nodes died time (ADT) and the first node died time (FDT) for ITS which signifies the time when the first node in the network dies with the minimum number of sensor nodes. For validating the results after performing some computations, we have compared our statistical DCGCR approach for ITS with the existing routing algorithms namely, DEBR, GGR, DCFR.

We found that our approach is performing better computations as compared to the other approaches concerning the size of the network and ADT for 1200 and 200 data rounds.

Device Simulations of Efficient Perovskite–Silicon Tandem Solar Cells with Reduced Thermalization and Photon Losses

By: Nikhil Shrivastav - PhD Scholar, CURIN

This article is based on the research paper titled "Investigations Aimed at Producing 33% Efficient Enhanced Hole Extraction Perovskite-Silicon Tandem Solar Cell through Device Simulations" published by Nikhil Shrivasta, Dr. Jaya Madan, and Dr. Rahul Pandey from Chitkara University, Punjab, in journal entitled RSC Advances, Royal Society of Chemistry.

The conversion efficiencies for silicon-based photovoltaic devices have become stagnant, with the record conversion efficiency of 26.7% achieved in 2017. This record efficiency is also close to the theoretical Auger limit of 29.4% for single-junction silicon solar cells. Therefore, it is anticipated that further enhancement in conversion efficiency could only be achieved by adopting multi-junction or tandem concepts for silicon PV devices. In this context, perovskites are widely preferred for tandem application with silicon solar cells to mitigate thermalization and non-absorbed photon losses to achieve higher conversion efficiencies. The perovskite–silicon (PVK–Si) tandem design can deliver 45.1% efficiency, and currently, this design holds a record conversion efficiency of 29.5%. Therefore, critical research and development activities are required to unlock the potential of such devices.

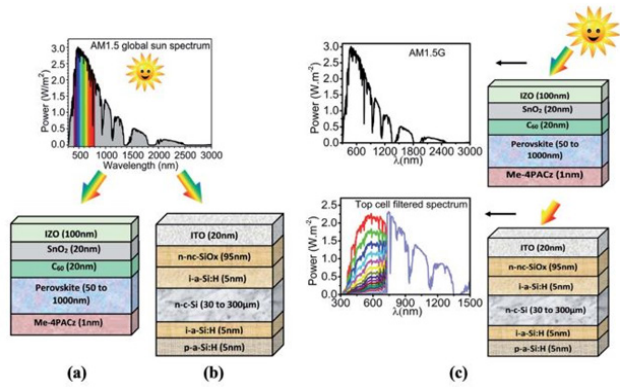


Illustration is borrowed from the published paper

A research team at VLSI Centre of Excellence, CURIN comprising of Nikhil Shrivastav, Dr. Jaya Madan and Dr. Rahul Pandey have proposed a 33% efficient two-terminal monolithic perovskite–silicon (PVK–Si) tandem solar cell to reduce the thermalization and non-absorbed photon losses. The proposed device is facilitated with Me-4PACz and ITO-based ideal tunnel recombination junctions for current matching, with parasitic absorption losses. Tandem device is optimized at 336 nm and 150 mm thick absorber layer-based top and bottom sub cell. The device constructed using a 1.68 eV perovskite top cell and 1.12 eV c-Si-based heterojunction with an intrinsic thin layer (HIT) based bottom cell showed an open circuit voltage, VOC, of as high as 2.02 V with other PV parameters are as follows JSC (20.11 mA cm2) and FF (81.36%).The comprehensive analysis of PVK–Si tandem devices presented in this research effort may pave the way for developing high-efficiency tandem solar cells in the future.

Therapeutic Implications of Cox Inhibitor in Ischemic Injury

By: Dr. Thakur Gurjeet Singh – Dean (Research), CURIN

This article is based on the research paper titled "Therapeutic Implications of Cox Inhibitor in Ischemic Injury" published by Heena Khan, Kunal Sharma, Amit Kumar, Amarjot Kaur, and Dr. Thakur Gurjeet Singh from Chitkara University, Punjab in Springer journal entitled Inflammation Research.

Poly (ADP-ribose) is distributed widely amongst vertebrates and further metabolized via PARP and PARG. The PARP is the nuclear enzyme family found in various organs, including the brain, catalyzes the transfer of ribose to target proteins, i.e., undergoes poly-ribosylation. The critical role of PARPs in various cell processes includes transcription, replication, and modulation of chromatin structure, recombination, and DNA repair. PARP is strongly activated by both chemotherapy and oxidative stress. The activation is primarily due to transient and localized DNA strand breaks caused by various biological processes such as replication, DNA repair, gene re-arrangement, recombination, oxidative stress, and DNA binding drugs. Various signaling pathways have been correlated with PARP modulation. The anti-apoptotic pro-survival kinase signaling pathways, including PI3k/Akt and extracellular signal-regulated kinases (Erk1/2), are activated in response to I/R injury. Pharmacological and ischemic preconditioning modulates such pathways and might protect them from reperfusion-induced cell death. Cumulative evidence has recognized the role of protein kinase A, ERK1/2, and Akt in inhibiting Bad function as signaling pathways for cell survival post-ischemia. A survival kinase (Akt) performs its action to affect the glycogen synthase kinase and NFκB by phosphorylation of various apoptosis regulatory molecules, including Fork head transcription factors, BAD, IκB kinase (IKKα), and caspase-9. IKKα is a kinase that results inthe degradation of NF-κB inhibitor (IκB) and is phosphory lated or activated by Akt. Once the IκB is degraded, NF-kB will be released from the cytoplasm and then travels to the nucleus, inducing anti-apoptotic gene transcription. The interactions among nuclear respiratory factors (NRFs) and PARP-1 are autonomous with the enzymatic activation of PARP-1, which suggests that it is vital for the recovery of cells from sub-lethal oxidative damage. PARP inhibition has proven to be potent for reducing infarct volumes in stroke models since these drugs directly affect neuronal survival, maintain the integrity of the BBB and cause a reduction in the level of inflammatory reactions. To date, PARP inhibitors are already in phase III of clinical development to treat breast cancers. However, preclinical studies indicate that PARP inhibitors maybe a potential target for clinical studies on stroke. Also, these agents still lag for clinical development due to the large series of failures in clinical trials in the 1990s. Several compounds exhibiting a higher PARP-1 inhibition have emerged in recent times, which seem favorable for ischemic neuro protection. Observations suggested the treatment with MP-124 (a novel PARP-1inhibitor) in an animal stroke model might have the potential, and this agent is on the edge of stepping into human clinical trials. JPI-289 is also one of the PARP inhibitors currently under investigation for stroke. Its phase I study suggested that its safety and efficacy should be further investigated in clinical studies. Experiments intended to identify the mechanisms behind ischemic neuro protection via poly-ADP-ribo sylation inhibition might also reveal novel modulators for post-ischemic brain damage besides providing new targets of pharmacological importance. In the upcoming times, one can predict the generation of additional clinically relevant data that will forecast these PARP inhibitors' role in the clinical management of stroke.

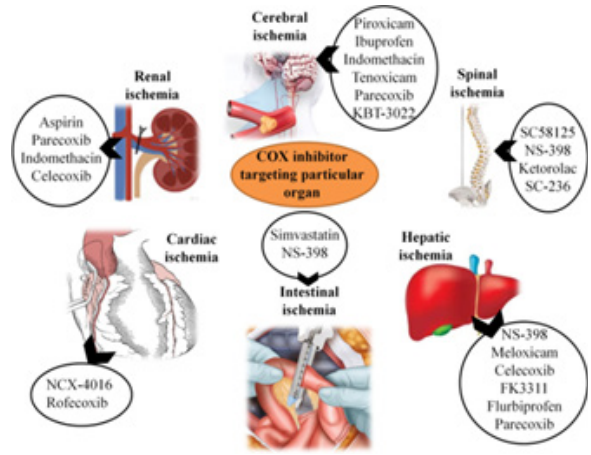


Illustration is borrowed from the published paper

CURIN Announced the 4th Annual Hackathon – NOVATE+ 2022

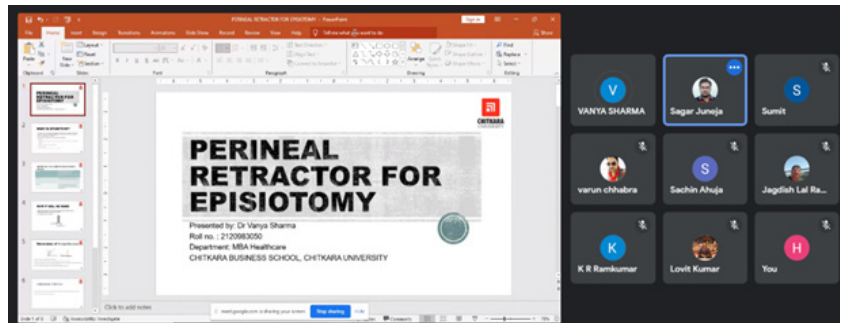
Total Prototyping Funding of INR 50 Lacs to be Awarded

CURIN announced the 4th edition of NOVATE+ 2022 in March 2022 with a theme Biggest Confluence of Academia and Industry for Working on Joint Projects. In this flagship event of CURIN, we invite innovative joint project ideas from academia and industry and top project ideas receive prototyping grant for implementation. The aim of the competition is to support industry-academia collaborations for solving engineering problems through new innovations. We encourage students and faculty to reach out to industry to understand their problems and then submit joint project proposals for prototyping funding support to build solutions. This year we plan to award a total prototyping funding of INR 50 lacs to at-least 10 projects and we hope to receive about 100 entries. NOVATE+ 2022 is supported and anchored by Government of India sponsored projects at Chitkara University - NewGen IEDC and Technology Enabling Centre.

Mr. Sagar Juneja (Assistant Dean, CURIN and Coordinator - NewGen IEDC and TEC) and Mr. Chanpreet Singh (Project Manager, CURIN and Co-coordinator, NewGen IEDC) are the conveners of NOVATE+ 2022.

Other Activities of Chitkara University NewGen IEDC and TEC during January – March 2022

1. **Project Pitches for Prototyping Funding Support from NewGen IEDC (January 20, 2022)**

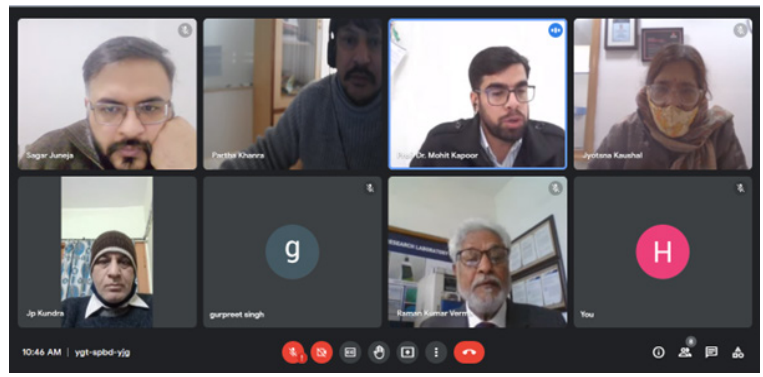


On January 20, 2022, NewGen IEDC conducted Project Pitches session to provide an opportunity to those student applicants who had applied for funding support from NewGen IEDC for their project ideas. Four student teams one each from Computer Applications, Pharmacy, Business Administration, and Hospitality Management departments presented their ideas to a jury. Jury members included Dr. Jagdish Lal Raheja (Former Chief Scientist, CEERI, Pilani), Dr. Sachin Ahuja (Director, Research, CURIN), Dr. K.R. Ramkumar (Associate Professor, CURIN), Dr. Varun Chhabra (Associate Professor, CURIN), and Mr. Sumit Kumar (Assistant Professor, CCAE).

2. **Industry Session on Design of a Filter to Separate Carbon and Hydrogen from Gaseous Mixture, by Cheema Boilers Pvt. Ltd., Punjab (January 24, 2022)**

TEC conducted a session on the Design of a Filter to Separate Carbon and Hydrogen from Gaseous Mixture on January 24, 2022. The session was organized to connect industry with a research team of Chitkara University for a joint project. Dr. J. P. Kundra from Cheema Boilers Pvt. Ltd, Punjab shared a problem statement with the faculty members of Chitkara University

to design a filter for the separation of carbon and hydrogen from the gaseous mixture. Currently the team is working on finding out ways to raise funding for a joint project.



3. Understanding the Challenges of Automotive Industries in the Region and Exploring Opportunities of Joint Projects (January 28 and February 25, 2022)

TEC facilitated the participation of five faculty members from the university, Dr. K. D. Chattopadhyay, and Dr. Kulwinder Singh, (Professors, Mechanical Engineering), Dr. Varun Chhabra, Dr. Prateek Srivastava (Associate Professors, CURIN), and Mr. Sagar Juneja in the one-day workshop on 'Future Technologies in Automotive Domain for Sustainable Mobility'. The workshop was held on January 28, 2022 at Municipal Corporation Office, Sector 17, Chandigarh and it was jointly organized by the Chandigarh administration and the Technology Enabling Centre of the Panjab University, Chandigarh. In this workshop as many as 10 industries from automotive domain discussed about their problems and challenges. The audience comprised of faculty members and researchers from different universities, colleges and research institutions of the region.

In continuation, a session was organized at the university to discuss the challenges faced by the automotive industries and to identify the possibilities of collaborating with these industries for joint projects. In this interactive session faculty members shared their views and explored different possibilities of collaborating with automotive industries. The resources persons of the session were Dr. K. D. Chattopadhyay, Dr. Kulwinder Singh, Dr. Rajeev Kamal Sharma (Dean, Mechanical Engineering) and Mr. Sagar Juneja. Around 50 faculty members from the department of Mechanical Engineering, Electrical Engineering, and Mechatronics took the advantage of the session. The objective of the session was to motivate the faculty members to connect with the industries in this region.

4. Third Annual Progress Review Meeting of NewGen IEDC Projects (Feb 11, 14-15, 2022)

Chitkara University NewGen IEDC has sanctioned more than 80 projects till date and out of which close to 30 projects have been completed. 40 patents have been filed out of NewGen IEDC projects and 12 start-ups have been registered. NewGen IEDC has spent close to INR 1.5 Crores on these projects so far. The core committee of NewGen IEDC closely monitors the progress of each sanctioned project and provides expert guidance as well as mentoring. During February 11, 14-15, 2022, third annual progress review meeting was organized to review the progress of 20 ongoing projects. The objective of this review meeting was to understand the current status of each project, to understand their challenges, future plans and the status of their budgets. The meeting was chaired by Dr. Archana Mantri – Vice Chancellor, Chitkara University, Punjab and Chief Coordinator, NewGen IEDC, and a five member committee comprising of Dr. Sachin Ahuja, Dr. Jagdish Lal Raheja, Dr. Varun Chhabra, Mr. Sanjay Bhatnagar (Visiting Faculty, CURIN) and Mr. Sagar Juneja evaluated each project presentation and gave valuable inputs.

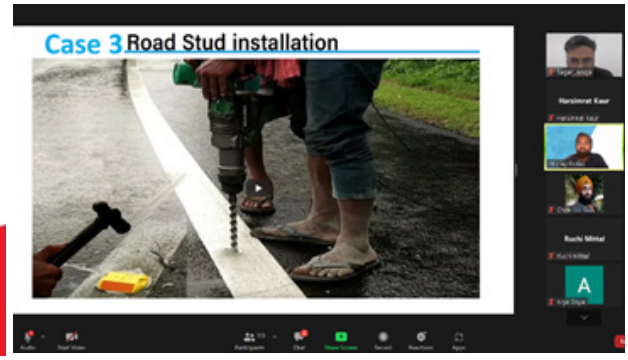
5. Participation in MACHAUTO EXPO 2022 @ Ludhiana (March 11, 2022)

A team from CU TEC participated in an annual exhibition MACHAUTO EXPO 2022 on March 11, 2022, at Ludhiana Exhibition Centre, Ludhiana, Punjab. It was organized to provide a platform for the MSMEs units across the country to showcase their technologies. We participated in this event in order to build tie-ups with the MSMEs and we are in talks with many MSMEs for different activities.

Additionally, we were among the very few people from academia to put-up an exhibit during in this exhibition to display our technologies. We showcased four projects that have been developed at Chitkara University and are ready for commercialization. These projects were - 80 Wash (a waterless washing machine), Grain Paddy Drying Machine, Solar Powered Multipurpose Canopy and UV Robot for Automatic Sanitization of Indoor Areas. Here are details of the team from Chitkara University that participated in this event – Dr. Sachin Ahuja, Mr. Sagar Juneja, Dr. K.Z. Molla (Associate Professor, Mechanical Engineering), Dr. Varun Chhabra, and Mr. Chanpreet Singh.

6. Invited Talk on Product Design (March 16, 2022)

Faculty members and students of Chitkara University do a lot of innovative projects, but for the commercialization of technologies it is important that our faculty members and students learn to convert their prototypes into products. This is a reason, an industry expert was invited to deliver a lecture on how to convert prototypes into end products. Mr. Akshay Dolas, Principal Engineer, ADD WORKS, Mumbai gave a lecture on the real-time challenges while translating prototypes into end products. The talk was organized on March 16, 2022. The session included several case studies of innovative products designed by ADD WORKS, like a Mileage air filter, Ka'an binaural microphone, Road stud installation etc., wherein he discussed the topics like the importance of data collection, identification of end-user, and the impact of the product on the customers etc. A total of 116 participants attended this session.



7. Five-day DIY Workshop on Prototyping (March 28 – April 1, 2022)

NewGen IEDC and TEC conducted a Five-day DIY Workshop on Prototyping to give an opportunity to faculty members and students of the university to actually build a tangible and useful end product, and in the process learn about product designing skills, and develop an understanding about various prototyping tools. 20 people signed–up for this workshop, and they built a wooden laptop stand on their own for their personal use. Mr. Chanpreet Singh, and Mr. Krishna Das (Department of Mechanical Engineering) were the resource persons. Additionally, an invited talk on product designing was conducted during this five-day workshop, and the invited speaker for the same was Mr. Vyasateja Rao, Founder and Creative Director, Analogy Design, Bengaluru.

All India Radio (AIR) organized an NXT Talent Hunt Program under Azadi Ka Amrit Mahotsav to encourage young inventors. Rouble Gupta, alumnus of Chitkara University (B.Tech 2021) was invited by AIR Patiala on March 6, 2022. He discussed the issues of the environment and the significance of his innovation titled '80WASH'. It is a device which facilitates waterless cleaning and sterilization of fabrics, metal components, PPE kits etc. in 80 seconds and reduces the consumption of electricity by 1/10. He has developed this device under the guidance of Dr. Nitin Saluja – Associate Director, CURIN.

Dr. Nitin Saluja and Mr. Varinder Singh, Project Manager, CURIN were also invited by the AIR Patiala in another program titled VIBGYOR-Science Sunday in February 2022 to discuss about their innovations.

Collaboration with C-DAC Mohali for a Research Project

Cyber Security Project on Risk Assessment

In January 2022, Chitkara University got a consultancy project in cyber security from C-DAC, Mohali, and it is related to the topic of IT Risk Assessment. The Centre for Development of Advanced Computing (C-DAC) is a Scientific Society of the Ministry of Electronics and Information Technology, Government of India. C-DAC has emerged today as a premier R&D organization in Information Technologies and Electronics, working on strengthening national technological capabilities in the context of global developments in the field, and responding to changes in the market need in selected foundation areas.

Risk assessment plays an important role in the proper selection of security controls and it involves the identification of assets, vulnerabilities, threats, and estimation of the relative level of risks. Risk assessment delineates both the strategy to reduce the likelihood of occurrence of risks (also called preventative measures), as well as the measures to respond effectively if a risk becomes a direct threat. Risk Assessment in IT systems is a process of identifying, estimating and prioritizing information security risks. It is a critical component of the overall risk management strategy. The main objective of this activity is to calculate the risk associated with the IT assets connected over the local network in an organization. This particular consultancy project has the following objectives –

1. To do the R&D on innovative methods for automatic discovery of an IT asset in an organization /institution/ establishment.
2. To devise a practical method/approach for the computation of MAC-address (without using ARP) of the assets connected to a network within an organization /institution/ establishment.
3. To do the vulnerability assessment of both active and dormant assets
4. To determine the threat score in the discovered IT assets.

This one year project will be jointly executed by the following researchers from CURIN – Dr. Meenu Khurana - Director (Research), Dr. Sudesh Mittal - Professor, Dr. K. R. Ramkumar - Associate Professor, and Dr. Ishu Sharma - Assistant Professor, and also part of the team is Dr. Vikas Khullar - Assistant Professor (CSE), Chitkara University.

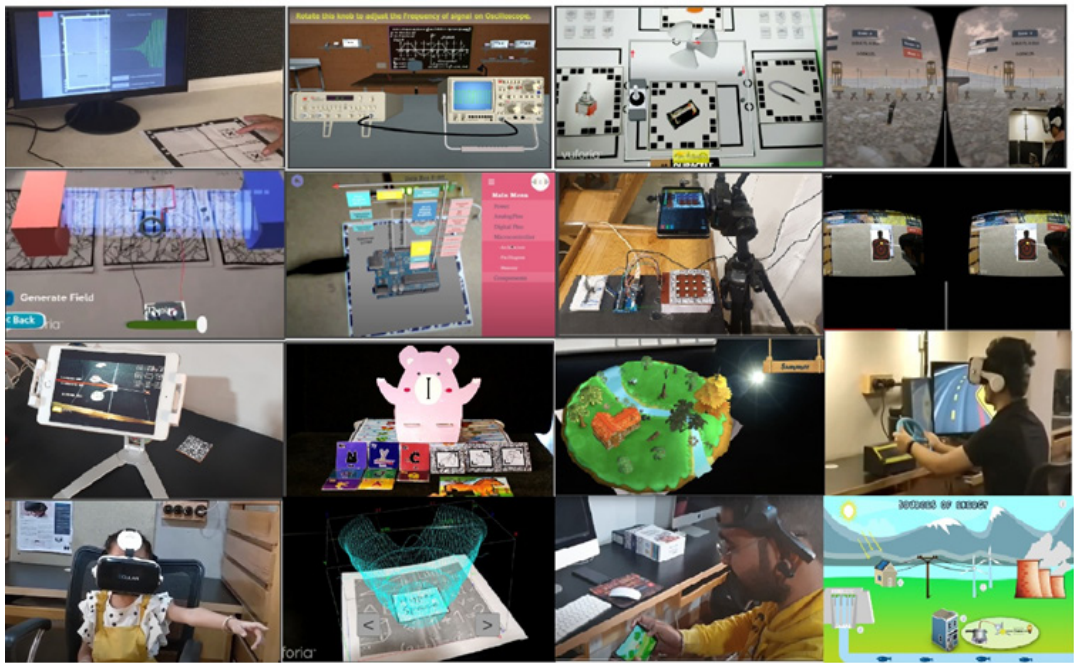
Glimpses of Innovations at Immersive and Interactive Technology Lab (IITL)

IITL works in different immersive technologies for a wide range of applications

By: Dr. Bhanu Sharma – Assistant Professor, CURIN

Immersive and Interactive Technology Lab (IITL), CURIN, Chitkara University works in different immersive technologies including Augmented Reality, Virtual Reality, Mixed Reality and Extended Reality for diverse applications. The lab is headed by Dr. Archana Mantri - Vice Chancellor, Chitkara University, Punjab, and a team of researchers, PhD scholars, and interns are working under her guidance on several projects, some of which are funded by the Government of India.

IITL team is working in multidisciplinary fields such as Brain Computer Interface, Machine learning, Internet of Things, Virtual Instrumentation, Metaverse, Embedded Systems etc. Here are some of the projects (along with the pictures) that have been carried out by IITL in the recent past - Augmented Reality Learning Environment for Oscilloscope and Function Generator in Electronics Engineering Laboratories, Vidyut AR, Learn'o' Little, Virtual Shooting Tutor with Hybrid Tracking, Augmented Shooting Tutor with Hybrid Tracking, Virtual Reality-Based Driving Test Simulator, Visual Physics, Embed AR, Augmented Reality based Learning System and method for K-map Logic Design, Edu Geo, Augmented Reality based Magic Book for Autistic Children (AR Jadoo), Dhwani VR, Hyperspace, Mano-Aid, Ghoom AR, Covid-19 Fighter, and Brain runner (Brain Computer Interface).



IITL has already produced 100+ research publications, and filed more than 50 patents, out of which 5 have already been granted. One of the projects from this lab titled Learn-O-Little by Dr. Neha Tuli has been converted into a start-up, which is getting a lot of traction as well as funding from different sources.

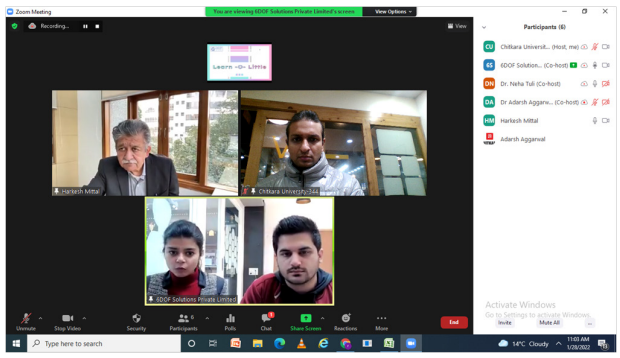
In addition, IITL also conducts a lot of training program and workshops on AR/VR software, tools and products including Oculus, Microsoft Hololens 2, Leap Motion, HTC Vive etc.

There are collaboration opportunities available for working with IITL, please visit https://curin.chitkara.edu.in/labs/immersive-interactive-technology-lab/ for more details.

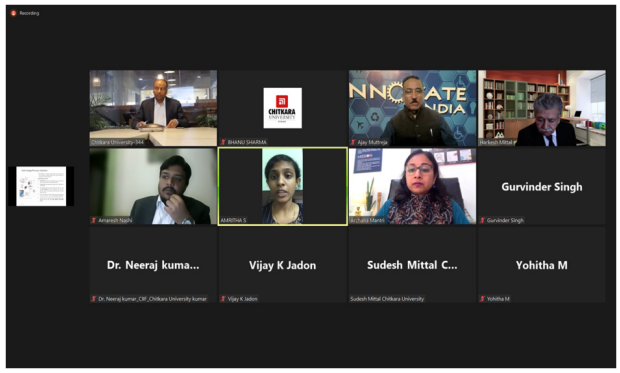
Activities to Support the Start-up Eco-system in the Region

Organized by Chitkara Innovation Incubator Foundation (CIIF), Chitkara University

- A half-day event titled 'Mentor-Mentee Connect' was organised to connect the mentors with budding start-ups, and it was held on January 28, 2022. Seven faculty and student start-ups from the university pitched their ideas to the jury panel that comprised Dr. H. K. Mittal - Chairman, Start-up India Seed Fund Committee (SISF), Dr. Adarsh Kumar Aggarwal - Head Incubation, CIIF and Dr. Neeraj Kumar - Incubation Manager, CIIF. The jury provided one to one mentoring to each start-up and gave their valuable feedback that will help the teams in making their presentations ready for pitching for MEITY TIDE 2.0 funding.



- On February 15 CIIF organized an event titled 'PITCH IT! & WIN IT: A Funding Opportunity Competition'. A total of 19 start-ups from all over the country pitched their ideas in front of the jury to win start-up funding of upto INR 10 Lakhs each. The start-up ideas were from diverse fields including EdTech, Deeptech, Pharmtech, Agritech and many more.



- On March 10 CIIF invited Mr. Brijesh Aggarwal, CEO and Co-Founder, DocsinBlocks.com to deliver a talk that would encourage students to think about building technology based start-ups. In his talk, Mr. Brijesh discussed about different aspects of blockchain technology from the start-ups point of view and discussed how students can build start-ups using blockchain technology. He also talked about the future of cryptocurrencies and NFT.
- In order to sensitize the budding entrepreneurs about product designing, CIIF organised an event on the topic 'ABCD of Product Designing for Startups' wherein 120 students and budding entrepreneurs participated and

learnt the technical aspects of product designing from Mr. Aniket Bhardwaj – Founder, Seacup Visionaries Products Pvt. Ltd. According to the speaker, one should first understand the significance of the problem and should write down the problem statement before start thinking about the product. He also mentioned that one should identify smaller problems that need to be solved to solve a bigger problem. The session was held on March 16, 2022.

- CIIF organised a session on the topic Do's & Don'ts in Building a Tech Start-up for the Budding Entrepreneurs on March 21, 2022. The speaker was Mr. Sameer Sharma - Founder, Uengage Services Pvt. Ltd who mentioned that establishing & running a start-up is one of the biggest challenges. One must be ready and confident enough to face these challenges. He suggested that one should not waste time, resources and energy in grand and impressive strategies. He also mentioned that self-realization makes a start-up unique, and start-up should invest in whatever makes it stand out from the competition.

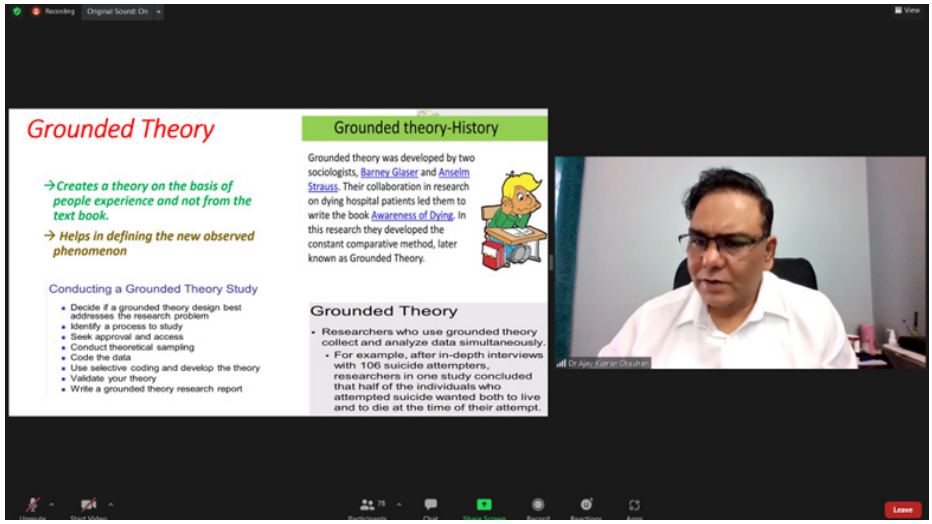
- On March 23, CIIF organised a session on the topic 'Global Opportunities for Start-ups' for the budding entrepreneurs and invited Ms. Inu Rana - Senior Business Manager, Launch Pad Innovation Program, Western

Sydney University, Australia. She explained that once start-ups gain stable financial footing, they may look at various global markets to grow and enhance their operations. She also mentioned that today large domestic and consumer markets are in China and India, and hence global start-ups are also looking to expand their operations in India and China. She also discussed about the possibilities of joint start-up collaborations between India and Australia especially in the areas of AR/VR, Agritech and Healthtech.

A session titled 'Recognizing Your Love for Startup at First Sight' was organized on March 28, and it was delivered by one of the Shark Tank India finalists, Mr. Sharad Dabra - Founder, SD Fine Arts LLP. The speaker motivated the students to opt for entrepreneurship in the early years of their under graduation course, since by starting early they will get enough time to build their start-ups. The speaker mentioned that one should try to convert his/her hobbies into a start-up as when someone does something that s/he likes, the chances are high that it eventually would result into a success. The speaker said one should opt for entrepreneurship by choice and not by force.

Understanding Qualitative Research Design

A two-day symposium by DRC, CBS during March 5-6, 2022



Seminars and workshops on topics like research design provide a platform to allow young researchers to explore different areas related to their research topics, and understand the complicated research models. Sessions like these, also help research scholars in developing new skill set, which may further simplify their research. Doctoral Research Centre (DRC), Chitkara Business School (CBS) organized a two-day symposium on 'Understanding Qualitative Research Design' during March 5-6, 2022. The resource person was Dr. Ajay Chauhan - Founder, Research Shiksha, New Delhi, and the objective of program was to enable research scholars to understand the significance and utility

of qualitative research design. Dr. Chauhan discussed various methods of data collection including documents, archival records, direct observation, participant observation, interviews and physical records. He also made participants aware about the numerous issues related to the design of qualitative case study research. Participating research scholars also got a hands-on exposure of NVIVO software, using which participants learned to perform different qualitative techniques. Dr. Chauhan built the background of qualitative research and described the shift in the research paradigm through various relevant and interesting examples. He also discussed thematic analysis, content analysis, and analysing Twitter and Facebook comments for information extraction. The workshop was attended by more than 70 research scholars.

Invited Talks and Experts Lectures

Dr. Amit Mittal - Professor & Dean, DRC, CBS was invited to deliver a keynote address in the Workshop on Research Methodology organized by Neville Wadia Institute of Management Studies and Research, Pune on Feb 18, 2022.

Dr. Mittal gave an overview of the quantitative & qualitative research methods, and engaged the participants with the key debates in the area, including those that argue on the essential unity of the logic of inference across research methods—qualitative as well as quantitative.

In another keynote address at Hiraben Nanavati Institute of Management, Pune, India on March 4, 2022, Dr. Amit Mittal focussed on examples, exercises, and texts enabling scholars to learn the scholarly writing process. The workshop was sponsored by NAAC.

Dr. Amit Mittal was also invited to deliver an expert session on the topic of 'Technology and Disruption - Idea Screening and New Product Development'. More than 100 students and faculty members of CT University, Punjab attended the session that was held on March 16, 2022.

Recognition

1. Dr Arun Aggarwal – Assistant Professor, DRC, CBS won the Best Paper Award at the 12th International Business Research Conference with the theme Business Trends Ensuring Growth, Sustainability, Innovation, Happiness, and Well-being in the Next Normal organised by IES's Management College and Research Centre in association with AMIDSA on March 5, 2022.
2. Dr. Amit Mittal has been appointed as one of the two external experts in the Institutional Research Committee, Faculty of Management Sciences and Commerce, MD University, Rohtak for a period of two years.

Participation in External Events/Conferences

1. Dr. Balraj Verma - Assistant Professor, DRC, CBS participated and presented a paper titled 'FDI-linked Spillovers and the Indian Economic Growth: The Role of Country's Absorptive Capacity' in IEEE DELCON 2022 conference held during February 11-13, 2022. The theme of the conference was Technology Intervention to Build Future-Ready Society.

   Dr. Verma also attended a one-week online faculty development program on Teaching and Collaborative Learning for Business Education that was organized by Faculties of Management Studies, Gurukul Kangri (Deemed to be University), Haridwar during March 23- 29, 2022.
2. Dr. Deepika Jhamb - Associate Professor, DRC, CBS presented a paper titled 'Modelling the Adoption of Hybrid Rice Seeds Brands among Farmers' at the Third International Conference on Decision Aid Sciences and Applications (DASA -2022) organized by Mae Fah Leung University, Thailand on March 23-25, 2022.

CURIN organized a three-day event to mark the celebration of National Science Day 2022

Expert talk, quizzes, poster making and declamation competitions organized

National Science Day is celebrated each year to commemorate the discovery of scattering of light by Sir Dr. C. V. Raman in 1928, today known as 'Raman Effect', for which he was awarded Nobel Prize in Physics in 1930. Theme-based science communication activities are carried out all over the country on the occasion of National Science Day. This year`s theme was 'Integrated Approach in Science & Technology for Sustainable Future'. Chitkara University organized a three-day event to celebrate the National Science Day 2022, and this event was jointly organized by CURIN, Institution's Innovation Council (IIC) and National Service Scheme (NSS). The event was catalyzed and supported by Punjab State Council for Science & Technology (PSCST) and National Council for Science & Technology Communication (NCSTC), Department of Science & Technology (DST), GoI.

On Day 1, an outreach program at Government Middle School, Shamdu Village, Rajpura was conducted, wherein a total of 104 students from class 6 to 8 participated in an expert talk that was delivered by Dr. Satyam Agarwal – Professor, CURIN. He discussed about the role of science in our day to day activities, and he also taught some useful mathematics techniques to students. This was followed by a poster making competition on the topics including eco-friendly living, pollution, recycling, environment, natural resources, etc.

On Day 2 and 3, a science quiz for the students of the Chitkara University was conducted in which more than 100 students participated. In addition, a poster making competition on the theme of National Science Day 2022 was organized wherein top three winners were declared on the basis of creativity, thought process and presentation. A declamation competition was also organized, which provided a platform to students to share their thoughts and insights about science and technology. These competitions were judged by Dr. S. N. Panda - Director (Research), CURIN, Dr. Neelam Verma - Programme Co-ordinator, NSS, Chitkara University and Dr. Madhunika Agrawal – UIPS, Panjab University. Dr. S.N. Panda also delivered a talk on the topic New technologies and how to incorporate them into their lives for a better tomorrow.

Activities Conducted by CURIN during January-March 2022

Workshops, Hackathons, Faculty Development Programs etc.

- Dr. Neha Tuli - Assistant Professor, and Shivam Sharma - Software Developer from Immersive & Interactive Technology Lab (IITL), CURIN conducted a workshop on the Role of Augmented Reality in Educational Environments in the International Conference on Transformations in Engineering Education (ICTIEE-2022) organized during January 7-9, 2022. They discussed about role of augmented reality, virtual reality, and mixed reality in EdTech industry and different opportunities these technologies offer in EdTech domain.

  Another workshop by IITL was organized on March 25, 2022 for Chitkara Design School. The participants were given hands-on exposure of game engine Unity 3D & Vuforia software development kit. They learned about 2D/3D graphics design, designing and modeling software like Adobe Photoshop, Blender and Photopia. At the culmination of the training program, participants made Interactive AR Applications. Dr. Bhanu Sharma, Dr. Amanpreet Kaur, Mr. Narinder Pal Singh, Dr. Neha Tuli and Mr. Shivam Sharma from IITL were the resource persons.

- Two-day Faculty Development Program on 'Organizing a Successful Academic Conference' was organized by CURIN during February 4-5, 2022. Faculty members from different departments attended the program and learned about different aspects of building and executing a conference. Mr. Sagar Juneja – Assistant Dean, CURIN was the resource person of the program who shared his experiences of organizing academic conferences. A panel discussion session was also conducted wherein Dr. Sonika Bakshi (Dean, Chitkara School of Health Sciences), Dr. Urvashi Tandon (Associate Professor, DRC, CBS) and Dr. Arun Upmanyu (Associate Professor, CURIN) were the panelists, and Mr. Sagar Juneja was the moderator. Each panel member had a good experience of organizing an academic conference. The workshop also included activity based sessions, wherein participants made dummy conference proposals and obtained feedback from the experts. The program was convened by Dr. Meenu Khurana - Director Research, CURIN and there were a total of 26 participants in the program.

- CURIN organized a one-day workshop on Vedic Mathematics for the students of Government Senior Secondary School, Jhansla on March 5, 2022. Dr. Kalpan Guleria and Dr. Rajesh Kaushal - Associate Professors, CURIN were the resource persons of the event. The workshop was catalyzed and supported by Punjab State Council for Science & Technology (PSCST) and National Council for Science and Technology Communication (NCSTC), Department of Science and Technology (DST), Govt. of India, New Delhi. Vedic Mathematics was written by an Indian monk Swami Bharatikrishna Tirtha and it was first published in 1965. It contains a list of mathematical techniques retrieved from the Vedas, which help in solving the problems of mathematics with ease.

- On the occasion of World Water Day 2022, Center for Water Sciences, CURIN conducted a two-day workshop during March 22-23, 2022 on theme 'Ground Water: Making the Invisible Visible'. In this workshop several activities were conducted for students, researchers, faculty members as well as people from the rural community of the nearby villages.

Some of the activities included, A poster making competition titled 'Water through the Eyes of an Artist' for the students of the university, Water Testing Training for the women of a nearby Fateh Garhi village, training program for the research scholars and faculty members on Atomic Absorption Spectrophotometer and Flame Photometer to analyze heavy metals and light metals in water samples etc. This two-day program was convened by Dr. Jyotsna Kaushal – Professor, Center for Water Sciences, CURIN.

- Smart India Hackathon is a nationwide initiative to provide students a platform for solving pressing problems we face in our daily lives. It inculcates a culture of product innovation and create a problem-solving mindset among students. Students are encouraged to solve the problems given by the different industries and ministries including, AICTE, Ministry of Rural Development, Ministry of Finance, Ministry of External Affairs and many more. Chitkara University has been participating in both the hardware and software editions of SIH since its inception. Chitkara University conducted an internal hackathon on March 28, 2022 to shortlist the entries for SIH 2022. A total of 31 teams, each comprising of 6 students participated in the event. Three-member jury comprising of Dr. Sachin Ahuja – Director, Research, CURIN, Dr. Prateek Srivastva - Assistant Professor, CURIN and Mr. Varinder Singh - Project Manager, CURIN evaluated these projects ideas and shortlisted 15 of them for participation in the main event. This internal hackathon program was organized by CURIN.

A Start-up from IITL, 6DOF Solutions Pvt. Ltd. Launched an AR Integrated Book

Dr. Neha Tuli – Assistant Professor, IITL under the guidance of Dr. Archana Mantri – Professor and Head, IITL, along with her team members Mr. Sanchit and Mr. Shivam Sharma, launched the first AR integrated Magic Coloring Workbook with over 18 activities to improve more than 16 skills among children. This coloring book will allow children to visualize their drawings in 3D.

Dr. Tuli and Shivam Sharma also qualified in a pool of 100 entrepreneurs in a startup contest organized by Lemon Ideas. They have a start-up, 6DOF Solutions Pvt. Ltd. that was established in 2021. They also got recognition in the Startup India Innovation Week.

Dr. Tuli guided a team of three under graduate (UG) students in building a virtual reality (VR) based project for the Indo Universal Collaboration for Engineering Education (IUCEE) initiative on promoting research culture in UG student. This team proposed a VR based solution to cure anxiety among autistic kids.

Participation of CURIN Faculty Members and Scholars in External Events

Both as resource persons and attendees

1) Dr. Naveen Kumar - Associate Professor, CURIN was invited to deliver a talk in the AICTE-ISTE sponsored induction program entitled A Strategic Awareness about Start-ups and Emerging Business Opportunities for Electrical Engineer, which was organized by Galgotias College of Engineering and Technology, Greater Noida during January 3 - 8, 2022. Dr. Naveen delivered a talk on the topic of Converting Ideas into Intellectual Property wherein he discussed about intellectual property rights including patents, copyrights and trademarks.

2) Dr. Neha Tuli - Assistant Professor, CURIN and Mr. Shivam Sharma - Developer, IITL, CURIN delivered an invited talk on Augmented Reality and its Application Areas during a program organized by K S R Institute for Engineering and Technology, Tamil Nadu. It was sponsored by AICTE-ISTE and held during February 14 - 19, 2022.

3) On February 25, 2022, Dr. Sudesh Mittal – Professor, Dr. K.R. Ramkumar- Associate Professor and Dr. Amanpreet Kaur - Assistant Professor from CURIN were invited to attend a webinar entitled Atmanirbharta in Defence – Call to Action that was organized by the Ministry of Defence. The webinar was attended by the stakeholders from the Ministry of Defence, industry, startups, and academia with an objective to work on defense related projects. Honorable Prime Minister, Shri Narendra Modi ji and Honorable Defence Minister Shri Rajnath Singh ji were also present during the event.

   On March 10, 2022, Dr. Ramkumar K R, was also invited to deliver a lecture on the topic of Homomorphic Encryption Challenges and Opportunities in a faculty development program (FDP) on the Recent Trends in Network Security. It was conducted by the Department of Electronics and Communication Engineering, Sri Venkateswara College of Engineering, Chennai in association with IETE Chennai Centre.

4) An invited lecture by Dr. Himanshi Babar - Assistant Professor, CURIN was delivered in a webinar on Software Defined Networking (SDN) and Wireless Sensor Networks that was organized by the Department of Information Technology, PSG College of Arts & Science, Coimbatore. The topics of her talk were implementation of SDN in

WSNs, challenges of SDN implementation, its architecture, tools and simulators used for the implementation. The webinar was held on March 24, 2022.

5) Dr. Jasminder Kaur Sandhu - Assistant Professor, CURIN was invited to deliver an expert talk on the topic of Regression and Classification Models using R in a one-week FDP titled 'Machine Learning Fundamentals'. The program was organized by the Department of Computer Science and Information Technology, University of Jammu. Her talk that was held on March 25 focused on the basic concepts of machine learning and hands-on experience of implementing the classification and regression models in R.

6) Savita Kashyap - PhD Scholar, VLSI CoE, CURIN participated in the 3rd International IEEE VLSI DCS 2022 conference on VLSI Device, Circuit and System held in Kolkata during February 26-27, 2022. She presented a research paper titled 'Silicide on Oxide based Carrier Selective Front Contact for 24% Efficient PERC Solar Cell' that was co-authored by Dr. Rahul Pandey, Dr. Jaya Madan and Dr. Rajnish Sharma. The conference was organized by IEEE Electron Device MSIT Student Branch Chapter.

7) Dr. Vandna Sharma - Assistant Professor attended a one-week FDP on Computing with MATLAB and LATEX Software: Indispensable Tools for Researchers, which was organized by the Department of Mathematics, Baba Farid College, and Bathinda during January 5-11, 2022. She attended a workshop on Basic Computing with MATLAB during January 23-February 13, 2022 and another one-day workshop on Cross-Discipline Platforms: Scopus, Science Direct and Mendeley on March 11. Both these workshops were organized by Math Tech Thinking Foundation (MTTF).

She also participated in a National Seminar on Advanced Functional Materials that was organized by the Department of Applied Sciences, Maharaja Agrasen Institute of Technology, Delhi, in association with Materials Research Society of India during February 24-25, 2022 and she attended a short term course on Emerging Trends and Modeling in Advanced Functional Materials & Devices by Dr B R Ambedkar National Institute of Technology, Jalandhar, Punjab during March 28 - April 1, 2022.

UPCOMING CONFERENCE

Patents Filed by CURIN Members and Scholars

66 Patents Filed by CURIN during January to March 2022

A total of 187 Patents (including industrial designs) have been filed by different departments of Chitkara University during January-March 2022, out of which 66 have been filed by CURIN faculty members and researchers. The details of these patents are given below -

Sr. No.	Title	Inventor	Application No.
1	A MICROPARTICLES-BASED INHALABLE PHARMACEUTICAL COMPOSITION COMPRISING 5-[(1S)-1-(2,3-DIMETHYLPHENYL) ETHYL]- 1H-IMIDAZOLE	Sukhbir Singh, Sandeep Arora, Neelam Sharma, Tapan Behl, Pritima, Ishrat Zahoor, Sridevi Chigurupati	202211000480
2	A PHARMACEUTICAL GEL FORMULATION FOR WOUND HEALING COMPRISING NANO-LIPOSOMAL MIMOSA PUDICA	Arvind Sharma, Rakesh K Sindhu, Thakur Gurjeet Singh, Sandeep Arora, Saurabh Gupta, Chitanya MVNL, Malika Arora	202211001807
3	ACCIDENT DETECTION AND REPORTING SYSTEM	Umesh Kumar Lilhore, Sarita Simaiya, Meenu Khurana	202211003728
4	ALCOHOL-FREE HERBAL HAND SANITIZER GEL COMPOSITION	Rakesh K Sindhu, Arvind Sharma, Saurabh Gupta, Chaitanaya MVNL, Sandeep Arora	202211003726
5	AUTOMATED SYSTEM FOR ANALYZING MORRIS WATER MAZE TEST	Vikas Khullar, Satyam Kumar Agarwal, Madhunika Agarwal	202211010383
6	BINDER CLIP WITH SHUTTER ASSEMBLY FOR ELECTRONIC DEVICES	Rajesh Kumar Kaushal, Naveen Kumar, Surya Narayan Panda, Simranjeet Singh, Jaswinder Singh, Shilpi Singhal, Tanuja Dhope, Meenakshi Sharma	202211010433
7	CIRCUIT AND A METHOD FOR OPERATING QUASI FLOATING BULK DIRECT GATE DRIVEN MOSFET	Kulbhushan Sharma	202211001806
8	COMPLEMENTARY SUPER SOURCE FOLLOWER METAL OXIDE SILICON FIELD EFFECT TRANSISTOR BASED FILTER	Diksha Thakur, Kulbhushan Sharma	202211002114
9	COMPOSITIONS FOR MANAGEMENT OF EPILEPSY COMPRISING IMATINIB	Thakur Gurjeet Singh, Shareen Singh	202211003362
10	COMPOUNDS INHIBITING PROTEOLYTIC ENZYMES FOR ANTI-SARS-CORONAVIRUS (SARS-CoV-2)ACTIVITY	Manjinder Singh, Pratibha Sharma, Thakur Gurjeet Singh, Varinder Singh, Maninder Kaur, Sandeep Arora	202211013566

11	DEVICE FOR DETECTION OF PURITY OF A FLUID	Nitika Dhingra, Nitin Kumar Saluja, Chanpreet Singh, Mohit Kapoor, Gurjinder Singh, Debrashi Ghosh, Rouble Gupta	202211002675
12	FAUCET ASSEMBLY FOR REGULATING FLUID FLOW	Shilpi Gupta, Chanpreet Singh, Satinder Singh, Sarabjeet Singh, Shelly Singhal, Jashandeep Singh, Priyanka Sharma	202211015831
13	HANDHELD INTERACTIVE DEVICE FOR FACILITATING INSERTION AND REMOVAL OF CONTACT LENS	Nikit Kundra, Neeraj Kumar, Adarsh Aggarwal	202211007039
14	HERBAL COMPOSITION FOR DIABETIC NEUROPATHY	Gurjeet Singh Thakur, Shrey Kumar Bhargava, Ashi Mannan, Shareen Singh, Manjinder Singh, Saurabh Gupta, Arvind Sharma	202211008744
15	METHOD FOR FORMATION OF A LIQUID FILM FOR REDUCING HEADACHE	Deepika Raina, Sandeep Arora, Nasim Sahin, Lovleen Kaur	202211012449
16	NODE LOCALIZATION SYSTEM FOR UNDERWATER WIRELESS SENSOR NETWORK AND METHOD THEREOF	Nitin Goyal, Mamta Nain, Manish Sharma, Vikas Khullar, Nidhi Bansal Garg, Bhanu Sharma	202211013565
17	OLEIC ACID LIPOSOME-BASED TOPICAL COMPOSITION FOR HAIR CARE	Arvind Sharma, Rakesh K Sindhu, Shivani Savana, Ansuri Guha, Thakur Gurjeet Singh, Sandeep Arora, Harapriya Mohapatra, Sourabh Gupta	202211000231
18	PAINTING MACHINE	Rupali Gill, Pawan Kumar, Jaiteg Singh, Meenu Khurana	202211003687
19	PEG-COATED CHITOSAN HYBRID NANOPARTICLES FOR HEPATIC TARGETING	Manju Nagpal, Madhusmita Bhuyan, Malkiet Kaur, Gurjeet Singh Thakur, Sandeep Arora	202211000482
20	PRINTABLE SOLAR CELL	Rahul Pandey, Darryl Anderson Swamy, Jaya Madan	202211009134
21	PYRANOINDOLE COMPOUNDS AND PHARMACEUTICAL COMPOSITION COMPRISING THEREOF	Rajwinder Kaur, Nidhi Rani, Sandeep Arora, Thakur Gurjeet Singh, Varinder Singh, Md Altamash Ahmad, Rashmi Arora, Rupinder Kaur	202211013419
22	RISK ASSESSMENT USING FACIAL ANALYTICS	Pallavi Sood, Shivinder Nijjer, Sandhir Sharma, Sachin Ahuja	202211004984
23	THERMALLY STABLE ANTENNA	Anita Rani, Nitin Kumar Saluja, Bhawna Sharma, Varinder Singh, Chanpreet Singh, Gurjinder Singh	202211002336
24	TRAFFIC MANAGEMENT SYSTEM FOR EMERGENCY VEHICLES	Umesh Kumar Lilhore, Sarita Simaiya, Praneet Saurabh, Jasminder Sandhu	202211000483
25	WEARABLE MEDICATION ORGANISER	Meenu Khurana, Amandeep Kaur, Devendra Prasad, Umesh Kumar Lilhore, Sarita Simaiya	202211000818
26	WEARABLE MONITORING SYSTEM FOR VOCALLY DISABLED	Shivinder Nijjer, Bhalinder Kaur, Sandhir Sharma, Sachin Ahuja, Devesh Bathla	202211003725

INDUSTRIAL DESIGN REGISTRATIONS

ALL-IN-ONE WATER BOTTLE

By: *Monika Gupta, Shubhi Bansal, Prateek Srivastava*

Application No. 360714-001

BIKE MOBILE ARMOR

By: *Vikas Rattan, Ruchi Mittal, Jaiteg Singh, Sushil Narang, Amit Mittal, Varun Malik, Gurdyal Singh, Anoop Aggarwal, Gaurav Jain, Preetinder Brar*

Application No. 356405-001

BUTTER POT

By: *Monika Sethi, Sachin Ahuja, Manasvi Raheja, Jyoti Snehi, Manish Snehi, Bhuvan Ahuja*

Application No. 358343-001

CHAIR CUM LADDER AND STOOL

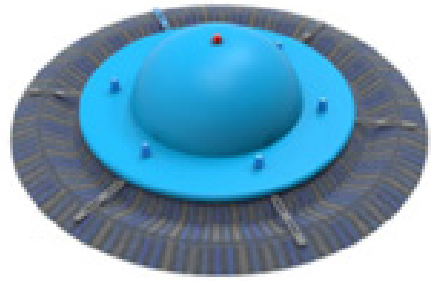
By: *Varun Malik, Ruchi Mittal, Jaiteg Singh, Vikas Rattan, Vikram Singh, Amit Mittal, Preetinder Singh Brar, Amandeep Kaur, Geetanjali*

Application No. 356983-001

CONVERTIBLE CAP

By: *Shalli Rani, Ankita, Himanshi Babbar*

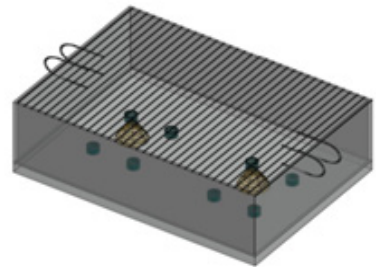
Application No. 357440-001



CUP FILLING APPARATUS FOR EVALUATION OF REPETITIVE BEHAVIOUR IN AUTISTIC RATS

By: *Gaaminepreet Singh, Sandeep Arora, Manish Kumar, Onkar Bedi, Gurjeet Singh Thakur, Ravinder Singh Jaura, Prateek Srivastava*

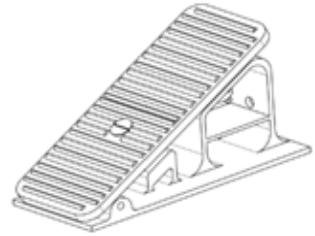
Application No. 358345-001



CUSTOM BRAKE AND ACCELERATOR PEDAL

By: *Chanpreet Singh, Shivam Sharma, Neha Tuli, Archana Mantri*

Application No. 360867-001



DOOR SANITIZER

By: *Thakur Gurjeet Singh, Gaamine Preet Singh, Nitin Kumar Saluja, Gurjinder Singh, Ashwani Singh*

Application No. 359422-001

E- BATTERY SOLUTION VAN

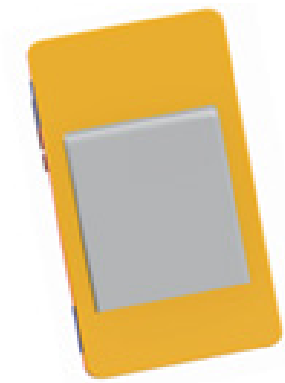
By: *Abhishek Anand, Dhiresh Kulshrestha, Sandhir Sharma, Sumit Agarwal, Sachin Ahuja*

Application No. 360715-001

FLAP MOBILE COVER WITH POWER BANK AND CARD HOLDER

By: *Chinky Jaggi, Manoj Gaur, Pankaj Kumar*

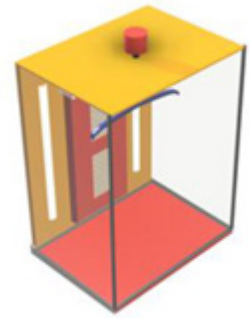
Application No. 361182-001



FULLY AUTOMATED GARMENT SANITIZING RACK

By: *Shraddha Awasthi, Devesh Bathla, Sandhir Sharma, Sachin Ahuja*

Application No.356407-001



GLASS WITH STRAW/SPOON HOLDER

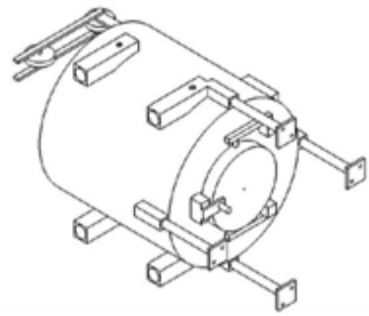
By*: Monika Sethi, Sachin Ahuja, Bhuvan Ahuja, Manasvi Raheja, Jyoti Snehi, Manish Snehi*

Application No. 359821-001

HEAT TREATMENT ELECTRIC FURNACE

By*: Rakesh Goyal, Sushanta Jashwara, Kamaljeet Singh, Kashidas Chattopadhyay, Punam*

Application No. 360479-001



KEYBOARD WITH SLIDING MOUSE PAD

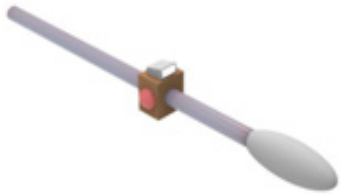
By*: Amanpreet Singh, Jaiteg Singh, Deepika Chaudhary, Vandana, Jaswinder Singh, Nishu Bali, Preetinder Singh Brar*

Application No. 356402-001

LED BACKED EAR CLEANING TOOL WITH REPLACEABLE BUD EXTENSION

By: *Deepika Chaudhary, Jaiteg Singh, Nishu Bali, Neelam Dahiya, Ashwani Singh*

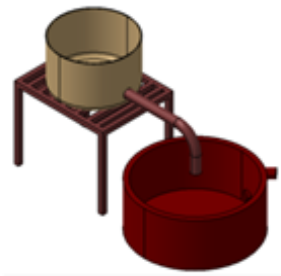
Application No.359409-001



MACHINE FOR ANTI FUNGAL AND CATALYTIC

By: *Dhiresh Kulshrestha, Sandhir Sharma, Sumit Agarwal, Abhishek Anad, Sachin Ahuja*

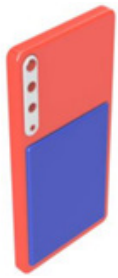
Application No.359407-001



MOBILE COVER WITH POWER BANK

By: *Manoj Gaur, Chinky Jaggi, Pankaj Kumar*

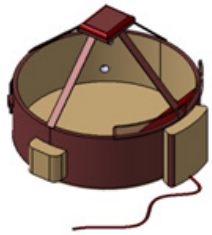
Application No. 360482-001



MORRIS WATER MAZE TANK WITH INTELLIGENT MONITORING

By: *Satyam Kumar Agarwal, Vikas Khullar, Madhunika Agarwal*

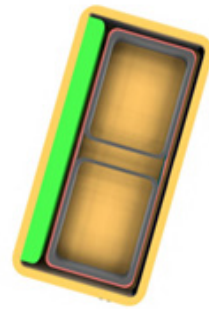
Application No. 361484-001



MULTIFUNCTION BATTERY POWERED PORTABLE FOOD WARMER WITH USB MOBILE CHARGER

By: *Devesh Bathla, Raina Ahuja, Awasthi Shraddha, Sandhir Sharma, Sachin Ahuja*

Application No. 360872-001



MULTI-PURPOSE SERVICE PLATE

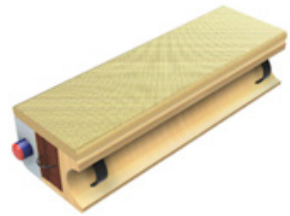
By: *Nidhi Bansal Garg, Atul Garg, Mohit Kumar Kakkar, Mohit Bansal, Reetu Malhotra*

Application No. 359360-001

MULTIPURPOSE SMART DUSTER

By: *Kamini, Sachin Ahuja, Vijaita Kashyap, Preeti Saini*

Application No. 356249-001



MULTI-USABLE ELECTRIC PLUG

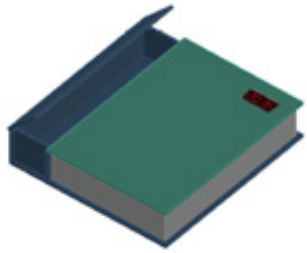
By: *Pradeepta Kumar Sarangi, Gurpreet Singh, Kapil Sharma, Kalpna Guleria, Lekha Rani, Deepti Sinha*

Application No. 360871-001

MULTIUSE DIARY

By: *Reena Malik, Nitish Arora, Tanvi Jindal, Manni Kumar, Prateek Srivastava*

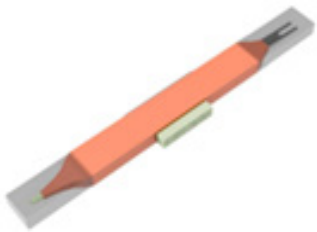
Application No. 356248-001



MULTIUTILITY NAIL CLEANER HANDSTICK

By: *Rajwinder Kaur, Jasminder Kaur Sandhu, Meena Pundir, Puninder Kaur, Anjali, Prateek Srivastava*

Application No. 359424-001



OFFICE CHAIR WITH JAGGED FOOTREST

By: *Rishu Chhabra, Vikas Khullar, Saravjeet Singh, Jatin Arora, Meenu Khurana*

Application No. 358337-001

PLIER

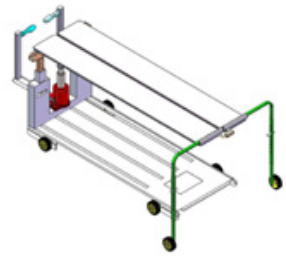
By: *Devesh Bathla, Shraddha Awasthi, Sandhir Sharma, Sachin Ahuja*

Application No.356408-001

PORTABLE BED ATTACHMENT

By: *Surya Narayan Panda, Archana Mantri, Sachin Ahuja, Sonu Goel, Simranjeet Singh,Naveen Kumar*

Application No. 356406-001



PORTABLE CHAIR FOR ELDERLY/CRITICALLY ILL PATIENTS

By: *Surya Narayan Panda, Archana Mantri, Sachin Ahuja, Sonu Goel, Simranjeet Singh, Sudarson Jena, Naveen Kumar*

Application No. 357442-001

REMOVABLE MULTIPURPOSE KNIFE CUM SCISSOR WITH TOOL KIT

By: *Rajat, Priyanka Jaroli, Ruchi Kawatra, Naveen Kumar, Rajesh Kumar Kaushal, Vikas Solanki, Meenu Khurana, Sachin Ahuja*

Application No. 356247-001

REUSABLE LED BULBS

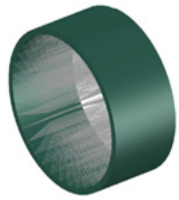
By: *Pradeepta Kumar Sarang, Gurpreet Singh, Kapil Sharma, Lekha Rani, Kalpna Guleria, Bishnu Prasad Rath, Neetu Mittal, Sachin Sinha, Vidhu Baggan*

Application No. 361024-001

RODENT TAIL CLEANEAR

By: *Onkar Bedi, Gaaminepreeet Singh, Manish Kumar, Sandeep Arora, Prateek Srivastava*

Application No. 356401-001



ROLLING BOARD AND PIN STAND (SET) FOR MAKING CHAPATI

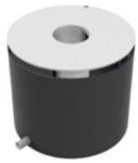
By: *Amandeep Kaur, Meenu Khurana, Poonam Panwar, Chetna Kaushal*

Application No. 361188-001

SEED TREATMENT MACHINE

By: *Dhiresh Kulshrestha, Sandhir Sharma, Sumit Agarwal, Abhishek Anad, Sachin Ahuja*

Application No. 360132-001



SNUG FOOTWEAR

By: *Priya Jindal, Jasmine Kaur, Sandhir Sharma, Sachin Ahuja, Gurjinder Singh, Ashu Gupta*

Application No. 359423-001

TABLE EMBEDDED WITH WRITING DESK OFFICE FRIENDLY STUDY DESK/SMART DESK

By: *Ruchi Mittal, Yash Mittal, Varun Malik, Jaiteg Singh, Surya Narayan Panda, Amit Mittal, Vikas Rattan, Devansh Gupta*

Application No. 356404-001

TEA STRAINER

By: *Meenu Khurana, Rina Angel*

Application No. 356816-001

WHEEL CHAIR WITH INTEGRATED COMMODE ASSEMBLY

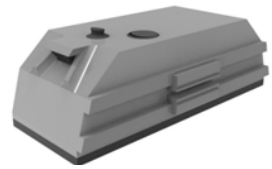
By: *Naveen Kumar, Rajesh Kumar Kaushal, S N Panda*

Application No. 361186-001

WHITE BOARD LIQUID CLEANER DUSTER

By: *Vikas Solanki, Sachin Ahuja, Rajat, Sachin Ahuja, Susheela Hooda, Bidush Kumar Sahoo, Srikanta Kumar Mohapatra*

Application No. 358131-001



WHITE BOARD MARKER WITH ERASER

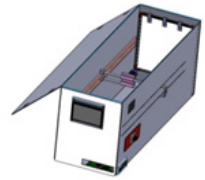
By: *Monika Sethi, Sachin Ahuja, Manasvi Raheja, Jyoti Snehi, Manish Snehi, Amandeep Kaur, Bhuvan Ahuja*

Application No. 358178-001

X-RAY ANALYZER DEVICE

By: *Raj Gaurang Tiwari, Surya Narayan Panda, Vikas Kullar, Ambuj Kumar Agarwal, Sonu Goel, Ajay Kumar, Ruchi Mittal*

Application No. 356982-001



List of Publications

CURIN faculty members and scholars have published research papers/book chapters in SCI and Scopus indexed journals, conferences, and books. This alphabetically sorted list contains those publications that have been indexed in Scopus during January- March 2022.

1. A. Kaur, A. Mantri, K. Ramkumar, and B. Sharma, "Conducting Field Programmable Gate Array Experiments Using Augmented Reality and Virtual Reality: A Review," in 6th International Conference on Signal Processing, Computing and Control (ISPCC), IEEE, pp. 182-185, 2021.
2. A. Kumar et al., "Revolutionary Strategies Analysis and Proposed System for Future Infrastructure in Internet of Things," Sustainability, vol. 14, no. 1, p. 71, 2021.
3. A. Kumar, N. Kumar, M. Chitkara, and G. Dhillon, "Physicochemical Investigations of Structurally Enriched Sm3+ Substituted SnO2 Nanocrystals," Journal of Materials Science: Materials in Electronics, pp. 1-14, 2022.
4. A. Rani, B. Sharma, C. Singh, and N. Saluja, "A Computational Analysis to Model Thermal and Non-Thermal Behavior of the Microwave Drying Process for Apple Fruit," in 6th International Conference on Signal Processing, Computing and Control (ISPCC), IEEE, pp. 755-759, 2021.
5. B. Gill, M. Singh, R. Kumar, and M. Sharma, "Design, Analysis, and Study of Fractal MIMO Antenna with Dual Filters for UWB/X/Partial Ku Band Wireless Applications," in 12th Annual Information Technology, Electronics and Mobile Communication Conference (IEMCON), IEEE, pp. 0915-0920, 2021.
6. B. Sharma, K. D. Sharma, and A. Mantri, "Internet of Things: An Emerging Paradigm for Social Safety and Security," in Artificial Intelligence, Machine Learning, and Data Science Technologies: CRC Press, pp. 131-153, 2021.
7. B. Sharma, N. P. Singh, A. Mantri, S. Gargrish, N. Tuli, and S. Sharma, "Save the Earth: Teaching Environment Studies using Augmented Reality," in 6th International Conference on Signal Processing, Computing and Control (ISPCC), IEEE, pp. 336-339, 2021.
8. C. Mangla and S. Rani, "Comparative Study of Classical and Quantum Cryptographic Techniques Using QKD Simulator," Intelligent Data Engineering and Analytics: Springer, pp. 521-530, 2022.
9. C. Mangla, S. Rani, and H. K. Atiglah, "Secure Data Transmission Using Quantum Cryptography in Fog Computing," Wireless Communications and Mobile Computing, vol. 2022, 2022.
10. D. Gupta and M. Madhukar, "Operational Challenges in Online Self-Learning Education Adoption," in 6th International Conference on Signal Processing, Computing and Control (ISPCC), IEEE, pp. 51-55, 2021.
11. D. Gupta, "Prediction of Sensor Faults and Outliers in IoT Devices," in 9th International Conference on Reliability, Infocom Technologies and Optimization (Trends and Future Directions), IEEE, pp. 1-5, 2021.
12. E. S. JeyaJothi, J. Anitha, S. Rani, and B. Tiwari, "A Comprehensive Review: Computational Models for Obstructive Sleep Apnea Detection In Biomedical Applications," BioMed Research International, vol. 2022, 2022.
13. H. Babbar, S. Parthiban, G. Radhakrishnan, and S. Rani, "A Genetic Load Balancing Algorithm to Improve the QoS Metrics For Software Defined Networking for Multimedia Applications," Multimedia Tools and Applications, pp. 1-19, 2022.
14. H. Babbar, S. Rani, S. Garg, G. Kaddoum, M. J. Piran, and M. S. Hossain, "A Secure Multi-layer Architecture for Software-Defined Space Information Networks (SDSINs)," IEEE Consumer Electronics Magazine, 2021.
15. H. Khan, K. Sharma, A. Kumar, A. Kaur, and T. G. Singh, "Therapeutic Implications of Cyclooxygenase (COX) Inhibitors in Ischemic Injury," Inflammation Research, pp. 1-16, 2022.
16. H. Malhotra, N. Chaudhary, N. Kumar, and M. Sharma, "Polygon Patch Antenna for Bluetooth and UWB Applications with Single Notch Rejection Characteristics," in 9th International Conference on

Reliability, Infocom Technologies and Optimization (Trends and Future Directions), IEEE, pp. 1-5, 2021.

17. H. Singh, R. K. Sharma, and M. Malarvel, "Post-Processing Algorithms for the Formation of Online Handwritten Gurmukhi Character/Akshara," Journal of Intelligent & Fuzzy Systems, vol. 40, no. 3, pp. 4799-4809, 2021.
18. I. Seth, S. N. Panda, and K. Guleria, "IoT based Smart Applications and Recent Research Trends," in 6th International Conference on Signal Processing, Computing and Control, IEEE, pp. 407-412, 2021.
19. I. Seth, S. N. Panda, and K. Guleria, "The Essence of Smart Computing: Internet of Things, Architecture, Protocols, and Challenges," in 9th International Conference on Reliability, Infocom Technologies and Optimization (Trends and Future Directions), IEEE, pp. 1-6, 2021.
20. K. Kour et al., "Smart-Hydroponic-Based Framework for Saffron Cultivation: A Precision Smart Agriculture Perspective," Sustainability, vol. 14, no. 3, p. 1120, 2022.
21. K. Kumar, A. Kaur, K. Ramkumar, A. Shrivastava, V. Moyal, and Y. Kumar, "A Design of Power-Efficient AES Algorithm on Artix-7 FPGA for Green Communication," in International Conference on Technological Advancements and Innovations (ICTAI), IEEE, pp. 561-564, 2021.
22. L. Kakkar, D. Gupta, and S. Tanwar, "Comparative Analysis of Various Encryption Algorithms Used In IoT Security," in 9th International Conference on Reliability, Infocom Technologies and Optimization (Trends and Future Directions), IEEE, pp. 1-4, 2021.
23. M. Choudhary and N. Goyal, "A Rendezvous Point-Based Data Gathering in Underwater Wireless Sensor Networks for Monitoring Applications," International Journal of Communication Systems, p. e5078, 2022.
24. M. Choudhary and N. Goyal, "Data Collection Routing Techniques in Underwater Wireless Sensor Networks," in 9th International Conference on Reliability, Infocom Technologies and Optimization (Trends and Future Directions), IEEE, pp. 1-6, 2021.
25. M. Choudhary and N. Goyal, "Dynamic Topology Control Algorithm for Node Deployment in Mobile Underwater Wireless Sensor Networks," Concurrency and Computation: Practice and Experience, p. e6942, 2022.
26. M. Dassi, J. Madan, R. Pandey, and R. Sharma, "Chemical Modulation Of Conducting Polymer Gate Electrode Work Function Based Double Gate Mg2Si TFET for Gas Sensing Applications," Journal of Materials Science: Materials in Electronics, pp. 1-10, 2022.
27. M. Kumar, M. Jindal, R. Sharma, S. R. Jindal, and H. Singh, "Improved Recognition Results Of Offline Handwritten Gurumukhi Characters Using Hybrid Features and Adaptive Boosting," Soft Computing, vol. 25, no. 17, pp. 11589-11601, 2021.
28. M. Nain and N. Goyal, "Localization Techniques in Underwater Wireless Sensor Network," in International Conference on Advance Computing and Innovative Technologies in Engineering (ICACITE), IEEE, pp. 747-751, 2021.
29. M. Nain, N. Goyal, L. K. Awasthi, and A. Malik, "A Range Based Node Localization Scheme with Hybrid Optimization for Underwater Wireless Sensor Network," International Journal of Communication Systems, p. e5147, 2022.
30. M. Pandit and D. Gupta, "Performance of Genetic Programming-based Software Defect Prediction Models," International Journal of Performability Engineering, vol. 17, no. 9, 2021.
31. M. Pandit et al., "Towards Design and Feasibility Analysis of DePaaS: AI Based Global Unified Software Defect Prediction Framework," Applied Sciences, vol. 12, no. 1, p. 493, 2022.
32. M. Rani, K. Guleria, and S. N. Panda, "Cloud Computing An Empowering Technology: Architecture, Applications and Challenges," in 9th International Conference on Reliability, Infocom Technologies and Optimization (Trends and Future Directions), IEEE, pp. 1-6, 2021.
33. M. Rani, K. Guleria, and S. N. Panda, "Enhancing Performance of Cloud: Fog Computing Architecture, Challenges and Open Issues," in 9th International Conference on Reliability, Infocom Technologies and Optimization (Trends and Future Directions) (ICRITO),IEEE, pp. 1-7, 2021.
34. M. Sharma, "Microstrip Patch Antennas: Past and Present State of the Art," in Smart Antennas: Springer, pp. 131-145, 2022.
35. M. Sharma, "Planar Design, Analysis, and Characterization of Multiple-Input Multiple-Output Antenna," in Smart Antennas: Springer, pp. 149-162, 2022.
36. M. Sharma, H. Malhotra, S. Sharma, and S. Panda, "2 × 2 MIMO Antenna Design & Analysis Strategies: A systematic Review and Classifications," in 6th International Conference on Signal Processing, Computing and Control (ISPCC), IEEE, pp. 209-212, 2021.
37. M. Sharma, N. Choudhary, N. Kumar, S. Panda, and R. Kaushal, "A Slotted Hexagonal 4× 4 MIMO Antenna with Tapered Feed Designed for High Speed IoT Wireless Applications," in 6th International Conference on Signal Processing, Computing and Control (ISPCC), IEEE, pp. 203-208, 2021.
38. M. Sharma, P. C. Vashist, I. Alsukayti, N. Goyal, D. Anand, and A. H. Mosavi, "A Wider Impedance

Bandwidth Dual Filter Symmetrical MIMO Antenna for High-Speed Wideband Wireless Applications," Symmetry, vol. 14, no. 1, p. 29, 2021.

39. M. Uppal et al., "Fault Pattern Diagnosis and Classification in Sensor Nodes Using Fall Curve," CMC-Computers Materials & Continua, vol. 72, no. 1, pp. 1799-1814, 2022.
40. M. Uppal, D. Gupta, S. Juneja, G. Dhiman, and S. Kautish, "Cloud-Based Fault Prediction Using IoT in Office Automation for Improvisation of Health of Employees," Journal of Healthcare Engineering, vol. 2021, 2021.
41. N. Choudhary, H. Malhotra, N. Kumar, and M. Sharma, "Compact Cross Elliptical Patch Antenna with Wideband Characteristics for IOT Applications," in 9th International Conference on Reliability, Infocom Technologies and Optimization (Trends and Future Directions), IEEE, pp. 1-4, 2021.
42. N. Choudhary, H. Malhotra, N. Kumar, and M. Sharma, "Polygon Patch Antenna For UWB and RADAR Applications with Notched Filter Characteristics Realized by inverted T-type stub," in 8th International Conference on Signal Processing and Integrated Networks (SPIN), IEEE, pp. 637-640, 2021
43. N. Goyal and H. Singh, "A Design of Customer Service Request Desk to Improve the Efficiency using Robotics Process Automation," in 6th International Conference on Signal Processing, Computing and Control (ISPCC), IEEE, pp. 21-24, 2021.
44. N. Goyal and H. Singh, "Process Automation Techniques in Hospitality Industry," in 9th International Conference on Reliability, Infocom Technologies and Optimization (Trends and Future Directions), IEEE, pp. 1-5, 2021.
45. N. Goyal and H. Singh, "Workflow Automation for Implementing Customer Service Request Desk in Hotel Industry," in 6th International Conference on Signal Processing, Computing and Control (ISPCC), IEEE, pp. 25-28, 2021.
46. N. Goyal and M. Aggarwal, "The Data Fusion Models in Underwater Wireless Sensor Network," in 9th International Conference on Reliability, Infocom Technologies and Optimization (Trends and Future Directions), IEEE, pp. 1-5, 2021.
47. N. Goyal, A. Kumar, R. Popli, L. K. Awasthi, N. Sharma, and G. Sharma, "Priority Based Data Gathering Using Multiple Mobile Sinks in Cluster Based UWSNs for Oil Pipeline Leakage Detection," Cluster Computing, pp. 1-14, 2022.
48. N. Shrivastav, J. Madan, R. Pandey, and A. E. Shalan, "Investigations Aimed at Producing 33% Efficient Perovskite–Silicon Tandem Solar Cells Through Device Simulations," RSC Advances, vol. 11, no. 59, pp. 37366-37374, 2021.
49. P. Bawa, V. Kadyan, A. Mantri, and V. Kumar, "Optimal Fractal Feature Selection and Estimation for Speech Recognition Under Mismatched Conditions," Deep Learning Approaches for Spoken and Natural Language Processing, Springer, pp. 41-53, 2021.
50. P. Bawa, V. Kumar, V. Kadyan, and A. Singh, "Noise-Robust Gender Classification System Through Optimal Selection of Acoustic Features," Deep Learning Approaches for Spoken and Natural Language Processing, Springer, pp. 147-159, 2021.
51. P. Goyal, J. Madan, G. Srivastava, R. Pandey, and R. Gupta, "Performance Analysis of Drain Pocket Hetero Gate Dielectric DG-TFET: Solution for Ambipolar Conduction and Enhanced Drive Current," Silicon, pp. 1-11, 2022.
52. P. Sharma, J. Madan, R. Pandey, and R. Sharma, "Reliability Analysis of Cost-Efficient CH3NH3PbI3 Based Dopingless Tunnel FET," Semiconductor Science and Technology, vol. 37, no. 1, p. 015011, 2021.
53. R. Dogra, S. Rani, H. Babbar, S. Verma, K. Verma, and J. J. Rodrigues, "DCGCR: Dynamic Clustering Green Communication Routing for Intelligent Transportation Systems," IEEE Transactions on Intelligent Transportation Systems, 2022.
54. R. Kaur, R. K. Ramachandran, R. Doss, and L. Pan, "The Importance Of Selecting Clustering Parameters in VANETs: A Survey," Computer Science Review, vol. 40, p. 100392, 2021.
55. R. Pandey, S. Sharma, J. Madan, and R. Sharma, "Numerical Simulations of 22% Efficient all-Perovskite Tandem Solar Cell Utilizing Lead-Free and Low Lead Content Halide Perovskites," Journal of Micromechanics and Microengineering, vol. 32, no. 1, p. 014004, 2021.
56. S. Gupta, R. Gupta, and D. Gupta, "An Implementation of Automated Service Request Desk for Hotel Industry," in 9th International Conference on Reliability, Infocom Technologies and Optimization (Trends and Future Directions), IEEE, pp. 1-5,2021.
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