



## ABOUT US

The Innovation Research & Development (IRD) unit is specifically setup in the institute to provide specialized administrative and managerial support for the operation of sponsored research projects, consultancy jobs, and other IRD activities. IIIT-Delhi has made concerted efforts to align its R&D focus with the national goal of achieving technological self-reliance, thereby encouraging students and faculty to conduct research projects in thrust areas of science and engineering. It maintains its pre-eminent position as one of valued institutes for dissemination of cutting edge research and technological progress, catering to both our national needs and global developments. Research apart from education is one of the main pillars of the institute and the ambience is one in which new ideas and creativity can flourish. A key goal of the institute is to provide a creative atmosphere in which higher studies and research thrive amongst the students and the faculty. IIIT-Delhi's commitment to merging education with the creation of knowledge provides a fertile ground for productive research that has led to a range of scientific and technological achievements. The options are endless!

## DIRECTOR'S MESSAGE



Dear Readers,

Welcome to the first newsletter from IRD@IIITD! Through this newsletter, we plan to share some of the exciting R&D-related initiatives taken at IIIT-Delhi. As you know, IIIT-Delhi is accelerating on the path of becoming one of the leading comprehensive research-led teaching institutes in the country, and is actively addressing the evolving needs of the society.

The Institute believes in amalgamating education and research, through increased multi-disciplinary, inter-disciplinary and trans-disciplinary collaborations. Collaboration is valued at all levels – between departments, between research institutions, with partners in the industry and the government. Promoting innovation is also important in a knowledge-based society, and IIIT-Delhi is committed to this goal. An entrepreneurial mind-set is also being leveraged at the Institute to maximize the research impact. IIIT-Delhi has been recently selected for being a host for the Technology Innovation Hub under the National Mission on Interdisciplinary Cyber Physical Systems supported by DST. IIIT-Delhi has also started a new Center of Excellence in Healthcare, which is likely to catalyze research, education and entrepreneurial activities in the healthcare space. The IRD division has also taken several initiatives to encourage filing of patents, technology transfers and the automation of internal processes. You will find more information about the current activities related to research, development and innovation in this issue.

Please enjoy the inaugural newsletter! As always, your comments and suggestions are most welcome.

# DEAN (IRD) MESSAGE



Prof. Mukesh Mohania

We are happy to bring out the first edition of IIIT-Delhi IRD Newsletter for the year 2020. This last one year has been quite challenging for us due to the COVID-19 pandemic, but despite this hurdle, the institute and the IRD Unit have taken up several activities and contributed to diverse research areas in science and technology which have been highlighted in the current issue. The institute received various research grants including Distributed Intelligent Intrusion Detection and Deterrence System (SPADE) and Autonomous Last Mile Vehicle (ALIVE). To augment the research and education culture, we have signed 17 MoUs with industry and other academic institutions. We are also one of the few institutes in India selected to establish a Technology Innovation Hub (TIH) in the technology vertical “Cognitive Computing Social Sensing” under the National Mission on Interdisciplinary Cyber Physical Systems supported by DST with a budget of INR 100 Cr for a period of 5 years. IIIT-Delhi has also contributed towards the efforts of Delhi Government to combat COVID-19 through its WashKaro app for raising awareness about the virus. We are proud of the exceptional research work being carried out in the institute and commit to continue making an impact on our society through our work.

## IRD TEAM



Prof. Mukesh Mohania  
Dean (IRD)



Dr. Sanjit Krishnan Kaul  
Associate Dean (IRD)



Kapil Dev Garg  
Finance Manager



Imran Khan  
Junior Manager

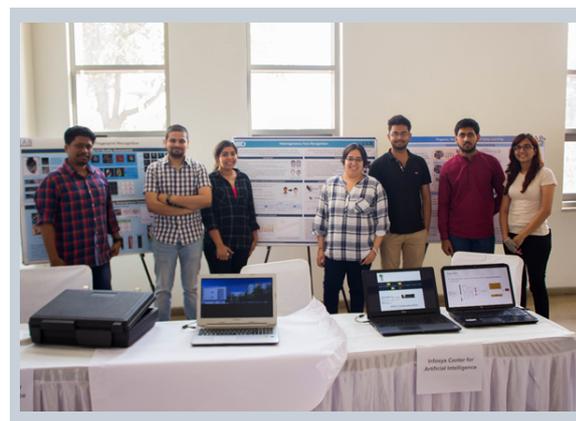


Nidhi Yadav  
Junior Manager

## RESEARCH CENTRES

### Infosys Centre for Artificial Intelligence (CAI)

The faculty and research scholars of CAI are actively involved in high quality research in AI related areas that lead to on-ground impact. The centre signed an MoU with International Digital Health and AI Research, Graduate Institute, Geneva, Switzerland in December 2020. In the past one year, CAI has published on scientific advancements and technology developments relevant to healthcare and COVID-19 in high impact journals such as IEEE Transactions, NeurIPS, Artificial Intelligence in Medicine, and Briefings in Bioinformatics.



### TCS Centre for Design and New Media (CDNM)

In the last year, CDNM has shown tremendous growth in terms of faculty and PhD strength and has published over 30+ Publications in top Avenues like CHI, IEEE, ESEM, AAAI, Elsevier Knowledge-Based Systems, InterSpeech, ACM, etc. CDNM initiated the development of 3 New Research Facilities - Audio & Video Lab, LIVING Lab, & Cognitive Science Lab led by the affiliated faculty members. The centre pitched an idea of supporting community health workers in rural India which led to funding by the Bill & Melinda Gates Foundation with a support of \$100,000.



## Centre of Technology in Policing

To strengthen Delhi Police with cutting-edge technology in the field of crime prevention and control, Indraprastha Institute of Information Technology Delhi (IIITD) has come up with the “Centre of Technology in Policing”, which was inaugurated by the Lieutenant Governor of Delhi, Mr. Anil Baijal. This unique research centre is aimed to improve policing in the capital. It will assist the concerned department in criminal's identification, law and order management, cyber policing, traffic management, and combating terrorist activities using Artificial Intelligence (AI), social media analysis, biometrics, image processing, big data, and network forensics.



## Centre for Excellence in Healthcare

In the year 2020, IIIT-Delhi started a new Center of Excellence in Healthcare, funded by Delhi Knowledge Development Foundation (DKDF). The sanctioned amount for the Center is INR 12 crores. The primary aim of this center is to catalyze research, education and entrepreneurial activities in the healthcare space by making healthcare accessible, accountable, and affordable to all through innovation and low-cost technology solutions.



## Centre of Excellence for Lifi/VLC

This centre has been established recently in Dec 2020 to facilitate research, development, training, and skill-building of students and faculty on VLC and allied areas. In the first quarter of 2021, the centre will organize FDPs and workshops with invited talks from industry, academia (from EU and India), and start-ups.

# RESEARCH HIGHLIGHTS

### FY 2019-2020

**35** Sponsored Projects with a total sanctioned value of **17.2 Cr** (approx)

**10** Consultancy Projects with a total sanctioned value of **74 Lacs** (approx)

138\*

Papers in National and International Journals

153\*

Papers in National and International Conferences

65\*

Papers in Workshops

17#

MoUs with Industries and Academic Institutions

14\*

Books and Book Chapters

20

Patents Filed in Last Few Years

\*The information is for the Academic Year 2019-20  
#The information is for the Calendar Year 2020

# A FOCUS ON COVID-19

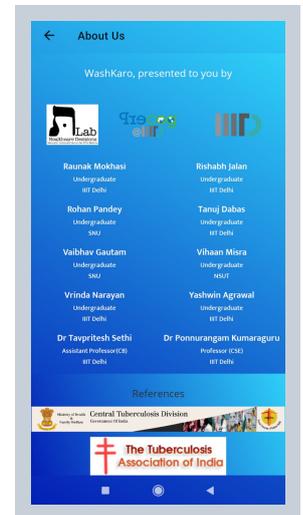
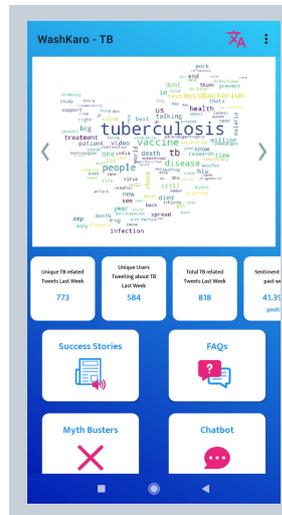
The Institute remains committed to developing technologies that can be transferred for commercial and societal use by other organizations. There are many initiatives taken by different departments of IIITD in collaboration with the Delhi Government as well as some foreign institutes to combat the COVID-19 situation. We are actively engaged in COVID-19 related research on contact tracing, face mask identification, spread prediction, image analysis for x-rays for early detection of symptoms. The institute is involved in research related to misinformation and fraud activities in online social networks, user behaviour



analysis in online marketing, parallel computation and system programming, signal processing and networking research, 5G technologies, signal optimization, and various other research areas. Our institute's research work on COVID-19 has been highly appreciated by the state government and got featured in media throughout the country.

## WashKaro App

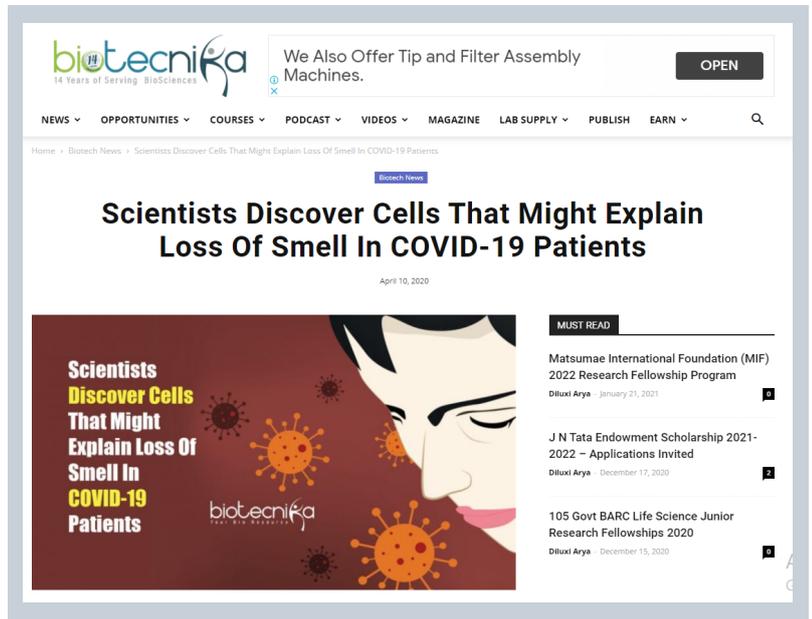
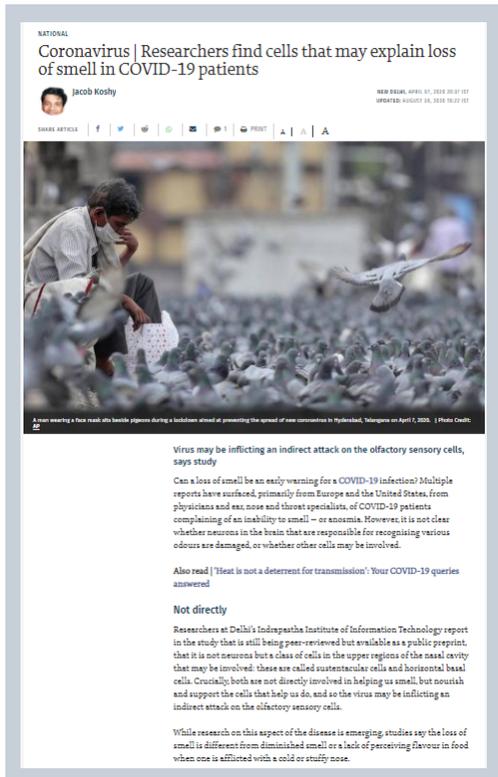
WashKaro application is proactively raising Covid-19 awareness by providing right information in the right format at the right time. It is targeted at the layman, and the daily updated content is delivered in Hindi as bite-sized audios for those who may not be able to read. This application, developed by Prof. Ponnurangam Kumaraguru and Dr. Tavpritesh Sethi, is used by the public.



## The Molecular Basis of Loss of Smell in 2019-nCoV Infected Individuals

Researchers from IIIT-Delhi, led by Dr. Ahuja and Dr. Sengupta underpinned the cellular basis of loss of smell in COVID-19 infected patients. Authors suggested that in addition to the prominent clinical symptoms such as fatigue, shortness of breath, fever, and cough, 2019-nCoV infected individuals often experience hyposmia/anosmia (decrease or loss of sense of smell). They reported that infection does not affect the sensory neurons, but rather attack non-sensory cell-types such as sustentacular cells and horizontal basal cells. Both of these cells nourish and support the cells that are responsible for the sense of smell in humans, and so the virus may be inflicting an indirect attack on the olfactory sensory cells. Their research work gained a lot of media echo in the national and international magazines/news outlets. Soon after a follow-up collaborative work from Dr. Ahuja's and Dr. Sengupta's laboratories with the international community, (GCCR) confirmed the prevalence of this symptom across multiple genetic backgrounds.

Furthermore, to aid clinicians and contact tracers in identifying individuals with a high likelihood of having COVID-19, this subsequent study proposed a novel 0-10 scale to screen for recent olfactory loss, the ODoR-19. The results suggested that the numeric ratings  $\leq 2$  indicate high odds of symptomatic COVID-19 ( $4 < OR < 10$ ).



## KEY RESEARCH PROJECTS

### Contactless E-Ticketing on Delhi Buses Application

The Delhi Transport Corporation in August 2020 launched a three-day trial of e-ticketing system and covered 31 buses of a cluster bus route. The special app 'Chartr' for this project has been developed with the technical support of our faculty Dr. Pravesh Biyani and his team. The second phase trials of contactless ticketing in Delhi's public buses began in September with a number of updates in the mobile app including availability of pink passes for women, a feature to find out commuting time by factoring in road traffic, among others. Around 350 buses plying across 25 routes were covered during the 15-day trial.

**CHARTR - TICKETS, BUS AND METRO**

**FEATURES IN THIS APP**

- Public information system (PIS)**  
Using the live location of buses, we show the estimated time of arrival (eta) of all buses and type of bus (AC / Non-AC) coming at a particular bus stop.
- Live bus tracking and route information**  
Get details of all routes and track live buses running on those routes. We use information from the Open Transit Data platform to show the live location of buses.
- Other Features**
  - Auto detect the closest bus stops and metro stations near you.
  - Save HOME and OFFICE for an easy commute.
  - Hindi language support
- E-Ticketing**  
Passengers will be able to buy tickets on this app soon. (Feature coming soon)

**Transport Department, NCT, Delhi Government**

**Contact-less Ticketing**

A trial for contactless & digital ticketing is scheduled from 7th September to 21st September, 2020 by Delhi Government.

**Chartr**

**1 How to download the app?**  
Search **Chartr** on Google Play Store and download the app.

**See ETA of buses on bus stops using STOPS tab**

**2 How to buy a ticket?** If you know the fare

- Buy new ticket
- Scan QR code
- Select fare
- Pay
- Get ticket

**Get Pink Pass** If you know the route, source and destination

- Buy new ticket
- Scan QR code
- Select route, source and destination
- Pay
- Get ticket

**See live buses using LIVE tab** Powered by **chartr**

\*You can book ticket only inside the bus, not outside. In case of any issue, contact conductor.

## Automatic Species Categorization in Camera Trap Images for Tiger Population Monitoring

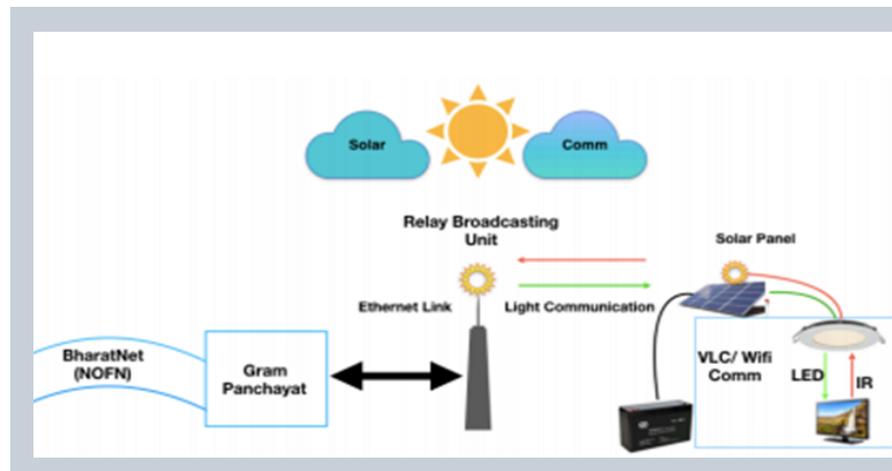
The project led to a module that used Deep Neural Networks based solutions to automatically categorize land animals by species. The module was used in the 2018 Tiger Census to process 3.5 Crore images collected by the forest departments from forest areas over the entire country. The module helped segregate ~70,000 images of tigers and ~50,000 images of leopards, which were used for population estimation. This algorithm is developed by Dr. Saket Anand and is used by Wildlife conservation.

The project was featured in the Guinness World Records (GWR) for the 'Largest Camera Trap Wildlife Survey'.



## Optical Wireless Access Network for Rural and Urban Communication

The aim of this project is to implement a low cost and energy efficient broadband telecom access network which will utilise the existing solar cells or photodiodes as data receivers. This project compliments the investment made by the Government of India in the renewable energy infrastructure where it can provide a possible solution for the last mile access to rural areas. The technology can also be used in solar-power grids, Internet of Things smart devices, defence and space mission payloads where reconfigurable information can be received over the same solar panel used for electrical energy harvesting. Overall, the successful outcome of the project will make a significant contribution towards Digital India and BharatNet, explore the coexistence between LiFi and WiFi to achieve high system throughput and improve energy efficiency.



This project is funded by Meity and led by Prof. Anand Srivastava.

## Investigation of Tunnel Field-Effect Transistors for Energy Efficient Circuits

Tunneling Field-Effect Transistor (TFET) is considered a future transistor option due to its steep-slope prospects and the resulting advantages in operating at low supply voltage. This project contributed towards establishing the credentials of TFETs as an alternative to MOSFETs. Once TFETs are capable to replace MOSFETs in future, the battery life of some of the electronic gadgets such as mobile phones, laptops etc. can increase dramatically. Therefore, from the perspective of addressing the problems of energy crisis and global climate change, the problems tackled in this project assume special importance.

This project was funded by DST SERB and led by Dr. Sneha Saurabh.

## AI-enabled Social Counselling System

According to the World Health Organisation, one in every four people on the planet is affected by mental disorders of some kind, out of which only one-third of the population ever seeks professional help. This is primarily due to the stigma and fear of being judged and discrimination by society. Researchers at IIIT-Delhi are in the process of designing an AI-enabled social counselling system that will interact with the user through question-answer mode, and analyse the mental situation to carry out the Emotion-Focused Therapy (EFT). It will utilise a chatbot to analyse the underlying human emotions and help the user navigate from a negative to a positive state of mind.

**This project is funded by Dawnjest Pvt Ltd, Australia and led by Prof. Mukesh Mohania.**

## MAJOR RESEARCH FUNDING

### Technology Innovation Hub (TIH)

The mission of the Technology Innovation Hub on Cognitive Computing and Social Sensing (iHub Anubhuti) is to provide a thriving ecosystem for research & educational institutes and industries to collaborate and develop technological solutions which will address short-term and long-term societal crises. Its twin aims are:

- To provide world-class technological support on cognitive computing and social sensing to enable world-class research and development with the additional emphasis on translating research into commercialization, and enhancing entrepreneurship, innovation and startup culture.
- To train human resources and develop skills on cognitive computing and social sensing by supporting undergraduate, postgraduate, doctoral and postdoctoral fellowships, early career research grant, chair professors, and conducting continuing education program, workshops and seminars, programs for upgrading industry skills and synchronizing industry-academic skill sets.

**TIH is funded by the Department of Science and Technology and its operations will be governed as Section 8 Company.**

## Spatially Distributed Intelligent Intrusion Detection and Deterrence System (SPADE)

The main objective of the project is to (a) Design, implement and test smart firewall, SPADES, a firewall-cum-IDS-honeypot that employs deep learning and (b) Network cartography and multilateration to identify key locations where SPADES can be positioned to defend against external cyber attacks.

**This project is funded by the National Security Council Secretariat (NSCS) and led by Dr. Sambuddho Chakravarty**

## FACULTY FOCUS



Dr. Tanmoy Chakraborty is an Assistant Professor and a Ramanujan Fellow in the Dept. of Computer Science and Engineering, associated with the Infosys Centre for Artificial Intelligence. He did his Postdoctoral Research at University of Maryland, College Park and his broad research interests include Graph Mining (Complex Networks), Social Computing, Natural Language Processing, Data-driven Cybersecurity. He has got about 8 projects from different funding agencies like DST, SERB, WIPRO, Logically Ltd. and has won many awards like ECR, Ramanujan.

Dr. Saket Anand is an Associate Professor in the Dept. of Electronics and Communication Engineering and is also Head of Centre Infosys Centre for Artificial Intelligence, the biggest centre in the IIITD whose main focus is to solve the problems in the areas of AI and ML. He did his PhD at Rutgers University and his broad research interest includes Visual Wildlife Monitoring, Autonomous Driving and Road Safety and Target Tracking in Surveillance Camera Networks. Most of these problems require decision making based on lower-level learning tasks like object detection, tracking and domain adaptation. He has also marked his presence in the Guinness World Records (GWR) for the largest camera trap wildlife survey. He has also received a grant from Meity for the project Autonomous Last Mile Vehicle (ALIVE) to demonstrate an autonomous electric vehicle platform that will operate at a maximum speed of 20 kmph as an intra-campus autonomous shuttle for transportation services within the IIIT-Delhi campus.



Dr. Saket Anand

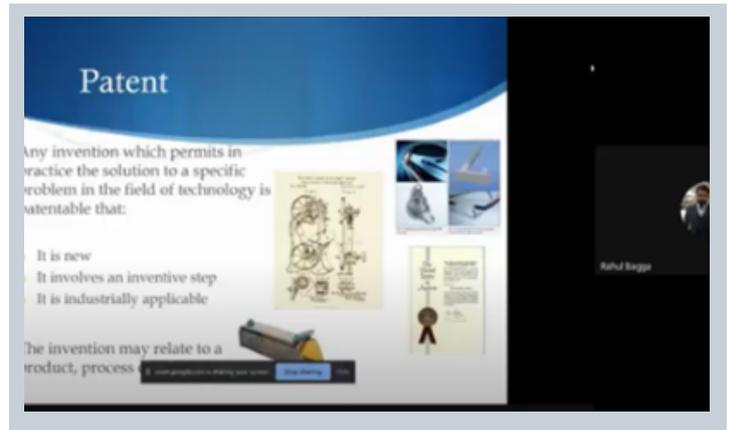
## OTHER ACTIVITIES

### Dean's Award Ceremony



Dean IRD had taken an initiative to conduct a Dean Award ceremony which was held virtually on 14th January 2021. More than 100 participants attended the ceremony.

### Patent Workshop



A patent workshop was conducted recently by IRD Unit in collaboration with Adatastra IP Pvt. Ltd. The workshop was well attended by the faculty members and students.

### Organized IEEE ANTS 2020



IIIT-Delhi along with the IEEE Communication Society (IEEE ComSoc) organized 14th IEEE International Conference on Advanced Networks and Telecommunications Systems 2020 (IEEE ANTS 2020) from Dec 14-17 with the theme "ICT for Connecting Humanity". Prof. Anand Srivastava was the General Chair of the conference and Dr. Vivek Bohara and Dr Gourab Ghatak were the TPC Chairs.

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