IDAPT HUB FOUNDATION
IIT (BHU) VARANASI
Under the aegis of
NM-ICPS, DST, Govt. of India
Overview

I-DAPT- HUB FOUNDATION is a non-profit initiative at IIT (BHU) Varanasi acting as a nodal center and a Technology Innovation Hub (TIH) for technology development and entrepreneurial activities in “Data Analytics and Predictive Technologies (DAPT)” and other related areas under National Mission on Interdisciplinary Cyber Physical Systems (NMICPS), DST, Govt. of India.

The broader scope of this mission is to promote:

- Translational Research and Technology Development,
- Establishment of Centers of Excellence,
- Human Resource Development & Skill Development,
- Innovation, Entrepreneurship & Start-up Ecosystem and
- International linkages & collaborations in Research

I-DAPT-HUB FOUNDATION will collaborate with NSF in following thrust areas-

- Telecommunications
- Power
- Road Transport and Highways
- Health and Family Welfare
Mission and Vision

Mission

• The Mission is to support translational research and innovation in the identified thrust areas leading to the development of DAPT technologies and applications.

• To will support centers of Excellence (CoEs) in academic and research institutions across the country, in association with the industrial and financial sector, with significant economic and technical collaborations.

• To develop enterprise grade prototypes and proofs-of-concepts (PoC) following internationally standardized norms (e.g. IEEE, E.U.-ESO, FDA and others) and translate them into commercial products, in conjunction with industry and start-ups leading to significant job creation and economic growth, across the country and the globe.

Vision

The activities envisioned under this mission will provide a great fillip to societal betterment, via the development of new protocols, inventions of novel products/processes and services. The endeavor will also catalyse the creation of skilled young engineers, researchers, technicians, and entrepreneurs, together with human resource development at all levels, besides become a key contributor to realizing the vision of “Digital India”, “Innovate in India”, and “Make in India”.

Activities (Research Projects, Publications, Patents, Grand Challenges, Short-term courses etc. )

Research Projects

• Development of a scalable volatile organic compound (VOC) sensing based intelligent cyber physical system for near real-time vehicular pollution monitoring and recommendation for reduced emissions.
• Demonstrable Prototype of IoT enabled DC/AC Smart Grid at Library Building, IIT (BHU) Varanasi with Solar Photovoltaic Integration
• Data-driven battery sizing for standalone solar electric drive system for river boats
• Integrated computational and experimental studies to potential therapy of kala-azar targeting Dephosphocoenzyme A Kinase (LdDPCK) of the pathogen as a target
<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Title of Publication</th>
<th>Authors</th>
<th>Published In</th>
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<tr>
<td>No.</td>
<td>Title</td>
<td>Authors</td>
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**Patent**
Indian Patent entitled "Adaptive Optimal Power Management Technique for Renewable Based Mix Energy System" Application No.: 202111031286  
Inventors: Dr. R. K. Singh and Priyatosh Jena, Department of Electrical Engineering, IIT (BHU)  
Status: Published
Overall Accomplishments

Short Term Courses

**Next Generation Networks (NGN) & AI for Data Analytics and Predictive Technology Applications (NGN & AI for DAPT)**

- **One Week Online Short-term Course**
- **With live hands-on**
- **(March 22-27, 2021)**
- **Hosted by**

**in support with**

**Cisco**

**TLC**

**IIT (BHU)**

**A TECHNOLOGICAL INNOVATION HUB ON INTERDISCIPLINARY DATA ANALYTICS AND PREDICTIVE TECHNOLOGY (IDAPT)**

**A TECHNOLOGY INNOVATION HUB ON INTERDISCIPLINARY DATA ANALYTICS AND PREDICTIVE TECHNOLOGY (IDAPT)**

**UNDER NATIONAL MISSION ON INTERDISCIPLINARY CYBER PHYSICAL SYSTEM (NM-ICPS)**

**CELEBRATING CENTENARY OF 100 YEARS (1921-2021) BHU-INDORE**

**SUPPORTED BY**

**ONE WEEK SHORT TERM COURSE ON DATA ANALYTICS AND PREDICTIVE TECHNOLOGIES**

**05-10 July 2021**

**SUPPORTED BY**

**A TECHNOLOGICAL INNOVATION HUB ON INTERDISCIPLINARY DATA ANALYTICS AND PREDICTIVE TECHNOLOGY (IDAPT)**

**COORDINATOR:** Dr. R. K. Singh

**CO-COORDINATOR:** Dr. V. N. Lal

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**KEY SPEAKERS**

- Suhas Mansingh
  - VP (Engineering), Cisco Systems

- Prof. Shiho Kim
  - Director
  - Yonsei Institute of Convergence technology, South Korea

- Prashant Anand
  - Distinguished Engineer
  - NGN, Cisco Systems

- Laxmi Mukund
  - Distinguished Engineer
  - NGN, Cisco Systems

- Raghu Kulkarni
  - Technical Leader
  - Security, Cisco Systems

- Prof. Dhananay Singh
  - CTO, Vestella Inc.
  - Hankuk University of Foreign Studies (HUFS), Seoul, South Korea

6 more distinguished speakers are scheduled.
Short Term Courses

Data Collection and Analytics in Pavement Management Systems

Online Short-term Course
March 01-05, 2021
At

Supported by
A TECHNOLOGICAL INNOVATION HUB
ON INTERDISCIPLINARY DATA ANALYTICS AND PREDICTIVE TECHNOLOGY (IDAPT)

Data Analytics and Predictive Technology for Intelligent Transportation Systems (DAPT-ITS)

Online Short-term Course
March 15-19, 2021
Hosted by

Supported by
A TECHNOLOGICAL INNOVATION HUB
ON INTERDISCIPLINARY DATA ANALYTICS AND PREDICTIVE TECHNOLOGY (IDAPT)
Short Term Courses

National Conference on Computational and Biochemical Drug Discovery [NCCBDD-2021]
September 11-12, 2021
Online conference jointly organized by
I-DAPT HUB FOUNDATION IIT (BHU), VARANASI
(A Section 8 - Not for profit Company)

Supported by
A TECHNOLOGICAL INNOVATION HUB ON INTERDISCIPLINARY DATA ANALYTICS AND PREDICTIVE TECHNOLOGY (IDAPT)

Computer Aided Drug Design and Protein Analysis
Online Short-term Course
February 22-26, 2021
At

Supported by
TECHNOLOGICAL INNOVATION HUB ON INTER-DISCIPLINARY DATA ANALYTICS & PREDICTIVE TECHNOLOGY (IDAPT)

Sponsored by
Dept. of Science & Technology, Ministry of Science & Technology, Govt. of India

Advances in Medical Imaging
Online Short-term Course
March 15-19, 2021
At IIT (BHU), Varanasi

Supported by

BIO STARTUPS
The journey from idea to reality
Saturday, 4th September, 2021
2:30 P.M. IST

• How to start a biotech company?
• Challenges with Startup
• Projected Growth in Biotech Sector

Organizing Chairman
Prof. Vikash Kumar Dubey,
IIT (BHU) Varanasi
Short Term Courses

**Industrial Conclave - 2021, IIT-BHU**

**Industry Institute Interaction**

**Short Term Course on**

**Advanced Techniques for Traffic Data Analysis, Visualization and State Estimation for Indian Cities**

**A Technology Innovation Hub on Interdisciplinary Data Analytics and Predictive Technology (IDAPT)**
Under National Mission on Interdisciplinary Cyber Physical System (NM-ICPS)

20th – 24th December 2021

**Coordinators:**
Dr. Ankit Gupta
Dr. Anilkumar Bachu
Dr. Agnivesh Pani

**Short Term Course on**

**Data Analytics and Predictive Techniques for Urban Freight Transportation System (FTS)**

**A Technology Innovation Hub on Interdisciplinary Data Analytics and Predictive Technology (IDAPT)**
Under National Mission on Interdisciplinary Cyber Physical System (NM-ICPS)

10th – 14th November

**Coordinators:**
Dr. S Pratap
Dr. Lakshay
Collaborations

<table>
<thead>
<tr>
<th>S. No.</th>
<th>First Party</th>
<th>Second Party</th>
<th>Date of Signing</th>
<th>Activities</th>
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<tbody>
<tr>
<td>1</td>
<td>I-DAPT-HUB FOUNDATION</td>
<td>Hughes Global Education India Private Limited</td>
<td>07-01-2021</td>
<td>Online training courses on AI</td>
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<td>2</td>
<td>I-DAPT-HUB FOUNDATION</td>
<td>HDFC Bank Ltd.</td>
<td>15-01-2021</td>
<td>Vernacular and affordable learning platform for school students.</td>
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<td>360-degrees tech and touch model named UDYAMITA to fosters rapid creation</td>
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<td>and development of nano/micro-entrepreneurs in the low-income/reverse-</td>
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<td>migrants/unemployed segment population</td>
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<td>3</td>
<td>I-DAPT-HUB FOUNDATION</td>
<td>The Technology Innovation Hub at Indian Statistical Institute, Kolkata</td>
<td>21-06-2021</td>
<td>Joint activities such as seminars, workshops, conferences and training</td>
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<td>programmes etc.</td>
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<td>Undertaking collaborative research activities through participation in</td>
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<td>nationally and internationally funded projects</td>
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<td>4</td>
<td>I-DAPT-HUB FOUNDATION</td>
<td>OPAL-RT TECHNOLOGIES INDIA PVT. LTD</td>
<td>08-10-2021</td>
<td>Development of test beds for various thrust areas</td>
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<td>Cloud based solution for power system studies and research.</td>
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<td>Development of digital twin technology.</td>
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<td>5</td>
<td>I-DAPT-HUB FOUNDATION</td>
<td>Premas Biotech Pvt. Ltd</td>
<td>06-12-2021</td>
<td>Collaboration related to Biomaterial and tissue scaffold products, biomedical devices, support for vaccine and drug discovery products</td>
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</table>

- Jointly organizing **13th International Conference on Computing, Communication and Networking Technologies** with University of South Alabama, USA between July 10-12, 2022.
I-DAPT HUB Foundation will conduct I-DAPT-HUB Pitch challenge for startups, entrepreneurs and Innovators developing cutting-edge/Innovative technologies in **Power, Telecommunications, Defense research & development, Road transport and Highways, Health & Family welfare sectors.**
Key Research Personnel

Dr. N. S. Rajput
Associate Professor in Electronics Engineering
IIT (BHU), Varanasi
https://iitbhu.ac.in/dept/ece/people/nsrajputece

Dr. R. K. Singh
Associate Professor in Electrical Engineering
IIT (BHU), Varanasi
https://www.iitbhu.ac.in/dept/eee/people/rksingheee

Prof. Rajiv Prakash
School of Material Sc. & Technology
IIT (BHU), Varanasi
https://iitbhu.ac.in/dept/mst/people/rprakashmst

Dr. Ankit Gupta
Associate Professor
Department of Civil Engineering
IIT (BHU), Varanasi
https://www.iitbhu.ac.in/dept/civ/people/ankitciv

Prof Prasun Kumar Roy
School of Biomedical Engineering
https://www.iitbhu.ac.in/dept/bme/people/pkroybme

Prof. V. K. Dubey
School of Biochemical Engineering
IIT(BHU), Varanasi
https://iitbhu.ac.in/dept/bce/people/vkdubeybce

Telecommunications

Power

Defense Research and Development

Road Transport and Highways

Health and Family Welfare
### Timeline, Plan for new research activities, and Milestones

<table>
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<tr>
<th>SI no.</th>
<th>Activity/Milestone</th>
<th>1&lt;sup&gt;st&lt;/sup&gt; year</th>
<th>2&lt;sup&gt;nd&lt;/sup&gt; year</th>
<th>3&lt;sup&gt;rd&lt;/sup&gt; year</th>
<th>4&lt;sup&gt;th&lt;/sup&gt; Year</th>
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<td>Q1 Q2 Q3 Q4</td>
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<tr>
<td>A1</td>
<td>Data collection, Literature review, and Preliminary System design</td>
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<td>A2</td>
<td>Simulation and paper design of planned prototype</td>
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<td>A3</td>
<td>Laboratory prototype design and development</td>
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<td>A4</td>
<td>Expert Driven New Knowledge Generation/Discovery (TRL5)</td>
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<td>A5</td>
<td>Development of products/prototypes from existing Knowledge (By experts or teams) (TRL6)</td>
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<td>A4</td>
<td>Technology/product delivery in specific sectors (TRL7)</td>
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<td>A5</td>
<td>Yearly review of progress</td>
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<td>A6</td>
<td>Mid Term Review</td>
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<td>A8</td>
<td>Preparation and Publication of final progress reports**</td>
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**Draft completion report for review (3 month prior to date of completion)**
Priority Areas for new US India Collaborations

Data Analytics and Predictive Technologies (DAPT) is an emerging approach to produce transformative technologies and novel solutions for societal, national and global problems. The following are some of the generic technologies for which Indo-US collaboration will play a crucial role in development of DAPT:

- **System Design** – Understanding the Integration of Physical and embedded systems.

- **Communication** - Communication networks are an essential part of any DAPT as they interconnect the DAPT subsystems and components.

- **Security** – DAPT has been increasingly involved in fields ranging from aerospace, automobile, industrial process control, energy, healthcare, manufacturing and transportation, etc. where secure operation is one of the key concerns.

- **Privacy** - Understanding the impact of cyber-attacks on any DAPT and in the design and assessment of detection mechanisms.

These aforementioned technologies will be implemented for the Priority Thrust-areas identified by I-DAPT-HUB Foundation as -

- Telecommunications
- Power
- Road Transport and Highways
- Health and Family Welfare
Telecommunications:

Industry 4.0 is driving the trends for digital transformation. Digital transformation is the change associated with the application of digital technology in all aspects of human society.

Since everything can be digitized, transformed, transported and stored, the ubiquitous telecommunication infrastructure will also need its transformation into digital infrastructure.

There are following enabling technology for which India-US may collaborate for this massive transformation:

• Industry 4.0 – 5G hyper connection and innovative Air Interface
• Massive scale Transport- Ethernet/IP, TSN.
• Low Latency computing at network scale e.g. MEC
• Massive “softwarization” where applications are, converging to IT methods e.g. Virtualization etc.

Power/ Energy:

The India-US collaboration will undertake the technology development in Power/Energy using DAPT for environment friendly, smart home automation with the system of Internet of Things (IoT)-activated smart devices that can be controlled remotely. The activities envisioned under the DAPT will provide a great impetus to Smart Cities Mission in terms of environment friendly, reliable, efficient, and IoT activated optimum power generation/flow and thus, setting up a DAPT based smart grid for smart homes and cities.

The technological areas on which the research can be done for this work package are as follows:

• Mix Energy Source Renewable Integration in Sustainable Smart Power Grid.
• Power Optimization in Smart Microgrid Infrastructure
• DAPT Driven IoT Based E-Vehicle Charging Infrastructure.
• Smart reconfigurable house
• IoT enabled demand response management in Power distribution system
Road Transport and Highways:

Transportation plays a vital role in transporting goods and services from one location to another in due estimated time. Smart mobility and transportation can be enhanced through data analytics and predictive technologies.

I-DAPT-HUB FOUNDATION proposes two major work plans where India-US researchers may collaborate –

1. Highway Knowledge Centre where a multitude of data would be collected, borrowed and fused together to support transportation decision making.

2. Intelligent Transportation Systems which includes testing relevant transportation algorithms and systems for real-time traffic management control system.

Health and Family Welfare:

In the present day health management scenario, the advent of Medical Expert Systems and the International Collaborative Epidemiology Programs have demonstrated the very reliable validated ability of “Data Analytics & Predictive Technologies”. Thereby, one can enable:

- The automated forecasting of the most efficient therapy protocol, and
- Judicious selection and optimization of the most feasible therapeutic agents.
- IoT enabled biosensors and portable kits based health monitoring
- Sensors for air, water and food
- Data Analytics & Predictive Technologies in Population health monitoring

I-DAPT-HUB Foundation proposes the program of Brain/Mind Health for National Mission on DAPT focusing on harnessing these technologies for developing Neuro informatics Platforms for:

1. Development of tools and databases for management and sharing of neuroscience / psychometric data at all levels of analysis.
2. Construction of tools for analyzing and modelling neuroscience / cognitive data, in normality and disease.
3. Formulation of computational models of the human brain, its neuronal processes and cognitive / perceptual / subconscious operations
Keywords for Applications/Platforms:
• Power/ Energy
• Telecommunications
• Road Transport and Highways
• Health and Family welfare
• Environment and Sensors/ Bio-Sensors

Keywords for Research Areas:
• Power Electronic Interface
• Software-Defined Networking (SDN) and Fog Computing
• Neurocomputing
• Virtual Radio Access Networks (vRAN) for Hardware Abstraction
• Advance Polymer Composites
• Smart Grid Infrastructure
• Non Conventional Energy System
• Medical Devices