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**ISGF**

India Smart Grid Forum

# Online (Recorded) Training Program on ARTIFICIAL INTELLIGENCE and ROBOTICS for UTILITIES and SMART CITIES



## INTRODUCTION

The lockdowns owing to COVID-19 around the world have dramatically changed the way we live and work within a short span of time. The operations and work style of governments, city/local administrations, businesses and utilities (electricity, water and gas) have changed drastically in the past few months. There is a greater need for governments, city managers and local authorities as well as all utilities to deploy advanced automation, remote working, remote monitoring, robotics and artificial intelligence to handle day-today operations. Artificial Intelligence (AI), Data Science (DS), Machine Learning (ML), Virtual Reality (VR), Augmented Reality (AR), Drones and other types of Robots could play crucial roles in various infrastructure and services in city management including utility operations. These new technologies and tools could make the operations more efficient, faster, reliable and economical. For example, artificial intelligence (AI) will be able to balance electricity grids, manage demand, negotiate actions, enable self-healing functions and facilitate a host of new products and services leading to the energy transition. It will also enable more efficient and effective utility operations by helping to analyze the massive amounts of data gathered from the digital devices. Robotic Process Automation (RPA) could automate all measurable, repeatable and predictable transactions in all domains of city management and utility operations.

Today, India operates the third largest power system in the world with an installed capacity of 375GW serving 750 million consumers covering a geographical area of over 3 million square kilometers operating in same frequency as one integrated grid. The share of renewable energy is presently (RE) is about 87GW which is targeted to be enhanced to 450GW by 2030. With the increasing share of renewable energy on the grid, flexibility in both demand and generation is essential for stable grid operations. Digital technologies will play crucial role for the stable grid operations. The high voltage transmission grid in India already deploy advanced automation and digital technologies and the electricity distribution companies have also embarked on their digital journey in the recent past through several programs promoted by the Ministry of Power (MoP), Government of India. However, post COVID-19, the pace of digitalization efforts in all businesses including utilities are gaining rapid momentum and officials are getting used to the paper-less operations. The digital devices (including the proposed 250 million smart meters) will generate humongous volume of data in each utility which would require AI tools to analyze and transform into business intelligence.

The 100 Smart Cities program in India has also gained considerable momentum and the city command and control centers operational in several of these smart cities are being leveraged for COVID-19 monitoring and management very efficiently. With advanced AI tools, these command and control centers could predict trends and suggest most optimized actions in a variety of scenarios for efficient management of the cities. Since inception in 2011, India Smart Grid Forum (ISGF) has been spearheading the movement towards digitalization in utilities. Although, the actual implementation in many utilities may still be in its infancy, there is already a unanimous voice for taking this journey to full digitalization. In the aftermath of COVID-19, the digital platforms have become the coveted assets for utilities in their business continuity and resiliency; and this movement towards digitalization is irreversible. Emerging technologies like Artificial Intelligence, Machine Learning, Data Science and Advanced Analytics, Blockchain, Virtual Reality, Augmented Reality and Robotics, will radically revolutionize the city management and utility operations and overall governance in every domain in the near future. ISGF has been working with eminent stakeholders in the AI and Robotics domains to create awareness and empower the city managers and utilities with domain knowledge for adoption of these technologies.

**With this background ISGF is pleased to invite you to join the Online (Recorded) Training Program on Artificial Intelligence and Robotics (AI&R) for Utilities and Smart Cities.**

## OBJECTIVES

1. To create awareness in utility officials, regulators and government officials regarding the potential of AI&R technologies such as Artificial Intelligence, Machine Learning, Data Science and Advanced Analytics, Blockchain, Virtual Reality, Augmented Reality and Robotics in the management of cities and utility (electricity, water and gas) operations
2. To give an overview of different applications of AI&R technologies in smart city management and utility business and explain them with actual use cases
3. To create empowered teams on AI&R technologies in utilities who could critically evaluate different solutions for their business needs
4. To build capacity in the industry, academia and amongst the student community to design and implement AI&R solutions in smart cities and utilities

## COURSE MODULES

- MODULE - A: Introductory Module (Chapters: 1 to 5)**  
 The first five Introductory Chapters in Module-A are common for all participants.
- MODULE - B: Foundation Module (Chapters: 6 to 10) – OPTIONAL**  
 The Foundation Chapters in Module - B are optional and cover the technologies and tools of Data Science, Machine Learning, Deep Learning, Reinforcement Learning, Virtual Reality, Augmented Reality and Robotics in detail.
- MODULE - C: AI & Robotics-Applications and Case Studies (Chapters: 11 to 17)**  
 Module-C covers applications of AI, Data Science, Machine Learning, Deep Learning, Reinforcement Learning and Robotics in utilities with potential Use Cases and Case Studies of successful projects.

## DETAILED COURSE MODULES

### MODULE – A: INTRODUCTORY MODULE

<b>Chapter-1: Introduction to Artificial Intelligence</b>	
1.1	What is AI?
1.2	AI Techniques
1.3	AI Frameworks
1.4	Social, Legal and Ethical Aspects of AI
<b>Chapter-2: Data Driven Smart Utilities - A Paradigm Shift in Utility Operations</b>	
2.1	Business and Technology Drivers of AI
2.2	Need of AI in Utilities
2.3	Key Benefits of AI Applications for Utilities
2.4	How AI can be applied in existing systems in Utilities
2.5	Overview of Tools
2.6	List of Use Cases

## MODULE – A: INTRODUCTORY MODULE

### Chapter-3: Programming Languages and Tools

- 3.1 Languages
- 3.2 Machine Learning Tools
- 3.3 Deep Learning Tools
- 3.4 Analytical Tools
- 3.5 Visualization Tools
- 3.6 Natural Language Processing (NLP) Tools
- 3.7 Signal Processing Tools
- 3.8 Other Tools

### Chapter-4: Introduction to Robotics

- 4.1 What is Robotics?
- 4.2 AI and Robotics
- 4.3 Use Cases of Robotics in Utilities

### Chapter-5: Infrastructure Requirements for AI & ML

- 5.1 Data Platforms and Architecture
- 5.2 Choices of Tools and Platforms for different Applications
- 5.3 Deploying AI Solutions on the Cloud

## MODULE - B: FOUNDATION MODULE (OPTIONAL)

### Chapter-6 (Part 1): Data Science and Analytics

- 6.1 Cleaning, Wrangling and Visualizing the Data
- 6.2 Analytics, Statistics, Probability and Statistical Inference
- 6.3 Regression Techniques
- 6.4 Classifications

### Chapter-6 (Part 2): Data Science and Analytics

- 6.5 Decision Tree Models
- 6.6 Neural Networks
- 6.7 Ensemble Modelling and Ensemble Learning

### Chapter-7 (Part 1): Machine Learning: Introduction, Approach and Landscape

- 7.1 Introduction
- 7.2 Machine Learning Approach and Landscape

### Chapter-7 (Part 2): Machine Learning: Introduction to Popular Algorithms

- 7.3 Functions and Algorithms

### Chapter-7 (Part 3): Machine Learning: Types of Machine Learnings

- 7.4 Supervised Learning
- 7.5 Unsupervised Learning
- 7.6 Ensemble Learning
- 7.7 Automated Machine Learning (AutoML)

## MODULE - B: FOUNDATION MODULE (OPTIONAL)

### Chapter-7 (Part 4 - A): Machine Learning: Deep Learning – Convoluted Neural Network (CNN)

- 7.8 Deep Learning
- 7.9 You Only Look Once (YOLO)

### Chapter-7 (Part 4 - B): Machine Learning: Deep Learning – RNN and ANN

- 7.10 Recurrent Neural Networks (RNN)
- 7.11 Automated Neural Networks (ANN)
- 7.12 App based Deep Learning Workflow

### Chapter-7 (Part 4 - C): Machine Learning: Reinforcement Learning

- 7.13 Classical Reinforcement Learning Algorithms
- 7.14 Deep Reinforcement Learning Algorithms
- 7.15 Career Building in Machine Learning

### Chapter-8 : Virtual Reality (VR) and Augmented Reality (AR)

- 8.1 Gesture Recognition
- 8.2 Virtual Reality (VR)
- 8.3 Augmented Reality (AR)
- 8.4 Autoencoders

### Chapter-9 (Part 1): Data Science and Advanced Analytics

- 9.1 Hadoop and Big Data Ecosystem and Architecture
- 9.2 Hadoop Data Integration Flume, SQOOP, Restful API Framework
- 9.3 Hadoop – HDFS and MAP REDUCE
- 9.4 Big Data Visualization and Dash Boards

### Chapter-9 (Part 2): Data Science and Advanced Analytics

- 9.5 Time Series Forecasting
- 9.6 Understanding Forecasting Accuracy
- 9.7 Career Building in Data Science

### Chapter-10 (Part 1): Robotics

- 10.1 Robot Design
- 10.2 Robot Autonomy

### Chapter-10 (Part 2): Robotics

- 10.3 Robotics Software
- 10.4 Applied Robotics
- 10.5 Robot Operation Centre (ROC)
- 10.6 Career Building in Robotics

## **MODULE - C: AI AND ROBOTICS – APPLICATIONS AND USE CASES FOR UTILITIES AND SMART CITIES**

### **Chapter-11: AI and ML Applications for Utilities: Forecasting Solutions**

- 11.1 Forecasting Energy Production
- 11.2 Forecasting Energy Demand
- Case Study-1A: Forecasting Solar Generation
- Case Study 1B: Forecasting Solar and Wind Generation; Case Study from Hawaii
- Case Study-2A: Forecasting Energy Demand in a Distribution Utility
- Case Study- 2B: Weather based Energy Forecasting and Outage Management

### **Chapter-12: AI and ML Applications for Utilities: Monitoring Solutions**

- 12.1 Drone based Monitoring of Assets and Operations
- 12.2 Monitoring of Operations with Inputs from Sensors
- 12.3 Digital Twins
- 12.4 Case Study-3: Drone based Monitoring of Distribution Lines and Substations
- Case Study-4: Predictive Maintenance with inputs from Sensors and Digital Twins

### **Chapter-13: AI and ML Applications for Utilities: Part 3**

- 13.1 Prediction and Optimization Solutions
- Case Study -5A: Virtual Power Plants/Energy Management Systems
- Case Study -5B: Asset Performance Management and Vegetation Management
- Case Study -6: City Gas Distribution LUAG Analysis through Machine Learning methodology
- Case Study -7: Water Distribution – NRW and UFW Analysis through Machine Learning methodology

### **Chapter-14: Data Science Applications for Utilities: Part-1**

- Case Study-8A: Role of Revenue Recognition/Revenue Maximization from Billing/Payment/Payment mode/Customer
- Case Study -8B: AMI Analytics Case Studies from North America and Europe
- Case Study 8C: AI/ML Driven Global Customer behaviour to Address Energy Efficiency and Water Conservation- Case Studies from MNWD (Water), SWG (Gas), WSC (Electric + Water), Simply (Electric), GGL (Gas)

### **Chapter - 15: Data Science Applications for Utilities: Part 2**

- Case Study-9A: Approach to Transformer Ageing
- Case Study -9B: Total Transformer Monitoring and Analytics
- Case Study-10: False Alarm Suppression Using Predictive Modelling

### **Chapter-16: AI and ML Applications for Utilities: Part 3**

- Case Study-11: AI Driven Road Safety by monitoring and controlling over speeding of vehicles
- Case Study-12: Road Pot Hole Condition Analysis using AI
- Case Study-13: IoT Controlled Street Lighting for better Vehicle Movement and De-congestion
- Case Study-14: Loss Reduction/Power Theft Modelling Using Machine Learning

**Chapter-17 (Part 1): Robotics Case Studies**

Case Study-15: Robotic Process Automation and Virtual Tour of a Robot Operations Centre (ROC)

**Chapter-17 (Part 2): Robotics Case Studies**

Case Study-16: Other Robotics Applications for Utilities



## Training Methodology

Recording of Training Session by experts/speakers will be available on ISGF Portal to view or access at any time and any number of times for reference

Course Material/Presentations of all the Sessions will be emailed to the participants as soon as they are registered and Course Fee is paid.

### Assessment & Certification

At the end of the course an assessment will be conducted of Multiple -Choice Questions (MCQs). Trainees undergoing Online (Recorded) Training Courses will be awarded Certificate of Completion through Email

MODULES A & C	Level I
MODULES A, B & C	Level II

## TARGET AUDIENCE





## Course Fee

(in INR/USD)

COURSE MODULES	Mode of Training	
	Online (Recorded Video) Training	
	INR	USD
MODULES A & C	5000*+ 18% GST	70
MODULES A, B & C	9000* + 18% GST	125

**All Online (Recorded) Trainees will register following this link at ISGF Training Portal <https://indiasmartgrid.org/onlinetrainingprogram/>**

All Types of Debit Card / Credit Card, Netbanking and Paytm/Google Pay/UPI Linked Payments will be accepted for registration at ISGF Training Portal

**Bank details of ISGF for NEFT / Fund Transfer of ISGF as below**

Account Name: India Smart Grid Forum  
 Address: CBIP Building Malcha Marg New Delhi – 110021 Account Number: 00031110005017  
 Bank Name: HDFC Bank Ltd RTGS/NEFT/IFSC Code: HDFC0000003  
 Bank Address: 209-214 Kailash Building, 26 K G Marg, New Delhi – 11000

**Special Offers:**

- 25% discount for current ISGF Members
- 25% discount for Bonafide Students and Faculties from reputed Educational Institutions
- 25% discount on group booking of more than 4 persons from the same organization
- 15% discount to all participants of the past courses (AMI, Cyber Security, EV and Artificial Intelligence) conducted in 2020 via virtual training mode
- 10% discount for sharing this Training Program Banner/Brochure on your any 3 Social Media Accounts (LinkedIn, Facebook, Twitter, Instagram etc)
  - o Banner/Brochure can be downloaded from <https://indiasmartgrid.org/onlinetrainingprogram/>
  - o The links posted have to be shared with [ronkini.shome@indiasmartgrid.org](mailto:ronkini.shome@indiasmartgrid.org) to obtain the discount
  - o The above offer is Non-Transferable

**Please Note:**

- Two discount offers cannot be clubbed
- Valid identity proof of Bonafide Students/Faculties need to be emailed to [ronkini.shome@indiasmartgrid.org](mailto:ronkini.shome@indiasmartgrid.org) to avail the discount
- ISGF Members have to email to [ronkini.shome@indiasmartgrid.org](mailto:ronkini.shome@indiasmartgrid.org) to avail the discount
- Once Payment is made no refund, discount/offer request will be entertained

## List of Tutors



**Amitava Ghosh**  
Bidgely



**Amit Kumar Pandey**  
Hanson Robotics



**Ashutosh Nataraj**  
Vidrona



**Abhinav Srivastava**  
Bidgely



**Deva P Seetharam**  
Independent System Researcher



**Basant Kumar Pandey**  
Bidgely



**Shishir Shekhar**  
Mathworks



**Sumit Gupta**  
Assetplus Consulting



**Jayanth Balaji**  
Mathworks



**Mayank Sharan**  
Bidgely



**Ratna Gupta**  
AssetPlus Consulting



**Navin Kumar**  
AssetPlus Consulting



**Rohit Kumar**  
IBM



**Rob D'Arienzo**  
IBM



**Himanshu Goel**  
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**Rekha. A**  
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**Ankur Akash**  
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**Ralph Dsouza**  
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**Anish Verma**  
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**Jayanth Balaji**  
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**Reena Suri**  
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**Anant Venkateswaran**  
ISGF



**Ankush Sharma**  
Yeppar



**Ramanuja Jagannathan**  
MathWorks India

### About ISGF

India Smart Grid Forum (ISGF) was established as a Public Private Partnership (PPP) initiative of Government of India for accelerated development of smart grid technologies in the Indian power sector in March 2011. It is registered under Indian Societies Registration Act (Act XXI of 1860). ISGF was set-up to provide a mechanism through which academia, industry, utilities and other stakeholders could participate in the development of Indian smart grid systems and provide relevant inputs to the government's grid modernization program.

ISGF work closely with the Ministry of Power, Ministry of New and Renewable Energy, Department of Telecom, Ministry of Heavy Industries, Department of Science and Technology and Ministry of Urban Development and NCIIPC. With 180 + members comprising of ministries, utilities, technology providers, academia and students, ISGF has evolved as a globally reputed think tank in smart grids and smart cities.



**India Smart Grid Forum (ISGF)**

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