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(IEEE - ICRAIE-2020)

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PROCEEDING

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5th IEEE International Conference
On
Recent Advances and Innovation in Engineering
(ICRAIE-2020)
(IEEE Record # 51050)
Presentation Schedule
Technical Sessions
Track 1 - Computer Science Engineering and Information Technology

Track Chair: Dr. Ajay Khunteta	Track Co-Chair: Dr. SurendraYadav

Tuesday, Day 1: 1st December, 2020				
Sr.No	ID	Time	Authors	Paper Title

Session IA: Artificial Intelligence and Machine Learning (12:00 noon– 2:00 pm)				
Session Chair: Dr. Nilanjan Dey Rapporteur: Dr. Ajay Khunteta				
1.	1570658504	12.00 noon –12.15pm	**MadanLal Saini** (Poornima University, India); **ShilpiKulshrestha** (Jagannath University, India)	Study for the Prediction of E-Commerce Business Market Growth Using Machine Learning Algorithm
2.	1570678190	12.15 pm – 12.30 pm	**Sumindar Kaur Saini** (UG, India); **Vishal Dhull** (UIET, Panjab University, India); **Sarbjeet Singh &Akashdeep Sharma** (Panjab University, India)	Visual Exploratory Data Analysis of COVID-19 Pandemic
3.	1570682976	12.30 pm – 12.45 pm	**DiptiVermaNashine** (DYPIMCAM, India)	Implementation of Machine Learning Algorithm for Predicting Performance of Student With Specific Reference to Master of Computer Application (MCA) Programme
4.	1570683960	12.45 pm – 1.00 pm	**Yashvanth Kumar Guntupalli and VemulaSaiSaketh** (PES University, India); **Amudheswaran S** (VTU, India); **Devashish S Vaishnav**(PES University, India)	High-Scale Food Recommendation Built on Apache Spark Using Alternating Least Squares
5.	1570691475	1.00 pm – 1.15 pm	**Siwoo Kim and Ivy Liang** (Choice Research Group, USA)	Forecasting Housing Starts and Mortgage Rates Using Statistical and Computational Analysis
6.	1570691684	1.15 pm – 1.30 pm	**Mihir Gandhi; DevanshSanjeev Solanki; Rutwij Sanjay Daptardar; NirmalaShindeBaloorkar** (K J Somaiya College of Engineering, India)	Smart Control of Traffic Light Using Artificial Intelligence
7.	1570684251	1.30 pm – 1.45 pm	**PriyankaDwivedi**(IIT Delhi, India)	An Embedded Deep Learning Based Traffic Advisory System

Session IIA: Artificial Intelligence and Machine Learning (3:00 pm – 4:30 pm)				
Session Chair: Dr. Krishan Kumar, HoD CSE NIT Uttarakhand, Srinagar Rapporteur: Dr. Neelam Chaplot				
Sr.No	ID	Time	Authors	Paper
8.	1570692375	3.00 pm-3.15 pm	**BhawanaMaurya** (Government Women Engineering College, India); **SarojHiranwal** (RIET, India)	A Review on Liver Cancer Detection Techniques
9.	1570694211	3.15 pm-3.30 pm	**Anil Singh Parihar,ShivamSinghal, , SrishtiNanduri and YashRaghav,** Dept. of Computer Science and Engineering, Delhi Technological University New Delhi, India	A comparative analysis of Deep Learning based approaches for Low-light Image Enhancement
10.	1570693295	3.30 pm-3.45 pm	**Pushpendra Singh Sisodia** (Poornima College of Engineering, India)	An Elderly Fall Detection Techniques Using Depth Images
11.	1570693476	3.45 pm-4.00 pm	**SowmyaSanagavarapu** (Anna University, India), **Sashank Sridhar** (Anna University, India)	Dynamic Routing Framework Proposal for SDWAN Using Topology-Based Multitask Learning
12.	**Invited 1**	4.00 pm-4.15 pm	**CostinBadica, Amelia Badica**(University of Craiova Craiova, Romania); **Maria Ganzha** (Warsaw University of Technology Warsaw, Poland); M**arcin Paprzycki** (Systems Research Institute Polish Academy of Sciences Warsaw, Poland); **MirjanaIvanovic** (University of Novi Sad Novi Sad, Serbia)	Multi-Agent Simulation of Core Spatial SIR Models for Epidemics Spread in a Population
Session IIIA: Networks, Security and Biometrics (4:30 pm-6:00 pm)				
Session Chair: Dr. PriyankaDahiya, SOC, DIT Dehradun Rapporteur: Dr. Neelam Chaplot				
Sr.No	ID	Time	Authors	Paper
13.	1570688080	4.30 pm-4.45 pm	**Belen Septian** (Osmania University, India)	IoT Based Power Monitoring System for Diesel Generator
14.	1570691093	4.45 pm-5.00 pm	**PriyaMukundDeshmukh** (PRMIT&R, Amravati, Maharashtra, India)	Biometric Jammer: A Security Enhancement Using SVM Classifier
15.	1570693893	5.00 pm-5.15 pm	**GarimaMathur** (Poornima College of Engineering, Jaipur, India); **SanjeevYadav** (Govt. Women Engineering College Ajmer, India)	Monitoring and Detection of Blood Flow Based on Internet of Things
16.	1570692213	5.15 pm-5.30 pm	**DanialMubariq Mohamed Azzahar** (UniversitiTeknologi MARA Cawangan Kedah, Malaysia); **Siti Rafidah Muhamat Dawam** (UniversitiTeknologi MARA Cawangan Kedah & Faculty of Computer & Mathematical Sciences, Malaysia)	A Review: Standard Requirements for Internet of Vehicles (IoV) Safety Applications
17.	1570687975	5.30 pm-5.45 pm	**ShaifizatMansor** (UniversitiTeknologi Mara & Kedah Branch, Malaysia)	Blockchain-Based Internet of Vehicles (BIoV): An Approach Towards Smart Cities Development

Wednesday, Day 2: 2ⁿᵈ December, 2020

Session IVA: Natural Language Processing (8:00 am – 9:30 am)

Session Chair: Dr. Anil Kumar Dahiya, Head Research DIT Dehradun
Rapporteur: Dr. Praveen Gupta

Sr.No	ID	Time	Authors	Paper
18.	1570683255	8:00 am – 8:15 am	**Nor Hafizah Abdul Razak and NurulHusnaMahadzir** (UniversitiTeknologi MARA Cawangan Kedah, Malaysia)	A New Sentiment Analysis Model for Mixed Language Using Contextual Lexicon
19.	1570683464	8:15 am – 8:30 am	**Noor Hasnita Abdul Talib and SaffaRaihanZainalAbidin** (UniversitiTeknologi MARA, Malaysia); **SitiFadzilah Mat Noor** (National University Of Malaysia, Malaysia)	Serious Game Development - A Miraculous Literacy Tool for Halus Students
20.	1570688043	8:30 am – 8:45 am	**AparGarg and Rohit Kumar Kaliyar** (Bennett University, India)	PSent20: An Effective Political Sentiment Analysis With Deep Learning Using Real-Time Social Media Tweets
21.	1570688191	8:45 am – 9:00 am	**Tanmay Vijay** (Rajasthan Technical University, Kota, India); **Ayan Chawla** (Dav University, Jalandhar, India); **BalanDhanka** (CCT, University of Rajasthan, Jaipur, India); **PurnenduKarmakar** (The LNM Institute of Information Technology, India)	Sentiment Analysis on COVID-19 Twitter Data
22.	1570694115	09:00 am-09:15 am	**KamleshLakhwani** (Lovely Professional University Phagwara, Punjab, India); **Sandeep Bhargava** (Poornima College of Engineering Jaipur); **Devendra Somwanshi** (Poornima College of Engineering, Jaipur); **Dr. Ruchi Doshi** (Jayoti Vidyapeeth Women's University, Jaipur); **Kamal Kant Hiran** (Sir PadampatSinghania University Udaipur, Rajasthan, India);	An Enhanced Approach to Infer Potential Host of Coronavirus by Analysing Its Spike Genes Using Multilayer Artificial Neural Network

Session VA: Natural Language Processing (9:30 am – 10:30 am)

Session Chair: Dr. Anil Kumar Dahiya, Head Research DIT Dehradun
Rapporteur: Dr. Praveen Gupta

Sr.No	ID	Time	Authors	Paper
23.	1570693653	9:30 am – 9:45 am	**Amrita Sharma and Neha Chaudhary** (Manipal University Jaipur, India)	Linear Regression Model for Agile Software Development Effort Estimation
24.	1570693167	09.45am – 10.00 am	**SitiNurbaya Ismail** (UniversitiTeknologi MARA Kedah, Malaysia); **Shahirah Mohamed Hatim** (UniversitiTeknologi MARA, Perak Branch, Tapah Campus,	Chemistry Education (Rate of Reaction) via eLearning Mobile Application

Sr.No	ID	Time	Authors	Paper
			Malaysia); **Shamsul Jamel Elias** (Doctor of Philiosophy, Malaysia); **AbdRazakMansor**(UniversitiTeknologi MARA Kedah, Malaysia); **Adam Wong Yoon Khang** (UniversitiTeknikal Malaysia Melaka, Malaysia)	
25.	1570694117	10:00 am- 10:15 am	**Kamlesh Lakhwani** (Lovely Professional University Phagwara, Punjab, India); **Sandeep Bhargava** (Poornima College of Engineering Jaipur); **Mahesh Bundele** (PCE, Jaipur); **Kamal Kant Hiran** (Sir PadampatSinghania University, Udaipur, Rajasthan, India)	Prediction of the Onset of Diabetes Using Artificial Neural Network and Pima Indians Diabetes Dataset

Session VIA: Parallel, Distributed and High Performance Computing
(12:30 pm-1:30 pm)

Session Chair: Dr. Emmanuel Pilli, HoD CSE, MNIT, Jaipur
Rapporteur: Dr. Ajay Khunteta

Sr.No	ID	Time	Authors	Paper
26.	1570681977	12.30 pm – 12.45 pm	**DhavalJayendrakumarPujara and MathirajanMuthu**(Indian Institute of Science, India)	Mixed Integer Linear Programming Model for Scheduling Burn-In Ovens to Minimize Total Weighted Earliness/Lateness
27.	1570681984	12.45pm – 1.00 pm	**MinalMoharir and Shobha G** (R V College of Engineering, India); **AkshayOppiliappan** (RV College of Engineering, India); **Akash R and Rohit Mohan Krishna G V L** (R V College of Engineering, India); **S NitinPandit** (RV College of Engineering, India); **Mohit Prakash Saxena** (Citrix R & D India Pvt Ltd, India)	A Study and Comparision of Various Types of Load Balancers
28.	1570688194	1.00pm – 1.15m	**Inderjit Singh Dhanoa and Kulvinder Kaur** (Guru Nanak Dev Engineering College, Ludhiana, India); **PankajBhambri (**Guru Nanak Dev Engineering College, Ludhiana)	Optimized PSO-EFA Algorithm for Energy Efficient Virtual Machine Migrations
29.	1570691402	1.15pm- 1.30pm	**StefkaFidanova** (Institute of Information and Communication Technologies, Bulgaria)	Hybrid Ant Colony Optimization Algorithm for Multiple Knapsack Problem

Session VIIA: Deep Learning and Neural Networks (4:30 pm-6:00 pm)

Session Chair: Dr. Ajay Pratap, CSE Dept., IIT BHU
Rapporteur: Dr. Sunil Gupta

Sr.No	ID	Time	Authors	Paper
30.	1570678324	4.30 pm-4.45 pm	**LeenaChandrashekar** (RVCE, India); **A Sreedevi**(VTU, India)	Angle Classifier for Registration of MRI and CT Brain Images Using Deep Learning
31.	1570679627	4.45 pm-5.00 pm	**ALokNegi**(National Institute of Technology	Face Mask Detection Classifier and

Sr.No	ID	Time	Authors	Paper
			Uttarakhand, India); **Prachi Chauhan** (G. B. Pant University of Agriculture and Technology Pantnagar, India); **Krishan Kumar** (National Institute of Technology Uttarakhand, India); **Ravindra Rajput** (G. B. Pant University of Agriculture and Technology, Pantnagar, India)	Model Pruning with Keras-Surgeon
32.	1570682630	5.00 pm-5.15 pm	**KiranBisht**(G. B. Pant University of Agriculture and Technology, India)	Deep Reinforcement Learning Based Multi-Objective Systems for Financial Trading
33.	1570682898	5.15 pm-5.30 pm	**MamtaGehlot and MadanLal Saini** (Poornima University, India)	Analysis of Different CNN Architectures for Tomato Leaf Disease Classification
34.	1570692322	5.30 pm – 5.45 pm	**Jasmin Ilyani Ahmad** (UiTM, Malaysia); **Nor HanizaMohdKhir** (UniversitiTeknologi MARA (UiTM) Kedah, Malaysia); **Marina Ismail** (UniversitiTeknologi MARA, Malaysia)	Persona Modelling via Correlation and Regression Analysis in CCI Gamification
35.	1570694234	5.45 pm- 6.00 pm	**Anil Singh Parihar, Aditya Kaushik, Aditya VikramChoudhary, Amit Kumar Singh** Department of Computer Science and Engineering,Delhi Technological University Delhi, India	A Primer on Conditional Text based Image Generation through Generative Models
36.	1570683507	06:00PM-06:15PM	**PuneetDwivedi, Ravi Singh Pippal**, RKDF University Bhopal, India	Design and Performance Analysis of Routing Protocols for Delay Tolerant Networks

Thursday, Day 3: 3rdDecember, 2020

Session VIIIA: Deep Learning and Neural Networks (11:30 am – 12:45 pm)

Session Chair: Dr. Rajbir Kaur, CSE Dept. LNMIIT, Jaipur
Rapporteur: Dr. Ajay Khunteta

Sr.No	ID	Time	Authors	Paper
37.	1570683247	11:30 am – 11:45 am	**Afida Ahmad and Nora BaizuraMohd Isa** (UniversitiTeknologi Mara, Malaysia)	Using Bezier-Ball Function to Interpolate Positive Data and It's Application
38.	1570688433	11:45 am – 12:00 noon	**R KajaBanthaNavas and S Prakash Dr** (Sathyabama Institute of Science and Technology, India)	A Systematic Review on Wind Energy Resources Forecasting by Neural Network
39.	1570693179	12:00 noon -12:15 pm	**NurulFatinaYusni, Nur Farah HananiMohdZaim and SitiKhairulNizaSukri; NorehaCheSidik; Shamsul Jamel Elias; ZanariahIdrus (**UniversitiTeknologi MARA Kedah, Malaysia)	Quick Response Code: Medication Prescription
40.	**Invited 2**	12:15 pm-12:30 pm	**MarcinPaprzycki** (Systems Research Institute Polish Academy of Sciences Warsaw, Poland); **Maria Ganzha** (Warsaw	Development of a neural network library for resource constrained speech synthesis

			University of Technology Warsaw, Poland); **SujeendranMenon&PawełZarzycki** (Smartl Life Systems Sp. z O.O. Warsaw, Poland)	
41.	**1570694690**	12:30 pm – 12:45 pm	**Ms. Deepti (**Poornima College of Engineering, Jaipur), **Dr. Ajay Khunteta**(Poornima University, Jaipur), **AjitNoonia**(Institute of Engineering and Technology, Chitkara University, Punjab, India)	An Efficient Two Stage Clustering Algorithm for Signed Social Networks
42.	**1570694695**	12:45 pm – 1:00 pm	**Neeraj Kumar Verma, Sandeep Kumar, Mukesh Kumar** (Poornima University, Jaipur), **PRAFUL SAXENA,** (Senior Faculty, iNurture Education Pvt Ltd., TMU Moradabad, India3)	An Alternate Approach to Improve Access Time For Defining Frequent Item Set Through 'A-Apriori' In Textual Data Set
43.	**1570694707**	1:00 pm – 1:15 pm	**AjitNoonia** (Chitkara University Institute of Engineering and Technology, Chitkara University, Punjab), **AlpanaDahiya**(MVJCE, Bangalore, India), **Ajay Khunteta,** (Poornima University, Jaipur)	A Hybrid Vehicular Network – Inter-Region & Intra-Region Communication
44.	**1570693909**	1:15 pm – 1:30 pm	**Maged M. Eljazzar and Elsayed E. Hemayed (**Computer Engineering Dept., Faculty of Engineering, Cairo University, Giza 12613, Egypt)	Impact of Economic, Social and Meteorological Factors on Load Forecasting in Different Timeframes– A Survey

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Presentation Schedule
Technical Sessions
Track 2 - Electronics & Communication Engineering

Track Chair: Dr. GarimaMathur		Track Co-Chair: Dr. Ashok Kajla		
Tuesday, Day 1: 1st December, 2020				
Sr.No	ID	Time	Authors	Paper Title
Session IB: Wireless Communication & Networks (12:00 noon– 2:00 pm)				
Session Chair: Dr. MenkaYadav, ECE Dept., MNIT Jaipur				
Rapporteur: Dr. Ashok Kajla				
1.	1570680535	12:00PM-12:15PM	**Aasif Bashir Dar, Faroze Ahmad** ,(Islamic University of Science & Technology, India)	Realization of Mach-Zehnder Modulator with Ultrahigh Extinction Ratio at Maximum Transmission Bias Point
2.	1570680717	12:15PM-12:30PM	**BismaBukhari, GulamMohd Rather**, (National Institute of Technology, Srinagar, India)	Ground Plane Effects on the Performance of a Rectangular Microstrip Patch Antenna: A Study
3.	1570681381	12:30PM-12:45PM	**Ambresh G. Biradar,**(M. S. Ramaiah University of Applied Sciences, Bangalore, India)	A Comparative Study on Routing Protocols: RIP, OSPF and EIGRP and Their Analysis Using GNS-3
4.	1570682738	12:45PM-01:00PM	**Sathwic S and Saradeep M,**(Amrita VishwaVidyapeetham, India),ArpitaThakre(PES University)	Symbol Detection in Presence of Symbol Timing Offset Using Machine Learning Technique
5.	1570682871	1:00PM-1:15PM	**Shubham Jain, Zaurez Ahmad, Mohammad SaadAlam, Yasser Rafat,**(Aligarh Muslim University, India)	Battery Swapping Technology
6.	1570682887	1:15PM-1:30PM	**A K Gandharva, J CH L Ramoji, K P Akshay(**Amrita VishwaVidyapeetham, Bengaluru, India), ArpitaThakre, (PES University, Bengaluru, India)	Dual Mode OFDM-IM With Multiple Choice of Constellations
7.	1570683223	1:30PM-1:45PM	**ZainabHussam Al-Araji,**(University of Baghdad, Iraq**), Nada Ali Swaikat**(University of Voronezh State Technical, Syria),**Valeria Korneeva**(Voronezh State Technical University, Russia),**Hassan ALI Souikat(**Voronezh State University, Russia),**AlevtinaSergeevnaSamofalova**, (Voronezh State Technical University, Russia)	The New Way of Estimating the PCB 's Lifetime of Fatigue Using the Principle of Linear Accumulated Damage in Various Boundary Condition

Sr.No	ID	Time	Authors	Paper
8.	1570689026	1:45PM-2:00PM	**Kailash Chandra Bandhu,**(ShivajiraoKadam Institute of Technology and Management - Technical Campus, Indore, MP, India),**Ashok Bhansali,**(OP Jindal University, Raigarh, CG, India)	Comparison of Transmission Control Protocol Variants for Two Way Transfer and Propagation Model With WiMAX Network Bandwidth Asymmetry

Session II B: Digital Electronics(03:00 pm– 04:15 pm)

Session Chair: Dr. Aditya Pundir, ECE Dept. Arya COET, Jaipur
Rapporteur: Dr. AnilaDhingra

Sr.No	ID	Time	Authors	Paper
9.	1570667817	03:00PM-03:15PM	**VidhatriGujela**, (HMFA Memorial Institute of Engineering & Technology, India), **Om Prakash Gujela,**(Bakhtiyarpur College of Engineering, Patna, India)	Multiple Module Manipulator with Control Strategy for Minimally Invasive Surgery
10.	1570667822	03:15PM-03:30PM	**VidhatriGujela,**(HMFA Memorial Institute of Engineering & Technology, India), **Om Prakash Gujela,**(Bakhtiyarpur College of Engineering, Patna, India)	Emergence of Nanotchnology in Sensing and Actuation of Biorobotics
11.	1570681631	03:30PM-03:45PM	**Debadrata Sarkar, Aman Arora &Shibendu Roy,**(National Institute of Technology Durgapur, India),**Sayantan Pal, Amit Kumar,**(CSIR-Central Mechanical Engineering Research Institute Durgapur, India)	Estimation of Transmission Force in Assistive Devices Using Conductive Liquid Metal Based Sensorized Pneumatic Artificial Muscle
12.	1570682220	03:45PM-04:00PM	**PreetiSahu,**(Poornima University, India)	Comparative Analysis of Different Clock Gating Techniques
13.	1570686116	04:00PM-04:15PM	**JeetKishorbhaiVora, JaineelPurani and Vipin Shukla,**(PanditDeendayal Petroleum University, India)	Design of Novel Time Monitored Touchless Operation Using 555 Timer for Automatic Dispenser

Session IIIB: VLSI, VHDL & Chip Level Design(04:30 pm– 06:00 pm)

Session Chair: Dr. Rajnish Sharma, Dear Research & Academics, Chitkara University, Punjab
Rapporteur: Mr. Durgesh Kumar

Sr.No	ID	Time	Authors	Paper
14.	1570657915	04:30PM-04:45PM	**JasdeepDhanoa&Manibha Sharma,**(Indira Gandhi Delhi	Smart Logic Built in Self-Test in SOC
15.	1570662928	04:45PM-05:00PM	**AditiChhabra&JasdeepDhanoa,**(Indira Gandhi Delhi Technical University	A Design Approach for MAC Unit Using Vedic Multiplier
16.	1570687640	05:00 PM-05:15PM	**PriyanshiGoyal,**(University of Delhi, India),**Harsupreet Kaur,**(University of Delhi, South Campus, India)	Analytical Modeling and Design of Ga2O3 MOSFET

Sr.No	ID	Time	Authors	Paper
17.	**1570688044**	05:15PM-05:30PM	**Swati Sharma,**(Guru Gobind Singh Indraprastha University, India)	Schottky Barrier Double Surrounding Gate MOSFET for High-Frequency Implementation
18.	**1570691686**	05:30PM-05:4+5PM	**Payal Bansal, Devendra Kumar Somwanshi,**Poornima College of Engineering, Jaipur	Study of MSPA in Aspect of Design & Parameter With Three Different Substrate Materials
19.	**1570686180**	05:45PM-06:00PM	**HimaniGoyal Sharma,**(Poornima College of Engineering) **Rina Sharma, (**I. K. Gujral Punjab Technical University, Jalandhar, Punjab**), Devendra Somwanshi** (Poornima College of Engineering, Jaipur)	A Comparison of Lifetime in WSN with Static and Mobile Sink

Wednesday, Day 2: 2nd December, 2020

Session IV B: Smart Antennas and Wave Propagation(08:00am– 09:30 am)

Session Chair: Dr. Sanjeev Yadav, ECE Dept., WCOE, Ajmer
Rapporteur: Dr. Anila Dhingra

Sr.No	ID	Time	Authors	Paper
20.	**1570682500**	08:00AM-08:15AM	**PallavRawal,**(SKIT &Manipal University Jaipur, India), **SanyogRawat**, (Manipal University Jaipur)	A Bowtie Shaped Frequency Reconfigurable Microstrip Patch Antenna With Wide Coverage Area
21.	**1570683741**	08:15AM-08:30AM	**DurgaSuryachandGopavajhula,**(NITK, Suratkal, India), **Sandeep Kumar**, (NITK, Karnataka, India),**V Narasimhadhan A**, (NITK, India)	Dual-Band Antipodal Vivaldi Antenna for Wireless Neural Monitoring Applications
22.	**1570683594**	08:45AM-09:00AM	**DeepeshSahoo,** (PES University, India),**Abhishek Deshpande,**(PES University, India),**Sunita M S**(PES University, India)	Study of Different Adders Using Full Swing Gate Diffusion Input
23.	**1570688164**	09:00AM-09:15AM	**Mahendra Singh, Durgesh Kumar**(Poornima College of Engineering, Jaipur)	Design and Analysis of Ultra High Speed 16 Channel Cascaded EDFA-DWDM Network With Post Dispersion Compensations Using Optimization of Fiber Bragg Grating

Session V B: Wireless Communication & Networks(09:30 am– 10:30 am)

Session Chair: Dr. Amit Singhal, ECE Dept. Bennett University, Noida
Rapporteur: Dr. Anila Dhingra

Sr.No	ID	Time	Authors	Paper
24.	**1570694059**	09:30AM-09:45AM	**Shahbaz Akhtar**(Indian Institute of Technology Patna, India), **Jitendra Gupta** (Indian Institute of Technology, Patna, India), **Pramit**	Heuristic-Based Cost-Efficient C-RAN Fronthaul Deployment Over TWDM-PON

Sr.No	ID	Time	Authors	Paper
			Biswas(Indian Institute of Technology Patna, India), **AneekAdhya**(Indian Institute of Technology Kharagpur, India)	
25.	**1570681696**	09:45AM-10:00AM	**Kanchan Tiwari Swami** (RGPV Bhopal, India)	A Review of LiFi Technology
26.	**1570692193**	10:00AM-10:15AM	**Gayathri Narayanan**(Amrita VishwaVidyapeetham-AMRITA University, India), **Anupam Pedapudi** (Amrita Vishwa Vidyapeetham Bengaluru, India), **Sai Teja Kurapati** (Amrita Vishwa Vidyapeetham Bengaluru, India), **Dhanesh G. Kurup** (Amrita University, Bengaluru Campus, India)	Performance Analysis of Sensor Communications for Agriculture Systems Using SDR Platform
27.	**1570689168**	10:15AM-10:30AM	**Rami Mohaisen**(Jordan University of Science and Technology, Jordan),**Mamoun F. Al-Mistarihi**(Jordan University of Science and Technology, Jordan), **Khalid A. Darabkh**(The University of Jordan, Jordan)	Outage Probability Evaluation for Relay-Based DF Cooperative Diversity Systems with Multipath Fading Channels and Non-identical Interferers

Session VI B: Digital Signal Processing(12:30 pm– 01:30 pm)

Session Chair: Dr. Ashwini Kumar, ECE Dept. Amity University, Jaipur
Rapporteur: Mr. Durgesh Kumar

Sr.No	ID	Time	Authors	Paper
28.	**1570680957**	12:30PM-12:45PM	**MadhavPrabhu,** (MEC, Oman)	A Comprehensive Survey on Implementation of Image Processing Algorithms Using FPGA
29.	**1570680992**	12:45PM-01:00PM	**PushpaKoranga**, (BSDU, Jaipur)	A Review on Classification of Different Techniques of Image Dehazing
30.	**1570681725**	01:00PM-01:15PM	**AtharvPaliwal**(New Delhi, India),**BhavikMohindroo and KritiSuneja,**(Delhi Technological University, India)	Hardware Design of Image Encryption and Decryption Using CORDIC Based Chaotic Generator
31.	**1570682710**	01:15PM-01:30PM	**Ashish Sharma &SatyasaiJagannath Nanda,**(Malaviya National Institute of Technology Jaipur, India)	Timely Detection of Seismic Waves in Ground Motion Data Using Improved S-Transform
32.	**1570686195**	01:30PM-01:45PM	**DevendraSomwanshi, KalpitJain,Dhananjay Kumar(**Poornima College of Engineering, Jaipur) '	Optimal ParameterSelection for Multi Blade Granite Block Cutting Machine Ensuring High Production

| **Session VII B:** EMI and EMC Technology(04:30 pm– 06:00 pm) |

| **Session Chair: Dr. Abhishek Sharma, ECE Dept. LNMIIT Jaipur**
Rapporteur: Dr. Ashok Kajla |

Sr.No	ID	Time	Authors	Paper
33.	1570681672	04:30PM-04:45PM	**Mamta Sharma**, (Global Institute of Technology, India)**, Ajay Yadav, SarthakSinghal&Ritu Sharma** (Malaviya National Institute of Technology Jaipur, India)	Design and Simulation of Flexible Substrate Based Wearable Antenna for WBAN Applications
34.	1570680778	04:45PM-05:00PM	**Shivangi Sharma&JasdeepDhanoa** (Indira Gandhi Delhi Technical University for Women, Delhi, India)	Analog Circuit Implementation of a Cortical Neuron
35.	1570687745	05:00PM-05:15PM	**PreetiGoyal,**(MAIT Sec-22 Rohini Delhi, India)	Controlling Ambipolarity and Rising Ion in TFETs for Enhanced Reliability: A Review
36.	1570694209	05:315M-5:30PM	**Anil singhparihar,** Department of Computer Science and Engineering,,Delhi Technological University, New Delhi, India	A Study on Image Matting Techniques
37.	1570681628	05:30PM-05:45PM	**Aman Arora and Debadrata Sarkar** (National Institute of Technology Durgapur, India);**Sayantan Pal** (CSIR-Central Mechanical Engineering Research Institute, India); **Amit Kumar (**CSIR-Central Mechanical Engineering Research Institute Durgapur, India); **SoumenSen**(CSIR - Central Mechanical Engineering Research Institute, India); **Shibendu Roy** (National Institute of Technology Durgapur, India)	A Multi-technique Measurement and Estimation ofVolume for Pneumatic Artificial Muscle

5th IEEE International Conference
On
Recent Advances and Innovation in Engineering
(ICRAIE-2020)
(IEEE Record # 51050)
Presentation Schedule
Technical Sessions
Track 3 - Electrical Engineering

Track Chair: Dr. VirendraSangtani	Track Co-Chair: Dr. Praveen Sonwane

Tuesday, Day 1: 1st December, 2020

Sr.No	ID	Time	Authors	Paper Title

**Session IC: Integrated Conventional and Renewable Power Generation
(12:00 Noon-02:00 PM)**

**Session Chair:Dr. Gagandeep Kaur, E & IC Dept. Thapar University, Patiyala
Rapporteur: Dr. Himani Goyal**

Sr.No	ID	Time	Authors	Paper Title
1.	1570682774	12:00PM-12:15PM	Saksham Agarwal ; Mohammad SaadAlam ;Yasser Rafat ; Mahdi ShafaatiShemami (Aligarh Muslim University, India)	Data Analysis of Grid-Connected Solar Setup and Regression Based Predictive Models
2.	1570682794	12:15PM-12:30PM	Dr. Javed Khan Bhutto; Dr.Abdulwasa B. Barnawi; Mohammad Abdullah Mohammad Aldosari (King Khalid University, Abha, KSA, India); Dr.Sunil Kumar Gupta (Poornima University Jaipur, India)	Integration of Solar Photovoltaic Systems to Grid Using Loss Sensitivity Factor Method for Improvement of Voltage Profile
3.	1570682903	12:30PM-12:45PM	Smriti Jain (Reader SKIT M&G, India); Ramesh Pachar (SKIT, India); LataGidwani (Rajasthan Technical University, India)	Reliability Constrained Day Ahead Unit Commitment With Optimal Spinning Reserve Allocation for Solar Integrated Power System
4.	1570684412	12:45PM-1:00PM	Uma Yadav (J C bose UST, YMCA,Faridabad, Haryana, India); Dr.Anju Gupta (J C bose UST, YMCA,Faridabad, Haryana, India)	Current Harmonic Mitigation in Grid Tied Solar Photovoltaic System via PRES
5.	1570688086	01:00PM-1:15PM	DikshaMurlidharKharat (Government College Of Engineering, Aurangabad, India); Prof. M.S. Morey (Government College Of Engineering, Aurangabad, India)	Solar PV Fed Proposed Simple Boost Controlled Z-Source Inverter for Grid
6.	1570688295	01:15PM-1:30PM	AnushikaBandara (Univetrsity of Moratuwa, Sri Lanka); KTM UdayangaHemapala (University of Moratuwa, Sri Lanka); AkilaHerath (University of Peradeniya, Sri Lanka)	Optimal Sizing and Economic Evaluation of a Photovoltaic Integrated Energy System - A Case Study for a Semi-Urban Area in Sri Lanka

SrNo	ID	Time	Authors	Paper
7.	1570657695	01:30PM-1:45PM	**BhuvneshRathor** (Student, Electrical Engineering, Rajasthan Technical University, Kota, Kota, India); **Gaurav Jain** (Assistant Professor, Electrical Engineering Poornima College of of Engineering, Jaipur, India); **Rajkumar Jain** (Assistant Professor, Elect. &Comm.Engg. Poornima College of Engineering, Jaipur, India**); PravinSonwane** Professor, Electrical Engineering Poornima College of of Engineering, Jaipur, India	Smart Modern AC Microgrid Monitoring System using Power Line Communication

Session IIC: Power Quality (03:00PM-04:00PM)

Session Chair:Dr. Pushpendra Singh, EE Dept. JKLU Jaipur
Rapporteur: Dr. Deepika Chauhan

SrNo	ID	Time	Authors	Paper
8.	1570653220	03.00PM-03.15PM	**DheerajVerma** (IIT, Jammu, India); **Anup Shukla** (IIT, Jammu, India); **Prerna Jain** (MNIT Jaipur, India)	COVID19: Impact on Indian Power Sector
9.	1570677374	03:15PM-03:30PM	**Praful Vijay Nandankar; Prashant P. Bedekar; Prashantkumar V. Dhawas** (Electrical Engineering Department, Government College of Engineering Chandrapur, Chandrapur, India)	Variable Switching Frequency for Synchronous Buck Converter
10.	1570678291	03:30PM-03:45PM	**AradhanaKhillo; SushreeSangitaPatnaik** (Department of Electrical Engineering, PMEC, Berhampur, India)	Performance Study of 6-Pulse HVDC-VSC Using Particle Swarm Optimization(PSO) Based Controller in d-q Reference Frame Under Transient AC Fault Conditions

Session IIIC: Power Quality (04:30PM-06:00PM)

Session Chair: Dr.RAVINDRA JOSHI | Project Head-MARAFIQ Smart Metering Project, Saudi Arabia
Rapporteur: Dr. Praveen Sonwane

Sr.No	ID	Time	Authors	Paper
11.	1570680988	04:30PM-04:45PM	**Praful Vijay Nandankar; Prashant P. Bedekar; Prashantkumar V. Dhawas** (Electrical Engineering Department, Government College of Engineering Chandrapur, Chandrapur, India)	Efficient DC-DC Converter Using Variable Switching Frequency Digital Controller

Sr.No	ID	Time	Authors	Paper
12.	**1570681163**	04:45PM-5:00PM	**Mahendra Kumar Gupta** (National Institute of Technology Jamshedpur, India); **NutanTomar** (Indian Institute of Technology Patna, India); **Dipa Sharma** (SDM Govt PG College Doiwala, Dehradun, India); **JuhiJaiswal** (Indian Institute of Technology Patna, India)	PD Observer Design for Descriptor Systems with Unknown Inputs: Application to Infinite Bus System
13.	**1570677524**	05:00PM-05:15PM	**ShailendraKasera; RajlakshmiNayak** (Department of Mechanical Engineering, JK Lakshmipat University, India); **Shishir Chandra Bhaduri** (Dean, Faculty of RAC, Automotive, Electrical Skills, Bhartiya Skill Development University, Jaipur, India)	Energy Efficiency Analysis of Variable Speed DC Compressor Using R290

Wednesday, Day 2: 2nd December, 2020

Session IVC: Advances of Renewable Energy Sources & Electric Drives (08:00AM-09:30AM)

Session Chair: Dr. Nandkishore Gupta, Govt. COE Ajmer
Rapporteur: Dr. Himani Goyal

Sr.No	ID	Time	Authors	Paper
14.	**1570679056**	08:00AM-08:15AM	**HarshitKargeti** (Department of Information & Technology, ABES Institute of Technology, Ghaziabad, UP-India); **ArpitBhushan Sharma** (Student Member IEEE, Department of Electrical & Electronics Engineering, KIET Group of Institutions, Ghaziabad, UP-India) ; **Brijesh Singh** (Senior Member IEEE, Department of Electrical & Electronics Engineering, KIET Group of Institutions, Ghaziabad, UP-India)	Performance evaluation of PV integrated DC-DC converter with load demand, irradiance, and temperature variations
15.	**1570681656**	08:15AM-08:30AM	**Trisha Bora, Prateekee Chatterjee and Saradindu Ghosh** (National Institute of Technology, Durgapur, India)	Fuzzy Logic Based Control of Variable Wind Energy System
16.	**1570682759**	08:30AM-08:45AM	**VaishaliShirsath** (Sandip University, India); **Rahul Agrawal** (Sandip University Nashik, India)	Optimization Through Wind Modeling by Means of Mechanical Design to Enhance Wind Power Generation and System Reliability

Session VC: Advances of Renewable Energy Sources & Electric Drives (09:30AM-10:30AM)				
Session Chair: Dr. Subrata Mukhopadhyay			Rapporteur: Dr. Himani Goyal	
Sr.No	ID	Time	Authors	Paper
17.	1570688363	09:30AM-09:45AM	**Ms. Rutuja Suresh Zargad** (M.Tech Student, Department of Electrical Engineering,Government College of Engineering, Aurangabad); **Prof. Meghraj S Morey** (Department of Electrical Engineering,Government College of Engineering, Aurangabad)	Standalone PV Based Vector Controlled Induction Motor Drive for Renewable Energy Application
18.	1570688651	09:45AM-10:00AM	**VaishaliShirsath; Rahul Agrawal**(Department of Electrical and Electronics Engineering, Sandip University, Nashik, India)	A Review of Wind Station Data Modeling for Wind Turbine Reliability Enhancement to Optimize Wind Energy Considering Turbine Design
19.	1570684733	10:00AM-10:15AM	**PoonamDhabai** (PES Modern College of Engineering, India); **Neeraj Tiwari** (Poornima University, Jaipur, India)	Computation of Locational Marginal Pricing in the Presence of Uncertainty of Solar Generation
Session VIC : Hybrid Electric Vehicles (12:30PM-01:30PM)				
Session Chair: Dr. Kailash Sharma, EE Dept, NIT Jalandhar Rapporteur: Dr. Deepika Chauhan				
Sr.No	ID	Time	Authors	Paper
20.	1570681845	12:30PM-12:45PM	**Karthika B.** (Department of Electrical Engineering, College of Engineering Trivandrum, Trivandrum, India); **V.R.Jisha**(Department of Electrical Engineering, Government Engineering College Thrissur, Thrissur, India)	Nonlinear Optimal Control of a Two Wheeled Self Balancing Robot
21.	1570682112	12.45PM-01.00PM	**Ahmed WaquasUsmani** (Aligarh Muslim University, India); **Mohammad SaadAlam** (Aligrah Muslim University, India); **Yasser Rafat** (Aligarh Muslim University, India); **Ibrahim Al Saidan** (Qassim University, Saudi Arabia)	An IoT Based Solution to Avoid Venting in Lithium Ion Battery Due to Overcharging
22.	1570682623	04:30PM-04:45PM	**Charu Singh** (Aligarh Muslim University, India); **Sanchari Deb** (VTT Technical Research Centre, Finland); **Mohammad SaadAlam** (Aligrah Muslim University, India); **Yasser Rafat** (Aligarh Muslim University, India)	Analytical Strategy for Deployment of EV Fast-Charging Stations
23.	1570682719	04:45PM-05.00PM	**MohdJaved** (Aligarh Muslim University, India); **Sanchari Deb** (VIT Technical Research Centre, Espoo, Finland); **Mohammad SaadAlam**; **Dr. Yasser Rafat**; **Prof. Salman Hameed** (Aligarh Muslim University, India)	Impact of Vehicle to Grid on Power System

Session VIIIC: Power System Stability and Control (11:30AM-1:30PM)

Session Chair: Dr. Rachana Garg, EE Dept., DTU, Delhi
Rapporteur: Dr. Himani Goyal

Sr.No	ID	Time	Authors	Paper
24.	1570681559	11:30AM-11.45AM	**Suresh K. Jamure; P. Agnihotri** (Indian Institute of Technology Bhilai, India)	Determining the Inter-Area Modes of the Power System Network Using Circuit Analogy
25.	1570682751	11:45AM-12.00PM	**PravinSonwane, EED** (Poornima COE, EED,PCE,Jaipur, India); **VaishaliShirsath**(EED, Sandip University, Nashik, India); **Himani Sharma**(EED, Poornima COE, Jaipur, India); **Gaurav Jain**(EED, Poornima COE, Jaipur, India)	Failure Analysis of 30 Bus System by Capacitor Sizing and Placement
26.	1570682924	12:00PM-12.15PM	**Komal Sharma** (SKIT M&G Jaipur, India); **Sarfaraz Nawaz** (SKIT M&G Jaipur, India)	Allocation of DG Units in Distribution System to Minimize Reactive Power Loss
27.	1570688062	12:15PM-12.30PM	**MaanviBhatnagar** (National Institute of Technology Raipur, India); **AnamikaYadav** (National Institute of Technology, Raipur Raipur, India)	Fault Detection and Classification in Transmission Line Using Fuzzy Inference System
28.	1570694680	12.30PM--12.45 PM	**Arpita Singh , Ashish Raj , Dr. Manoj Gupta, Mohammed Sayeeduddin Habeeb , Dr. Sunil Kumar Gupta,** 1-2 Assistant Professor, Department of Electrical and Electronics Engineering, Poornima University, Jaipur, Rajasthan, India 3,5 Professor, Department of Electrical and Electronics Engineering, Poornima University, Jaipur, Rajasthan, India 4 Lecturer, Department of Electrical Engineering, college of Engineering, King Khalid University, Abha, KSA	TWDM-PON: The Enhanced PON for Triple Play Services
29.	1570694770	12.45 PM-01:00PM	**PushpendraPratap Singh1 , Ashish Raj2 , Dr. M Ram Kumar Raja3 , Mohammed abdul muqeet4** 1M.Tech (Scholar), Department of Electrical and Electronics Engineering, Poornima University, Jaipur, Rajasthan, India 2Assistant Professor, Department of Electrical and Electronics Engineering, Poornima University, Jaipur, Rajasthan, India 3 Associate Professor, Department of Electrical Engineering, college of Engineering, King Khalid University, Abha, KSA 4 lecturer, Department of Electrical Engineering, college of Engineering, King Khalid University, Abha, KSA	Interfacing Problems of Programmable Logic Controller In Hardware Replacement

Reliability Constrained day ahead Unit Commitment with optimal spinning reserve allocation for solar integrated power system

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Abstract: **Unit commitment is becoming a complex problem with the increasing constraints due to the restructuring of power system and the escalation in inclusion of various types of Distributed Generation sources. These sources offer a significantly lower generation compared to the conventional sources. Also they pose synchronising problems with the grid since the electricity cannot be transmitted over long distances and thus they provide the localized consumption of energy.**

In this paper, unit commitment is performed with optimal spinning reserve allocation and the assessment of reliability in terms of loss of load, in the presence of solar integration into the power system. The 'Loss Of Load Probability' (LOLP) index is utilized for determining the level of reliability of the obtained results. The Spinning Reserve (SR) considered in the UC calculations, is a constant value and it is not varied with respect to the changes in solar generation. Here, the spinning reserve optimality is determined with respect to the changes in power injection due to the solar energy integration into the power system.

Dynamic programming technique is applied on two systems (four generator and ten generator systems) and the results are compared with those obtained without the consideration of LOLP, SR optimality and solar energy sources.

Keywords : Unit Commitment, LOLP, Reliability, spinning reserve, solar integration.

NOMENCLATURE

I	Index of generators, i=1 to N
N	Total number of generators
T	Index of hours/time periods, t=1 to T
T	Total time periods
a_i, b_i, c_i	Coefficients of quadratic fuel cost curves of generating unit, i
AS_{it}	Boiler cool down coefficient of unit 'i' at time period 't'
BM_{it}	Base Maintenance Cost of unit 'i' at time period 't'
BS_{it}	Boiler Start-up cost of unit 'i' at time period/hour 't' ($/hour)
$Cost_{gen}$	Generation cost of the plant ($/hour)
$Cost_{fuel,it}$	Fuel cost of unit 'i' at time period/hour 't' ($/hour)
D_{it}	Number of hours the unit 'i' is offline, before it is to be committed again at hour 't' (hour)
Dm_t^f	Forecasted Demand at hour 't' (MW)

IM_{it}	Incremental Maintenance Cost of unit 'i' at time period 't' ($/hour)
MC_{it}	Maintenance Cost of unit 'i' at time period 't' ($/hour)
MS_{it}	Maintenance Start-up cost of unit 'i' at time period 't' ($/hour)
P_{it}	Generated power of unit 'i' at time period 't'(MW)
P_i^{min}	Minimum power generation limit of unit 'i' (MW)
P_i^{max}	Maximum power generation limit of unit 'i' (MW)
S_{it}	State (ON/OFF) of generator 'i' at time period 't'; '0' for OFF and '1' for ON
SD_{it}	Shut Down cost of unit 'i' at time period 't' ($/hour)
ST_{it}	Start-up cost of unit 'i' at time period 't' ($/hour)
TS_{it}	Turbine Start-up cost of unit 'i' when it is offline, before it is to be committed again at hour 't' ($/hour)

I. INTRODUCTION

Unit commitment is a widely researched topic and it becomes a significant one in the restructured power system scenario. Many techniques have been researched and new techniques evolved over time to analyze the system.

UC is proposed using Forward Dynamic Programming (FDP) [1] taking the basic system constraints. FDP gives minimum cost, optimal results compared to that obtained by the application of the new and emerging techniques. With the advancements in simulation tools, the simulation time is also reduced [1]. Application of FDP for performing unit commitment is also stressed in [2]. When an optimal solution is required considering uncertainties and diverse scenarios, stochastic UC is solved, though it doesn't take 'reliability' contraint into account. The fundamentals of stochastic unit commitment with uncertain factors like forecast errors, equipment failure etc are discussed in [3]. Many techniques are proposed for UC in the previous few decades and a comparison of various such methods is provided in [4] in 2020, giving a reference to all the researchers in the field.

There are many system characteristics which are considered for UC, along with the newer constituents which are analyzed by various pioneers in the field. Resilience constrained UC considering the weather factors is explored in [5]. The reliability analysis with the solar generation are examined in [6], while the SR optimization is assessed in [7] for analyzing UC. As the focus on renewable generation by solar & wind power is increasing, the analysis of such small plants becomes necessary in the restructured domain of power systems. In this regard, analysis of solar photovoltaic plants is provided [8,9] by various researchers. A SWOT analysis of the solar energy generation is presented in [10]. UC has been worked upon in the previous decade with many constraints, like reliability [11], demand response [12] and distributed generation. Various techniques are employed for performing UC like FDP, PSO, Differential Evolution (DE), Genetic Algorithms (GA) etc. A comparison of FDP and PSO techniques is presented in [13].

In the past half century and the present times, UC is being studied over various networks like power system networks, Gas-Power network [14] and microgrids [12]. The various factors like hurricanes [15], clustering [16] etc. are also studied with UC. In another recent paper [17] UC is solved by PSO in the presence of two simultaneous faults into the generation system. Alinson Santos Xavier et.al [18] proposed an algorithm by which some of the described transmission constraints can be eliminated in the problem of security constrained UC, when solved using mixed integer linear programming.

A modified Bender's algorithm is presented in [19] to solve security constrained UC with N-1 security constraints and wind uncertainty. A robust solution of the UC problem with economic dispatch, using box based decomposition is analyzed in [20]. In [21] multi stage UC with storage is studied in continuous time domain and is analyzed by stochastic approach. Various other techniques and.or algorithms have been suggested by researchers. In this paper, the problem of unit commitment is analyzed with reliability and solar power generation along with the SR optimization calculations.

The paper is organized as follows.

The UC problem with the necessary constraints considered in this paper and the added reliability constraint, is reviewed in Section II. Dynamic Programming is discussed in short, in Section III. All the related relevant results of UC by FDP, for the 4-G and 10-G systems are compiled and compared in Section IV. Conclusion and the extent of the further work that can be done, are put forward in the next Section.

II. PROBLEM FORMULATION

The main objective of unit commitment is to find out which combination of generators yields the most cost effective solution, in terms of the various constraints briefly described below[1].

Objective function:
Minimize

$$Cost_{gen} = \sum_{i=1}^{N}\sum_{t=1}^{T}[Cost_{fuel,it}(P_{it}) + MC_{it}(P_{it}) + ST_{it} + SD_{it}] \quad (1)$$

Constraints:

i) Fuel Cost (FC) of individual generator *'i'*, is evaluated by its quadratic approximation equation, given by,

$$Cost_{fuel,it}(P_{it}) = (a_i P_{it}^2 + b_i P_{it} + c_i) \quad (2)$$

ii) Maintenance cost (MC) is composed of Base MC (BM_{it}) and Incremental MC (IM_{it}), defined by the following expression

$$MC_{it}(P_{it}) = BM_{it} + IM_{it}(P_{it}) \quad (3)$$

iii) Start-up cost (ST_{it}) comprises Turbine Start-up cost (TS_{it}), Boiler Start-up cost (BS_{it}) and Maintenance Start-up cost (MS_{it}), defined by the following equation

$$ST_{it} = TS_{it} + \{1 - e^{Dit/ASit}\}BS_{it} + MS_{it} \quad (4)$$

where, D_{it} = Number of hours a unit is down,

AS_{it} = Boiler Cool Down Coefficient

iv) Shut Down Cost (SD_{it}) is the cost that is required for shutting down a generating unit in operation,

$$SD_{it} = KP_{it} \quad (5)$$

where, K = Incremental shut down cost

v) Minimum up time: It is the number of hours the unit must be in 'ON' state, before it can be shut off.

vi) Minimum down time: A unit must be in 'OFF' state for a certain number of hours before it can be brought online. This time is known as minimum down time.

vii) Maximum and minimum output limits on generators: The active power output of each generating unit must be within the minimum and maximum operating limits, specified by the following inequality constraint,

$$P_i^{min} \leq P_{it} \leq P_i^{max} \quad (6)$$

viii) Ramp rate : The rate of change of active power output of generators (increase or reduction) per minute, must not exceed it's maximum specified value.

$$\nabla P_{it} \leq \nabla P_i^{max} \quad (7)$$

ix) Power Balance equation: The total active power generated by all units must supply the forecasted load demand and the power system losses.

$$\sum_{i=1}^{N} S_{it} P_{it} = Dm_t^f + losses \quad (8)$$

x) Must run Units: These units include those which must be online due to operating or other constraints/limitations.

xi) Must out Units: The units which are on forced outages or out due to maintenance are must out units. These are not available for commitment.

xii) Spinning Reserve: These generation units are put online for avoiding load interruption. Their capacities are specified in terms of excess MW.

xiii) Crew: Crew size is a deciding factor in the commitment and de-commitment of generating units. Generating plants with a limited crew may not run or shut down two or more units simultaneously.

The additional constraints are discussed below:

xiv) Reliability assessment in terms of LOLP index calculation: The LOLP index is given by the following equation

$$\text{LOLP} = \sum_{i=1}^{n} P[D_m^f > C_{G,i}]$$

(9)

For an expected load demand D_m^f and the available generation capacity $C_{G,i}$, if the probability of unavailability of generation exceeds the pre-defined limit of LOLP, then appropriate measures need to be taken.

The limit for LOLP is decided by electricity authorities, for example in India it is decided by the Central Electricity Authority (CEA). The relevant data is available on it's website www.cea.nic.in

III. TECHNIQUE FOR DETERMINING CONSTRAINED UC PROBLEM

The technique used for determining the optimal solution of UC is Dynamic Programming with the estimation of optimal SR, while the solar energy generation is taken into account. The flowchart for the applied technique is shown in Fig.1.

A. Forward Dynamic Programming (FDP)

There are many methods to solve the unit commitment problem, out of which FDP gives the most cost effective solution when compared with other new emerging techniques [1].
As per the FDP approach, the minimum cost of supplying electricity to *x* MW (which is equal to the forecasted demand of that hour) is evaluated by dividing the function $f_n(x)$ into two functions, $f_n(y)$ and $f_{n-1}(x-y)$ [4].

$$f_n(x) = \min .[f_n(y) + f_{n-1}(x-y)]$$

(10)

where,
$f_n(x)$ = minimum cost of carrying *x* MW load on *n* generating units
$f_n(y)$ = cost of carrying *y* MW load on the nth generating unit
$f_{n-1}(x-y)$ = minimum cost of carrying (*x-y*) MW load on the remaining (*n*-1) generating units.

B. Spinning Reserve Estimation

The SR of both the test systems are varied in the following sequence so as to obtain optimal results:
i) Initially the unit commitment problem is run with spinning reserve equal to 10 percent spinning reserve of the total generating capacity.
ii) The solar energy generation is added into the system, (equal to eight percent of the total generation capacity). The SR is gradually reduced from 10 percent to 5 percent until the optimal balance between the two, is reached.
iii) The results of all the simulations are recorded and the minimum cost result is evaluated. For this result, the value of SR is found out.

C. Solar Energy variation

The solar energy penetration into the system is assumed to be five percent of the installed capacity, for the two considered systems. However, the variation in generation due to the changes in solar intensity throughout the day, is considered. The solar generation is assumed to gradually increase from morning to noon and decrease from noon to evening. It is assumed to be injected in the power system, for ten hours in a day.
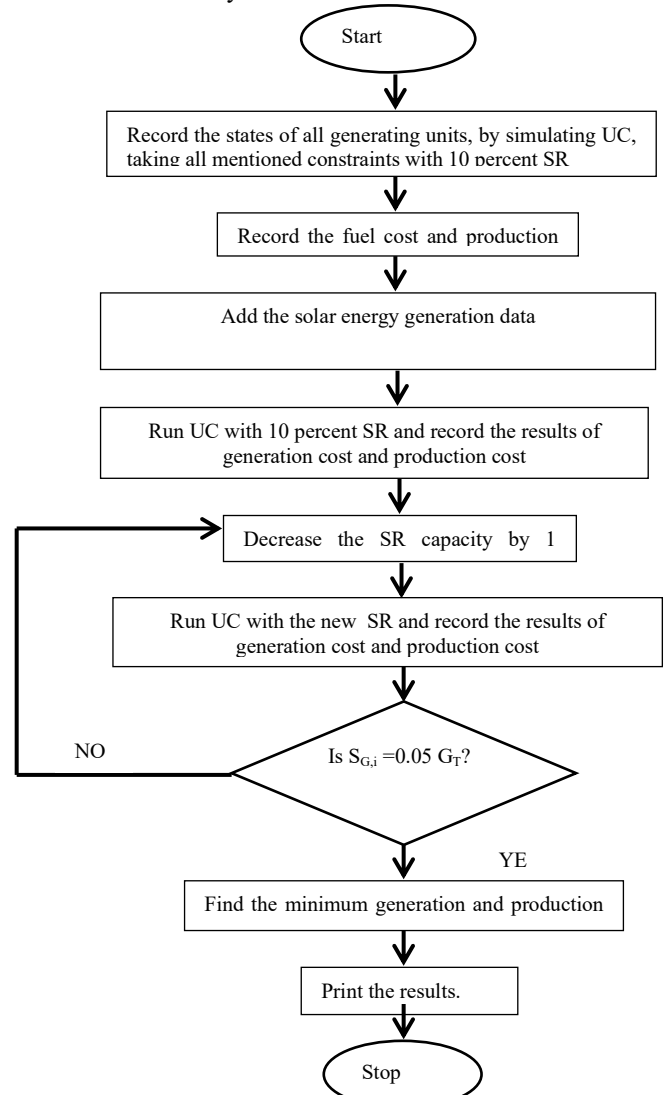

Fig.1. Flowchart of applied technique

IV. Results And Discussions

Forward Dynamic Programing (FDP) is applied for performing UC for the two test systems. These systems were considered for analysis by many other techniques. The first system consists of four thermal generators (4-G). The second system has ten generators (10-G). The parameters of both the systems are referred from [1]. The results of other techniques to which FDP is compared in Fig.1 and Fig.2, are referred from [1]. The results are summarised from Table I to Table VI.

A. 4-G System

This system is composed of four thermal generation units. UC is run taking into account the above mentioned factors (as per the process shown in Fig.1). The load demand is given for eight hours and the results are obtained in accordance.

The COPT and LOLP results are shown in Tables-I and II. The UC results are then evaluated (by processing the SR and solar energy data), which are compiled in Table-III. Fig.2 shows the comparison of costs with and without the application of the LOLP, SR and solar energy generation by FDP and various other techniques.

The generation cost is the minimum and the UC pattern is slightly different than that obtained with FDP while none of the constraints were considered [1].

Also, it took 0.4 seconds in performing simulation time which is appropriate and less due to only four generators in the system.

TABLE I. Capacity Outage Probability Table (COPT) for 4-G system (Maximum generation=690 MW)

Case	Generator out (G)	Max Capacity of G (MW)	Total Capacity available after outage of G (MW)	Probability of Generation Unavailability after outage of G
I	1	80	610	0.00050893= **P.I**
II	2	250	440	0.00095035= **P.II**
III	3	300	390	0.0008677095= **P.III**
IV	4	60	630	0.0006654456= **P.IV**

TABLE II. LOLP calculation for 4-G system (for 8-hour forecasted demand)
Expected value of LOLP=5%, aimed in 2006-07 by CEA

Hour, H	Forecasted load (in MW)	Loss Of Load Probability, LOLP
1	450	LOLP.I = P.II+P.III = 0.0018180615
2	530	LOLP.II = P.II+P.III = 0.0018180615
3	600	LOLP.III = P.II+P.III = 0.0018180615
4	540	LOLP.IV = P.II+P.III = 0.0018180615
5	400	LOLP.V = 0.0008677095
6	280	LOLP.VI = 0
7	290	LOLP.VII = 0
8	500	LOLP.VIII = P.II+P.III = 0.0018180615
LOLP =		0.009958017

TABLE III. UC solution for 4-G system by FDP

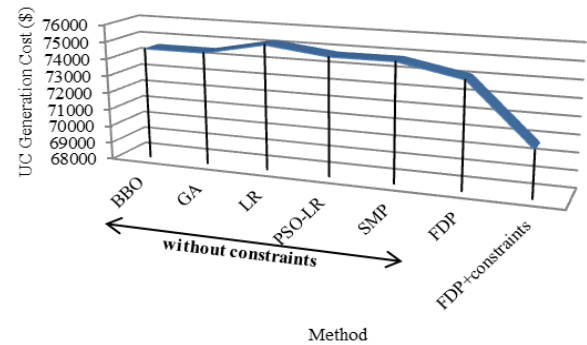| Hour	Cost$_{Fuel}$	Unit Status
0	0	0110
1	8783	0110
2	19579	**1110**
3	31647	**1111**
4	42168	**1110**
5	50112	**1011**
6	55225	**0010**
7	60571	**0010**
8	**70667**	**0110**

Fig. 2. UC generation cost for 4-G system

B. 10-G system

This system has ten thermal generation units. The generators are scheduled for twenty four hour forecasted load demand [1]. The COPT and LOLP results are compiled in Tables-IV and V. The UC results are summarized in Table-VI. Fig.2 shows the comparison of costs with and without the application of the LOLP, SR and solar energy generation by FDP and various other techniques. The cost of generation is $538920 and it is the lowest cost as compared with other techniques without constraints (shown in Fig. 2).

The time taken for simulation is about an hour, which is, not much considering the increase in the number of generators from the previous system.

TABLE IV. Capacity Outage Probability Table (COPT) for 10-G system (Maximum generation = 1662 MW)

Case	Generator out (G)	Max Capacity of G (MW)	Total Capacity available after outage of G (MW)	Probability of Generation Unavailability after outage of G
I	1	455	1207	0.000909
II	2	455	1207	0.000909
III	3	130	1532	0.00102
IV	4	130	1532	0.00102
V	5	162	1500	0.001041
VI	6	80	1582	0.0005102
VII	7	85	1577	0.0005102
VIII	8	55	1607	0.002
IX	9	55	1607	0..002
X	10	55	1607	0.002

Hour, H	Forecasted load (in MW)	LOLP$_i$
1	700	0
2	750	0
3	850	0
4	950	0
5	1000	0
6	1100	0
7	1150	0
8	1200	0
9	1300	0.001818
10	1400	0.001818
11	1450	0.001818
12	1500	0.002838
13	1400	0.001818
14	1300	0.001818
15	1000	0
16	1050	0
17	1000	0
18	1100	0
19	1200	0
20	1400	0.001818
21	1300	0.001818
22	1100	0
23	900	0
24	800	0
LOLP =		0.015564

TABLE VI. UC SOLUTION FOR 10-G SYSTEM, BY FDP

| Hour	Cost$_{Fuel}$	Unit Status
0	0	1 1 0 0 0 0 0 0 0 0
1	13683	1 1 0 0 0 0 0 0 0 0
2	28238	1 1 0 0 0 0 0 0 0 0
3	43403	1 1 0 0 0 0 0 0 0 0
4	61690	1 1 0 0 1 0 0 0 0 0
5	79901	1 1 0 0 1 0 0 0 0 0
6	100988	1 1 0 1 1 0 0 0 0 0
7	122347	1 1 0 1 1 0 0 0 0 0
8	145336	1 1 0 1 1 1 0 0 0 0
9	171115	1 1 1 1 1 1 0 0 0 0
10	199344	1 1 1 1 1 1 1 0 0 0
11	229160	1 1 1 1 1 1 1 1 0 0
12	260873	1 1 1 1 1 1 1 1 1 0
13	289008	1 1 1 1 1 1 1 0 0 0
14	316259	1 1 1 1 1 1 1 0 0 0
15	336279	1 1 0 1 1 0 0 0 0 0
16	357175	1 1 0 1 1 0 0 0 0 0
17	377195	1 1 0 1 1 0 0 0 0 0
18	399641	1 1 0 1 1 1 0 0 0 0
19	424876	1 1 0 1 1 1 1 0 0 0
20	455513	1 1 1 1 1 1 1 1 0 0
21	482764	1 1 1 1 1 1 1 0 0 0
22	505072	1 1 1 0 1 1 0 0 0 0
23	522867	1 1 1 0 0 0 0 0 0 0
24	**538920**	1 1 1 0 0 0 0 0 0 0
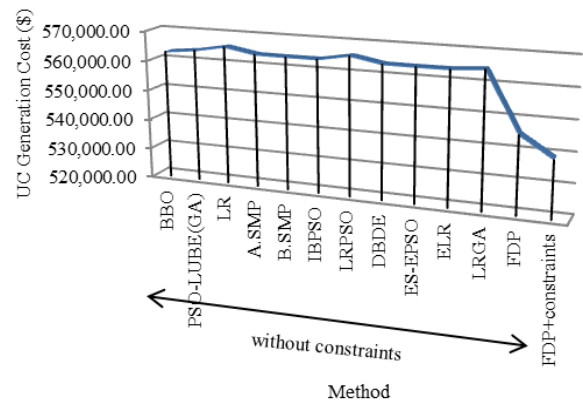
Fig. 3. UC generation cost for 10-G System

V. CONCLUSION

There are many conventional methods to solve UC and new techniques are emerging over time. Though the developed algorithms take lesser simulation time, the solution they provide is not as optimal as that given by FDP.

In this paper UC is performed with the additional constraint of reliability in the restructured power system scenario. The solar energy generation is considered for eight to ten hours a day with varying MW output. The spinning reserve allocation is also allocated optimally. However the UC results are compiled for 10 percent SR, to ensure a reliable and stable power system operation. The results obtained give the least cost solution, whose reliability is ensured by the index LOLP.

In previous times, the computational time was more but with the advancements in computer technology, the simulation time is not a binding constraint. The simulation time can be reduced further by using certain refinements in the algorithm of FDP and decreasing the search space.

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