*International Journal of Computational Intelligence in Control*

# Increased Voltage Compensation and an Improved DVR Control Strategy

*A.Alekhya[1] , Prof J Sreenivasa Rao [2] , Prof J Krishna Kishore [3]*

*1 AssistantProfessor,DepartmentofEEE,QISCollegeofEngineeringandTechnology,Ongole,India*

*2 Professor, Department of EEE, QIS College of Engineering and Technology, Ongole, India*

*3 Professor, Department of EEE, QIS College of Engineering and Technology, Ongole, India*

**Abstract:**

This work focuses on using a fuel cell-powered dynamic voltage restorer to enhance the voltage quality of delicate loads during voltage sags (FC-DVR). By either 1) reducing the injected voltage's amplitude or 2) improving the dc bus energy support, the current control options either reduce the phase jump or increase the use of dc link energy. The study suggests an improved sag compensation technique that reduces load voltage sag while cutting down on overall sag compensation time. When compared to the current compensatory approaches, the proposed methodology significantly lengthens the FC- DVR sag support period (by more than 50%), according to analytical research. Simulator analysis is done to evaluate the effectiveness of the technique, and MATLAB/SIMULINK is then utilised to empirically support it. Keywords: BESS, DVR, SRF, and VSC.

## I. INTRODUCTION

The demand for voltage-sensitive equipment has been rising, including programmable logic controllers (PLC), adjustable speed drives (ASD), air-conditioning controllers, computer centres, automated production lines, and medical equipment [1]. The reduction in voltage RMS between 0.1 and 0.9 PU over a period of 0.5 cycles to a few seconds is referred to as voltage sag. A rise in nominal voltage between 1.1 and 1.8 PU during a period of 0.5 cycles to 1 minute is referred to as swell. Voltage sags or swells in the power supply could be caused by faults or by big induction motors beginning. As a result, further machinery can stop working. Utilizing specialised power equipment, such as a dynamic voltage restorer, is a way to improve the quality of theCustom powerdevices are mainly of three categories such as series-connected compensators known as dynamic voltage restorers (DVRs),shunt-connectedcompensatorssuchasdistributionstaticcompensators,andacombinationofseries-andshunt-connectedcompensatorsknownasunifiedpowerqualityconditioner[2]–[6].TheDVRcanregulatetheload

Voltagefromtheproblemssuchassag,swell,andharmonics in the supply voltages. Hence, it can protect thecritical consumer loads from tripping and consequent losses[2].Thecustompowerdevicesaredevelopedandinstalledat consumerpointtomeetthepowerqualitystandardssuchasIEEE-519[7].

Voltage sags in an electrical grid are not always possible toavoidbecauseofthefiniteclearingtimeofthefaultsthatcausethevoltagesagsandthepropagationofsagsfr omthe Transmission and distribution systems to the low-voltageloads. Voltage sags are the common reasons for interruption inproduction plants and for end-user equipment malfunctions ingeneral. In particular, tripping of equipment in a productionlinecancauseproductioninterruptionandsignificantcostsdueto loss of production. One solution to this problem is to makethe equipment itself more tolerant to sags, either by intelligentcontrolorbystoring–ride-through‖energyintheequipment. An alternative solution, instead of modifying each componentinaplanttobetolerantagainstvoltagesags,is to install a plant wide uninterruptible power supply systemforlongerpowerinterruptionsoraDVRontheincomingsupply to mitigate voltage sags for shorter periods [8]–[23].DVRs can eliminate most of the sags and minimize the risk ofload tripping for very deep sags, but their main drawbacks aretheirstandbylosses,theequipmentcost,andalsotheprotectionschemerequiredfordownstreamshortc ircuits. There are other DVR-based solutions and issues that they address, such as balancing the voltages in a three-phase system [8] and discussing energy-optimized DVR control in [10]. Industrial DVR examples are provided in [11], and [12] through [18] investigate various control strategies for various voltage sags. [19] presents a comparison of various topologies and control strategies for a DVR. [17] discusses the design of a capacitor-supported DVR that guards against sag, swell, distortion, or unbalance in the supply voltages. [24] discusses a DVR's performance when using a high-frequency link transformer. In this study, a reduced-rating voltage source converter is used to demonstrate how a DVR can be controlled and perform (VSC).

## II. FUELCELL

A fuel cell is a device that converts the chemical energyfrom afuelintoelectricity throughachemicalreaction ofpositivelychargedhydrogenionswithoxygenoranotheroxidizingagent.[1]Fuelcellsaredifferentfromba tteriesinthatthey require a continuous source of fuel and oxygen or air tosustainthechemicalreaction,whereasinabatterythe chemicalspresentinthebatteryreactwitheachothertogenerate an electromotive force (emf). Fuel cells can produceelectricitycontinuouslyforaslongastheseinputsaresupplied.

Thefirstfuelcellswereinventedin1838.Thefirstcommercial use of fuel cells came more than a century later inNASA space programs to generate power for satellites andspace capsules. Since then, fuel cells have been used in manyother applications. Fuel cells are used for primary and backuppower for commercial, industrial and residential buildings andin remote or inaccessible areas. They are also used to powerfuelcellvehicles,includingforklifts,automobiles,buses,boats,motorcyclesand submarines.

Fuel cells come in a variety of shapes and sizes, but they all have three basic components: an anode, a cathode, and an electrolyte that enables the movement of positively charged hydrogen ions (or protons) between the two sides of the fuel cell. Catalysts in the anode and cathode cause oxidation processes in the fuel that result in positively charged hydrogen ions and electrons. After the reaction, the hydrogen ions are pulled through the electrolyte. Direct current electricity is created at the same time that electrons are pulled from the anode to the cathode through an external circuit. Hydrogen ions, electrons, and oxygen interact at the cathode to create water. Fuel cells are categorised according to the type of electrolyte they utilise because the electrolyte is what distinguishes the various types of fuel cells.

## III. WORKINGOFDVR

The schematic of a DVR-Connected system is shown inFig. 1. The voltage $V_{inj}$ is inserted such that the load voltage$V_{load}$ is constant in magnitude and is undistorted, although thesupplyvoltageVsisnotconstantinmagnitudeorisdistorted.

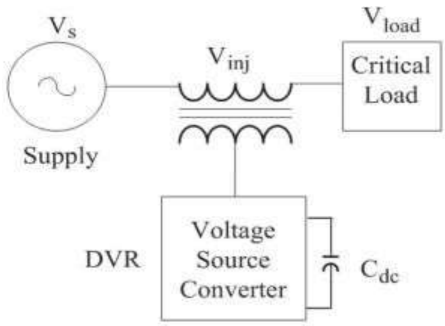


Fig.1.BasiccircuitofDVR.

Injection schemes of the DVR. $V_L$ (pre—sag) is a voltageacrossthecriticalloadpriortothevoltagesagcondition.During the Voltage sag, the voltage is reduced to Vs with aphase lag angle of θ. Now, the DVR injects a voltage such thattheloadvoltagemagnitudeismaintainedatthepre-sagcondition.

The DVR is operated in this scheme with a Lithium-Ionbatteryenergystoragesystem(LI-BESS).Fig.2showsaschematicofathree-phaseDVRconnectedtorestorethevoltage of a three-phase critical load. A three-phase supply isconnected to a critical and sensitive load through a three-phaseseriesinjectiontransformer.Theequivalentvoltageofthesupply of phase a $V_{Ma}$ is connected to the point of commoncoupling (PCC) $V_{Sa}$ through short-circuit impedance $Z_{sa}$. Thevoltage injected by the DVR in phase a $V_{Ca}$ is such that theload voltage $V_{La}$ is of rated magnitude and undistorted. Thethree-phase DVR is connected to the line to inject a voltage inseriesusingthreesingle-phasetransformersTr.$L_r$and$C_r$represent the filter components used to filter the ripples in theinjected voltage. A three-leg VSC with Insulated-Gate BipolarTransistors(IGBTs)isusedasaDVR,andaLI-BESSisconnectedtoitsDCbus.

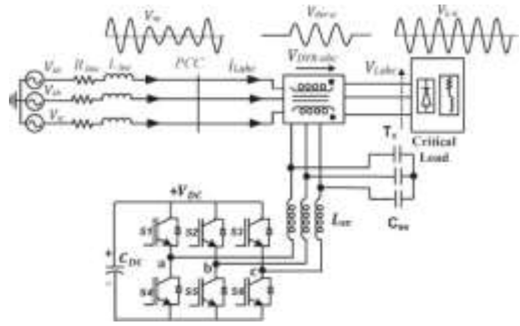


**Fig**.2.SchematicoftheDVR-connectedsystem

Fuel cells come in a variety of shapes and sizes, but they all have three basic components: an anode, a cathode, and an electrolyte that enables the movement of positively charged hydrogen ions (or protons) between the two sides of the fuel cell. a node, By injecting or absorbing the reactive power or the real power, voltage sag adjustment utilising a DVR can be carried out [17]. Reactive power is used to compensate when the injected voltage is in quadrature with the current at the fundamental frequency, and the DVR has a self-supported dc bus. However, if the injected voltage and current are in phase, DVR injects real power; as a result, a fuel cell is needed at the VSC's dc bus. The method of control usedFig. 3 shows a control block of the DVR in which the SRFtheory is used for reference signal estimation. The voltages atthePCC$V_S$andattheloadterminal$V_{La}$aresensedforderivingtheIGBTs'gatesignals.Thereferenceloadv oltageV*isextracted using the derived unit vector [23]. Load volt- ages($V_{La}$ ,$V_{Lb}$ , $V_{Lc}$ ) are converted to the rotating reference frameusing abc−dqo conversion using Park's transformation withunitvectors(sin,θ,cos,θ)derivedusingaphase-lockedloops.

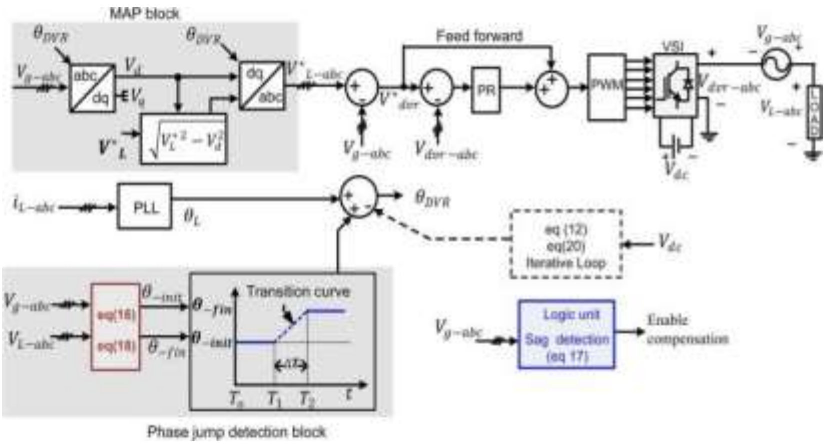


Fig.3.ControlblockoftheDVRthatusestheSRFmethodofcontrol

IV. SIMULATIONANDMODELING

*A.SimulinkofFuelCell based DVR:*

The Fuel Cellbased DVR connectedsystem consisting ofa three-phase supply, three-phase critical loads, and the seriesinjectiontransformersshowninFig.5issimulated asfollows.

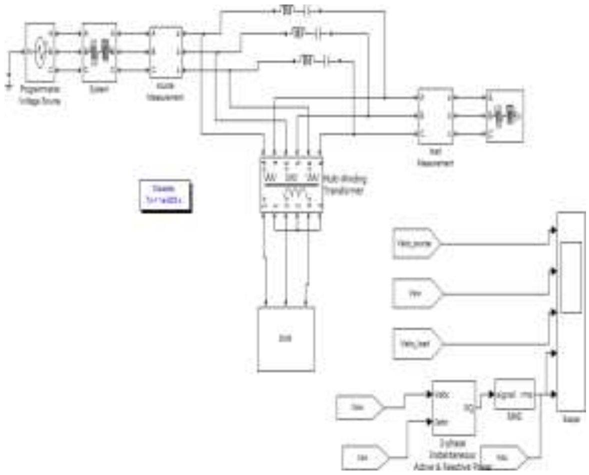

Fig:5SimulinkofDVRbasedFuelCe

V. PERFORMANCE OFFUELCELL BASEDDVR

TheperformanceoftheFuelcellbasedDVRisdemonstrated for supply voltage disturbances i.e voltage sag.At0.1s,asag in supply voltageis created.In this papersimulation results for both with and without Fuel Cell basedDVRhasbeenpresented

*A. Case:1DVRwithBESSsystem.*

In this case performance of the DVR has been observedwithout BESS, a voltage disturbance i.e voltage sag has beencreated at 0.1 and removed at 0.15s. Here the DVR injectedvoltagemagnitude is200V.

.

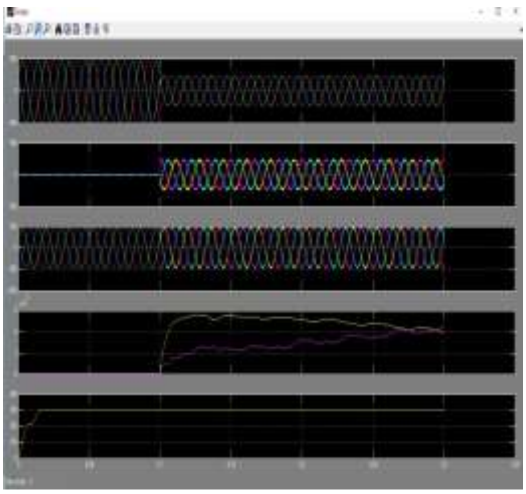

Fig.6.PerformanceoftheDVRwithBESS

*B. Case:2DVRwithFuelCellsystem.*

In this case performance of the DVR has been observedwith Fuel Cell, a voltage disturbance i.e voltage sag has beencreated at 0.1sandremovedat0.15s

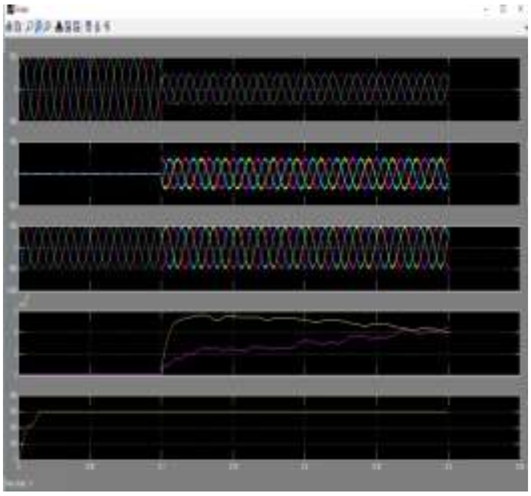

Fig.8.PerformanceoftheDVRwithFuelCell

## VI. CONCLUSION

The capacitor-supported DVR has been given a proposed improved sag correction mechanism. By shielding sensitive loads from grid voltage sags caused by the phase leap, the suggested technique enhances the voltage quality of such loads. DVR with BESS and DVR with FUEL CELL have both been demonstrated in this project. Due to its ability to maintain a steady voltage, the DVR with Fuel Cell can be utilised as a battery replacement, according to the simulation results.

## REFERENCES


[1] M.H.J.Bollen,UnderstandingPowerQualityProblems—VoltageSagsandInterruptions.NewYork,NY,USA:IEEEPress,2000.

[2] A.GhoshandG.Ledwich,PowerQualityEnhancementUsingCustom *PowerDevices*.London,U.K.:Kluwer,2002.

[3] M.H.J.BollenandI.Gu,*SignalProcessingofPowerQualityDistur-bances*.Hoboken,NJ,USA:Wiley-IEEEPress,2006.

[4] R.C.Dugan,M.F.McGranaghan,andH.W.Beaty,*ElectricPowerSystemsQuality*,2nded.NewYork,NY,USA:McGraw-Hill,2006.

[5] A.Moreno-Munoz,PowerQuality:MitigationTechnologiesinaDis-tributedEnvironment.London,U.K.:Springer-Verlag,2007.

[6] K.R.Padiyar,FACTSControllersinTransmissionandDistribution. New Delhi, India: New Age Int., 2007. IEEERecommendedPracticesandRecommendationsforHarmonicsControlinElectricPowerSystems,IEEEStd. 519,1992.

[7] V.B.BhavrajuandP.N.Enjeti,–Anactivelineconditionertobalance voltages in a three phase system,‖ *IEEE Trans. Ind. Appl.*, vol. 32, no. 2,pp.287–292,Mar./Apr.1996.

[8] S. MiddlekauffandE. Collins, –System and customer impact,‖*IEEE Trans.PowerDel.*,vol.13,no.1,pp.278–282,Jan.1998.

[9] M.Vilathgamuwa,R.Perera,S.Choi,andK.Tseng,–Controlofenergy optimizeddynamicvoltagerestorer,‖in*Proc.IEEEIECON*,1999,vol.2,pp.873–878.

[10] J.G.Nielsen,F.Blaabjerg,andN.Mohan,–Controlstrategiesfordynamic voltage restorer compensating voltage sags with phase jump,‖ in *Proc.IEEEAPEC*,2001,vol.2,pp.1267–1273.

[11] A. GhoshandG. Ledwich,–Compensationof distributionsystemvolt- age using DVR,‖ *IEEE Trans. Power Del.*, vol. 17, no. 4, pp. 1030–1036,Oct.2002.

[12] A. Ghosh andA. Joshi, –A new algorithm for the generation of ref- erence voltages of a DVR using the method of instantaneous symmet-rical components,‖ *IEEE Power Eng.Rev.*,vol.22, no.1,pp.63–65,Jan.2002.

[13] I.-Y. Chung, D.-J. Won, S.-Y. Park, S.-I. Moon, andJ.-K. Park, –The DClinkenergycontrolmethodindynamicvoltagerestorersys-tem,‖*Int.J.Elect.PowerEnergySyst.*,vol.25,no.7,pp.525–531,Sep.2003.

[14] E.C.Aeloíza,P.N.Enjeti,L.A.Morán, O.C.Montero-Hernandez,and S.Kim,–Analysisanddesignofanewvoltagesagcompensatorforcritical loads in electrical power distribution systems,‖ *IEEE Trans. Ind. Appl.*,vol.39,no.4,pp.1143–1150,Jul./Aug.2003.

[15] J.W.Liu,S.S.Choi,andS.Chen,–Designofstepdynamicvoltagereg- ulator for power quality enhancement,‖ *IEEE Trans. Power Del.*, vol. 18,no.4,pp.1403–1409,Oct.2003.

[16] A.Ghosh,A.K.Jindal,andA.Joshi,–Designofacapacitorsupported dynamicvoltagerestorerforunbalancedanddistortedloads,‖*IEEETrans.PowerDel.*,vol.19,no.1,pp.405–413,Jan.2004.

[17] A.Ghosh,–Performancestudyoftwodifferentcompensating devicesin a custom power park,‖*Proc. Inst. Elect. Eng.—Gener.,Transm. Distrib.*,vol.152,no.4,pp.521–528,Jul.2005.

[18] J.G.NielsenandF.Blaabjerg,–Adetailedcomparison of system topolo-giesfordynamicvoltagerestorers,‖*IEEETrans.Ind.Appl.*,vol.41,no.5,pp.1272–1280,Sep./Oct.2005.

[19] M.R.Banaei,S.H.Hosseini,S.Khanmohamadi,andG.B.Gharehpetian, –Verificationofanewenergycontrolstrategyfordynamicvoltagerestorer by simulation,‖*Simul. Model. Pract. Theory*, vol. 14, no. 2, pp. 112–125,Feb.2006.

[20] A.K.Jindal,A.Ghosh,andA.Joshi,–Criticalloadbusvoltagecontrol using DVR under system frequency variation,‖*Elect. Power Syst. Res.*,vol.78,no.2,pp.255–263,Feb.2008.

[21] D.M.Vilathgamuwa,H.M.Wijekoon,andS.S.Choi,–Anoveltechnique to compensate voltage sags in multiline distribution system—The interlinedynamic voltage restorer,‖ *IEEETrans. Ind. Electron.*, vol.53, no.5,pp.1603–1611,Oct.2006.

[22] A. Chandra,B. Singh,B. N. Singh,and K. Al-Haddad,–An improved control algorithm of shunt active filter for voltage regulation, harmonicelimination, power-factor correction, and balancing of nonlinear loads,‖*IEEETrans.PowerElectron.*,vol.15,no.3,pp.495–507,May2000.

[23] Tabassum, Saleha, and B. Mouli Chandra. "Power Quality improvement by UPQC using ANN Controller." International Journal of Engineering Research and Applications 2.4 (2012): 2019-2024.

[24] Chandra, B. Mouli, and Dr S. Tara Kalyani. "FPGA controlled stator resistance estimation in IVC of IM using FLC." Global Journal of Researches in Engineering Electrical and Electronics Engineering 13.13 (2013).

[25] Chandra, B. Mouli, and S. Tara Kalyani. "Online identification and adaptation of rotor resistance in feedforward vector controlled induction motor drive." Power Electronics (IICPE), 2012 IEEE 5th India International Conference on. IEEE, 2012.

[26] Chandra, B. Mouli, and S. Tara Kalyani. "Online estimation of Stator resistance in vector control of Induction motor

drive." Power India Conference, 2012 IEEE Fifth. IEEE, 2012.

[27] MURALI, S., and B. MOULI CHANDRA. "THREE PHASE 11-LEVEL INVERTER WITH REDUCED NUMBER OF SWITCHES FOR GRID CONNECTED PV SYSTEMS USING VARIOUS PWM TECHNIQUES."

[28] BABU, GANDI SUNIL, and B. MOULI CHANDRA. "POWER QUALITY IMPROVEMENT WITH NINE LEVEL MULTILEVEL INVERTER FOR SINGLE PHASE GRID CONNECTED SYSTEM."

[29] NAVEENKUMAR, K., and B. MOULI CHANDRA. "Performance Evaluation of HVDC Transmission system with the Combination of VSC and H-Bridge cells." Performance Evaluation 3.02 (2016).

[30] Vijayalakshmi, R., G. Naga Mahesh, and B. Mouli Chandra. "Seven Level Shunt Active Power Filter for Induction Motor Drive System." International Journal of Research 2.12 (2015): 578-583.

[31] BAI, RM DEEPTHI, and B. MOULI CHANDRA. "Speed Sensorless Control Scheme of Induction Motor against Rotor Resistance Variation." (2013).

[32] Chandra, B. Mouli, and S. Tara Kalyani. "Online Rotor Time Constant Tuning in Indirect Vector Control of Induction Motor Drive." International Journal on Engineering Applications (IREA) 1.1 (2013): 10-15.

[33] Rajesh, P., Shajin, F. H., Mouli Chandra, B., &Kommula, B. N. (2021). Diminishing Energy Consumption Cost and Optimal Energy Management of Photovoltaic Aided Electric Vehicle (PV-EV) By GFO-VITG Approach. Energy Sources, Part A: Recovery, Utilization, and Environmental Effects, 1-19.

[34] Reddy C, Narukullapati BK, Uma Maheswara Rao M, Ravindra S, Venkatesh PM, Kumar A, Ch T, Chandra BM, Berhanu AA. Nonisolated DC to DC Converters for High-Voltage Gain Applications Using the MPPT Approach. Mathematical Problems in Engineering. 2022 Aug 22;2022.

[35] Sravani, B., C. Moulika, and M. Prudhvi. "Touchlessdoor bell for post-covid." South Asian Journal of Engineering and Technology 12.2 (2022): 54-56.

[36] Mounika, P., V. Rani, and P. Sushma. "Embedded solar tracking system using arduino." South Asian Journal of Engineering and Technology 12.2 (2022): 1-4.

[37] Prakash, A., Srikanth, T., Moulichandra, B., &Krishnakumar, R. (2022, February). Search and Rescue Optimization to solve Economic Emission Dispatch. In 2022 First International Conference on Electrical, Electronics, Information and Communication Technologies (ICEEICT) (pp. 1-5). IEEE.

[38] Kannan, A. S., SrikanthThummala, and B. Mouli Chandra. "Cost Optimization Of Micro-Grid Of Renewable Energy Resources Connected With And Without Utility Grid." Materials Today: Proceedings (2021).

[39] Chandra, B. M., Sonia, D., Roopa Devi, A., YaminiSaraswathi, C., Mighty Rathan, K., &Bharghavi, K. (2021). Recognition of vehicle number plate using Matlab. J. Univ. Shanghai Sci. Technol, 23(2), 363-370.

[40] Noushin, S. K., and Daka Prasad2 Dr B. Mouli Chandra. "A Hybrid AC/DC Micro grid for Improving the Grid current and Capacitor Voltage Balancing by Three-Phase AC Current and DC Rail Voltage Balancing Method."

[41] Deepika, M., Kavitha, M., Chakravarthy, N. K., Rao, J. S., Reddy, D. M., & Chandra, B. M. (2021, January). A Critical Study on Campus Energy Monitoring System and Role of IoT. In 2021 International Conference on Sustainable Energy and Future Electric Transportation (SEFET) (pp. 1-6). IEEE.

[42] ANITHA, CH, and B. MOULI CHANDRA. "A SINGLE-PHASE GRID-CONNECTED PHOTOVOLTAIC INVERTER BASED ON A THREE-SWITCH THREE-PORT FLYBACK WITH SERIES POWER DECOUPLING CIRCUIT."

[43] Sai, V. N. V., Kumar, V. B. C., Kumar, P. A., Pranav, I. S., Venkatesh, R., Srinivasulu, T. S., ... & Chandra, B. M. Performance Analysis of a DC Grid-Based Wind Power Generation System in a Microgrid.

[44] Prakash, A., R. Anand, and B. Mouli Chandra. "Forward Search Approach using Power Search Algorithm (FSA-PSA) to solve Dynamic Economic Load Dispatch problems." 2019 5th International Conference on Advanced Computing & Communication Systems (ICACCS). IEEE, 2019.

45. **Dr**.R.Chinnaiyan , M.S.Nidhya (2018), " ReliabilityEvaluationofWirelessSensorNetworksusingEERNAlgorithm",LectureNotesonDataEngineeringandCommunicationsTechnologies,SpringerInternationalconferenceonComputerNetworksandInventiveCommunicationTechnologies(ICCNCT-2018),August2018(Online)
46. Dr.R.Chinnaiyan , R.Divya (2018), " Reliable AIBasedSmartSensorsforManagingIrrigationResources in Agriculture" , Lecture Notes on DataEngineeringandCommunicationsTechnologies,SpringerInternationalconferenceonComputerNetworksandInventiveCommunicationTechnologies(ICCNCT-2018),August2018(Online)
47. Dr.R.Chinnaiyan,S.Balachandar(2018),"Reliable Digital Twin for Connected Footballer" ,LectureNotesonDataEngineeringandCommunicationsTechnologies,SpringerInternationalconferenceonComputerNetworksandInventiveCommunicationTechnologies(ICCNCT- 2018),August 2018(Online)
48. Dr.R.Chinnaiyan,S.Balachandar(2018),"Centralized Reliability and Security Management ofDatainInternetofThings(IoT)withRuleBuilder" ,LectureNotesonDataEngineeringandCommunicationsTechnologies,SpringerInternationalconferenceonComputerNetworksandInventiveCommunicationTechnologies(ICCNCT- 2018),August 2018(Online)
49. Dr.R.Chinnaiyan,AbishekKumar(2017)"ReliabilityAssessmentofComponentBasedSoftware Systems using Basis Path Testing" , IEEEInternational Conference on Intelligent Computingand ControlSystems, ICICCS2017, 512– 517
50. Dr.R.Chinnaiyan, AbishekKumar(2017) ,"Construction of Estimated Level Based BalancedBinarySearchTree",2017IEEEInternationalConferenceonElectronics,Communication,andAerospaceTechnology(ICECA2017),344 -348, 978-1-5090-5686-6.
51. Dr.R.Chinnaiyan, AbishekKumar(2017), Estimationof Optimal Path in Wireless Sensor Networks basedonAdjancyList,2017IEEEInternationalConference on Telecommunication,Power Analysisand Computing Techniques (ICTPACT2017) ,6,7,8thApril2017,IEEE978-1-5090-3381-2.
52. Dr.R.Chinnaiyan,R.Divya(2017),"ReliabilityEvaluationofWirelessSensorNetworks",IEEEInternational Conference on Intelligent Computingand ControlSystems, ICICCS2017, 847– 852
53. Dr.R.Chinnaiyan,Sabarmathi.G(2017),"InvestigationsonBigDataFeatures,ResearchChallengesandApplications",IEEEInternational Conference on Intelligent Computing and ControlSystems,ICICCS 2017, 782–786
54. G.Sabarmathi,Dr.R.Chinnaiyan(2018),"EnvisagationandAnalysisofMosquitoBorneFevers–AHealthMonitoringSystembyEnvisagative Computing using Big Data Analytics"inICCBI2018–Springeron19.12.2018to20.12.2018(RecommendedforScopusIndexedPublicationIEEEXploredigital library)
55. G.Sabarmathi,Dr.R.Chinnaiyan,ReliableDataMiningTasksandTechniquesforIndustrialApplications,IAETSDJOURNALFORADVANCEDRESEARCHINAPPLIEDSCIENCES, VOLUME 4, ISSUE 7, DEC/2017,PP-138-142,ISSN NO:2394-8442
56. Dr. M. Thangamani, Jafar Ali Ibrahim, Information Technology E-Service Management System, International Scientific Global Journal in Engineering Science and Applied Research (ISGJESAR). Vol.1. Issue 4, pp. 13-18, 2017. http://isgjesar.com/Papers/Volume1,Issue4/paper2.pdf
57. Ibrahim, Mr S. Jafar Ali, K. Singaraj, P. Jebaroopan, and S. A. Sheikfareed. "Android Based Robot for Industrial Application." International Journal of Engineering Research & Technology 3, no. 3 (2014).
58. Ibrahim, S. Jafar Ali, and M. Thangamani. "Momentous Innovations in the Prospective Method of Drug Development." In Proceedings of the 2018 International Conference on Digital Medicine and Image Processing, pp. 37-41. 2018.

59. Ibrahim, S. Jafar Ali, and M. Thangamani. "Prediction of Novel Drugs and Diseases for Hepatocellular Carcinoma Based on Multi-Source Simulated Annealing Based Random Walk." Journal of medical systems 42, no. 10 (2018): 188. https://doi.org/10.1007/s10916-018-1038-yISSN 1311-8080, https://acadpubl.eu/hub/2018-119-16/1/94.pdf
60. Jafar Ali Ibrahim. S, Mohamed Affir. A "Effective Scheduling of Jobs Using Reallocation of Resources Along With Best Fit Strategy and Priority", International Journal of Science Engineering and Advanced Technology(IJSEAT) – ISSN No: 2321- 6905, Vol.2, Issue.2, Feb-2014, http://www.ijseat.com/index.php/ijseat/article/view/62
61. M. Thangamani, and Jafar Ali Ibrahim. S, "Knowledge Exploration in Image Text Data using Data Hiding Scheme," Lecture Notes in Engineering and Computer Science: Proceedings of The International MultiConference of Engineers and Computer Scientists 2018, 14-16 March, 2018, Hong Kong, pp352-357http://www.iaeng.org/publication/IMECS2018/IMECS2018_pp352-357.pdf
62. M. Thangamani, and Jafar Ali Ibrahim. S, "Knowledge Exploration in Image Text Data using Data Hiding Scheme," Lecture Notes in Engineering and Computer Science: Proceedings of The International MultiConference of Engineers and Computer Scientists 2018, 14-16 March, 2018, Hong Kong, pp352-357http://www.iaeng.org/publication/IMECS2018/IMECS2018_pp352-357.pdf
63. S. Jafar Ali Ibrahim and M. Thangamani. 2018. Momentous Innovations in the Prospective Method of Drug Development. In Proceedings of the 2018 International Conference on Digital Medicine and Image Processing (DMIP '18). Association for Computing Machinery, New York, NY, USA, 37–41. https://doi.org/10.1145/3299852.3299854
64. S. Jafar Ali Ibrahim and Thangamani, M "Proliferators and Inhibitors Of Hepatocellular Carcinoma", International Journal of Pure and Applied Mathematics (IJPAM) Special Issue of Mathematical Modelling of Engineering ProblemsVol 119 Issue. 15. July 2018
65. Thangamani, M., and S. Jafar Ali Ibrahim. "Ensemble Based Fuzzy with Particle Swarm Optimization Based Weighted Clustering (Efpso-Wc) and Gene Ontology for Microarray Gene Expression."In Proceedings of the 2018 International Conference on Digital Medicine and Image Processing, pp. 48-55. 2018. https://dl.acm.org/doi/abs/10.1145/3299852.3299866
66. Dr.R.Chinnaiyan, Abishek Kumar (2017) " Reliability Assessment of Component Based Software Systems using Basis Path Testing" , IEEE International Conference on Intelligent Computing and Control Systems, ICICCS 2017, 512 – 517
67. Dr.R.Chinnaiyan, AbishekKumar(2017) ,"Construction of Estimated Level Based Balanced Binary Search Tree", 2017 IEEE International Conference on Electronics,Communication, and Aerospace Technology (ICECA 2017), 344 - 348, 978-1-5090-5686-6.
68. R.Chinnaiyan, S.Somasundaram (2012) , Reliability Estimation Model for Software Components using CEP", International Journal of Mechanical and Industrial Engineering (IJMIE) , ISSN No.2231-6477, Volume-2, Issue-2, 2012, pp.89-93.
69. R.Chinnaiyan, S. Somasundaram (2011) ,"An SMS based Failure Maintenance and Reliability Management of Component Based Software Systems", European Journal of Scientific Research, Vol. 59 Issue 1, 9/1/2011, pp.123 ( cited in EBSCO, Impact Factor: 0.045)
70. R.Chinnaiyan, S.Somasundaram(2011), "An Experimental Study on Reliability Estimation of GNU Compiler Components - A Review", International Journal of Computer Applications, Vol.25, No.3, July 2011, pp.13-16. (Impact Factor: 0.814)
71. R.Chinnaiyan, S.Somasundaram(2010) "Evaluating the Reliability of Component Based Software Systems " ,International Journal of Quality and Reliability Management , Vol. 27, No. 1., pp. 78-88 (Impact Factor: 0.406)
72. Dr.R.Chinnaiyan, AbishekKumar(2017), Estimation of Optimal Path in Wireless Sensor Networks based on Adjancy List, 2017 IEEE International Conference on Telecommunication,Power Analysis and Computing Techniques (ICTPACT2017) ,6,7,8th April 2017,IEEE 978-1-5090-3381-2.

73. Ibrahim, S. Jafar Ali, and M. Thangamani. "Enhanced singular value decomposition for prediction of drugs and diseases with hepatocellular carcinoma based on multi-source bat algorithm based random walk." Measurement 141 (2019): 176-183. https://doi.org/10.1016/j.measurement.2019.02.056
74. Compound feature generation and boosting model for cancer gene classification Ibrahim, S. Jafar Ali Ibrahim., Affir, A.M., Thangamani, M.International Journal of Engineering Trends and Technology, 2020, 68(10), pp. 48–51, Doi No:doi:10.14445/22315381/IJETT-V68I10P208 https://ijettjournal.org/Volume-68/Issue-10/IJETT-V68I10P208.pdf
75. Innovative drug and disease prediction with dimensionality reduction and intelligence based random walk methods, Ibrahim, S.J.A., Thangamani, M.International Journal of Advanced Trends in Computer Science and Engineering, 2019, 8(4), pp. 1668–1673, https://www.warse.org/IJATCSE/static/pdf/file/ijatcse93842019.pdf
76. R. Ganesan, M. Thangamani, S. Jafar Ali Ibrahim, "Recent Research Trends and Advancements in Computational Linguistics", International Journal of Psychosocial Rehabilitation Vol 24, no 8 (2020):1154-1162, DOI: **10.37200/IJPR/V24I8/PR280128**
77. C. Narmatha , Dr. M. Thangamani , S. Jafar Ali Ibrahim, " Research Scenario of Medical Data Mining Using Fuzzy and Graph theory", International Journal of Advanced Trends in Computer Science and Engineering, Vol 9, No 1 (2020): 349-355