BEC – SCADA for Distribution and Automation Research Center

SCADA for Distribution & Automation laboratory is established in the year 2014 as part of MOU between BEC Bagalkot and PRDC Bengaluru. This laboratory aims to provide UG, PG and Research students a feel of Power System Distribution. They will be able to conduct energy management studies. Financial assistance is received form VGST-KFIST level-II & BEC TEQIP-II.

List of Major Equipment

Sl.	Details of Equipment's	Year of Purchase	Amount
1.	**SCADA for Distribution and Automation Laboratory** Distribution SCADA Version 1.0 Control & Monitoring Software, IEC 61036, 3Ph LV Measurement, 60-100 A direct measurement from CT, harmonics upto 51 level, RS485 network, MySQL server, HMI Viewer & IFCU, Digital output-4 potential free contacts with programmable timed delay, Data logger- 1MB/8MB, Demand Controller, Dual Port communication, PN8500.	2014	25,84,280.00
2.	**Grid tie Inverter with FCU, Installation and Configuration** Grid Tie Inverter for 1.5 kW Wind Turbine Generator: 1 phase in/1-phase out, rated output power 1500 W, MPP voltage Range 120 VDC~320 VDC, Nominal output voltage 220 VAC, power factor > 0.99, output waveform Pure sinewave, Efficiency(DC to DC) 90%. Bi-Directional Meter for existing FCU: connection type direct connected, wiring configuration 3-phase 4-wire, voltage range 230/240 V(P-N), 400/415 V(P-P, current range 5-10 A, Accuracy class 1.0, mains frequency 50 Hz ±5%.	2017	1,85,834.00
3.	**Mi Power** MiPower V10.1 15 user license Graphical User Interfaces, Load Flow Analysis-Power LFA Short-Circuit Study-Power SCS Transient Stability Study-Power TRS Relay Co-ordination-ORCD& DRCD Renewables, 3 Phase Load Flow Analysis, Economic Dispatch, Harmonic analysis, Electromagnetic Transient Stability(EMT), Ground Grid Design, Dynamic Stability Analysis, Voltage Instability Analysis, Load Forecasting, Sub Synchronous Resonance, MiPower Tools, Upgradation of existing MiPower,	2020	11, 62,500.00

Number of UG Projects and Details:

Academic Year 2013-14

- Design, Implementation and Testing of Waste Heat recovery system & thermoelectric cooling

Academic Year 2015-16

- Performance analysis of supercapacitor on small energy storage system
- Dynamic analysis of wind penetration into the distribution system

Academic Year 2016-17

- Dynamic analysis of WTG in microgrid environment
- Study of fault ride through for WTG

Academic Year 2017-18

- Load flow analysis of campus distribution system using Mi-Power

Academic Year 2018-19

- Modelling and simulation of RSC controlled FRT capability of WTG
- Simple power flow algorithm for BEC distribution network with WTG integration

Academic Year 2019-20

- Penetration of the small wind turbine generation in three phase unbalanced distribution system
- Three phase load flow analysis of unbalanced secondary distribution system using MATLAB software
- Estimation and analysis of carbon footprint – a case study on BEC (A) campus

Academic Year 2020-21

- Probabilistic fault assessment of n-WTG in BEC distribution system

Academic Year 2021-22

- AI Based Phase Identification to integrate DERs in BEC Distribution System

Academic Year 2022-23

- Design and Implementation of Optimal Network Reconfiguration of BEC Distribution using ADP

Academic Year 2023-24

- Development and Prediction of Energy Behavior of Prosumers using AI Technique

Academic Year 2024-25

- Development and Prediction of Fault Detection in BEC Distribution System using AI Technique

Academic Year 2025-26

- AI-Driven Energy Management System in a Data Enabled Microgrid.
- AI Based Identification and Prediction of Faults in Transmission Line

Number of PG Projects and Details:

Academic Year 2014-15

- Simulation Model for designing LVDC microgrid for residential and commercial buildings

Academic Year 2017-18

- Load flow analysis of 15-Bus system of BEC(A) campus distribution network
- Design and modelling of droop control for small wind turbine in microgrid
- Controlling of lighting loads through SCADA

Academic Year 2018-19

- Coherency based network reduction method for transient stability studies- A case study of BEC distribution network

Number of Ph.D's and Details: 02

1. Shivappa Sobarad
   Short term wind forecasting model for planning of wind plants and scheduling of power – 2020
   (AYoR: 2010-11, DoR: 20.11.2010, DoViva: 29.05.2020 USN 2BA10PEN01)
2. Sangamesh Goudappanavar
   Modeling and performance analysis of small wind turbine generators in Microgrid — Thesis submitted
   (AYoR: 2014-15, DoR: 12.12.2014, USN 2BA15PEJ04)

Number of Products Developed and Details:

SCADA for Distribution Automation R&D center - funded by VGST and TEQIP-II (2014)

Inside view of SCADA Laboratory

Number of Publications and Details:

Technical Papers published in International Journals:

[1]. Sangamesh, Y. Goudappanavar, Suresh H. Jangamshetti, "Stochastic Power Flow Analysis of Unbalanced Distribution System based on cluster of SWTG-SPV", Innovation in Computing, Engineering Science & Technology Advances in Science, Technology and Engineering Systems Journal.

[2]. Sangamesh, Y. Goudappanavar, Suresh H. Jangamshetti, "High Tension Voltage Regulation Based Power Flow Analysis of Radial Distribution Network", International Journal of Engineering Sciences and Management - A Multidisciplinary Publication of VTU, Vol.2, issue 2, pp:8-13, June 2020.

[3]. Sangamesh, Y. Goudappanavar, Suresh H. Jangamshetti & Pallavi Hosamath, "Optimal Sizing and Placement of µ-WTG in µGrid based on Loss Estimation", Journal of Information and Computational Science, ISSN:1548-7741, Vol.12 Issue 6, pp.34-40, Dec.2019.

[4]. Sangamesh, Y. G., Suchitra, G., and Jangamshetti, S. H. "Performance Assessment of 2500 TCD Cogeneration Plant", International Journal of Scientific & Engineering Research (IJSER), Volume 3, Issue 5, pp. 1-6, May-2012.

Technical Papers Presented in International Conferences:

[1]. S. Y. Goudappanavar, S. S. Kandagal, M. L. Chikkadesai, B. S. Hadapad and P. Nargund, "Performance Evaluation and Energy Flow Optimization of a Grid-Connected 250 kWp Rooftop Solar PV System in Institute Distribution Network," *2025 IEEE North Karnataka Subsection Flagship International Conference (NKCon)*, Hubballi, India, 2025, pp. 1-6, doi: 10.1109/NKCon66957.2025.11345757.

[2]. S. Y. Goudappanavar, D. Gowda and S. Kandagal, **"AI Based Development and Prediction of Energy Prosumers,"** *2025 3rd International Conference on Integrated Circuits and Communication Systems (ICICACS)*, Raichur, India, 2025, pp. 1-7, doi: 10.1109/ICICACS65178.2025.10968430.

[3]. S. Y. Goudappanavar, Santhoshkumar S. Kandagal, Mahantesh L. Chikkadesai, Basavaraju S. Hadapad and Pradeepkumar Nargund, **"Performance Evaluation and Energy Flow Optimization of a Grid-Connected 250 kWp Rooftop Solar PV System in Institute Distribution Network"**, 2025 IEEE North Karnataka Subsection Flagship International Conference (NKCon), Sept. 2025, KLEIT, Hubballi.

[4]. S. Y. Goudappanavar, S. Kandagal and D. Gowda, **"Development and Analysis of Power Balancing Control for nWTG in Secondary Distribution System,"** *2025 4th International Conference on Distributed Computing and Electrical Circuits and Electronics (ICDCECE)*, Ballari, India, 2025, pp. 1-5, doi: 10.1109/ICDCECE65353.2025.11035168.

[5]. Suresh H. Jangamshetti, Sangamesh Y. Goudappanavar, **"Representation of Distribution Network for Teaching Power Flow Analysis- A Case Study of an Academic Campus"**, 13th IEEE Integrated STEM Education Conference, John's Hopkins University, ML USA, 2023.

[6]. Jaijagdeesh O, Sangamesh, Y. Goudappanavar, Suresh H. Jangamshetti, "Identification of Fault Area in the Distribution System based on Rotor Angle behavior of Diesel Generator", IEEE International Conference on Energy, Power and Environment, NIT Meghalaya 5-7, March 2021.

[7]. Sangamesh, Y. Goudappanavar, Suresh H. Jangamshetti, "Stochastic Power Flow Analysis of Unbalanced Distribution System based on cluster of SWTG-SPV", IEEE PhD Colloquium on Ethically Driven and Innovation for Society (EDITS), 8-8 Nov. 2020, DOI: 10.1109/PhDEDITS51180.2020.9315298.

[8]. Sangamesh Y. Goudappanavar, Suresh H. Jangamshetti and Rubinabegum H. Yadahalli, "Design and Modelling of Droop Control for Small Wind Turbine Generators in Microgrid", International Conference on Small Wind Turbine, NIWE, MNRE, Chennai, 10-12 Dec. 2018.

[9]. Varsha S. Atur, Sangamesh Y. Goudappanavar, Dr.Suresh H. Jangamshetti.,"Novel Control Algortihm for Storage System for Small Wind Turbine Generator", IEEE-ICTCEEC, Mysore, 8-9 Sep.2017.

[10]. Sangamesh G, Naik Raghuram L., Jangamshetti Suresh H., "Simple Control Strategy for UPF Power Conditioner of GSC connected to Wind Turbine", IASTED Asia PES-2013, April 10-12, 2013, Phuket Thailand. Paper Id 800-060. DOI: 10.2316/P.2013.800-060

[11]. Sushma Patted, Sangamesh Goudappanavar., "Optimization of Earthing System in Industrial Plant", presented at IRAJ, Mumbai, 25.09.2015.

Book Chapters

[1]. Sangamesh Y. Goudappanavar, Kumar Shree Harsha S. S., Santhoshkumar S. Kandagal, Anilkumar C. Benny and Madhusudhan S., **"AI-powered predictive analysis of ICU patient survival: A comparative study of model performance and SHAP interpretability"**, Emerging Technologies in AI, Computation, Communication, and Cybersecurity, CRC Press, Taylor & Francis, 1st Ed, Pg.24, 1st Ed., ISBN 9781041240396. https://doi.org/10.1201/9781003739791 (Q1).

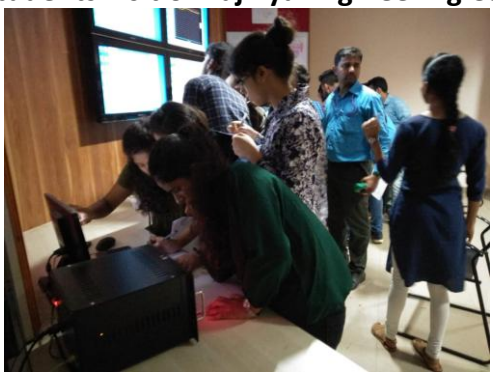
[2]. Goudappanavar, S.Y., Nayak, S.G., Preetha, P.S. (2026). **Development and Performance Analysis of ATS for IoT-Enabled SPV-Based RO Water Purifier in Academic Campus**. In: Upadhyaya, T., Mahmud, M., Palandoken, M. (eds) Proceedings of International Conference on Artificial Intelligence, Communication Technologies and Smart Cities. ICACS 2025. Lecture Notes in Networks and Systems, vol 1533. Springer, Singapore. https://doi.org/10.1007/978-981-96-9196-8_8

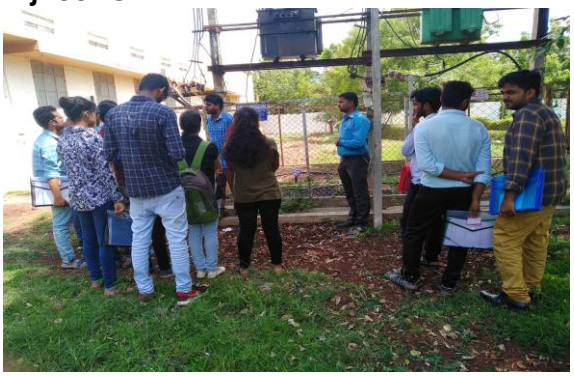
[3]. Goudappanavar Sangamesh Y., Jangamshetti, S.H. (2025). **AI Based Phase Identification to Integrate Distributed Energy Resources in Distribution Network**. Innovations in Electrical and Electronics Engineering. ICEEE 2024. Lecture Notes in Electrical Engineering, vol 1294. Springer, Singapore. https://doi.org/10.1007/978-981-97-9037-1_7. (Q3)

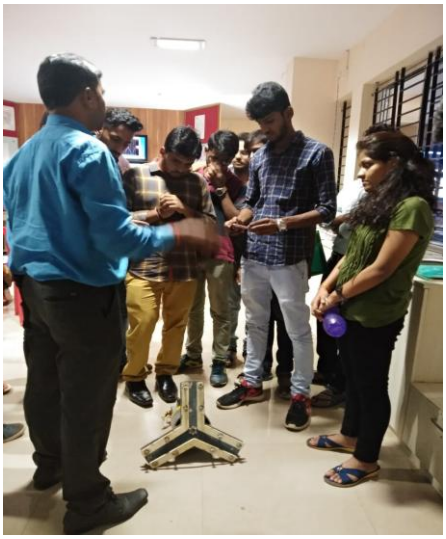
[4]. Basanagouda Ronad, Sangamesh Y. Goudappanavar, Basavaraj Hugar, Santosh Kumbalavati, Kiran Bendigeri, "**IOT Based Control mechanism for Solar PV Water Pumps Employed for Water Distribution in Academic Campus",** Lecture Notes in Networks and Systems, Inderscience, BITS Pilani K K Birla Goa, **Springer Book Series**, Sep. 2024.

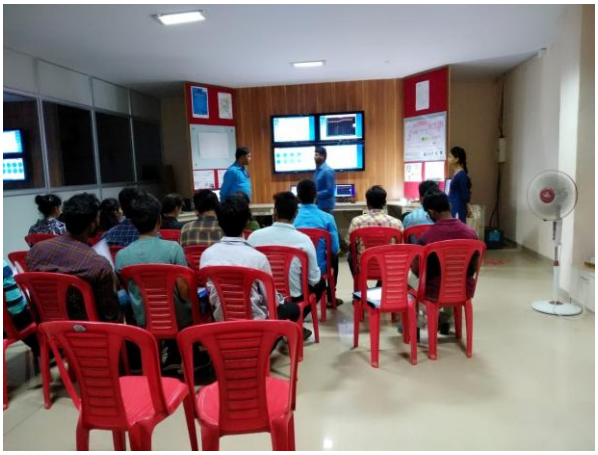
Technical Activities:

Students visit of Rajkiya Engineering College, Bijnoor UP

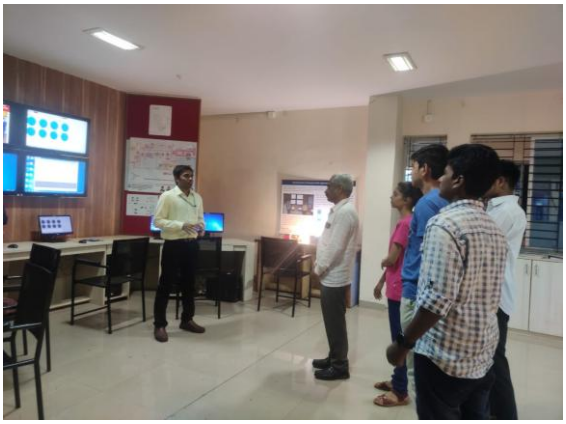


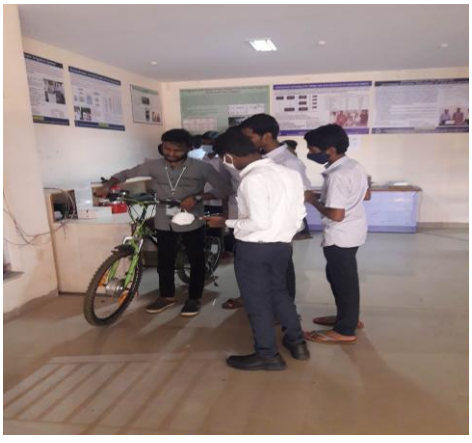




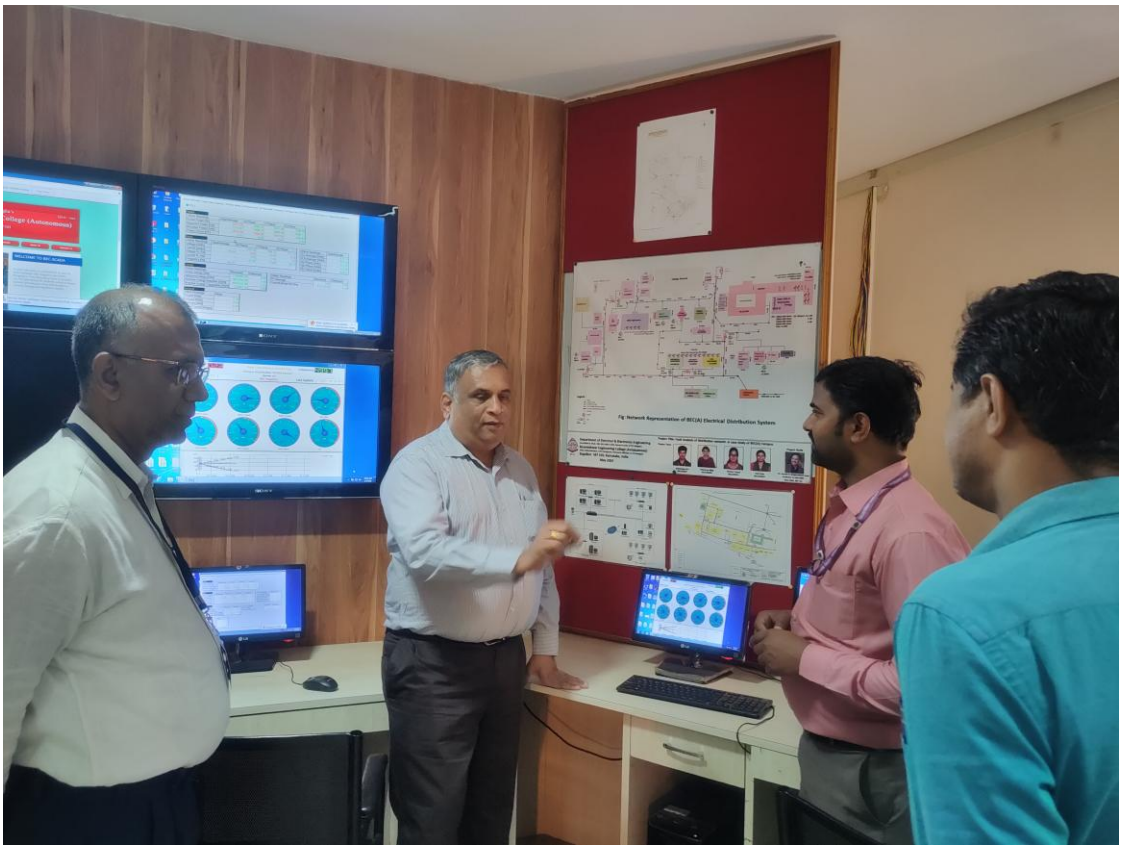


Awareness of monitoring of distribution system for Students from Vagdevi PU School, Bagalkot on 22.09.2021

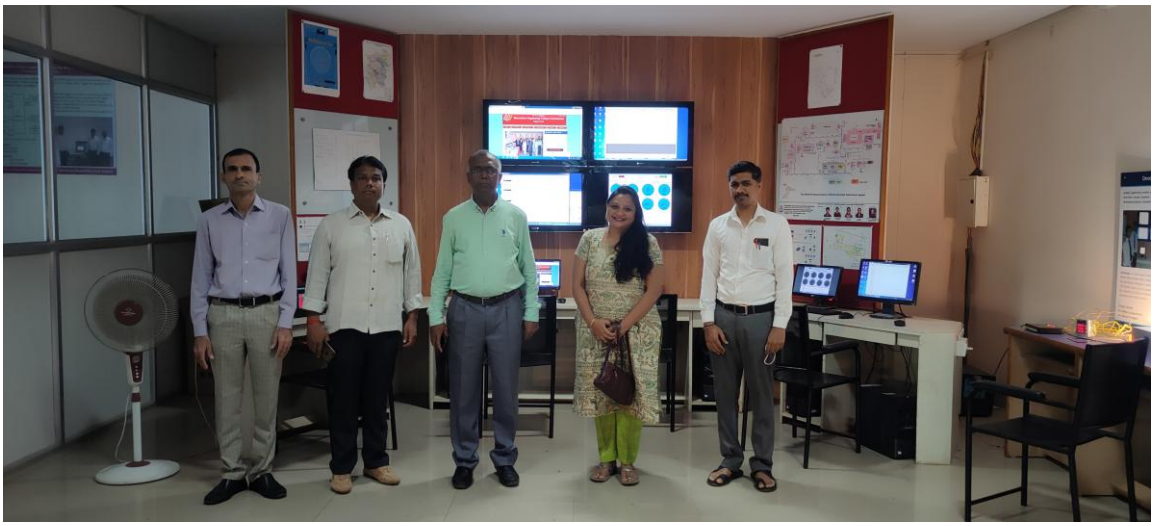




Visitors from reputed Engineering College Professors (IISc, NITK, IITs, IIIT)



Visitors from Industries



Visit of an entrepreneur and discussion with students