Dr. Sivaneasan Bala Krishnan Biography:

Dr Sivaneasan received the B.Eng. and Ph.D. degrees in Electrical and Electronic Engineering from Nanyang Technological University, Singapore, in 2007 and 2012 respectively. In 2011, he joined the School of Electrical and Electronic Engineering, Nanyang Technological University, Singapore, as a Research Engineer and subsequently as a Research Fellow until 2015. He then joined Nanyang Polytechnic as a Lecturer in 2015. In 2019, he joined Singapore Institute of Technology as an Assistant Professor and subsequently promoted to an Associate Professor in 2023. He is registered as Chartered Engineer with UK Engineering Council.

Dr Sivaneasan conducted research and development in the areas of power engineering in particular microgrids and smart grid technologies. He has published more than 35 technical papers. He also co-authored two scholarly book chapter on “Vehicle-to-Grid (V2G)” for a book titled "Energy Storage for Smart Grids: Planning and Operation for Renewable and Variable Energy Resources (VERs)" and “Energy Storage in EVs and Mitigating Impact of EV Charging on Power Grid” for a book titled “Advanced Concepts and Technologies for Electric Vehicles”. In addition, he also won the “Best Innovation in Renewable Energy” award at National Instruments ASEAN Graphical System Design Achievement Awards for his work on a functional smart grid prototype. His work on IIoT based electrical asset management system at a local shipyard won the Best Paper Award at the IEEE International Conference in Power Engineering Applications (ICPEA 2022).

Currently, Dr Sivaneasan is actively involved in applied research projects with strategic industry partners to help the organizations implement new technologies that help improve productivity and work efficiency while ensuring a sustainable operation. In total, he has obtained more than SGD8million in research grant funding. His project IP on condition monitoring has been licensed to EA Technology and deployed at industry sites. His current research focuses on advanced metering infrastructure, condition monitoring system, renewable energy technologies, electric vehicles, energy storage systems, demand response and cloud-based EMS. Till date, Dr Sivaneasan has gathered more than ten years of lecturing, tutoring and laboratory supervision experience in numerous electrical engineering modules. He is also a recognized Associate Adult Educator under the Institute for Adult Education. He has taught various industry relevant Continuing Education and Training (CET) programs for working adults and foreign participants.

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Topic 1: Electric Vehicles as Energy Storage in Smart Grids

Conversion of conventional fossil fuel powered vehicles to electric vehicles (EVs) is considered as one of the best solutions to decrease the emissions of transportation sector and increase the efficiency of transportation system. EVs when aggregated can be treated as large smart energy storage (SES) and used as a fast-responding energy source to overcome the intermittency of renewable sources. SES can be either used to flexible load to store energy when surplus energy is available or as a source when there is power deficit. For utilizing the SES as a source, the vehicle to grid (V2G) capacity estimation is vital and with the help of scheduling, SES can be made to behave like a flexible load. In this talk, the availability/travel pattern of EVs and their suitability for being used as SES is discussed. Different dynamic EV charge scheduling and the associated V2G capacity estimation which considers the main constraints on meeting the load demand while ensuring the chargeability of the EVs will also be shared.

Topic 2: Condition Monitoring of Electrical Assets in Smart Grids

Asset maintenance and system performance management plays a vital role in industrial and commercial facilities because if an asset breaks down, it can cause long downtimes that may affect a company's production costs or disrupt the availability of its services. Traditional manual maintenance rendering is a very manpower-intensive and costly operation. Furthermore, these traditional offline assessment techniques have long maintenance intervals, which makes timely detection of declining asset performance or failure defects near impossible. This talk will discuss on condition-based maintenance of electrical assets in smart grids and its associated challenges and opportunities. The use of data analytics to detect unusual patterns and anomalies will also be shared. Case studies on different detection techniques for high voltage and low voltage system will be discussed.

Topic 3: Cyber-Physical Security Vulnerabilities in Smart Grids

SCADA (Supervisory Control and Data Acquisition) system forms the backbone of smart grids. It provides the communication and control architecture to monitor and manage the smart grids. From the cyber security aspect of a smart grid, the SCADA system are the greatest concerns as it provides the cyber entry point to the smart grid through wired/wireless communication. The vulnerabilities in smart grids are very much focused on the controlling the Industrial Control System (ICS) hardware and software connected to the SCADA system. This talk aims to share the use of digital twin to study the security vulnerabilities in smart grid network infrastructure and the potential impact of cyberattack on the smart grid system operation. Various potential cyber-attacks on smart grid SCADA including sending false signal to the master controller, violating the integrity of physical sensors, and data spoofing attacks due to lack of authentication, confidentiality and weak session structure in communication protocols will be discussed.