



Housing and Building  
National Research Center



Housing & Building National Research Center International Conference  
Future Vision & Challenges for Urban Development  
"Green Smart Sustainable Building between Present & Future"  
Cairo, Egypt - 15<sup>th</sup> - 17<sup>th</sup> December 2024



Ministry of Housing, Utilities  
and Urban Communities



## Dr. Mustafa Gül

Professor, Civil & Env. Eng.

### **Lecture Title: Towards Sustainable, Resilient, and Energy-Efficient Smart Cities: Building Infrastructure and Energy Systems of the Future**

#### **Abstract :**

Building sustainable, resilient, and energy-efficient smart cities is one of the significant challenges of our time. Dr. Mustafa Gül's research addresses this challenge by developing innovative solutions that enhance the resilience and sustainability of urban infrastructure systems. The core of his research is twofold: the Crowdsensing-based Monitoring of Built and Natural Environments (CoMBiNE) framework and the integration of solar PV systems in smart buildings.

The CoMBiNE framework leverages big data from existing sensors and cameras within current vehicles, as well as connected and autonomous vehicles, to monitor infrastructure systems. It enables real-time assessment and management of transportation and energy infrastructure, as well as Wildland-Urban Interface (WUI) fire risks, enhancing urban resiliency. The integration of AI-powered automated inspection tools further complements traditional systems, offering a cost-effective and efficient approach to maintaining and improving the sustainability and resilience of urban systems in the face of climate change.

In addition, Dr. Gül's research on solar PV-integrated smart buildings focuses on enhancing sustainability and energy efficiency in communities and cities. By integrating AI and IoT technologies, this research supports the design of solar PV-integrated smart buildings, optimizing energy use and enhancing grid interaction. The focus extends to community-wide applications, developing automated methodologies for the optimal layout of solar PV systems on building rooftops and façades. This approach not only improves energy efficiency but also contributes to the overall sustainability and resilience of urban environments. Recently, his team has been developing an IoT system to increase onsite usage of the energy generated by residential solar PV systems.

Through these combined efforts, Dr. Gül's research provides a comprehensive and forward-thinking approach to building sustainable, resilient, and energy-efficient smart urban environments, addressing the pressing issues of climate change and urbanization. This presentation will discuss the methodologies, technological integrations, and real-world applications of these research initiatives.



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## **Field of Experience:**

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Dr. Mustafa Gül is a Professor in the Department of Civil and Environmental Engineering at the University of Alberta (UofA). Dr. Gül’s current research focuses mainly on developing novel technologies for smart, sustainable, and resilient cities and societies by developing technologies for Crowdsensing-based Monitoring of Built and Natural Environments (CoMBiNE). In addition, Dr. Gül investigates various topics, such as efficient integration of solar PV Systems into energy-efficient buildings and community-wide and city-wide solar PV applications. Dr. Gül has led more than 25+ large-scale research projects in the infrastructure and energy areas funded by various federal and provincial organizations and industry partners, and he has published 90+ journal papers and 100+ conference papers in the areas of infrastructure and energy.

Dr. Mustafa Gül received his BSc and MSc in Civil Engineering from Boğaziçi University in Turkey in 2002 and 2004, respectively. He then pursued doctoral studies at the University of Central Florida (UCF), obtaining his PhD in Civil Engineering in 2009 on monitoring of civil infrastructure systems. While conducting his postdoctoral research, he also obtained an MSc degree in Electrical Engineering at the UCF in 2011 with a focus on image/signal processing and Artificial Intelligence (AI). Dr. Gül has been an Assistant, Associate and Full Professor at the University of Alberta since 2011. Additionally, Dr. Gül is currently serving as the Director of Internationalization for the Faculty of Engineering.