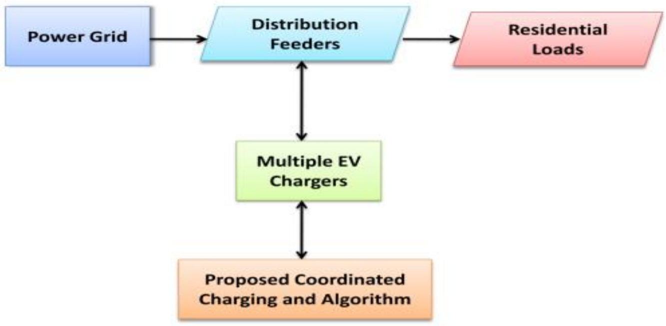
Program Profile		
Program	Program name	Coordinated Charging of Electric Vehicles (EVs) to Minimize Grid Stress in a Smart Grid Environment Using Simulink.
	Category	B4: Research and Development

Summary of Program	
Program Name	Coordinated Charging of Electric Vehicles (EVs) to Minimize Grid Stress in a Smart Grid Environment Using Simulink.
Category	B4: Research and Development
Abstract of Program	The rapid adoption of Electric Vehicles (EVs) presents both opportunities and challenges for modern power systems. While EVs can contribute to sustainable transportation, their uncoordinated charging behavior significantly increases the risk of grid stress, voltage fluctuations, and peak demand. This paper investigates a coordinated charging strategy for EVs in a smart grid environment, modeled and simulated using MATLAB/Simulink. The proposed framework employs a scheduling algorithm that dynamically adjusts charging rates based on grid load conditions, available generation, and user requirements. The simulation results demonstrate that coordinated charging not only reduces peak load and enhances grid stability but also improves overall energy utilization efficiency. The findings highlight the potential of intelligent charging coordination as a practical solution for integrating large-scale EV deployment into future smart grids while maintaining reliable and sustainable power system operation.

Details of Program		
Planning		
Objectives	Long-term Goals	The long-term goal of this research is to develop an intelligent and scalable coordinated charging framework that enables seamless integration of a large number of Electric Vehicles (EVs) into future smart grids without causing adverse effects on grid stability, reliability, or efficiency. This includes minimizing peak demand, reducing infrastructure stress, and supporting renewable energy integration while ensuring user charging requirements are met.
	Short-term Targets	The short-term goal is to design and simulate a coordinated EV charging model in MATLAB/Simulink that dynamically schedules charging activities based on real-time grid conditions and user demand profiles. The model aims to demonstrate reduction in peak load, smoother load profiles, and improved voltage stability when compared to uncoordinated charging scenarios.
	Rationale	The electrification of the transportation sector is growing rapidly, with EV adoption projected to increase significantly in the coming years. However, unregulated and simultaneous charging of EVs can lead to excessive peak loads, transformer overloading, voltage

		instability, and higher operational costs for utilities. Coordinated charging strategies present a practical solution by intelligently managing charging times and rates, thereby balancing the trade-off between user convenience and grid stability. Using Simulink as a simulation platform allows for accurate modeling of both EV charging dynamics and grid performance, providing a controlled environment to evaluate the effectiveness of the proposed strategy. This research not only addresses pressing challenges in smart grid operation but also contributes to sustainable energy management and policy planning for large-scale EV deployment.
Subject (Leader)	Initiator(s)	RAHMAN, Md. Istianatur
	Champion(s)	RAHMAN, Md. Istianatur
	Major team member(s)	Research team of EEE Department, World University of Bangladesh
Environment	Nature/Society	Coordinated EV charging reduces carbon emissions and enhances sustainable energy use by alleviating grid stress and enabling higher renewable energy penetration.
	Industry/Market	Smart charging strategies lower infrastructure costs, extend asset lifespan, and create new business opportunities for utilities and EV service providers.
	Citizen/Government	Coordinated EV charging ensures reliable electricity supply, supports national energy policies, and promotes wider EV adoption with minimal disruption to consumers.
Resources	Human resources	Faculty, researchers, and graduate students with wireless/ML expertise.
	Financial resources	Internal funding is available; external grants are needed for scaling.
	Technological resources	The coordinated EV charging framework leverages MATLAB/Simulink for modeling, smart grid communication infrastructure, and advanced control algorithms to optimize charging while minimizing grid stress.
Mechanism	Strategy (Weight/Sequence)	The proposed strategy prioritizes minimizing peak grid load (highest weight), followed by maintaining voltage stability, optimizing user charging satisfaction, and finally reducing overall system losses, executed sequentially through adaptive charging control in Simulink simulations.
	Organization	Program aligns with WUB's EEE Department research agenda.
	Culture	University promotes applied, industry-linked innovation.
Doing		
Launch date		January 2024

Responsible organization	Department of EEE, World University of Bangladesh
Program content and process	The program develops a coordinated EV charging framework in MATLAB/Simulink, where charging schedules are dynamically controlled based on grid load, user demand, and renewable energy availability. The process involves modeling EVs as dynamic loads, simulating smart grid operation, applying coordination algorithms, and comparing performance against uncoordinated charging.
Key highlights of the content/process	I. Dynamic charging scheduling based on real-time grid conditions. II. Integration of user demand profiles with grid stability requirements. III. Use of Simulink for accurate system-level modeling and validation. IV. Reduction of peak load and smoother load profiles. V. Support for renewable energy integration.
Differences from traditional approaches	I. Traditional charging is uncoordinated, leading to peak demand and transformer stress, whereas the proposed method uses intelligent coordination to balance grid and user needs. II. Unlike static load models, this approach uses dynamic simulations with adaptive scheduling. III. Traditional systems focus on individual EVs, while this framework considers aggregate system-level impacts in a smart grid environment.
Progress as of today	Basic EV charging and smart grid models have been developed in Simulink.
Problems in implementation	High computational complexity for large-scale EV integration.
Approaches to solve the problems	Use of hierarchical control strategies to reduce computational burden.
Completion date, if completed	3 months required
Seeing	
Impacts on students	Students gain hands-on experience with smart grid simulation, EV integration, and optimization algorithms, preparing them with practical skills for future careers in renewable energy and power systems.
Impacts on professors	Professors benefit from new research opportunities, publications, and collaborations in the field of smart grids, EV technology, and sustainable energy management.
Impacts on university administration	The university strengthens its research profile, attracts funding opportunities, and enhances its reputation as a hub for innovation in smart energy and transportation systems.
Responses from industry/market	Industry views coordinated EV charging research as a solution to reduce infrastructure costs, improve asset reliability, and open new

	markets for smart charging services and renewable integration.
Responses from citizen/government	Governments and citizens see the approach as supporting national energy policies, ensuring reliable electricity supply, reducing emissions, and encouraging wider EV adoption.
Measurable output (revenues)	Publications, patents, licensing opportunities, projected USD 15,000.
Measurable input (expenses)	Staff, labs, grants, estimated USD 10,000.
Cost-benefit analysis for effectiveness	2:1 ratio (benefits exceed costs).
Future Planning	
Where does the project go from here?	The project will advance by scaling the coordinated EV charging framework to larger networks with thousands of vehicles, integrating real-time renewable generation data, implementing predictive and adaptive algorithms, validating performance with hardware-in-the-loop (HIL) simulations, and exploring interactions with demand response programs to further enhance grid stability and energy efficiency.
Addendum	
Exhibits, pictures, diagrams, etc.	
Reports, mimeos, monographs, books, etc.	
Others which may help explain the program (including website links)	