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Design Of Power Converter for Solar Powered Green House Using V2h Technology

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ABSTRACT: This project proposes a solution aimed at optimizing energy utilization and promoting sustainability through a renewable energy-based bidirectional charging system. The primary objective is to establish a seamless energy exchange between a residential home and an electric vehicle (EV) by leveraging photovoltaic (PV) panels, home batteries, and a bidirectional converter. Initially, the PV panels capture solar energy to charge the home battery, facilitating efficient storage of renewable energy. When both PV and mains supply are unavailable, and the EV battery level exceeds 50%, the system shifts into discharge mode. In this mode, the bidirectional converter efficiently draws power from the EV battery and converts it for home use, ensuring continuous power supply even during grid outages or low solar irradiance. This approach not only maximizes the utilization of renewable energy sources but also enhances energy resilience and grid stability. It presents a sustainable and adaptable strategy for energy management, reducing dependence on non-renewable sources and cutting carbon emissions while offering a reliable backup power solution.

KEYWORDS: Solar PV Module, Bidirectional Converter, V2H, State of Charge

I. INTRODUCTION

The global transition towards cleaner and more sustainable energy sources has led to the development of innovative technologies that aim to reduce our reliance on fossil fuels and mitigate the impact of climate change. One such technology is the integration of renewable energy sources with electric vehicles (EVs) and residential energy systems. This integration has paved the way for a groundbreaking concept known as the "Renewable Energy-Based Bidirectional Charging System." This system provides a comprehensive solution for optimizing energy utilization, enhancing sustainability, and increasing energy resilience by facilitating bidirectional power flow between a residential home and an EV. In this introduction, we will delve into the key components of this system, including Vehicle-to-Home (V2H) capabilities and bidirectional converters, as well as its numerous advantages and the pressing necessity for its implementation in our rapidly evolving energy landscape.

1. Photovoltaic (PV) System Installation: The first step in implementing the Renewable Energy-Based Bidirectional Charging System involves the installation of a PV system on the roof of the residential home. PV panels are responsible for harnessing solar energy and converting it into electrical power.
2. Buck Converter for PV Integration: To efficiently utilize the electricity generated by the PV panels, a buck converter is employed. The buck converter, also known as a step-down converter, lowers the voltage generated by the PV panels to match the voltage required for charging the home battery. This ensures that the power generated by the PV system is compatible with the battery's charging specifications.
3. Charging the Home Battery: The output from the buck converter is then connected to the home battery. The home battery stores excess energy produced by the PV panels during the day. This energy can be used at night or during periods of low solar irradiance, enhancing energy self-sufficiency and reducing reliance on the grid.
4. Bidirectional Converter for EV Integration: In parallel, a bidirectional converter is connected to the home battery. The bidirectional converter is designed to facilitate bidirectional power flow between the home battery and the electric vehicle (EV). It acts as the intermediary, ensuring that power can be efficiently transferred between the home and the EV in both charging and discharging modes.
5. Inverter Circuit for Home Consumption: In the event of insufficient solar generation or during power outages, the home's energy demand is met by the stored energy in the home battery. An inverter circuit is used to convert the direct current (DC) electricity stored in the battery into alternating current (AC), which is the standard form of electricity used in homes. This AC power is then distributed to the home's electrical system for various household appliances and lighting.

The paper is concluded with an overview, other contributions, and future scope.

This study investigates David P. Tuttle, Robert L. Fares [1], Plug-in Electric Vehicles (PEVs) in Vehicle-to-Home (V2H) setups, where PEVs act as residential battery storage or backup generators during grid failures. Using real data from a smart grid in Austin, Texas, and a custom PEV model, the research evaluates how PEVs perform as backup power sources. It considers factors like PV generation, PEV battery size, and gasoline availability to analyse backup duration. The results inform optimal control strategies for PV-enabled V2H systems, methods to extend backup time, and self-sustaining off-grid solutions.

Ahmed A. S. Mohamed., [2] found a novel strategy using bidirectional-capable electric vehicles (EVs) as backup batteries in AC vehicle-to-home (V2H) systems, ensuring uninterrupted power for critical home loads during outages. It employs smart breaker technology and a home energy management system (HEMS) for real-time control. The study evaluates system performance using simulations and compares it with a residential battery, showing superior load support, solar utilization, and cost savings with the V2H approach.

Martin Kosinka., [3] and associates ("V2H control system software analysis and design", ICCAS 2020) these author tells the help of vehicle-to-home systems, smart homes and electric cars can be connected to draw power from the latter in the event of a shortage or store excess energy from other sources, such solar power plants, inside the electric vehicle. A few fundamental algorithms must be implemented in order to manage the exchange and keep the energy needed to either reach the charging station or continue working. The study and partial implementation of control software for the Raspberry Pi platform are described in this article.

Shinya Ohara, Hideki Omori., [4] his paper proposes a novel single-ended bidirectional converter for wireless Vehicle-to-Home (V2H) systems, [5] aiming to improve power controllability and reliability. Traditional converters face challenges in frequency control and parameter variations, which this innovative converter addresses without mutual communication. It offers cost-effective implementation and effective phase-shift control, promising enhanced efficiency and reliability in integrating renewable energy into V2H systems.

Taichi Iwanaga., [8] found a new bidirectional inductive power transfer (IPT) system designed for wireless Vehicle-to-Home (V2H) applications, aiming to support the adoption of electric vehicles (EVs) in smart house systems. The system emphasizes simplicity, low cost, and efficiency, using basic components and a compact single-ended quasi-resonant high-frequency inverter. Its goal is to facilitate widespread adoption of wireless EV charging for home use, addressing the need for convenient and accessible battery charging infrastructure.

Yubo Wang., [15] in this research discusses the challenge of grid instability caused by charging electric vehicle (EV) batteries from the grid, especially in areas with frequent load shedding. It proposes using solar PV-based charging for EVs to mitigate this issue. The article introduces controllers that transform existing home inverters into PV grid-connected inverters, capable of utilizing surplus solar PV energy to charge EV batteries. These controllers incorporate advanced control strategies for reliable power supply and offer economy and reliable modes to enhance standby power supply while maximizing solar PV energy utilization. This approach eliminates the need for customers to invest in new solar grid-connected inverters or additional devices for EV battery charging if they already have a home-based inverter. Furthermore, Chaithanya K. Gowda and associates [18] ("Bidirectional on-board EV battery charger with V2H application" IPACT, 2019) Power electronic based power converters are used to charge high voltage traction battery of Electric vehicles from the grid. Bidirectional converter allows using this battery as an energy source. Such a bidirectional converter consists of frontend bidirectional AC-DC converter followed by a bidirectional DC-DC converter. The bidirectional AC-DC converter regulates current at the ac side to realize power factor correction. It also reduces THD of inverted AC voltage. The back end isolated DC-DC converter performs CC-CV battery charging by regulating battery side current or voltage. This paper proposes a unique control strategy for Dual Active Bridge (DAB) bidirectional DC-DC converter to regulate battery charging and discharging process and to run a standalone AC load from the battery.

II. PROPOSED SYSTEM

This project presents a solution for optimizing energy utilization and enhancing sustainability through a renewable energy-based bidirectional charging system. The core idea is to create an energy exchange between a residential home and an electric vehicle (EV) by utilizing photovoltaic (PV) panels, home batteries, and a bidirectional converter. When both PV and mains supply are unavailable, and the EV battery level exceeds 50%, the system transitions into discharge

mode. In this mode, the bidirectional converter efficiently draws power from the EV battery and inverts it for home use, ensuring uninterrupted power supply even during grid outages or low solar irradiance.

The global shift towards cleaner and more sustainable energy sources has spurred the development of innovative technologies aimed at reducing reliance on fossil fuels and combating climate change. Among these innovations is the integration of clean energy sources with electric vehicles (EVs) and residential energy systems. This integration has given rise to the revolutionary concept of the "Renewable Energy-Based Bidirectional Charging System." This system offers a holistic solution for optimizing energy usage, promoting sustainability, and bolstering energy resilience by enabling bidirectional power flow between residential homes and EVs. In this introduction, we will explore the key components of this system, including Vehicle-to-Home (V2H) capabilities and bidirectional converters [6], along with its myriad benefits and the urgent need for its adoption in our rapidly evolving energy landscape.

Vehicle-to-Home (V2H): The Vehicle-to-Home (V2H) concept plays a pivotal role within the Renewable Energy-Based Bidirectional Charging System, representing a fundamental component of its functionality. By leveraging V2H technology, electric vehicles (EVs) are transformed from mere transportation tools into versatile mobile energy storage units capable of supplying surplus energy to a residential home's electrical system. This bi-directional exchange of energy, facilitated by advanced bidirectional converters [7], offers a multitude of benefits to both EV owners and the broader energy grid.

Bidirectional Converter: At the core of this innovative system lies the bidirectional converter, serving as a critical facilitator of the V2H concept. This electronic device plays a pivotal role in efficiently managing the flow of power between the EV battery and the home. When surplus electricity is generated by the home's photovoltaic (PV) panels, the bidirectional converter directs this excess energy to charge the EV battery. Conversely, during periods of insufficient power generation from the PV panels or in the event of a grid outage, the bidirectional converter seamlessly transitions to discharge mode. In this mode, it supplies energy from the EV battery to the home, ensuring a continuous and reliable energy supply. This dynamic and versatile operation of the bidirectional converter enables uninterrupted energy flow, benefiting both the home and the EV.

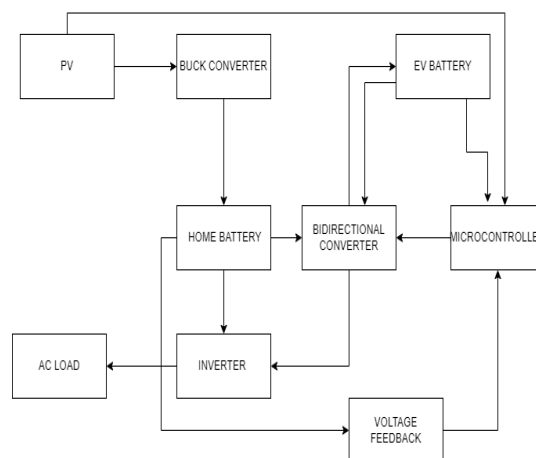


Fig.1. Block diagram.

The block diagram in Fig.1. outlines the power flow and control mechanism within the system. It begins with the Solar PV system, which supplies voltage to the Buck converter. This converter regulates the voltage supply before transferring it to the home battery for storage.

From the Home battery, the power can flow in two directions. One path leads to the Inverter, which converts the stored energy into usable AC power for the Load. Simultaneously, another branch connects the home battery to the Bidirectional converter.

The Bidirectional converter serves a dual purpose. When the PV system experiences power outages or limitations, it facilitates the transfer of power from the home battery to the Load through the Inverter. Additionally, if the Electric

Vehicle (EV) battery's State of Charge (SOC) is above 50%, the Bidirectional converter enables the discharge of energy from the EV battery to the Load via the Inverter, enhancing system efficiency.

To monitor and control these processes, a microcontroller integrates with the system, providing real-time status updates of the SOC of the EV battery and the operational status of the PV system.

III. METHODOLOGY OF THE PROPOSED SYSTEM

The methodology for charging the home battery utilizing PV and the bidirectional converter encompasses several key steps. It begins with the installation of PV panels, which capture solar energy and convert it into electrical power. A buck converter is then employed to efficiently manage this power, ensuring optimal utilization. Excess energy generated by the PV panels is stored in the home battery for later use. A bidirectional converter facilitates the exchange of power between the home battery and the electric vehicle, enabling seamless energy transfer in both directions. Additionally, an inverter circuit is incorporated to ensure that the stored energy is readily accessible for home consumption, thereby enhancing energy self-sufficiency and serving as a reliable backup power source during grid outages. The bidirectional converter equation plays a pivotal role in optimizing power flow and minimizing energy losses, thereby maximizing the efficiency of the overall charging process.

1. Photovoltaic (PV) System Installation: The initial phase in deploying the Renewable Energy-Based Bidirectional Charging System entails installing a PV system atop the residential home. PV panels are tasked with capturing solar energy from sunlight and converting it into electrical power.

2. Buck Converter for PV Integration: To optimize the utilization of electricity generated by the PV panels, a buck converter is utilized. Also referred to as a step-down converter, this component reduces the voltage produced by the PV panels to align with the voltage necessary for charging the home battery. This synchronization guarantees that the power generated by the PV system aligns with the battery's charging requirements.

3. Charging the Home Battery: The output from the buck converter is then connected to the home battery. The home battery stores excess energy produced by the PV panels during the day. This energy can be used at night or during periods of low solar irradiance, enhancing energy self-sufficiency and reducing reliance on the grid [13].

4. Bidirectional Converter for EV Integration: Simultaneously, a bidirectional converter is linked to the home battery. This converter is engineered to enable bidirectional power flow between the home battery and the electric vehicle (EV). Serving as an intermediary, it guarantees efficient transfer of power between the home and the EV in both charging and discharging modes.

5. Inverter Circuit for Home Consumption: During periods of inadequate solar generation or in the event of power outages, the energy requirements of the home are fulfilled by the stored energy within the home battery. An inverter circuit is employed to transform the direct current (DC) electricity stored in the battery into alternating current (AC), which is the conventional form of electricity utilized in households. Subsequently, this AC power is distributed throughout the home's electrical system to power various household appliances and lighting fixtures.

6. Bidirectional converter equation: The bidirectional converter plays a pivotal role in the described system, enabling bidirectional power flow between a home battery and an electric vehicle (EV). Its functionality revolves around efficient conversion and management of electrical energy in both charging and discharging modes.

$$P_{out} = \eta \times (P_{in} - P_{loss}) \quad (1)$$

Where:

P_{out} denotes the output power, which can be utilized for either charging the EV or supplying power to the home.

P_{in} represents the input power, sourced from the home battery during discharge or the PV system during charging. Any losses incurred during the bidirectional conversion process are denoted by P_{loss} .

The efficiency of the bidirectional converter, denoted by η (eta), factors in these losses and is typically expressed as a percentage.

This equation elucidates how the system efficiently manages power flow between the home battery and the EV, ensuring maximal energy transfer while minimizing losses.

Operating Modes: A bidirectional converter can operate in two primary modes: charging and discharging.

Charging Mode: When functioning in charging mode, the bidirectional converter facilitates the transfer of electrical energy from an external power source, such as a photovoltaic (PV) system or the grid, to the home battery. The converter adeptly adjusts the voltage and current levels to align with the battery's charging specifications. Furthermore, it diligently monitors and regulates the charging process to guarantee the battery is charged efficiently, without the risk of overcharging or inflicting damage.

Discharging Mode: During discharging mode, when power is required for the home or other loads, the bidirectional converter undergoes a reversal in its operation. It retrieves the stored energy from the home battery and transforms it from direct current (DC) to alternating current (AC), facilitating its utilization by household appliances, lighting, and other electrical loads. This conversion from DC to AC is executed by the inverter stage, which assumes responsibility for the seamless transition between the two forms of electrical current.

Efficiency: Efficiency stands as a crucial facet of a bidirectional converter's functionality, denoting the ratio of output power to input power, commonly expressed as a percentage. These converters are meticulously engineered to operate with high efficiency, typically falling within the range of 90% to 95%. This indicates that 90-95% of the input power is effectively converted into usable output power. It's important to note that the efficiency may vary based on the particular design, components utilized, and prevailing operating conditions of the converter.

Control and Monitoring: Bidirectional converters come equipped with sophisticated control and monitoring systems aimed at managing and optimizing their operation. These systems perform continuous evaluations of the system's state, environmental factors, and power requirements. Control algorithms are accurately programmed to make decisions regarding the transition between charging and discharging modes, considering factors such as the battery's state of charge, grid conditions, and prevailing power demand. The primary objective of these algorithms is to uphold the battery's health and ensure efficient utilization of energy resources.

IV. HARDWARE IMPLEMENTATION

The hardware implementation of the bidirectional converter as shown in Fig.2. involves precise assembly and integration of these components into a solid circuit design. By carefully selecting and configuring each component based on its electrical characteristics and operational requirements, the bidirectional converter ensures reliable and optimized energy utilization within the solar-powered greenhouse system.

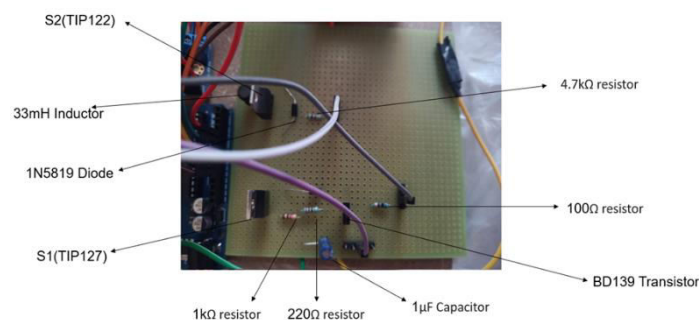


Fig.2. Bidirectional converter

Power Transistors (S2 - TIP122, S1 - TIP127): These high-current transistors are chosen for their ability to handle bidirectional power flow and control voltage levels effectively.

Diode (1N5819): The 1N5819 diode is utilized for its low forward voltage drop and fast switching characteristics, ensuring minimal power losses during energy transfer.

Inductor (33mH): The 33mH inductor acts as an energy storage element, smoothing out voltage fluctuations and providing stability to the power conversion process.

Resistors (1k Ω , 220 Ω , 100 Ω , 4.7k Ω): Various resistors are integrated into the circuit for purposes such as current limiting, voltage division, biasing, and signal conditioning, optimizing the performance of the bidirectional converter.

Capacitor (1 μ F): The 1 μ F capacitor complements the inductor by further storing energy and aiding in voltage regulation, enhancing the overall efficiency of the power conversion system.

Transistor (BD139): The BD139 transistor serves as a crucial switching element, controlling the direction and magnitude of current flow to enable bidirectional power transfer as per system requirements.

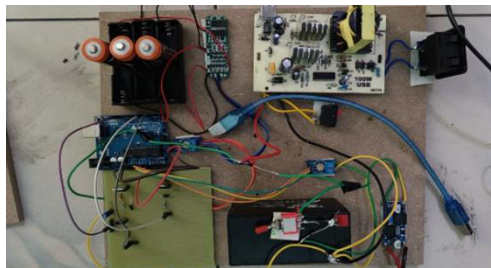


Fig.3. Hardware model of V2H technology

Fig.3. showcases the final hardware implementation for the proposed system. This configuration represents the culmination of the design process, incorporating components such as the solar panel model 10-36P, a Buck Converter with an output voltage range of 1.5-35V, a bidirectional converter with components S2 (TIP122) and S1 (TIP127), a lithium-ion battery setup with a Battery Management System (BMS) circuit, and an inverter module for powering the load.

Here Arduino Uno used as a micro controller to switch the bidirectional converter which provides power pins, including 5-volt and 3.3-volt outputs, as well as a ground (GND) pin for completing electrical circuits. These power pins are used to supply power to external components such as sensors, displays, and communication modules [17]. The availability of multiple voltage options allows developers to interface with a wide range of devices that operate at different voltage levels, enhancing the compatibility and versatility of the Arduino Uno platform.

Solar panel: The solar panel for this project is the 10-36P model, rated at 12 volts and 10 watts, with an open circuit voltage (Voc) of 22 volts. This specific model is designed to efficiently convert solar energy into electrical power for various applications.

Role in the Project: Energy Generation: The 10-36P solar panel serves as the primary energy source for the solar-powered greenhouse system, generating electrical power from sunlight.

Power Input for Converter: The output from the solar panel is integrated into the power converter system, providing the necessary voltage and power input for the converter's operation.

Voltage Compatibility: With its rated output voltage of 12 volts and open circuit voltage of 22 volts, the 10-36P model is compatible with the design requirements of the power converter and other components in the system.

Efficiency: The 10-36P solar panel is selected for its efficiency in converting sunlight into electricity, contributing to the overall performance and sustainability of the greenhouse system.

Environmental Impact: By utilizing solar energy, the project reduces reliance on non-renewable energy sources and helps mitigate environmental impact, aligning with sustainable practices.

DC-DC Buck Converter: The DC-DC Buck Converter Step Down Module, identified by model number 0219VCAZH90, stands as a versatile and efficient component tailored for voltage regulation and power conversion within electronic systems. Offering an output voltage range spanning from 1.5 volts to 35 volts, operating at a frequency of 50 Hz, and boasting a current rating of 3 amperes, this Buck Converter proves highly adaptable across a



spectrum of applications. Specifically, it finds relevance in projects such as the solar-powered greenhouse initiative employing V2H technology.

Voltage Regulation: The Buck Converter efficiently steps down higher input voltages from power sources such as solar panels to adjustable lower output voltages within the range of 1.5V to 35V, providing stable and regulated power for connected devices and components.

Lead Acid Battery: The 12V 1.3 Ah lead-acid battery is a rechargeable energy storage device commonly used in various applications, including backup power systems, portable electronics, and automotive applications. This type of battery is known for its reliability, relatively low cost, and ability to provide a stable voltage output.

Voltage Output: The battery provides a nominal voltage of 12 volts, making it compatible with a wide range of electronic devices and systems that require 12V power sources.

Capacity: With a capacity of 1.3 Ah (Ampere-hours), the battery can deliver a continuous current of 1.3 amperes for one hour or lower currents for longer durations, depending on the load and usage patterns.

Lithium Ion Battery: The Lithium Battery Protection Board, commonly referred to as a Battery Management System (BMS) as shown in Fig 2.3.4, is accurately engineered to guarantee the safe and effective functioning of lithium-ion battery packs. Tailored for a 3S (3 Series) battery configuration, this particular BMS offers an array of protection and management capabilities for battery packs with a combined output voltage of 12.6 volts and a current rating of 20 amps. This comprehensive system ensures the integrity and longevity of lithium-ion battery packs, enhancing both safety and performance in various applications.

Voltage Regulation: The BMS regulates the output voltage of the battery pack, ensuring that it remains within safe operating limits (in this case, 12.6 volts for a 3S configuration).

Voltage Sensor: The Voltage Sensor is a device designed to detect and monitor voltage levels within a specified range. In this case, the sensor is configured to trigger when the voltage level (VCC) falls below 25 volts, indicating a low voltage condition.

V. RESULT

The bidirectional converter implemented in this project has successfully delivered the expected output, ensuring sustainability through optimized energy utilization for vehicle to home

Condition	Output Voltage
Lead acid Battery ON	0V
Lead acid Battery OFF	11.9V
Bidirectional Converter Output- Lead acid Battery ON	3.89V
Bidirectional Converter Output- Lead acid Battery OFF	0V
Bidirectional Converter Output- Boost Mode (Open Circuit)	39.8V
Bidirectional Converter Output- Boost Mode (Close circuit)	12.2V

Table.1. Results of the proposed system

VI. CONCLUSION

In conclusion, the Renewable Energy-Based Bidirectional Charging System, with its core component, the bidirectional converter, represents a pivotal innovation in energy management. This system facilitates bidirectional power flow between a residential home and an electric vehicle (EV), harnessing the potential of renewable energy sources. It offers a dynamic approach to energy utilization, promoting sustainability by efficiently charging the home battery from photovoltaic panels, reducing reliance on non-renewable sources, and lowering carbon emissions. Additionally, the ability to switch seamlessly to discharging mode during grid outages or low solar production enhances energy resilience, providing homeowners with reliable backup power. The bidirectional converter's efficiency, control mechanisms, and protection features ensure safe and optimized operation. As the world transitions to cleaner energy solutions, this technology plays a pivotal role in mitigating climate change, improving energy efficiency, and strengthening grid reliability, making it a cornerstone of a sustainable and resilient energy future [18].

Future scope: The Renewable Energy-Based Bidirectional Charging System has a promising future, offering opportunities for advancement and widespread adoption. Its integration with renewable energy sources and electric vehicles can improve energy sustainability and grid stability. Future developments may enhance efficiency, integrate with smart grids, and establish communication protocols for seamless interoperability, building a more interconnected and sustainable energy ecosystem.

REFERENCES

- [1] Fares, Ross Baldick, Michael E. Webber, "Plug-In Vehicle to Home (V2H) duration and power output capability", 2013 IEEE Transportation Electrification Conference and Expo (ITEC)
- [2] Ahmed A. S. Mohamed, Azrin Mohd Zulkefli, Sadaraboina Moses Vidya Sagar, Uma Maheswari Gajjarapu, Amal Thomas, Vijay Bhavaraju, "Smart Vehicle-to-Home (V2H) Platform Enabled Home Energy Management System (HEMS) for Backup Supply", 2023 IEEE Green Technologies Conference (Greentech)
- [3] Martin Kosinka, Zdenek Slanina, Michal Petruzela, Vojtech Blazek, "V2H control system software analysis and design", 2020 20th International Conference on Control Automation and Systems (ICCAS)
- [4] Shinya Ohara, Hideki Omori, Noriyuki Kimura, Toshimitsu Morizane, Mutuo Nakaoka, Yoshimichi Nakamura, "A new V2H system with single-ended inverter drive bidirectional wireless resonant IPT", 2014 International Power Electronics and Application Conference and Exposition
- [5] Mahdi Shafaati Shemami, Syed Muhammad Amr, Mohammad Saad Alam, M. S. Jamil Asghar, "Reliable and Economy Modes of Operation for Electric Vehicle-to-Home (V2H) System", 2018 5th IEEE Uttar Pradesh Section International Conference on Electrical Electronics and Computer Engineering (UPCON)
- [6] "Plug-In Electric Vehicle to Home (V2H) Operation Under a Grid Outage", IEEE Transactions on Smart Grid
- [7] "On-board electric vehicle battery charger with enhanced V2H operation mode", IECON 2014 - 40th Annual Conference of the IEEE Industrial Electronics Society
- [8] Taichi Iwanaga, Hideki Omori, Tatsuya Takahashi, Masahito Tsuno, Toshimitsu Morizane, Noriyuki Kimura, "A Novel Type of Wireless V2H with Single Switch Dual-Active Seamless Converter in a Smart House", 2018 IEEE 18th International Power Electronics and Motion Control Conference (PEMC)
- [9] "Aggregation of V2H Systems to Participate in Regulation Market", IEEE Transactions on Automation Science and Engineering
- [10] Mahdi Shafaati Shemami, Mohammad Saad Alam, M.S. Jamil Asghar, "Load shedding mitigation through plug-in electric Vehicle-to-Home (V2H) system", 2017 IEEE Transportation Electrification Conference and Expo (ITEC)
- [11] Aoto Yamamoto, Hideki Omori, Masahito Tsuno, Junnosuke Nohara, Noriyuki Kimura, Toshimitsu Morizane, "A New Type of Single-Ended Wireless V2H System with Dual-Active Phase-Shift Control", 2018 IEEE International Power Electronics and Application Conference and Exposition (PEAC)
- [12] Homayon Soltani Gohari, Karim Abbaszadeh, Jafar Gholami Gorji, "A novel Off-Board Interleaved Charger for EVs with G2H/G2VH/V2H Functions and Capable of Controlling Reactive Power", 2020 28th Iranian Conference on Electrical Engineering (ICEE)
- [13] Dalong Guo, Peizhong Yi, Chi Zhou, Jia Wang, "Optimal electric vehicle scheduling in smart home with V2H/V2G regulation", 2015 IEEE Innovative Smart Grid Technologies - Asia (ISGT ASIA)
- [14] Iason Vittorias, Michael Metzger, Dennis Kunz, Matthias Gerlich, Georg Bachmaier, "A bidirectional battery charger for electric vehicles with V2G and V2H capability and active and reactive power control", 2014 IEEE Transportation Electrification Conference and Expo (ITEC)



- [15] Yubo Wang, Omar Sheikh, Boyang Hu, Chi-Cheng Chu, Rajit Gadh, "Integration of V2H/V2G hybrid system for demand response in distribution network", 2014 IEEE International Conference on Smart Grid Communications (SmartGridComm)
- [16] Minh Kwon, Sehyung Jung, Sewan Choi, "A high efficiency bi-directional EV charger with seamless mode transfer for V2G and V2H application", 2015 IEEE Energy Conversion Congress and Exposition (ECCE)
- [17] Viet T. Tran, Md. Rabiul Islam, Kashem M. Muttaqi, Danny Sutanto, "A Novel Universal Magnetic Power Plug to Facilitate V2V/V2G/G2V/V2H Connectivity for Future Grid Infrastructure", 2020 IEEE Industry Applications Society Annual Meeting
- [18] Chaithanya K. Gowda, Vibhav G. Khedekar, N. Anandh, Laxman Rao S. Paragond, Prakash Kulkarni, "Bidirectional on-board EV battery charger with V2H application", 2019 Innovations in Power and Advanced Computing Technologies (i-PACT)



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