DEVSEN

Decentralized
EVSE (Electric Vehicle Supply Equipment)
Network

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ABSTRACT

DEVSEN (Decentralized EVSE Network) revolutionizes the EV charging ecosystem by leveraging blockchain to replace centralized cloud systems with a decentralized, transparent, and interoperable infrastructure. Through smart contracts, DEVSEN manages authorized users, EVSE devices, and scalable device creation, ensuring seamless interaction between users and charging stations. DEVSEN integrates the Open Charge Point Protocol (OCPP) to handle real-time operations such as status updates, charging sessions, and device management, with all interactions immutably recorded on the blockchain.

1. INTRODUCTION

The current EVSE (Electric Vehicle Supply Equipment or EV Charger) networks operate on private, company-owned infrastructures, creating barriers to transparency, interoperability, and scalability. DEVSEN (Decentralized EVSE Network) proposes a transformative approach by utilizing blockchain technology to establish a public, decentralized network where EV chargers can communicate openly and securely.

DEVSEN replaces centralized cloud systems with decentralized nodes that implement the Open Charge Point Protocol (OCPP). These nodes manage critical functions, including processing boot notifications, charging session management, and real-time availability updates. The data is then securely and immutably recorded on a blockchain ledger, ensuring transparency and reliability.

2. KEY FEATURES

DEVSEN aims to redefine the EV charging ecosystem by democratizing access to charger data and enabling an open, sustainable, and universally accessible network. This innovative approach will empower EV users, charger operators, and stakeholders with a transparent, decentralized, and collaborative platform.

Here are the key aspects of bringing decentralization into EVSE ecosystem:

1. Decentralization: Independent nodes maintain the network, eliminating single points of failure and dependence on proprietary systems.
2. Transparency: Charger availability and operational data are publicly accessible, fostering trust and informed decision-making.
3. Interoperability: OCPP standardization ensures seamless communication across diverse chargers and decentralized nodes.
4. Scalability: The decentralized architecture supports global expansion without compromising performance or reliability.

3. ARCHITECTURE

DEVSEN's decentralized architecture has below core components:

3.1. DEVSEN Nodes

DEVSEN nodes will serve as intermediaries between EV chargers and the blockchain. Their key functionalities include:

- Listening for OCPP requests: Handle incoming HTTP/WebSocket messages from EV chargers.
- Processing data: Validate and prepare OCPP data for blockchain submission.
- Sending responses: Communicate commands or acknowledgments back to chargers.
- Interfacing with the blockchain: Use smart contracts to record, validate, and retrieve charger data.
- Ensuring multiple DEVSEN nodes can process the same request and reach

agreement on the data submitted to the blockchain via its Consensus mechanism.

3.2. DEVSEN Blockchain Database

DEVSEN's blockchain database, which aims to make the entire EVSE ecosystem visible; is structured around three primary smart contracts: UserDEVSEN, DeviceDEVSEN, and FactoryDEVSEN. The UserDEVSEN contract acts as the foundational access control layer, storing and managing authorized users who can interact with the network. This ensures that only validated participants, such as EV owners, charger managers, and operators, can execute actions within the system.

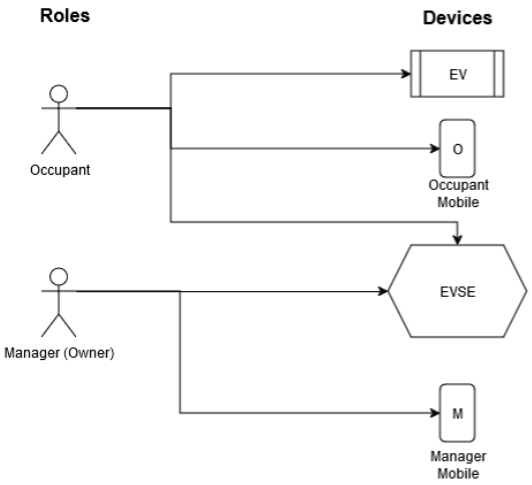
The DeviceDEVSEN contracts represent individual EVSE devices, encapsulating critical metadata such as device location, operational status, occupant details, and capabilities. Each DeviceDEVSEN contract functions as a decentralized database for its respective EVSE, recording real-time status updates and interactions like charging sessions and fault reports. All DeviceDEVSEN contracts are managed and deployed by the FactoryDEVSEN contract, which guarantees unique identifiers for devices and supports seamless scalability as the network grows.

4. IMPLEMENTATION

4.1. Roles

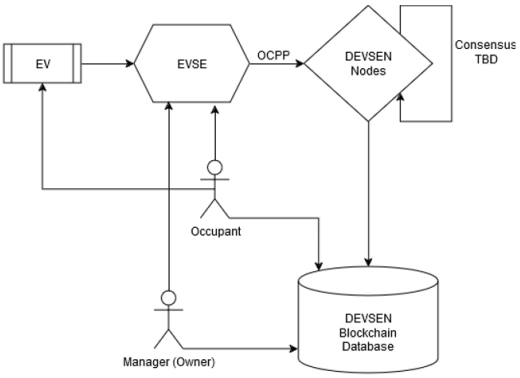
To define a proper implementation, we assigned some roles to corresponded users. An occupant will be the person who will use the charger. A manager is a person or institution who sets up the charger.

Roles and their relations in an EVSE ecosystem can be listed below.



4.2. Infrastructure

High level infrastructural relations between core components can be listed below. This time decentralization units like blockchain database and nodes are included in the figure to highlight the overall protocol.

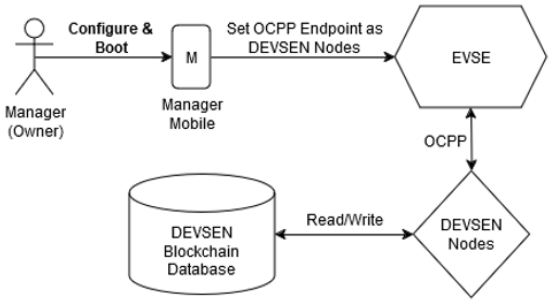


4.3. Scenarios

Here are the use cases and scenarios for a living EVSE ecosystem. Notice that there is a combination of OCPP and DEVSEN protocol mix to handle required actions defined below.

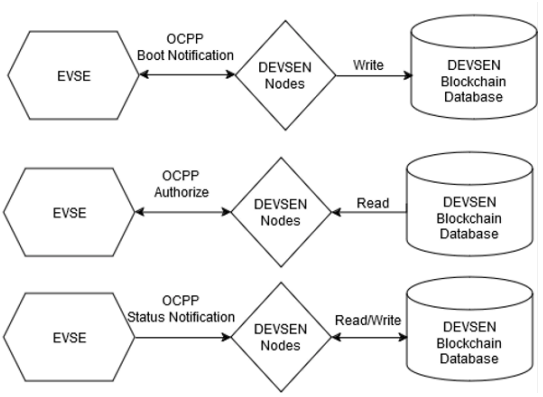
4.3.1. Configuration and Data Flow

This part is mostly related with initial integration/configuration of an EVSE and a high level architecture of the data flow.



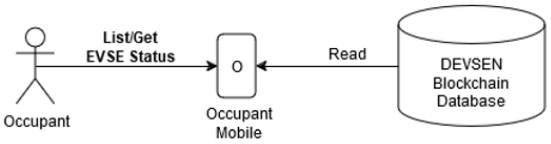
4.3.2. EVSE Data Flow

Below OCPP messages will be wrapped in DEVSEN nodes and get interacted within DEVSEN Blockchain. These are OCPP protocol messages which should be received and responded.



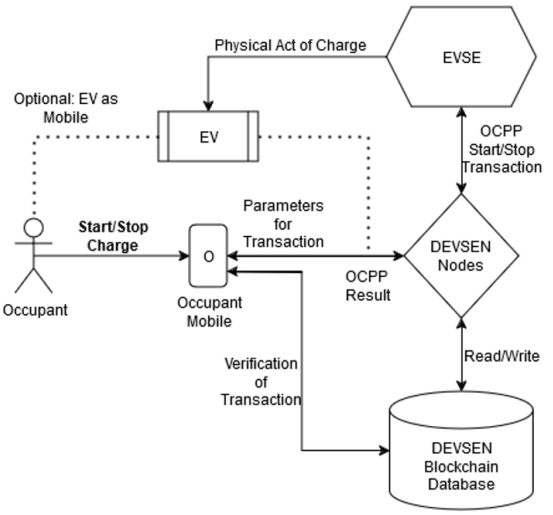
4.3.3. EVSE Retrieval

An occupant can list available EVSE(charger) points by querying the decentralized database via an application on mobile phone or on EV.



4.3.4. Start/Stop Charge

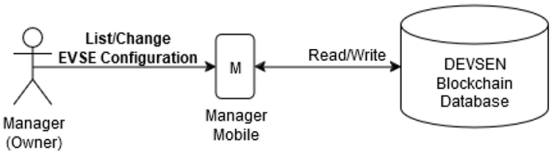
A charging session a.k.a. “transaction” in terms of OCPP, can be visualized in the diagram below.



An occupant can start a charging session via mobile app or EV app where those devices are şnteracting with DEVSEN Nodes and DEVSEN Blockchain to trigger EVSE and receive the response for the requested action.

4.3.5. Retrieve/Update EVSE Configuration

An EVSE owner/manager can get and change EVSE that he/she set up.



5. PAYMENT

In DEVSEN, token-based payment serves as the backbone for seamless and transparent transactions within the decentralized EVSE ecosystem. Users leverage blockchain-native tokens to pay for charging sessions, ensuring fast, secure, and trustless payments. When initiating a charging session, the occupant authorizes a predefined token amount, which will be locked/deposited in a smart contract. Upon session completion, the smart contract automatically settles the payment, transferring the tokens to the EVSE owner or to the institution. This process eliminates intermediaries, reduces transaction costs, and ensures real-time payment settlement. The token-based system also enables interoperability across different regions and charging networks, fostering a unified and scalable payment infrastructure for the growing electric vehicle ecosystem.

Token based payments can also be used for incentivization like incentivization for best performing EVSE (in terms of uptime) owner, frequent occupant and owners who construct a network of EVSEs.

6. SUMMARY

We believe that EV is now and the future and blockchain is for humanity. Combining both elements can bring several opportunities for people who want to get better quotes and accessibility.

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