



Blockchain and Web-Based electric vehicle charging station application design

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Cite this study: Yelman, A., Kaygusuz, A., & Ozdemir, M. F. (2022). Blockchain and Web-Based electric vehicle charging station application design. 2nd Advanced Engineering Days, 86-89

Keywords

Electric Vehicles
Blockchain Technology
Charging Stations
Renewable Energy
Energy Efficiency

Abstract

The rapid development of electric vehicle technology in the last 10 years and the expectation of widespread use of vehicles, along with the fact that vehicles can be charged quickly, safely and at an affordable price, and to obtain information about the battery life of vehicles. Renewable energy powered charging stations participating in smart grids prevent grid fluctuations and provide a more stable grid. Blockchain technology, which is one of the most popular technologies of today, allows vehicles to keep this desired data, as well as to charge them quickly, safely and at an affordable price. In this study, an application that can be made by combining blockchain technology with electric charging stations producing with renewable energy is mentioned. The application saves the previous charging data of the vehicles in blocks with blockchain technology and this data cannot be changed. It can be seen transparently by everyone. In addition, with the web-based application that is aimed to be developed, it is aimed that charging stations will be able to instantly sell the energy they obtain from renewable energies without storing them, and that electric vehicle users will be able to obtain electrical energy at affordable prices. The charging data of the vehicles are kept in blocks, and fast, safe and affordable charging is provided thanks to the web-based application. It allows the energy produced to be used efficiently. At the same time, the charging history of electric vehicles can provide information about battery life.

Introduction

A. Electric Vehicles

Since the invention of the wheel, humanity has devised means to transport people and goods from one place to another. After primitive designs, internal combustion engines and later electric motors were developed. After the development of these engines, fossil fuels or electrical energy were used for their movement. By the 1800s, electric vehicles began to become popular for reasons such as short range. It was used until the 1960s, but remained off the roads until 1980. After the oil crisis in the 1970s, electric vehicles came to the fore again. [1] Increasing ranges are no longer a problem with the development of battery technologies. In the last 10 years, the world agenda has focused on how to charge electric vehicles and the creation of charging infrastructures.

B. Electric Vehicle Charging Stations

Electric vehicles meet the energy they need through charging stations. Electric vehicles meet the energy they need through charging stations. Providing the energy needed by electric cars from renewable energy sources has often been the first target. For this purpose, various systems are designed and electric cars can be charged only with the help of photovoltaic panels or only wind turbines. It is common practice to install a charging station by placing photovoltaic panels on roofs [2].

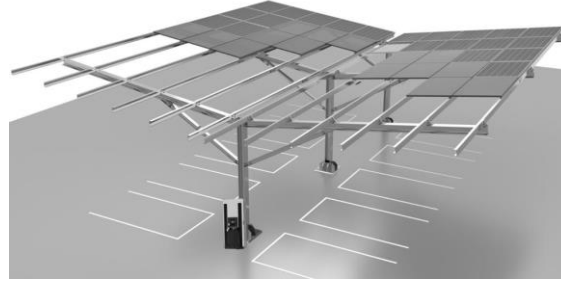


Figure 1. Solar charging station design

C. Smart Grids

Smart grids are a technological evolution of the 20th century electrical grid and are more efficient and controllable than traditional grids. Two-way flow in smart grids [3]. Excess energy can be sold to the grid. Energy tracking becomes easier.

D. Blockchain Technology

The concepts of bitcoin and blockchain were first coined in 2008 by an author named Satoshi Nakamoto, who explained how cryptology and an open distributed ledger could be combined in a digital currency application [4]. Blockchain advocates decentralized and self-management, planning and commerce rather than a centralized management approach. Due to the nature of blockchain technology, it keeps the data it records transparently and is publicly available. It is also secure and all blocks added to the blockchain are kept in a specific hash algorithm and cannot be changed. Because data resides in every block. If changed, the chain will break and the data will no longer be correct. Per-to-per energy trade is also possible through smart grids. Using this technology, a renewable energy-based charging station can sell or buy energy from the vehicle without the need for distribution companies. Even vehicles can sell energy among themselves [3]. In addition, by keeping the data in the blockchain, it is now possible to learn when, how much and at which charging station the vehicles are charged. This helps to see the history of vehicles transparently.

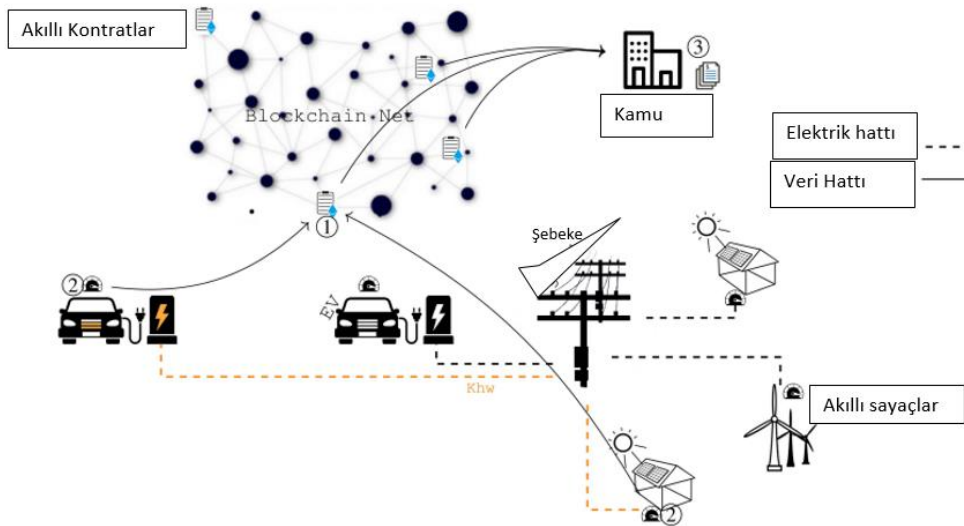
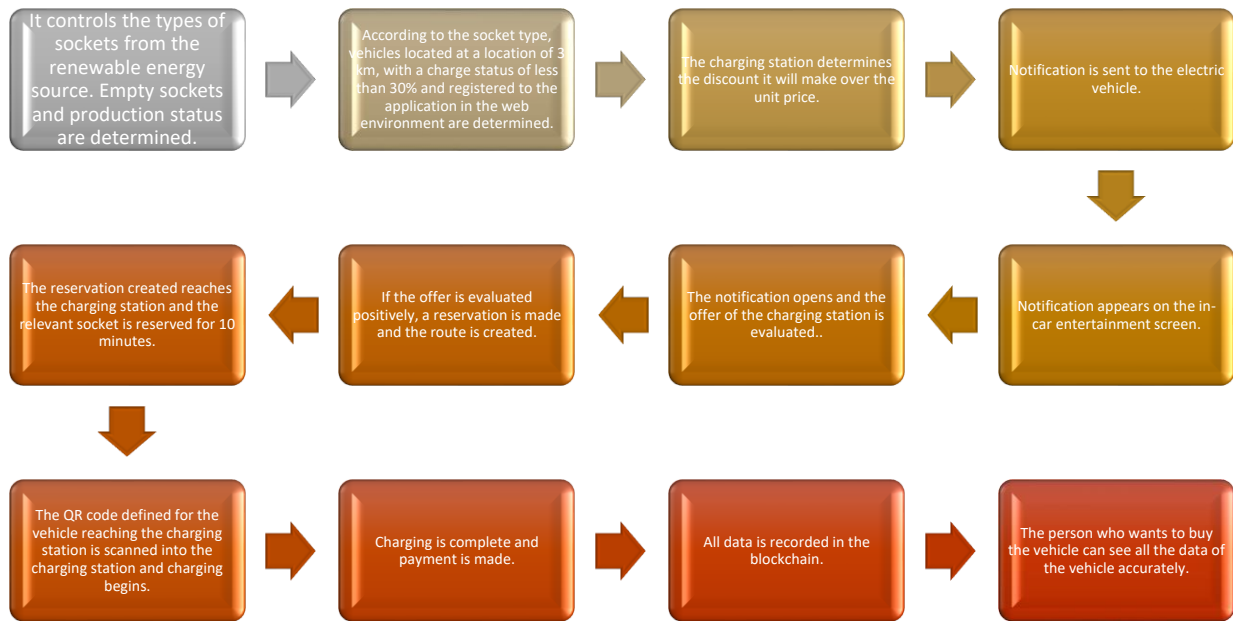


Figure 2. Blockchain-based energy trading [5]

Material and Method

Electric vehicles need charging stations to know that they meet their energy needs at an affordable price. In this study, a web-based software is proposed. A charging station that produces with a renewable energy source wants to instantly sell the energy it produces without storing it. The charging station determines the available socket types and production status. Vehicles that have previously registered to the system with license plates and allow data access are determined. It sends notifications to vehicles with a charge status of less than 30%, located within 3 km of the charging station, based on the type of charging socket the vehicle has. In this notification seen in the in-car entertainment system, it is stated that the socket of the charging station suitable for the vehicle is

empty and can provide charging at a lower price than the normal selling price. The vehicle driver reads the warning and makes a decision. If a positive decision is made, the corresponding socket of the charging station is reserved and the route is established. A 10-minute reservation request arrives at the charging station and the socket to which the notification is sent is reserved. When the vehicle reaches the charging station, the QR code created for the vehicle is scanned to the charging station. Charging starts. At the end of the pricing, the payment is made with the appropriate payment method and the pricing ends. In addition, the data obtained from here is recorded in the blockchain. By defining the hash function on the license plate of each vehicle, it is possible to determine how long the vehicle was charged at which charging station, how many cycles it made, how long it was charged in which charging state, etc. data is recorded in blocks. Since this data is non-changeable, it provides transparent and accurate information during the sale of the vehicle or in case of reviewing its history. The application can be written in the web environment using the python language. The algorithm created is shown in flowchart 1.



Flow Chart 1. Implementation Algorithm

Results

As a result of this study, it can be ensured that charging stations producing electrical energy from renewable energy sources can instantly sell the energy they produce. This can contribute to increased energy efficiency. Vehicle users, on the other hand, are offered the opportunity to charge their vehicles quickly, reliably and at affordable prices. With Blockchain technology, it is possible for people who will buy new vehicles to access real information without consulting anyone. As a result of such a study, reliable information can be obtained as well as providing energy efficiency.

Discussion

In order to achieve energy efficiency, consuming the produced energy immediately can be considered as the cheapest method. The common phenomenon of electric vehicle users is fast, reliable and affordable charging of the vehicle. In addition, people who will buy new electric vehicles can see accurate and reliable information about the vehicles they choose from the data recorded on the blockchain instead of learning from a center.

Conclusion

It can be facilitated to transfer instant generation from renewable energy sourced charging stations to electric vehicles without storage, to charge the electric vehicle more economically, and to access the previous data of the vehicle in a transparent manner with blockchain technology.

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