

Digitalization SCCER-FURIES Blockchain for EV Management

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Summary

Optimization of the management of charging stations for electric vehicles (EVs) within the network of Green Mobility hotels in Val d'Hérens (Figure 1) by exploiting the flexibility of EVs and simplify the exchange of energy between owners of the charging station using the blockchain technology.

Introduction

The project Digitalization SCCER-FURIES aims to simplify exchanges of photovoltaic kWh between electric vehicles (EV) charging stations. A first release is already implemented and will be deployed soon in our pilot environment.

Methods

The Two Tracks Unified Process (2TUP) methodology has been chosen for this project. This methodology merge the technical and functional branch before the development phase.

Technical branch

- The master thesis of Jérémie Vianin (2018) analysed of the technical possibility to link blockchain and a dynamic API request.
- Research analysis performed with our partners EPFL-PV-Lab and SUPSI during SCCER-FURIES project Digitalization (2019-2020) analysed and implemented a smart-contract with the framework AragonOS
- The master thesis of Nelson da Conceição (2020) described the blockchain's ecosystem for EV charging stations.
- EnergyWebFoundation proof of concept was implemented during the Bachelor thesis of Gabriel Riedo (2021)

Functional branch

After having analysed the business needs for our blockchain ecosystem, we studied private and public blockchain systems based on Ropsten testnet (Figure 1).

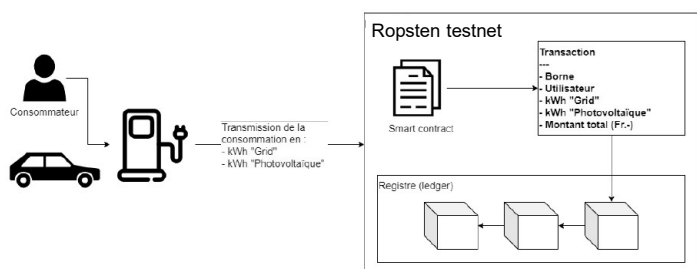


Figure 1 :Architecture of Ropsten testnet proof-of-concept

Development phase

We concluded that a simple smart-contract that contains three methods addHotel, AddEnergyTransaction and getBalance was needed to answer the business needs. This allows all hotel transactions and balances to be managed within the blockchain.

Conclusions

- Our objective is to analyse the pertinence of blockchain ecosystems in the energy sector.
- The platform is fully functional, deployed on test infrastructure and ready to be deployed in a production environment

Results

Pilot infrastructure deployed to hotels member of the Green Mobility network and a test infrastructure at our campus Siere.

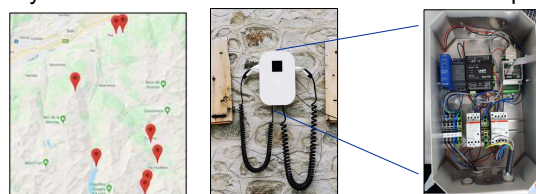


Figure 2 :pilot infrastructures deployed in the Val d'Hérens (Valais-Switzerland)

02/02/2021 13:07:33	00:01:26	TESLA	HOTEL Du Figne	0.036
02/02/2021 13:45:28	00:03:42	Kona	HOTEL Du Figne	0.109
02/02/2021 09:50:28	00:02:42	KONA	HOTEL La TOU	0.223

Balance
-0.12 kWh

Figure 3 : Management interface to check Blockchain transactions and balance

After having implemented the solution, we analysed the real costs. The notion of gas refers to the fee, required to successfully conduct a transaction or execute a contract. The gas is linked with the requested time response and the consensus (figure 1). Ethereum use the proof of work that requires a lot of computational resources. When the test was done, the transaction price was around CHF 70.- on the main network (Figure 4). Ethereum has planned to migrate to hybrid proof of stake/work that will be lighter.



Figure 4 : Confirmation time (secs) and gas price (Gwei) for the last 1000 blocks

We are now studying another approach which combine private and public blockchain systems to reduce the cost by a factor 10 and reach about CHF 7.00 per transaction. We are looking forward to testing the lighter version of Ethereum's consensus.

Partners

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra
Swiss Confederation
Innosuisse – Swiss Innovation Agency

