Using Blockchain in Peer-to-Peer Carsharing to Build Trust in the Sharing Economy

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Abstract. Trust is the lubricant of the sharing economy, especially in peer-to-peer carsharing where you leave a valuable good to a stranger in the hope of getting it back unscathed. Central mechanisms for handling this information gap nowadays are ratings and reviews of other users. The rising of connected car technology opens new possibilities to increase trust by collecting and providing e.g. driving behavior data. At the same time, this means an intrusion into the privacy of the user. Therefore, in this work we explore technological approaches that allow building trust without violating the privacy of individuals. We evaluate to what extent blockchain technology and smart contracts are suitable technologies to meet these challenges by setting up a prototype implementation of a blockchain-based carsharing approach. In this context, we present our research approach and evaluate the prototype in terms of trust and privacy.

Keywords: Blockchain, Carsharing, Trust, Peer-to-Peer, Privacy

1 Introduction

The sharing economy market has grown strongly in recent years [1, 2]. Peer-to-peer platforms (short: P2P-platforms) such as AirBnB, UBER, Drivy or BlaBlaCar enable private individuals to make a good or a service (e.g. a room, a trip or a car) available to someone else for a certain period of time or to use this good for a fee. Looking at P2P-carsharing, there is – in addition to the fee – a difference between the sharing of a car e.g. within the family or with a complete stranger. Therefore, trust plays a central role here [3–6]. Trust is also sometimes referred to as the *currency* or *lubricant* of the sharing economy, as it is an efficient way of reducing search and informational effort in social exchanges [7].

The lending of cars is a particularly emotional topic for many people. Traditional sharing concepts are often based on reputation systems where users evaluate each other. The rating and review processes aim at establishing trust towards unknown persons. The evaluation in such reputation systems is usually characterized by subjective ratings and reviews in respect of the experiences made during the rental process. The traditional reputation system in P2P-carsharing often reaches its limits, so that tenants often have a lack of confidence in a neutral damage event regulation [8]. Due to these challenges,

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P2P-carsharing is still a niche market in the everyday mobility. In this paper we want to examine, how blockchain can help to reduce these barriers and build trust by creating a blockchain-based P2P-carsharing prototype and evaluating it in existing living lab environments.

2 Related Work

A relatively new development in carsharing is the growth of P2P-carsharing platforms such as Turo, Snappcar, Getaway or Drivy, which allow users to rent or lend cars to each other. In contrast to the local context of traditional carsharing, the peers usually do not know each other personally. This gives rise to a similar challenge as in the case of e-commerce and online auctions to build trust among strangers via the Internet [9]. Over the last decades, reputation systems have been adopted as a prevailed mechanism, where users leave comments and rate others. This source of information was accomplished by information provided by oneself like name, images, and personal preferences. Both types of information serve as surrogates to build trust in an online world [10].

Nowadays, computational gathered information using connected car technology could be used as an additional source for building trust, e.g. monitoring the driving behavior and calculate trust scores based on these data. This, however, raises new questions with regard how these sources of information are valued by the users to gain knowledge about the other in order to increase the willingness to offer her or his good or service. In addition, it also raises new privacy issues as users must balance the costs to disclose the privacy opposite to the benefits of a better reputation.

There is no consistent definition of trust in the literature, but it is generally understood as a multidimensional, socio-psychological construct [3, 7]. Hawlitschek et al. [3] see trust as the expectation and obligation that an exchange will take place in the future. In this paper we follow the definition of Huurne et al. [7]:

"[Trust is] the willingness of a party to be vulnerable to the actions of another party based on the expectation that the other will perform a particular action important to the trustor, irrespective of the ability to monitor or control that other party"

This type of trust is particularly important in potentially risky and insecure situations where parties are interdependent [11]. Such situations are typical for the sharing economy since Internet-based mediation removes the usual mechanisms for developing social and economic bonds that promote the emergence of trust. In addition to the trust in the peer, trust in the platform and the product made available must also be built [3].

To solve this trust problem, an often-discussed technology is the blockchain [12–18]. Miraz describes Blockchain as the "Trust Machine", as it preserves a permanent record of all transactions while making sure that any identity-related information of users can be kept incognito [17]. Weber et al. [18] used the Blockchain to monitor and execute untrusted business processes with smart contracts. They explored the fundamental problem of trust in collaborative processes by using smart contracts in three use cases: supply chain choreography, incident management choreography, and insurance claim handling. There are various studies exploring the impact of blockchain on trust,

but none in the context of P2P-carsharing. Sarantini et al. give an insight how blockchain-based mobility concepts may look like in the future, but without discussing the trust issue in the sharing economy [19]. Therefore, we want to address this gap and take a closer look at how capable Blockchain is in solving trust issues in P2P-carsharing.

3 Research approach

In the first step, we carried out three focus group interviews and eight problem-centered individual interviews *to understand how car-lenders and car-tenants deal with connected car data and derive implications for blockchain-based carsharing*. We explored how these new possibilities of computational trust mechanisms are perceived by the users and discussed, what sensors might be relevant and what information they would be personally interested if they were a lender as well as where they see privacy concerns from the perspective of a tenant. In the focus group interviews the participants evaluated the data and information discussed from the perspectives of lenders and tenants, whereas in the individual interviews only one perspective was asked. The decision to analyze only one perspective in the individual interviews was made deliberately to prevent distortion of the results due to a perspective transfer. The focus groups were divided into mobility professionals (3 women, 3 men, 20-48 years), those interested in innovative sharing concepts (1 woman, 5 men, 20-32 years) and those highly interested in private car sharing (3 men, 28-47 years). The problem-centred individual interviews were divided between potential tenants and lenders (1 woman and 3 men per group, 20-65 years).

In the second step, we are programming a prototype in the sense of a minimum viable product (MVP) [20] for a blockchain-based carsharing platform. By iteratively testing, evaluating and improving the prototype in close cooperation with the users, we consider the Action Design Research principles [21]. The goal of the first prototype is *to achieve that users can execute the basic functions to get a fast feedback*. These include the initial rent, the return, and the payment. Each car creates a deployed contract on the Ethereum blockchain. Regarding to the MVP principle, we decided to use the Ethereum Blockchain, due to the high distribution as well as many existing projects and tutorials. When the prototype reaches an advanced stage of development, we must evaluate existing technologies in detail and decide whether a purpose-built or derived blockchain is more advantageous. Once the basic functionalities have been integrated, we want to add new functionalities to the smart contracts to simulate the scenario of the allocation of data to specific events.

The third step of our research will be the evaluation of the prototype in a living lab. In this step, *the hypothesis shall be tested whether the blockchain technology and the associated transparency of data access can increase the trust on the part of lenders and tenants*. The carsharing process will be carried out and validated via interviews and app feedback in a real environment with test households. Together with the participants, the prototype is to be further developed and evaluated according to their requirements.

4 Discussion and Conclusion

The current state of our research shows that many people do not use P2P-carsharing, because they are not ready to share their car with strangers due to a lack of trust. The lack of trust is particularly evident in the interviews with potential car lenders. From the tenant's perspective, privacy is often the reason for not disclosing their data. However, our findings show that the privacy concerns depend on the appropriateness and proportionality of the purposes. The willingness to respect the principle of reciprocity increases user acceptance and confidence that the data will not be misused. In this regard, respondents frequently argued that they accept the disclosure of data under certain conditions, such as e.g. accidents or the crossing of a spatial boundary. With smart contracts, such conditions can be technically implemented and thus allow a higher security for car lenders in cases of emergency, as well as the protection of privacy for car tenants if the emergency does not occur.

Currently, we are analyzing the findings from the focus groups and the problem-centered individual interviews more deeply to derive requirements for the prototype of the blockchain-based carsharing platform. Especially the data disclosure in certain situations or after certain events will be a challenge in the programming of smart contracts. Since these requirements differ from user to user, there must be a possibility that car lenders and car tenants can negotiate about the disclosure of certain types of data. After the requirements have been implemented in the prototype, it is to be researched and further developed in a real environment with a vehicle. In the literature, blockchain is often described as a substitute for intermediation [22]. An essential role of intermediaries in the internet economy is the regulation of supply and demand and in the sharing economy especially the building of trust [23]. Only by evaluating our prototype in a real environment will it become clear, whether blockchain technology plays a key role in building trust in the sharing economy or not.

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