**Decentralized Anonymous Micropayments for Dynamic Wireless Charging**

**Abstract:**

In recent years, the concept of micropayments has gained significant attention in the context of emerging technologies and payment systems. This paper explores the implementation of decentralized anonymous micropayments using blockchain-based continuous micropayment schemes with lockable signatures. Drawing insights from the electronic money model for micropayments [3], we propose a novel application - dynamic wireless charging for vehicles. This paradigm shift enables vehicles to receive power while on the move, with payments settled seamlessly online. This paper presents a comprehensive framework for implementing tiny payments and credit accrual as a versatile payment mechanism for goods and services, with a specific focus on the dynamic wireless charging use case.

**Introduction:**

Traditional payment systems often face challenges in handling small transactions efficiently. Micropayments, characterized by tiny payment amounts, have the potential to revolutionize the way we engage in economic activities. Decentralized and anonymous micropayments, facilitated by blockchain technology [17], offer increased security, reduced transaction costs, and enhanced privacy. This paper explores the integration of blockchain-based micropayments into dynamic wireless charging systems for vehicles, presenting a promising solution for the future of transportation and payment mechanisms.

**Concept and Algorithm:**

The concept of decentralized anonymous micropayments relies on a blockchain-based continuous micropayment scheme using lockable signatures [2]. This scheme enables the creation of secure and private transactions for tiny payment amounts. Here's an overview of the concept and the underlying algorithm:

Blockchain Infrastructure: The foundation of our system is a blockchain network, like Bitcoin [21]. This blockchain records all micropayment transactions securely and transparently.

Lockable Signatures: To ensure anonymity and security, we utilize lockable signatures [25]. These signatures allow users to lock a certain amount of cryptocurrency in a smart contract, which can be unlocked by the recipient upon receiving the payment.

Tiny Payments and Credit Accrual: Users can initiate tiny payments for services like dynamic wireless charging. These payments are executed as microtransactions on the blockchain. Additionally, users can accrue credit by participating in the network, contributing to the availability and security of the blockchain [4].

Dynamic Wireless Charging: The core innovation lies in the application of these micropayments to dynamic wireless charging systems. As vehicles move, they can access wireless charging stations that deliver electricity continuously. Payments for the power consumed are made seamlessly through tiny micropayments.

Decentralization and Security: The decentralized nature of the blockchain ensures trust and eliminates the need for intermediaries. Anonymity is maintained through cryptographic techniques [13], protecting user privacy.

**Micropayments in Action: Dynamic Wireless Charging**

Imagine a world where electric vehicles (EVs) are charged dynamically while on the road. As an EV moves along a highway equipped with dynamic wireless charging infrastructure, it taps into the grid and receives a continuous supply of electricity. The vehicle's onboard system calculates the power consumed in real-time.

Here's how the process works:

Continuous Charging: As the EV travels, it receives a constant flow of electricity from the charging infrastructure. This allows for uninterrupted journeys without the need for traditional charging stops [15].

Real-Time Payment: Tiny micropayments are initiated with each unit of electricity received. These micropayments are recorded on the blockchain, ensuring transparency and security [22].

Credit Accrual: EV owners who participate in the network by allowing their vehicles to act as charging nodes accrue credits. These credits can be used for future dynamic charging or other services within the network [38].

Seamless User Experience: Users experience a hassle-free journey, with payments settled automatically in the background. The cost of charging is calculated accurately, promoting fairness and efficiency [35].

**Conclusion:**

Decentralized anonymous micropayments, based on blockchain technology and lockable signatures, present a versatile solution for the future of payment mechanisms. This paper has introduced the concept of using tiny payments and credit accrual for goods and services, with a specific focus on dynamic wireless charging for electric vehicles. The proposed system not only enhances the efficiency and convenience of payments but also contributes to the evolution of transportation and energy management systems.

In an era where connectivity, sustainability, and efficiency are paramount, decentralized anonymous micropayments pave the way for innovative applications like dynamic wireless charging, transforming the way we interact with and pay for essential services.

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