SecuRyde: Blockchain Technology Applied to Autonomous Vehicles

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Motivation

- The recent advances of driverless technology are steadily replacing current modes of transportation, including in the ride-sharing industry
- Using autonomous vehicles for ride-sharing raises concerns for security, including authorization between the user and vehicle, safety arriving at set destinations, and secure forms of payment
- The continuous hacking of centralized databases of companies (such as LinkedIn, Yahoo, Target, and Dropbox) puts company and customer data at great risk

Blockchain Technology

The blockchain works as a decentralized, public ledger system that uses a network of nodes that communicate with each other through public/private key encryption. A constantly updated copy of the same public ledger, which keeps track of all the signed transactions, is stored throughout the blockchain network. A consensus algorithm runs whenever a transaction is initiated to verify it and update the public ledger in each node. The blockchain is known for using cryptocurrency, which is the form of money it uses to conduct transactions. SecuRyde takes advantage of this system of secure communication to create a safe form of ride payments as well as user/vehicle authentication by using Ethereum, a blockchain-based platform that allows for code execution among its nodes.

What is SecuRyde?

SecuRyde is an online application which enables ride-sharing industry customers to request rides using autonomous vehicles. The system is powered through blockchain technology, a decentralized computing system, which enables a secure environment for payments and allows for customer/vehicle authentication.

Are payments actually secure?

The blockchain is composed of multiple nodes which each hold encrypted copies of the same data. When transactions occur between two nodes (such as a user and a vehicle) data is updated on all nodes using public/private key encryption. Since encrypted data is stored on all nodes through a consensus, data cannot be hacked as easily or manipulated either.

Is user data anonymous?

Users are associated on the blockchain through their node accounts, which are identified by public key addresses. In addition, data is encrypted within the blockchain, making data difficult to access and identify where it comes from.

Is there authentication between the user and vehicle?

When the vehicle arrives to the user's location, their identities are verified with their public keys to ensure that the user paying for the ride is the one getting in and the car that arrived is the one that the user ordered.

Is this different from services like Uber or Lyft?

SecuRyde is different from Uber and Lyft because it is compatible with autonomous vehicles and provides increased security due to blockchain technology. The blockchain method of storing encrypted data on several nodes makes it more difficult to track user data and hack it.

How Does It Work?

**Web Application**

- User: The user can view the SecuRyde application online to see current balance, view interactive maps of vehicles, review quotes, and request rides (along with vehicle lock/unlock control).

**Ethereum Computer**

- Blockchain (Ethereum): Contracts, which are programs hosted on the blockchain, are how the web application and vehicles communicate. The blockchain will store the lock state, status of trips that are currently occurring, and facilitate payments between users and vehicles.

**Technology Stack**

- Google Geolocation Services: The locations of the user and the cars in the network are displayed through Google Maps API. This API also helps to show routes for requested quotes.

Impact

- Allows for identity verification between the user and vehicle in a secure and anonymous way
- Prevents fraudulent payments for rides
- SecuRyde promotes both the ride-sharing and autonomous vehicle industries
- Automated driving reduces crash rates, enabling car manufacturers to design lighter vehicles or potentially adopt clean vehicle technologies. [1]
- Study by MIT estimates that carpooling applications can reduce taxi traffic by 75%, which is currently contributing to an annual cost of congestion estimated at $160 billion. [2]

Cost Analysis

- Ethereum Transactions: Each line of code executed in the blockchain costs a unit of gas which is equivalent to 1/100,000 of an ether (or 1/20 of a cent). In order to request a ride and change the vehicle’s lock state, the user needs to pay a certain fixed amount of gas to pay for the program execution in the blockchain.
- Ethereum Computer: All of the autonomous vehicles in our network need to be running an Ethereum node on their internal computers. Since this is purely software, there is no cost for the owner/manufacturer to install it.

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References