A blockchain based car park management system

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Objectives

The project plan was split into three phases which are:

- The user registration, vehicle registration and parking slot registration.
- The parking slots being sent by the users must be shown as available for other users with a cool-down of 5 minutes.
- The booking will be stored on the blockchain itself and the slots will be amended to the ledger as transactions.

Introduction

Traffic and congestion in Malta is an ever increasing problem which is affecting the country negatively. Parking spaces are becoming more scarce due to the influx of vehicle ownership which has increased tremendously in the last few years. The present solution we are presented with consist of using alternative modes of transport such as the public transport system or using two-wheeled vehicles, but with the amount of vehicles on the roads people stay away from two-wheeled vehicles because they feel unsafe and undoubtedly so. The aim of this project is to see if it is possible to book and manage car park spaces in an open and transparent manner using the blockchain by using an easy to use mobile application that at which any given time can be used to see if there are any available parking spots in the vicinity.

Figure 1: Ethereum

Materials

The following materials were required to complete the research:

- Ganache
- Truffle
- Solidity + Solidity Compiler
- Android Studio
- web3j-android library

The materials were prepared according to the steps outlined below:

1. Test RPC server with a locally hosted ethereum blockchain using Ganache.
2. ERC20 Standard Token developed using Solidity deployed to the blockchain using Truffle.
3. Web3-android used to connect to the RPC Server for communication between application and blockchain.

Methods

For the main interface the Google Maps Android API was used to show the users location in real-time and only gets location updates if the GPS accuracy is within range of being accurate enough to be able to send accurate parking slot locations. The rest of the interface consists of a profile icon, that when pressed the details for the account are shown such as balance, date registered and the users name and surname. For the blockchain, an Ethereum smart contract based on the ERC20 token model was deployed using Truffle on a test Ethereum network provided by Ganache which is hosted locally. The Token was compiled using the Solidity compiler and then converted to java classes which the Android platform understands. The classes were added to the project and with the help of the web3j-android library it was possible to connect to the JSON RPC Server hosted by Ganache through the Android application.

Important Result

When evaluating the current progress of the prototype it is shown that the blockchain is ideal for this scenario to keep the data secure and anonymous. Basic features of the blockchain has been implemented with large room for improvement such as the process of fully-decentralizing the data on to the blockchain, storing any files using IPFS, generating wallets based on unique factors of the device and analyzing the overall performance when all the data is stored on the blockchain rather then using conventional methods.

Fraud Detection

As part of the specifications, an anti-fraud system was implemented to prevent users from abusing the reward system which works by checking the slots created by the user, takes the most recent one and checks if 15 minutes have passed from the last similar action.

Results

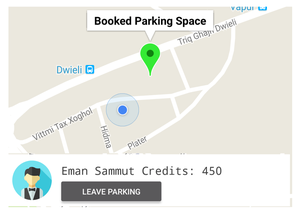

Figure 2: Application

The Figure: 2 shows the main interface with a booked parking space, credits and button which creates a parking slot.

Conclusion

Blockchain is going to be the next big thing since HTTP, it will be part of our lives in the near future fr sure. Many promising projects and ICOs are being launched based on this technology and even present companies are researching to integrate their current systems with the blockchain.I intend to continue researching this technology to hopefully fully move the data to a decentralized way of storing information about the user, the whereabouts, vehicle details, rewards, transactions and everything that is required for the application to function.

Future Releases

Since the implementation is just part of the features offered by the blockchain, in the pipeline the following features are going to be added.

- Wallet Creation
- IPFS Storage of Data
- Fully-Decentralized Application

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