Blockchain-Enabled Smart Parking

Dhruvil Shah 19BCE248

Smit Shah 19BCE259

Jurin Vachhani 19BCE286

***Abstract*—We present an integrated smart parking system in this paper. The proposed integrated smart parking system brings together multiple parking service providers under a single umbrella.In a smart city, a unified platform aims to provide commuters with one-stop parking information services. With such widespread use comes a high risk of this data being hacked and/or misused. Such attacks are common in applications that rely on a centralised server. Decentralized networks, such as the block chain, can compensate for the shortcomings of centralised servers.A consortium blockchain, in particular, is made up of parking lots to ensure the parking system's security, transparency, and availability. Then, in order to protect the drivers' location privacy, we utilise activating to conceal the drivers' locations. The blockchain validators return parking offers that are available within the cloaked area. Finally, the driver chooses the best offer and makes a direct reservation with the parking lot.**

***Index Terms*—Blockchain, Smart Parking, Privacy, Digital Signature, Ethereum, Privacy Protection.**

I. Introduction

With the increased number of vehicles in recent years, finding a vacant parking space has become a major issue for drivers, particularly in congested cities. According to the report, more than 1.3 million drivers in Shanghai city struggle every day to find available parking spaces. This issue can waste drivers' time, cause traffic jams, and increase fuel consumption. In Cairo, Egypt, for example, drivers waste more than 20 minutes looking for available parking spaces. Furthermore, 30 percent of traffic jams are attributed to a lack of available parking spaces. Furthermore, in Los Angeles, the amount of gasoline consumed in finding vacant parking spaces is approximately 47,000 gallons per year, resulting in 728 tonnes of CO_2 emissions per year.Smart parking systems have emerged to help people find available parking spaces as wireless communications and Internet of Things (IoT) devices have advanced. IoT device is installed in each parking space to detect availability and send status information to a service provider. Drivers can check available parking spots and make online reservations through the service provider.

The most popular mechanism proposed by researchers to overcome the risk of single-point failure that can affect the entire system of the centralised system is blockchain. The reason for this is that blockchain technology is known as a decentralised model that also ensures data integrity.A centralised system is one in which a single controller has central authority over all of the system's components. This power can be wielded directly or indirectly through the use of hierarchy. This exhibits relatively complex behaviour as a result of this central controller's authority over the other components in the system. A decentralised system, on the other hand, is one in which each component is equally responsible for contributing to the system's overall behaviour. It accomplishes this by relying on local information rather than following the orders of any central authority. We propose a blockchain-based smart parking management system in this paper. To begin, a consortium blockchain created by various parking lots is introduced in order to securely store parking availability, rates, and available services. Each parking lot submits its parking offers to the blockchain network, which records them in a distributed shared ledger. The driver then sends a transaction to the blockchain network to retrieve parking offers in a cloaked cell in order to maintain his or her privacy. The driver then chooses the best offer based on his preferences, such as parking location, price, services, and so on. Finally, in order to maintain privacy, the driver pays for parking services with currency accepted.

II. Related Work

There are numerous parking solutions on the market. However, the majority of them are ineffective in providing individualised smart parking services. The use of Internet of Things devices to control and monitor the overall parking system is rapidly expanding. Abhirup Khanna and Rishi Anand proposed an architecture[1] for exchanging parking data that makes use of IoT devices and the TCP/IP protocol. Furthermore, the application was hosted on a centralised server, which is always vulnerable to a single point of failure.In [2], Rachapol Lookmuang et al. proposed another smart parking model aimed at reducing traffic congestion in the parking area. The researchers combined IoT devices with utilizing computer vision techniques to locate parked vehicles via smartphone application. Ajay Zajam and Surekha Dholay conducted research to find a convenient and nearby parking spot [3]. The researchers created an algorithm based on real-time traffic data to determine the best route between the user and a nearby parking location. BlueParking, an IoT-based parking reservation system, was implemented to find the best routing path for their destinations. Their traffic estimator service can automatically represent the status of various roads by analysing the congestion of location nodes.Bin Liu et al. proposed a blockchain-based framework [4] to ensure transparency and data integrity due to the lack of frameworks that can integrate data with public auditability without a trusted third party. This framework solves and improves the problem of dynamic data integrity verification in a fully decentralised environment. However, the parking centres are not linked together in a unified model to provide users with personalised

parking information.
Some of the proposed schemes are incompatible with our smart parking scenario, in which parking owners own private idle parking spaces. Some of the existing schemes discussed above employ a centralised structure that is vulnerable to malicious central node misbehaviour.According to our review of existing research, the primary goal of current research on smart parking is to provide users with a parking location from a single parking service provider.Compared to previous works, we propose an integrated innovative parking system with the primary goal of connecting all parking service providers under a unified platform. While most existing solutions deal with the smart parking problem in a centralized manner that involves a trusted third party and cannot provide enough clarity, our proposed system produces transparency and is mostly inviolable due to the decentralized infrastructure.

III. Brief about the architecture

The most important part that plays a major role in any blockchain network are its stakeholders. We will primarily consider three stakeholders in this regard, namely :-

1) Consumer
   They are the customers who are in search of a service, i.e., parking space in a parking lot. Whenever a client arrives, information about vacant and occupied positions is displayed by means of any software mesaure along with different parameters like price, size, and location. Moreover, they are the ones to invoke a transaction once they are satisfied with one of the given options.

2) Provider We can consider these components as a service provider. They are responsible for taking note of all the activities pertaining to user action. In correspondence to that, it shows the current availability or screenshot of the total parking system. Whenever an individual's parking status changes from occupied to vacant or vice-versa, it invokes a transaction, or we can request for it. Smart Contract are implemented by provider according to their requirement of pricing and terms and condition.

3) Blockchain network Distributed and decentralised system that contains nodes representing parking spaces. Each of them contains a public ledger. They are responsible for taking transactions from the pool proposed by poll and then checking for pre-defined conditions to fulfill. They can be in terms of authenticity, price, or availability.

IV. Approach for extracting meaningful text

The task of compressing a piece of text into a shorter version, lowering the size of the original text while keeping crucial informational aspects and content meaning, is known as summarization. Because manual text summarising is a time-consuming and inherently tedious activity, automating it is expanding in popularity and so serves as a powerful motivator for academic study. So basically in the implementation part, we have done 2-3 algorithms and whichever suits best would be taken into consideration. Two algorithms that we have implemented are text summarization using rank-based and frequency-based.

1) Frequency-based: We have first of all tokenize all the sentences into words. Using the famous NLP library we have taken a set of stop words into the consideration and removed all of them so that frequency doesn't affect the main words. Now once this task has been completed we will tokenize once again. We need now some threshold value to differentiate between whether to take that word or not. The distinct words are taken along within the length of the sentence. Now taking the average we would arrive at threshold values. The below image shows the input of text and the output that would be generated using these frequency-based text summarization techniques.

A. Input

Content-based recommendation systems analyses properties of the items recommended. Predicts recommendation based on how similar the items are to those that user liked in the past. E.g. In a novel recommendation application, a novel may have author, rating, genre, and subject matter, etc. The user's interest or preference is also represented by the same set of features, called the user profile. Collaborative filtering systems works by recommending items based on similar properties between users and/or items .The items recommended to a user are those preferred by similar users.Collaborative filtering (CF) is the most studied and also the most widely-used recommendation approach in practice. key characteristic of CF: it predicts the items for a user based on the items previously rated by other like—minded users. Hybrid recommendation systems are comparatively better than the content based and collaborative systems. Hybrid systems integrate the different content and collaborative system to eliminate the drawbacks of both the recommendation systems. A survey on different e-commerce website was conducted. Various parameters were considered. Based on the responses from various users of these websites a competitive analyses is made. The survey includes 5 e-commerce websites, they are

B. Output

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From the above we can see that how the text is been summarized from 20 lines to just 11-12 lines.

2) Rank-based: TextRank has its origins in Google's PageRank (created by Larry Page), which is used to rank webpages in internet search results. However, before we can grasp TextRank, we must first understand PageRank and the logic behind it.The value of a website W is indicated by other web pages in terms of links to the page, so if a webpage 'X' has a link to webpage 'W,' 'X' contributes to the importance of 'W,' according to PageRank.
Suppose page 'X' has links to 5 other pages, The portion contributing to PageRank of 'W' from 'X' is PageRank(X)/5 i.e PageRank(x)/Total unique links it has.

Similarly, if Page 'W' has incoming links from Pages 'X','Y' and 'Z', its PageRank is a summation of contributions from all the 3 pages i.e

PageRank(W)=PageRank(X)/5 + Pagerank(Y)/4 + PageRank(Z)/3

C. Input

Recommendation in e-commerce means providing the users with products and services they are interested in. Recommendation system in e-commerce has become extremely popular in the recent years. E-commerce websites use different techniques to provide users with better experience in online shopping. With new technology and improved techniques e-commence is able to provide users product and services based on their interest. Different techniques such as content based , collaborative based and hybrid based are used to give users a better shopping experience[1]. Different ecommerce websites follow these techniques or combinations of these techniques. This paper also includes a survey on

D. Output

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V. Conclusion

In this paper initially we have found specific highlighted parts of document using free source tool called openCV. Using different type of filters of openCV we found possible bounding boxes in the provide paper. After finding the possible bounding we apply the extraction of text procedure using tesseract OCR. The extracted text is passed to text summarization model where all the text extracted are being summarized following research paper sections topics.

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