Blockchain-based system for digital ads

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Abstract

Advertising on the Internet is now done in the form of ads on sites, content production platforms or service platforms which named digital advertising. a publisher provides information which may be of value to the user. Users give attention to the publisher in return for information that they value with their attention. However, the digital ads marketplace suffers from many problems. user privacy has violated, excessive number of intermediaries have existed between the ad and the end user that has imposed a lot of cost on publisher. In addition, oligopoly and complexity.

Our solution is a blockchain based system; a fast, open-source, privacy-focused, and can block invasive ads and trackers, and includes an office system. Total, which anonymously measures user attention to accurately reward publishers.

This system has a native token is based on Ethereum technology, an open source, blockchain-based distributed computing platform with smart contracts. This solution is inspired by BAT and Helium blockchain in terms of token and browser ledger system.

1. Digital Ads market

The digital advertising market offers marketers unprecedented innovation. Companies can now place ads in a variety of formats, at specific locations and times, with promotional messages tailored to the exact group of people selected.

Compared to traditional advertising, digital advertising has better targeting and relevance, personalized advertising content, programmatic sales based on real-time auctions, and individual consumers with a variety of online and offline responsiveness. We promise to measure the concurrency of ad exposure. These features have radically changed the way marketers spend. Digital advertising revenue in the United States reached $ 189 billion in 2021, an increase of 80% from 2014 [1]. The digital advertising market sells marketers a variety of search and display advertising opportunities. Digital advertising has existed since 1995, but the market structure is still changing rapidly. For example, a survey of marketing technology companies shows an increase from 150 in 2011 to 7,040 in 2019 [2].
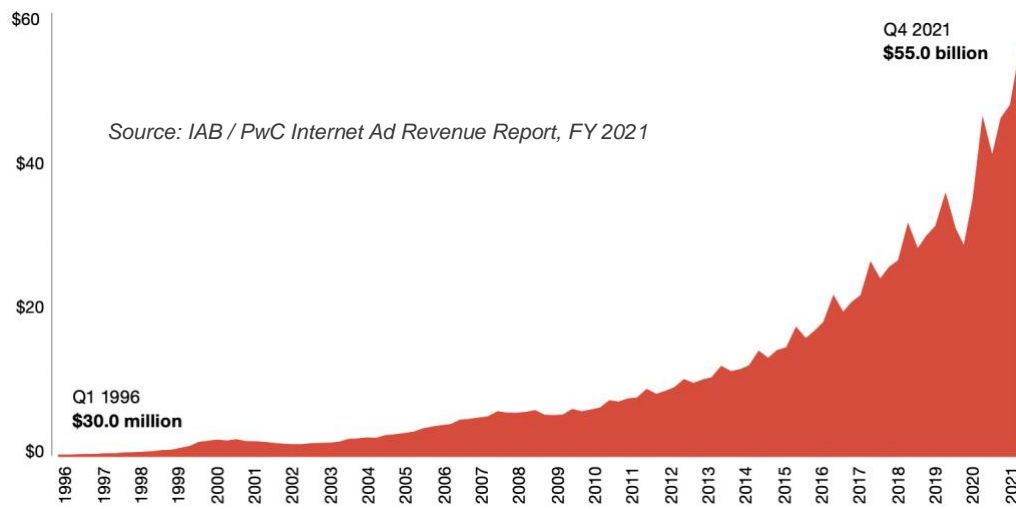
Figure1. Quarterly internet advertising revenue growth trends 1996 – *2021* ($ billions)

Statista announced that global digital advertising spending reached a record $ 325 billion in 2019. Advertising spending in 2020 was $ 332,840 million. Following the same trend, that number increased to $ 389.29 billion in 2021. Advertising spend is estimated to exceed $ 441 billion, a record high for all digital channels [3].

Publishers use a variety of ad formats, usually spending in response to consumer attention and media consumption. After desktop advertising and search first grew, recent growth has focused on social, video, audio and mobile advertising.
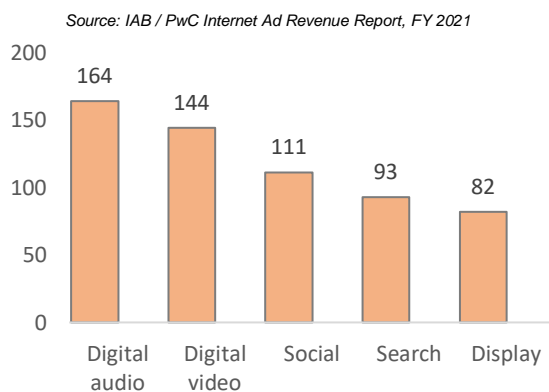

Source: IAB / PwC Internet Ad Revenue Report, FY 2021

Figure 2 Grows index (2021)

2. Problems

A bewildering variety of middlemen and complexity has evolved over the last two decades in the ad-tech ecosystem. Moreover, advertising technology brought with it a variety of problems for advertisers, publishers, and users. We have pointed out 4 general categories of problems related to privacy, competition and costs in this system that have caused the efficiency to decrease.

2.1. User privacy

Invasion of user privacy comes at a considerable social cost. Economists liken the invasion of user privacy to pollution. Altman defines privacy as "the selective control of access to the oneself" [4]. This requires an active and dynamic regulatory process. But in the online world, users feel they have lost control (European Commission 2015). The disclosed information is persistent in space and time and is searchable, shareable, and replicable [5], [6].

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This is not surprising given that readers often see 70 trackers when visiting popular media sites [7].

2.2. Middleman transactions

Currently, marketing managers in companies have to allocate more budgets to cover the costs of the interfaces between an advertisement and its target user. trading desks, Agencies, demand side platforms, desktop and mobile network exchanges, yield optimization, rich media vendors and partnered services often consume large part of the advertising budget.

On the other hand, publishers also pay a lot of money to deal with these intermediaries. they pay ad serving fees, operational fees for campaign setup, deployment and monitoring, publisher analytics tools. Some of these intermediaries simultaneously deduct a significant portion of the revenue of both publishers and brand advertisers.

2.3. Banner blindness

Many costs are imposed on web users in terms of hardware and efficiency of using the internet. According to Business Intelligence, one study found that up to 79% of mobile data transferred during visits to popular publishers was a result of ads [7].

These pressures on users cause their nervous system to respond by ignoring advertisements on the web. Finally, in the last decade, marketers have been dealing with the phenomenon of "banner blindness".

These pressures, which can include data costs, battery life, and privacy violations, have caused them to use ad-blocking software to deal with them significantly in recent years. This itself can lead to making it harder to draw the user's attention to advertisements and reduce the income of the advertiser and publisher. AudianceProject in a study on the reasons why Americans use ad-blocking software identifies the most important reason as "websites are more manageable without banners". 71% of AudienceProject respondents agreed with this statement [8]. Also, the result of 2021 survey of Blockthrough in PageFairAdblock Reports are shown in figure 5.
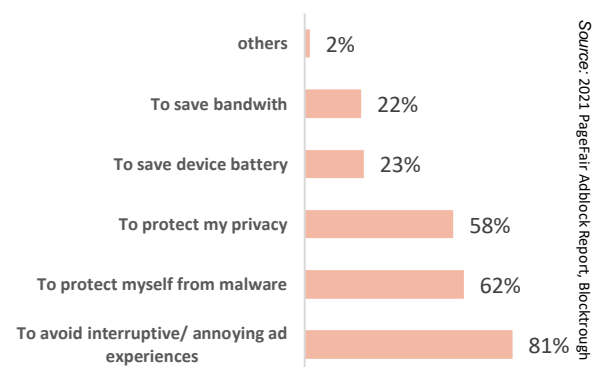

Source: 2021 PageFair Adblock Report, Blocktrough

Figure 3 motivation for using ad-blocking software

2.4. oligopoly

As a result of the current oligopolistic trend online marketing budgets are
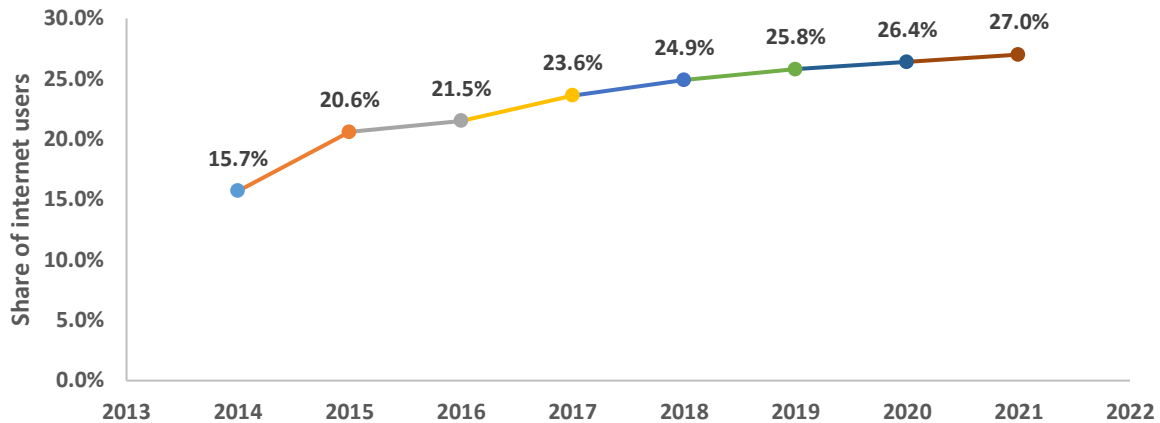
Figure4. Quarterly internet advertising revenue growth trends 1996 – *2021* ($ billions)

controlled primarily by gatekeeper companies like Google and Facebook, leaving publishers powerless over their revenues. These platforms also pose serious challenges to advertisers. It is difficult to assess the effectiveness of advertising campaigns on such platforms due to the sheer size of these platforms and the fact that they are opaque and difficult to calculate. The principal-agent conflict arises because most of the analytics products they are targeting are provided by the platform owners themselves. The walled gardens have been deemed useless by some advertisers due to the lower quality of traffic it's sending. Several authors have even suggested that based on the analysis performed by third parties, a substantial chunk of the traffic to advertisers can be considered unvaluable.

The digital ads ecosystem is exposed to threats. As a result of efficiency decrease, publishers and advertisers have faced declining revenues for decades. While the marketing budget increases, publishers' income not only has not increased, but in some cases has decreased.
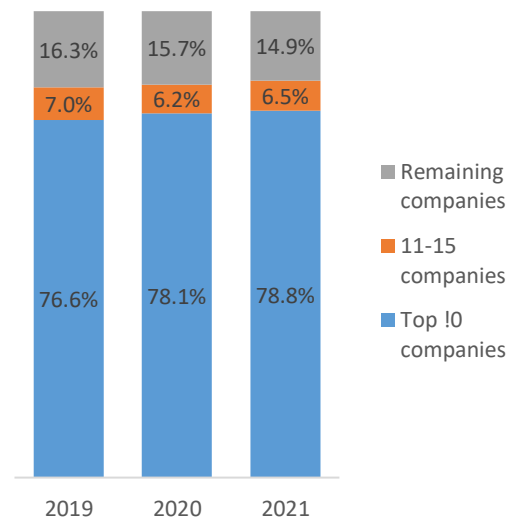
Figure 5. Three years (2019-2021) internet advertising revenue concentration

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3. Solution

We designed a system in which the advertiser buys some credit (Advertisement Credit or AC) with USD or any other stable coin first (fig 6). AC has a fixed price which is pegged to USD. It is because the advertiser must plan his expenses, which will prevent him from being affected by the volatility of the crypto market price and hedge himself against it. Converting dollars to AC and vice versa is done in X-Wallet. We got the idea of having a separate token with a fixed price from Helium [9]. But the overall economy of the blockchain is more efficient and just.
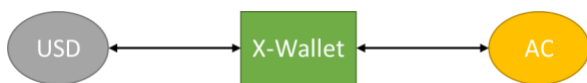

Figure 6. exchange subsystem

3.1. Cost of advertisement

In the next step, the advertiser pays for each ad by using the ACs in his wallet. But this cost depends on the following relationship:

$$AC\ cost = f_1(Score, IP, PoL) \times AC\ per\ view\ (base\ price)$$

In fact, the advertiser specifies a base price for each view and then, according to the characteristics of the visitor, this base price is multiplied by a number between zero and one $(f_1(Score, IP, PoL))$. The f_1 function consists of three parameters. The first parameter is a function called Score, which is a function as follows:

$$f_2\left(Time\ of\ watching\ ad,\ \frac{Cum\ sum\ of\ watching\ ad\ in\ a\ day}{Cum\ sum\ of\ using\ browser\ in\ a\ day}\right)$$

The Score function is designed to measure the quality of a user. The first parameter of this function (Time of watching ad) is the amount of time the user spends viewing the ad, this time can also be quality time, i.e. time other than when the user is forced to see the ad. This parameter (Time of watching ad) has a positive effect with a decreasing slope and no points are added to the user after t seconds. The philosophy of the existence of the second parameter:

$$\left(\frac{Cum\ sum\ of\ watching\ ad\ in\ a\ day}{Cum\ sum\ of\ using\ browser\ in\ a\ day}\right)$$

is to distinguish the robot from the human and also a parameter to distinguish the quality between two users. Suppose you are a user who spends two hours a day surfing the web. Probably, if you see an ad on any site you go to and spend time so that the more you see this ad, your score will increase (for example, 30 seconds per ad), then probably, in these two hours, at most 10 minutes have been spent on the ad (that is, this ratio is about 8 percentage), but a bot probably spends all the hours it uses the browser to see ads (that is, this ratio for a bot is close to 1 or more than 1 if the bot view

multiple ad at the same time). Now let's use this parameter for two users, if one user only uses the browser to see ads and earn money, this parameter shows that this user is of poor quality, because the main goal of this system is to optimize ads, more user quality and ultimately it is to generate income for the advertiser, but if a user only sees ads and uses the browser to earn money, there is little chance that these visits will lead to income for the advertiser. So, as a result of increasing the second parameter, it has a negative effect on the user score. If we return to $f_1(Score, IP, PoL)$, we conclude that the higher the score, the closer this value is to 1.

The second parameter of f_1 is IP, which is an important issue in efficiency of advertisement. This is a dummy variable that, for example, takes 1 if your IP is in Iran and 0 if it is outside Iran. This parameter is important in that it avoids the cost for the audiences that are outside the scope of the advertiser's service. Obviously, this variable can change for each country. For example, for Europe 1, North America 0.8, Asia 0.6 and Africa 0.1.

The third parameter of f_1 is PoL (Proof of Location), which is a supplement to IP. The idea of this part is taken from the helium network and it also requires helium. Suppose a person in Central Africa uses VPN due to the low

coefficient of the IP parameter, as a result the IP parameter loses its efficiency. By using the PoL mechanism, the location of the user can be detected. Of course, this information is still used through ZKP (Zero-Knowledge Proof). The way it works is that the system of the person who uses the browser must connect to one of Helium's hotspots and send his location signal in time intervals. The lower this interval is, the higher the score of this section and higher the overall value of f_1. Of course, the maximum score is in the weekly interval. For fully implementing this strategy X-Wallet should be able to store HNT and burn it to DC (Data Credit) to use hotspots.

3.2. Distribution of AC

The distribution of AC is such that XU% goes to user, XP% to Publisher and XT% to AC Treasury. The relation below also holds:

$$X_U + X_P + X_T = 1$$

The philosophy that users and publisher are given a AC which it's value is fixed, is that they should not be exposed to the risk of the cryptocurrency price like the advertiser. In this way, advertiser and publisher are better able to do the work they specialize in. Of course, with this strategy, the user will not earn much, but for more motivation to the user, another solution has been
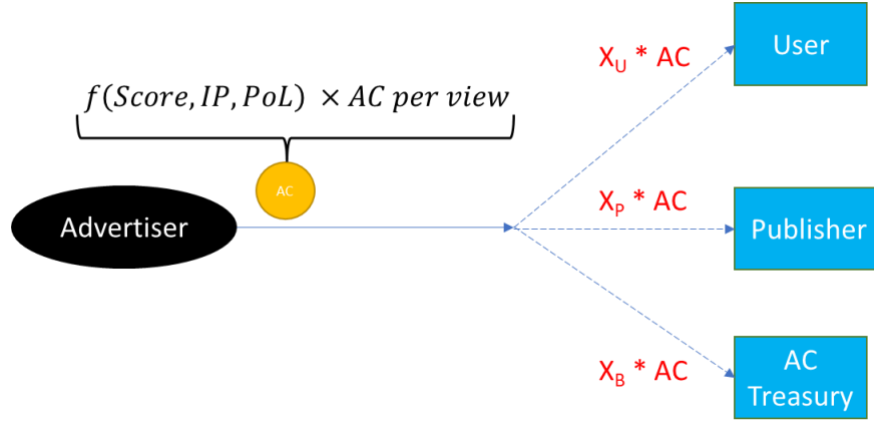
Fig7. AC distribution

considered, which is discussed in the lottery section. A simple schematic of AC distribution is shown in figure 7.

The reason for the existence of the AC treasury is to create a support for the native token. In fact, the value of the native token is the amounts of services it has provided so far and the value of these services shows itself in the AC treasury. It is obvious that:

$$Native\ Token\ Value = \frac{AC\ Treasury\ Value}{Native\ Token\ in\ the\ Network}$$

3.3. Distribution of Native Token

In this network each block is mined per 1 minute and each epoch consist of 60 blocks. The rate of mining Native Token follows the relation below:

$$Rate\ of\ Mining\ NT \\ = f_3(Year,\ Number\ of\ users, Average\ score\ of\ users\ in\ the\ epoch)$$

The first parameter has a negative effect on the mining rate. In this way, the closer we get to the year 30, the soup rate tends to zero. The second and third parameters, which indicate the average quality of users and their number, have a positive effect. The first parameter causes the amount of token supply to decrease over time, but the second two parameters increase the amount of incoming AC, and for this reason, more tokens can be created while maintaining the value of the token. Another point about this function is that with the increase of time, if the number of users and also their quality increase, the value of the mining rate will decrease, but at a slower speed. The distribution of tokens is shown schematically in figure 8.

In each period when some token is mined (the value obtained from function two), it is divided between three groups. A% is allocated to Lottery Pot which follows the relation below:

$$Lottery\ share\ (LS) \\ = f_4(number\ of\ users, average\ score\ of\ users) \\ \times 0.5\%$$

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$$ST\ Holders\ share = 1 - Server\ share - Lottery\ share$$

$$Server\ share = \frac{1-LS}{1.5} f(Number\ of\ users, Average\ score\ of\ users\ in\ the\ epoch)$$

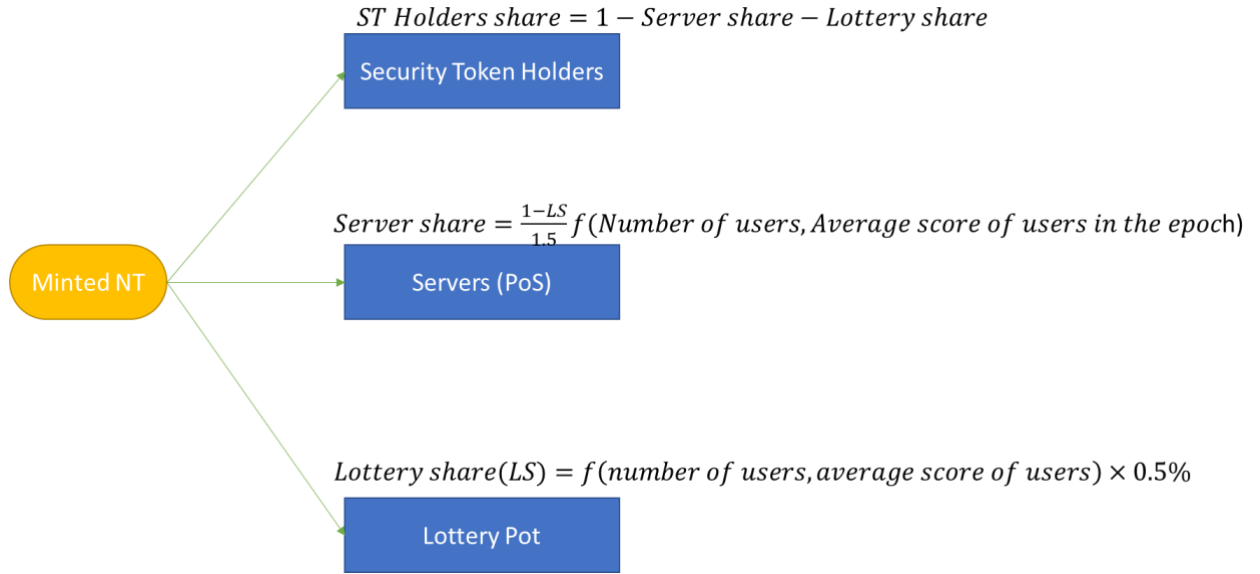$$Lottery\ share(LS) = f(number\ of\ users, average\ score\ of\ users) \times 0.5\%$$

Fig8. Native Token distribution in each epoch

Both the first and second parameters have a negative effect on the value of the function. The reason is that by increasing these two parameters, the amount of system income increases, so as a result, the value of each token increases. In order for the lottery winner not to have too much prize, this function has the role of controller. In this way, at the beginning of the growth of the network, the value of the f_4 is close to 1, but with the network growth (increase in amount of number of users and average score of users), f_4 value decreases, but the absolute value of the prize increases with a decreasing rate. The way to participate in the lottery is that during every 24 hours, if the user's score exceeds a certain limit, he will receive an Ultimate Freedom Token (UFT), and these tokens are used every 168 epoch (one week) for the weekly lottery. By using this strategy, a new incentive is given to users to use the browser. This motivation is based on the idea of Ultimate Freedom Fantasy [10], that is, people are interested in participating in the lottery because of the fantasy of financial freedom and are willing to pay a small amount to try this chance. But the important thing is that users don't need to pay money to participate in this lottery, they just need to use this browser and see a few ads daily.

Another part of the minted tokens allocated to the servers. Servers can enter the system through PoS (Proof-of-Stake), and their share in each period depends on the following relation:

$$server\ share = \frac{1-LS}{1.5} f_5(Number\ of\ users, Average\ score\ of\ users\ in\ the\ epoch)$$

Function 5 includes two parameters, the number of users and the quality of

users, which increases the value of the function and tends to 1 by increasing both of these parameters. The reason is that with the increase in the number of users as well as the increase in their quality, more load is putted on the servers and naturally they should receive more rewards, but the important thing is that this function should be defined in such a way that the absolute value of tokens allocated to the security token holders should increase with the increase the two parameters (due to the increase in the value of the tokens). Finally, the share of security token holders follows:

Security Token Holders share $= 1 - Server\ share - Lottery\ share$

4. Overview

With this blockchain, the current advertising system is optimized, in which the advertiser loses due to wasted capital, whereas the user loses due to privacy and time loss. Of course, some work has been done towards this goal, such as BAT, but it has shortcomings in terms of motivating the user and supporting the advertiser. In terms of motivating the user, we raised the issue of the lottery, which is much more motivating than trickle income, and this kind of work is like increasing the minimum wage, which, if it is the right amount, can increase demand (attract more users) and as a result increase Employers' income

(increasing the popularity of the network due to the increase of users and as a result the increase in publishers' income). It also has a few problems in terms of BAT advertiser support. The first case is the discussion of the user's IP and the second case is the user scoring system, which only mentioned the time spent on the ad as a measure of quality, but we brought a measure of the user's quality (other than the time spent on the ad) in the Score function. Another enhancement that we brought is Proof-of-Location, which optimizes ads more efficient. In the payment system BAT has a problem, it costs advertiser before the using Score (advertiser should spend equal amount of money for each view) but we use f_1 in order to solve this problem. Another problem is the issue of payment using a token (BAT) that has a variable price and exposes the members of this system (users, publishers and advertiser) to the risk of the price of cryptocurrencies. We were able to solve this problem by using a two-token system inspired by Helium. Of course, this system is more efficient and fairer than the helium payment system.

5. Roadmap

We intend to take the following steps to implement this idea:

5.1. system design

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A more detailed system that includes entities, subsystems, and how they interact with each other in presented in this white paper. 2 important subsystems are Browser and token exchange.

5.2. Browser development

The proposed blockchain system will be implemented on a browser, so the first step is to launch a new browser that is fast, open-source, privacy-focused, and can block invasive ads and trackers, and includes an office system. Total, which anonymously measures user attention to accurately reward publishers.

5.3. Token exchange development

The proposed blockchain system will be implemented on a browser, so the first step is to launch a new browser that is fast, open-source, privacy-focused, and can block invasive ads and trackers, and includes an office system. Total, which anonymously measures user attention to accurately reward publishers.

5.4. Operational development

Operational development of designed elements in the system. In addition to implementing the blockchain system, one of the most important elements required on a smart contract is machine learning that can optimally connect the advertising parties.

6. Competition

We examine the key competitor; Bat and Google Ads.

6.1. BAT

BAT is the most important competitor for this system. Their system, which also follows the blockchain, suffers from weaknesses that, in addition to solving them, this system also has a different business strategy. In general, these two systems are distinguished by two dimensions: go-to-market strategy advertiser budget.

1 .Go-to-market strategy

One of the major challenges in implementing this system is to attract users because advertisers are interested in this system if users are present. BAT system competitors are not properly defined. Content platforms like YouTube are one of the biggest competitors of this system because most of the users are present on these platforms. Therefore, how to enter this market is an important question that bat has not given an exact answer to. The system strategy presented in this white paper relies on niche marketing to enter the market. More focus on smaller sites that suffer from ad server issues. Of course, they have fewer users.

2 .Advertiser budget

In the presented bat system, not enough attention is paid to the advertiser as the most important beneficiary. If there is no advertiser, no income will be generated. The bat blockchain system can cause major problems for the advertiser:

- **Dependence of the token on the market price**

This dependence can lead to instability in the advertiser's planning in using this system. The system presented in this white paper, with a two-token mechanism, can fix the token price on a range.

- **Efficient use of advertiser budget**

In addition to the fact that the system must be programmable, the advertiser's budget must be used in the most optimal way. One of the important parameters in determining the quality is the suitability of the location of the viewing user and the location of the advertiser's business, which has not been considered in the design of the bat system.

6.2.   Google ads

Google is equipped with a powerful search engine that has made it have many users and this has helped it to take advantage of the opportunity of digital advertising by providing Google Ads service. However, this system can be a threat to the privacy of users, and it is also a centralized system.

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