Introducing JavaScript Mining as a Method of Payment and Its Hidden Cost*

Fajar Purnama†, Adi Juliawan Pawana, and Adi Panca Saputra Iskandar

Udayana University, Bali, Indonesia
{fajarpurnama,adijuliawanpawana,adipanca}@unud.ac.id

Abstract

It has been over a decade since the emergence of cryptocurrency mining. In 2017, cryptocurrency JavaScript web mining was introduced, allowing mining to occur directly within web browsers. However, this innovation was soon abused by malicious actors who secretly or forcibly executed mining scripts on visitors' browsers—an act infamously known as *cryptojacking*. In contrast, this paper presents a legitimate and ethical use case of JavaScript web mining: *JavaScript mining as a method of payment*. Unlike cryptojacking, this mechanism operates with full user consent, where customers compensate merchants by performing cryptocurrency mining tasks on their behalf. A prototype file-selling web application was implemented to demonstrate the feasibility of this concept.

Experimental results show that energy consumption increases with hash rate but differs by device type. For instance, the Acer Aspire E14 consumed 28 W more than idle to reach 60 hps, while the Orange Pi Plus 2e consumed only 3.1 W to achieve 7.5 hps, suggesting a sublinear energy-performance scaling. The power-to-hash efficiency ratio ranged from 0.106 to 0.466 W/hps across devices, where lower ratios indicate higher efficiency. Desktop-class CPUs (Acer Aspire E14, Asus VivoBook AA42U) achieved higher throughput but lower efficiency, whereas single-board computers (Orange Pi, Tinker Board) demonstrated greater per-hash efficiency despite limited speed.

Additionally, network usage measurements showed data rates of approximately 7-12 kbps per 100-250 hps, implying a non-trivial bandwidth cost during mining-based payment execution. Overall, the findings highlight that the practicality of JavaScript mining payments depends on the balance between mining speed, energy efficiency, and network cost, and that customers with energy-efficient or high-throughput devices can achieve fairer exchanges in mining-based payment ecosystems.

1 Introduction

Cryptocurrency mining already started ever since the introduction of Bitcoin as peer to peer cash system by Satoshi Nakamoto [1] which today many academics, cryptographers, experts, governments, and scientists known it as blockchain technology. The public knew the peer to peer cash system as cryptocurrencies. The mining itself became viral on 2011 [2] right after Bitcoin have a price in the market [3]. It intrigues many people that their computers can generate cryptocurrencies.

Not long afterwards, cryptocurrency mining develops into many variations [4]. There are mining on different hardware such as mining on central processing unit (CPU), mining on graphics processing unit (GPU), mining on application-specific integrated circuit (ASIC), mining on

*Proceedings of The 2025 IFIP WG 8.4 International Symposium on E-Business Information Systems Evolution (EBISION 2025), Article No. 16, December 16-18, 2025, Sapporo, Japan.

†Corresponding author

field programmable gate arrays (FPGA), and mining on ARM architectures (mobile phones, micro controllers, single board computers, etc.). There are also mining on different software such as on desktop, mobile, and now on the browser utilizing JavaScript programming language. Without installing anything except the browser, anybody can visit any JavaScript mining website and start mining cryptocurrencies. Afterwards JavaScript mining became known as one form of cryptocurrency web mining. In this manuscript afterwards, the key term cryptocurrency web mining will be simplified as web mining for simplicity.

Immediately, web mining was used as an alternative method of donation from the website visitors. It is a web mining conducted by the visitors on behalf of the beneficiary, recipients, or the receiver of the donation. In other words, the visitors mined the cryptocurrency for the website owners. The problem lies in the execution of asking donation through web mining. There is only one definite correct execution and that is mining must not start until the visitors gives their consent. The controversial execution is that mining already started even though there is a notice. In between is that mining already started with a notification and the ability for the visitors to stop the mining process. A definite misconduct is that mining without giving notice to the visitors which in other words the mining is hidden without the visitors knowledge. The worst is using the lots of the visitors' resources which led to web mining labeled as cryptojacking [5].

It is unfortunate that cryptocurrency web mining today is widely known as a malware while there are potential positive innovation of this cryptocurrency web mining. One of the potential positive innovation is proposed on this manuscript and that is cryptocurrency JavaScript web mining as a method of payment. Merchants can sell digital and physical items only and accept the web mining conducted by the customers in this case the website visitors a form of payment. The merchant can set the price as they normally would and the customers will mine cryptocurrency on the website until the mining result reached the price set by the merchant. On this manuscript, a simple prototype is introduced and simple analysis the payment process and the hidden aspect of the payment process.

This manuscript investigates how web-based cryptocurrency mining could function as an alternative payment system. In the next section State of The Art discusses what technical or ethical constraints arise in its implementation and end it with statements of why this manuscript is novel where nobody have published this topic formally. The remainder of this paper presents the system prototype, discusses its payment process, and analyzes the hidden computational aspects related to user contribution.

To align this study with the broader E-Business Information Systems (EBIS) domain, this work positions JavaScript-based mining payment as a microtransaction layer that can be embedded into existing online service architectures. Within EBIS frameworks, it may serve as an alternative or complementary payment gateway, particularly for low-value digital content or users lacking access to conventional financial infrastructure.

2 State of The Art

The start of the art overview diagram can be seen on Figure 1. It shows the time flow from cryptocurrency mining to this method cryptocurrency mining for payment which are cryptocurrency mining → browser-based JavaScript mining → web monetization mechanisms → applications such as donation, captcha, and payment. The detail explanation are on following subsections.

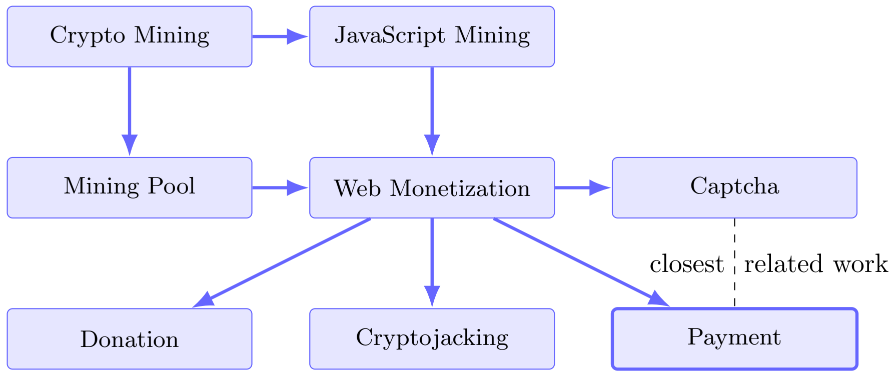


Figure 1: State of the art diagram overview.

2.1 Cryptocurrency Mining

Understanding cryptocurrency mining mechanisms is important because the proposed payment system depends on how computational work is measured and rewarded. This is relevant because in the proposed payment mechanism, user contribution is measured through the amount of work (hashes) performed, which directly reflects the Proof of Work (PoW) principle. Although other consensus algorithms such as Proof of Stake (PoS) and Proof of Authority (PoA) exist, this manuscript limits discussion to Proof of Work (PoW) since it directly associates computational effort with measurable value.

The term mining is literally taken from the physical labor of people mining in real physical mines. It costs the laborers energy in order to obtain valuable resources. For cryptocurrency mining, the laborers are computers using their computing powers to solve complex cryptography in order to obtain cryptocurrencies. Most of the general public forgot that cryptocurrency mining is not free. The author explained in the author's previous manuscript [6] that basic costs of cryptocurrency mining other than the initial capital of hardware and software are electricity usage cost and data usage cost which is usually Internet connection usage cost.

For the general public, mining is the easiest term to explain while in actual, it is the process of securing the decentralized distributed blockchain network [7]. Different from the traditional information system where the topology is clustered star tree, decentralized distributed blockchain information system the topology is mesh. Every node within the network holds a copy of the ledger and the problem lies in how to have general agreement (consensus) within the network regarding of which version of the blockchain ledger is valid. Therefore, honest nodes are busy maintaining that consensus but rewarded with cryptocurrency in exchange.

2.2 JavaScript Web Mining

The first Bitcoin mining software was written in C++ as a desktop software. This means that it opens possibilities to write the mining software using other programming language. In 2017, CoinHive released a mining software in JavaScript which enables mining on the web browser [8]. Unlike desktop mining which runs at near-hardware performance, browser-based mining operates under JavaScript runtime limitations, making it less efficient but more accessible. Not long afterwards, many website provides services for mining cryptocurrency on the web browser. Without additional software installations, the users only need to visit the websites on their web browser, input their cryptocurrency wallet address, and start mining [9]. It is important to understand that the scope of this manuscript is limited to JavaScript web mining which means not including other types of cryptocurrency mining. Typical browser mining hashrates range from tens to hundreds of hashes per second, several magnitudes lower than native miners, thus limiting its practicality to micro-payments or low-value exchanges.

2.3 Mining Pool

CoinHive did not survived but there is another JavaScript mining software provider called CoinIMP [10]. Currently is difficult to find working source code for JavaScript Web Mining. While it is always possible to write one, the author chose to utilize CoinIMP for this manuscript due to limited time. CoinIMP provides a vast library to implement JavaScript cryptocurrency mining on any website for mining MintMe coin formerly known as Webchain which the important component needed for the JavaScript mining payment execution is the amount of hashes generated by the customers and a dashboard showing the amount MintMe received based on the customers' hashes for the merchant.

The mining on CoinIMP is through its own mining pool. Since the nature of Proof of Work mining is that higher computing power that could generate more hashes per second tends to obtain more of the mining reward, smaller miners tend to join together into a mining pool to compete with these parties with high computing powers [11]. Mining pool is like a mining group where the group and not individually obtains the mining reward. The problem afterwards, is how to distribute the mining rewards to each members of the group. The generally accepted method of distribution is based on the computing power or hashes generated by each members. Those with higher hashes generated receives higher rewards while those with lower hashes generated received lower rewards. This is still preferred by smaller miners because mining alone or solo for them tends to be almost impossible to obtain rewards because they lose competition with the larger miners.

Not limited to CoinIMP but well operating mining pool is necessary to guarantee payment value to the merchant. Since rewards in PoW mining are competitive and random, there is no guarantee that merchants can receive cryptocurrency when the customer mines. Thus, the use of a mining pool is not only computationally advantageous but also economically necessary to ensure predictable value transfer in the payment process. Therefore the scope of this manuscript is limited to the necessary utilization of mining pools.

2.4 Online Monetizations

Previously, there were already many forms of monetizations for the website owners to generate income for their website but can be generally divided into two. The first one is donation transfers where the website owners post their bank and/or digital wallet accounts on their website. One of the earliest request for donation was from Wikipedia asking for donation through Paypal in 2005 [12]. The second one is advertisements (ads) where web owners allows any form of ads on their website and get paid by the advertisement owners. The most popular platform among bloggers or individual website owners is Google Adsense [13]. JavaScript Web Mining adds another form of online monetizations and became the third one where the visitors mines cryptocurrency on behalf of the website owners. Unlike donations or ads which rely on financial transfer or user attention, web mining monetizes computational work, converting visitors' processing power into value for the merchant.

From the authors knowledge, there are currently three forms of monetizations which are donations, advertisements, and cryptocurrency web minings summarized on Table 1. All three requires the merchant have accounts on each respected forms. While the customers requires

Table 1: Comparison of Online Monetization and Payment Methods

Method	Customer Account	Merchant Account	Privacy	User Action	Value Type
Donation	Required	Required	High (depends on channel)	Active (transfer)	Currency
Advertisement	Not required	Required	Low (tracking common)	Passive (viewing)	Attention
Web Mining	Not required	Required	Medium to High	Passive (computing)	Computation

having their own accounts for donation method, both advertisement and web mining method requires no setup from the customers rendering them more simple than the donation method. For privacy, all three are technically possible but currently there are very few to almost no existing platform that provides them except for the cryptocurrency web mining.

cryptocurrency web mining as a form of monetization is already a well known topic. Most research on this topic discusses security, ethics, or browser performance [14]. At least from the authors knowledge Never once mention about economic feasibility or payment systems.

2.5 Online Payments

Today there are many online payment methods but almost all of them requires account setup from both the merchants and the customers. For banks and other parties related to national governments requires to follow the know your customer (KYC) [15] practice which at least filling the form, providing identity card, email address, and phone number, also there are some strict countries requiring proof of address. Other than those usually only requires account setup but customers needs to handle the balance top up themselves. However, advertisement and cryptocurrency web mining only requires the merchant to setup an account or create their own platform while there are no setup requirements for the customers. Therefore for setup on the customers advertisement and cryptocurrency web mining are the most convenient. If the computational contribution from visitors can be reliably measured and valued, it may serve as an implicit form of payment—without requiring explicit account setup or currency transfer.

2.6 Limitation and Novelty

Unfortunately, JavaScript web mining became a controversy because most website owners misused it. Awarely or unawarely, most of the website owners execute the JavaScript web mining without the visitors' consent. Therefore up until today, JavaScript web mining is considered as a malware called cryptojacking derived from the hijacking which means the visitors' computer are hijacked to perform mining by the hijackers which is the website owner in this case. This became one of the main reasons why JavaScript web mining did not develop much where most of the articles published professionally and all other online contents including news, magazines, and blogs are about analysis and defending against cryptojacking [16]. There are very few to almost no developers in this field, which is why although the prototype introduced in this manuscript may not be impressive but the JavaScript mining as a method of payment is probably new. The closest only work in the world related to JavaScript mining as a method of payment is probably Coinhive's Captcha [17]. Therefore, this article is probably the first if not one of the first in the world to introduce this method. While previous works focus on detecting and preventing unauthorized mining, this manuscript explores how a transparent and consensual browser mining process could function as a legitimate payment method. The novelty of this work lies not in the mining algorithm itself but in its application as a voluntary, measurable, and browser-based micro-payment mechanism.

3 Method and Experiment

3.1 General JavaScript Mining Payment Method

For this manuscript, the author utilizes CoinIMP JavaScript mining software. Since CoinIMP is a mining pool, the currency is the mining power of the customers. Therefore, the price of the goods and/or services set by the merchant is in hashes, which represent the total amount of mining power generated by the customers. Each hash unit corresponds to a fragment of computational work performed within the CoinIMP network, which is automatically validated and credited to the merchant's pool account. Consequently, the customer's browser effectively becomes a temporary miner whose contribution measured in total hashes directly determines the completion of payment and access to the purchased digital goods.

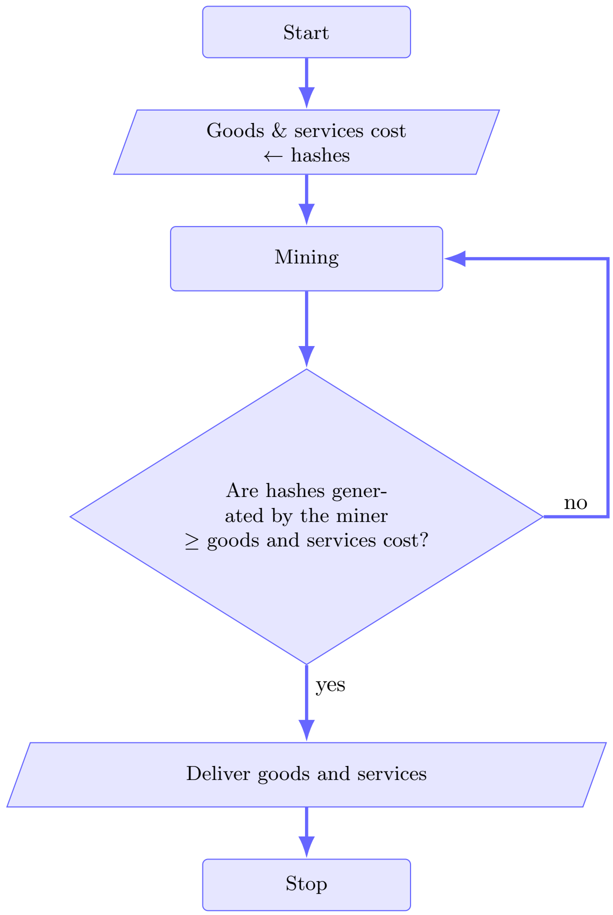


Figure 2: General JavaScript mining as a payment flowchart.

The process of JavaScript mining as a method of payment is very straightforward, as shown in Figure 2. Basically, the merchant sets the amount of hashes the customer has to generate through JavaScript web mining, and once the customer generates enough hashes, the goods and/or services are delivered. The source code for the program should be derived from Algorithm 1. This mechanism effectively turns computational work into a measurable form of digital payment, where the customer's processing power serves as the medium of exchange instead of conventional currency.

Algorithm 1 General JavaScript Mining Payment

```
goods and services cost ← hashes
while total amount of hashes generated by miner < goods and services cost do
    cryptocurrency mining
end while
deliver goods and services
```

3.2 File Selling Scenario through Websites

Listing 1: HTML and JavaScript Code of File Selling Scenario

```
<html>
    <p>
        <button id="button" onclick="start()">Start Mining Payment</button>
        <span id="hps"></span>
    </p>
    <p>
        <progress id="progress" value="0" max="100"></progress>
        <span id="hashes"></span>
    </p>
    <p id="the_file"></p>
</html>
<script src="https://www.hostingcloud.racing/QgkD.js"></script>
<script>
    const price = 2000;
    let mining_payment_progress;
    let hps;
    document.getElementById("progress").max = price;
    var _customer = new Client.Anonymous(
        '0f01ab5d9f918554840bde1897be3bfae2370ac9b5940da9e4abb572df9591df',
        { throttle: 0, c: 'w' }
    );
    function start() {
        _customer.start();
        setInterval(inprogress, 250);
    }
    function inprogress() {
        document.getElementById("button").innerHTML = "In Progress";
        hps = _customer.getHashesPerSecond();
        document.getElementById("hps").innerHTML = hps + " hashes/second";
        mining_payment_progress = _customer.getTotalHashes();
        document.getElementById("hashes").innerHTML =
            mining_payment_progress + "/" + price + " hashes";
        document.getElementById("progress").value = mining_payment_progress;
        if (mining_payment_progress >= price) {
            _customer.stop();
            document.getElementById("button").innerHTML = "Complete";
            document.getElementById("the_file").innerHTML =
                "<a href='file.zip'>Download File</a>";
        }
    }
</script>
```

To demonstrate JavaScript mining payment, this manuscript presents a scenario where a website owner sells a file and receives payment through browser-based mining. The implementation, shown in Listing 1, uses simple HTML and JavaScript: the file link is hidden, a button starts the CoinIMP mining process, and once sufficient hashes are generated, the mining stops and the link becomes visible. A progress bar indicates mining progress as payment status. In practice, the required hashes depend on the product price and the customer's device performance, while the progress bar visually shows how close the payment is to completion and when the file becomes accessible.

3.3 Simple Mining Resource Cost Measurement

The hidden cost in JavaScript mining as a method of payment is the resource cost to perform the mining. The general resource costs are electricity consumption and data transmission service. Since the currency of payment in this article is hash, the resource cost measurement is mostly related to hash. Note that the exchange rate between hashes and cryptocurrency value may fluctuate depending on network difficulty, mining pool reward distribution, block reward schedule.

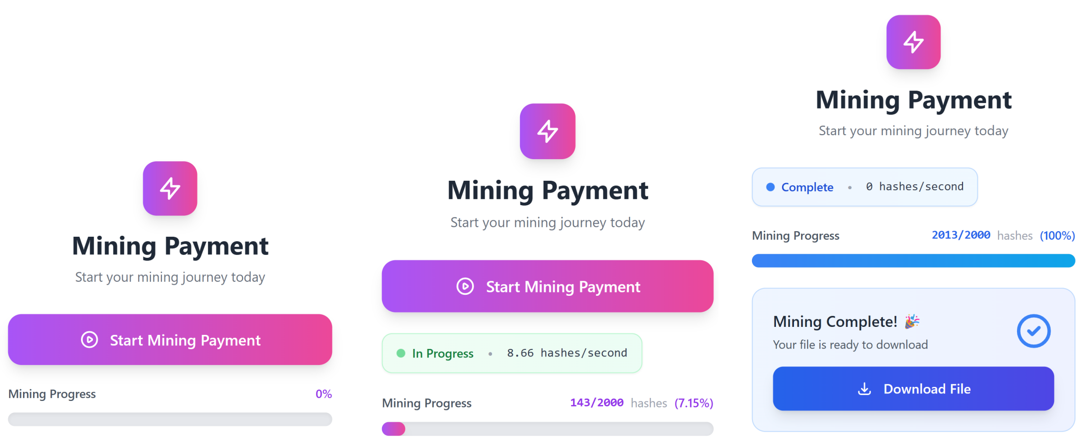
Few computers shown in Table 2 will be compared whether the amount of hash is equal to the electricity consumption. Different number of hash rate will be compared to see if more hashes costs more data transmission. Due to many limitations, the author only use Taffware KWH Meter 565 to measure electrical power used and the task manager in Windows to measure the data rate during mining. The electrical power measurement with Taffware KWH Meter 565 may not capture micro-fluctuations in short mining sessions, so results are approximate but sufficient for proportional analysis.

Table 2: Computers used in the experiment.

Computer	Operating System	Browser
Orange Pi Plus 2e	Armbian	Chromium
Raspberry Pi 3 Model B+	Raspbian	Chromium
Asus Tinker Board	Tinker OS	Chromium
Acer Aspire E 14	Ubuntu 22.04 LTS	Firefox
Asus VivoBook AA42U	Windows 10	Google Chrome
Fujitsu Lifebook T730	Ubuntu 22.04 LTS	Firefox
Asus X450LCP	Ubuntu 22.04 LTS	Firefox
Asus VivoBook Flip 14	Windows 11	Google Chrome

4 Result and Discussion

4.1 Prototype



(a) Before starting payment (b) Payment in progress (c) After finish payment

Figure 3: User Interface of the JavaScript mining payment.

The initial appearance of Listing 1 result on the browser can be seen on Figure 3a where there is a button to start the payment and the progress bar still empty. Once the buttoNote that the exchange rate between hashes and cryptocurrency value may fluctuate depending on network difficulty, mining pool reward distribution, block reward schedule.n is clicked or pressed, the JavaScript mining payment process starts shown on Figure 3b where the hashes per second indicator is shown, the total amount of hashes generated along with the total amount of hashes needed to be generated, and the progress bar filling gradually. Once enough hashes are generated, the mining process stops, the progress bar full, and the file link becomes visible as shown on Figure 3c. Overall, the application works as intended.

4.2 Hidden Resource Cost

Table 3: Hash relation to electrical power usage.

Computer	**Electrical Power (Watt) 0 hps**	**Electrical Power (Watt) ~7.5 hps**	**Electrical Power (Watt) Difference**
Orange Pi Plus 2e	4.8	7.9	3.1
Raspberry Pi 3 Model B+	3.8	5.1	1.3
Asus Tinker Board	4.2	6.9	2.7
Acer Aspire E 14	16	22	6
Asus VivoBook AA42U	36	38	2
Fujitsu Lifebook T730	23	25	2
Asus X450LCP	8	14	6
Asus VivoBook Flip 14	21	24	3

Table 4: Electrical Power Usage during Max Hash Rate

Computer	**Maximum hps**	**Electrical Power (Watt) 0 hps**	**Electrical Power (Watt) Max hps**	**Electrical Power (Watt) Difference**
Orange Pi Plus 2e	7.5	4.8	7.9	3.1
Raspberry Pi 3 Model B+	20	3.8	6.7	2.9
Asus Tinker Board	24	4.2	8.9	4.7
Acer Aspire E 14	60	16	44	28
Asus VivoBook AA42U	152	36	66	30
Fujitsu Lifebook T730	88	23	62	39
Asus X450LCP	141	8	30	22
Asus VivoBook Flip 14	555	21	80	59

Although the customers pay in hashes, there are resource costs to generate those hashes where customers mostly either unaware or forgotten. The cost of electricity are currently

Table 5: Electrical power usage of max hps divided by max hps.

Computer	**Max hps**	**Electrical Power Max hps difference / Max hps**	**Electrical Power Max hps / Max hps**
Orange Pi Plus 2e	7.5	0.4133333333	1.053333333
Raspberry Pi 3 Model B+	20	0.145	0.335
Asus Tinker Board (Note: the exchange rate between hashes and cryptocurrency value may fluctuate depending on network difficulty, mining pool reward distribution, and block reward schedule.)	24	0.1958333333	0.3708333333
Acer Aspire E 14	60	0.4666666667	0.7333333333
Asus VivoBook AA42U	152	0.1973684211	0.4342105263
Fujitsu Lifebook T730	88	0.4431818182	0.7045454545
Asus X450LCP	141	0.1560283688	0.2127659574
Asus VivoBook Flip 14	555	0.1063063063	0.1441441441

Table 6: Data Rate by Hashes Per Second

Hashes/Second	**Data Rate Received (kbps)**	**Data Rate Sent (kbps)**
12	10.20754717	9.166666667
25	9.442307692	7.442307692
44	10.1627907	6.666666667
59	11.51219512	9.69047619
100	11.73684211	7.605263158
140	11.15909091	11.06818182
180	12.42857143	10.16666667
250	11.24	10.92

different for each regions [18]. In Germany, electricity is expensive and therefore customers may pay more if they chose JavaScript mining as the payment method. On the other hand, electricity are cheap in Iran and therefore using JavaScript mining payment method maybe preferred.

In Table 3, the author tried to relate the hashes per second (hps) and the electrical power usage in watts using different computer devices. Theoretically, the electrical power usage for the mining is the difference between electrical power usage without mining and during mining. Result showed that the electrical power consumption of the same hashes per second between different computer does not vary too much. For instance, although Acer Aspire E14 consumes 28 W more than idle, it achieves 60 hps, while the Orange Pi consumes only 3.1 W but achieves 7.5 hps, suggesting that per-hash energy cost scales sublinearly with computing power. However in practice, the electrical power usage by the customer is not the difference but the whole usage from the cost of turning and leaving the computer device on to executing JavaScript mining payment. Therefore, computer devices matters where energy efficient ones are more preferred.

Although in practice again, there is another factor other than energy efficiency and that is

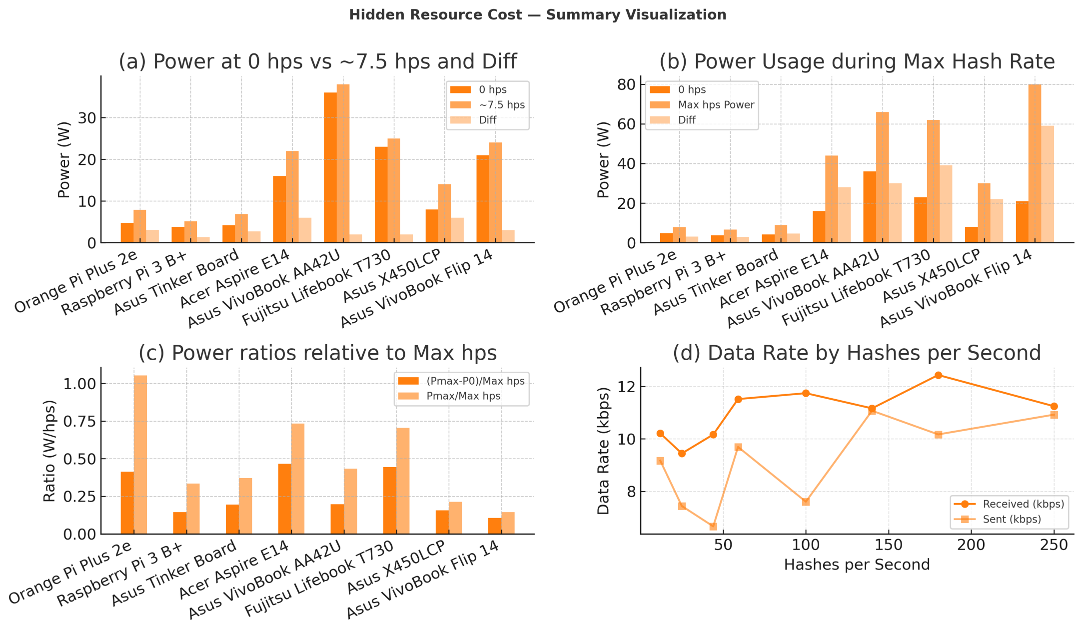


Figure 4: Visualization of Result.

the speed of performing JavaScript mining. Both customers and merchants may not want to wait long and therefore mining speed which is determined by the computer devices' computing power should also be taken in consideration. In Table 4, the author showed that different computer devices have different computing powers and thus different mining speed.

The right proportion between energy efficiency and mining speed should be carefully considered. Energy efficient devices with a low mining speed may not be practical while high mining speed devices with low energy efficiency maybe expensive. Although baseline value of the two variables should be made but it is still possible to simply compare between products by dividing the electrical power usage by the maximum hash per second to be compared between devices where lower result value means better device andNote that the exchange rate between hashes and cryptocurrency value may fluctuate depending on network difficulty, mining pool reward distribution, block reward schedule. vice versa by switching the division variables where higher value means better device shown in Table 5. The table shows desktop-class CPUs (Acer Aspire E14, VivoBook AA42U) produce higher throughput but lower efficiency, while SBCs (Orange Pi, Tinker Board) have lower throughput but high per-hash efficiency.

The other resource cost is the service for data transactions. Although the author did not find meaningful correlation between hashes and data transaction per second (data rate) in Table 6 but the values in general alone are worth consideration. If Internet connections are free, then it is the luck of the customers but if not, customers must also consider the cost offered by Internet service providers (ISP) and different ISP usually offer different cost and service quality [19].

On the merchant side, there is the mining difficulty. The mining difficulty changes depends on the amount of miners. This is to keep the rate of block creation consistent [20]. If the difficulty were too low, blocks would be added too quickly, and the blockchain would be vulnerable to attacks. If the difficulty were too high, blocks would be added too slowly, and the network would become congested. In this case, it will be difficult for the merchant to determine the amount of cryptocurrency to be received. If the merchant decided to price the goods and/or services in cryptocurrency instead of hashes, the customers will have to generate different amount of hashes as time passes. Merchants could adopt an adaptive pricing mechanism tied to real-time mining difficulty or hash-to-coin conversion API to maintain fair valuation.

5 Conclusion

This article has shown that JavaScript mining as method of payment technically possible by demonstrating a file can be downloaded after the customer mined the set amount of hashes determined by the merchant. This article also explained the general hidden cost of this method of payment which are electricity and data transaction services which people are unaware or have forgotten visualized in Figure 4. There is also the uncertainty of the amount cryptocurrency received by the merchant. From the experiments, JavaScript mining payment is technically viable but constrained by device performance, electricity cost, and mining difficulty fluctuation. Its practicality depends on balancing energy efficiency, mining throughput, and regional resource pricing. This study addressed whether JavaScript-based cryptocurrency mining can serve as a voluntary payment mechanism on the web. In the context of E-Business Information Systems, JavaScript mining may be considered a complementary micro-payment mechanism capable of integrating into e-commerce or content management systems as an ethical, consent-based, and low-entry digital transaction option.

6 Future Work

While this article proofed that the method is technically demonstrated as possible, there are still more complicated aspects that are left to be addressed. There are still the capital for purchasing the computer device and the lifetime change of the computer device as continuous mining can be a heavy burden for the device and may lead to shorter lifespan. Even though this work can be continued into building and integrating into an e-commerce and information system, there is still the even more complicated aspect and that is the economic aspect. Uncertain currency will hinder the adoption of this method as large merchants may not dare use this method. The only visible adoption of this method is adoption by small retails such as they now can sell files and contents online. Nevertheless, as energy-efficient hardware and stable crypto valuation mechanisms mature, this method may evolve into a niche micro-payment alternative for digital content distribution.

This work demonstrated a proof-of-concept of web-based cryptocurrency mining as an alternative payment mechanism using the CoinIMP platform. While the implementation was successful in validating the technical feasibility of browser mining for micropayments, it also revealed a critical limitation which is the system is heavily dependent on the availability and policy of the external platform. As observed in the case of Coinhive, the discontinuation of the provider immediately renders the system unusable. Therefore, the next step is to achieve independence by employing or developing open-source alternatives. In future work, several directions are proposed:

- **Integration of Open-Source Miners.** We plan to evaluate existing open-source JavaScript mining projects to replace the dependency on a third-party platform. Promising candidates include:

  - *Duino-JS* – a JavaScript miner for Duino-Coin using WebSockets and web workers [21].
  - *WebGRLC.js* – a WebAssembly-based miner for browser environments [22].
  - *BLOC JavaScript Miner* – a lightweight miner designed for web embedding [23].

  These will be benchmarked for browser compatibility, hash rate, CPU utilization, and network stability.

- **Mining Pool Development.** An independent backend will be explored using Node.js-based pool frameworks such as the Node Open Mining Portal (NOMP). This enables the creation of a self-managed mining pool and ensures the continuity of the payment system even if external services become unavailable.

- **Security and Ethical Evaluation.** The mining code will be audited to ensure transparency, open licensing, and the absence of malicious behavior. Future studies should also include an ethical framework for user consent and energy accountability in web mining.

- **System Performance Analysis.** Additional experiments are planned to measure computational contributions from users, total mined output, and energy efficiency. The performance of open-source implementations will be compared with that of CoinIMP as a baseline.

  Finally will also address system-level integration within EBIS platforms, including the design of API interfaces for mining-based payment gateways, consent management, and auditing modules for transparency and trust. Economic and regulatory modeling will further define how computational work can be fairly valued as a transferable digital asset. If integration with existing public operating EBIS platorms is not yet possible then the authors considers in building an EBIS platform from scratch and implement the method introduced in this manuscript.

- **EBIS Framework.**

Ultimately, these developments aim to create a self-sustaining, transparent, and open framework for web-based cryptocurrency monetization without reliance on proprietary services and integration to EBIS framework.

7 Acknowledgments

The main author conceived the overall idea of this manuscript but experienced uncertainty when deciding the title. Therefore, the author consulted with ChatGPT (OpenAI GPT-5, via chatgpt.com), which assisted in refining the title selection. After completing the initial 12-page draft using the EasyChair LaTeX template, the author further consulted with ChatGPT on each section and subsection regarding possible elaborations, clarifications, or structural improvements—while ensuring that the authenticity and capability level of the author's own writing were preserved. Its contributions include:

- Clarifying the research objective and focus by suggesting the addition of the last paragraph in the Introduction section.

- Inspiring a potential future topic, "Online Advertisements as a Method of Payment," through discussions on the Introduction and State of the Art sections.

- Clarifying the lineage from cryptocurrency mining to browser-based JavaScript mining and its connection to web monetization and payment systems; refining the scope limitation to Proof of Work (PoW) consensus; emphasizing the necessity of mining pools for stable and predictable payments; structuring a comparative table of online monetization methods; and articulating the research novelty as the conceptualization of browser-based web mining as a voluntary, measurable micro-payment mechanism rather than a security threat. These inputs were provided for academic structuring and contextual refinement; all writing decisions and interpretations remain the author's own.

- Refining the Result and Discussion section by clarifying comparative interpretations across device classes and suggesting structured summaries linking user and merchant perspectives.

- Identifying relevant open-source JavaScript mining projects for future exploration.

- Identiry the relationship of this manuscript with EBIS framework.

Despite these valuable inputs, the author takes full responsibility for maintaining the authenticity, direction, and originality of the manuscript's writing and ideas.

References

[1] Satoshi Nakamoto. Bitcoin: A peer-to-peer electronic cash system, 2008. White Paper.

[2] Benjamin Wallace. The rise and fall of bitcoin, 2011. Online Article.

[3] Brian Nibley. Bitcoin price history, 2023. Web Page.

[4] Whattomine. Accessed on October 14, 2025.

[5] Shayan Eskandari, Andreas Leoutsarakos, Troy Mursch, and Jeremy Clark. A first look at browser-based cryptojacking. In *2018 IEEE European Symposium on Security and Privacy Workshops (EuroS&PW)*, pages 58–66, 2018.

[6] Fajar Purnama, Irwansyah, Muhammad Bagus Andra, and Tsuyoshi Usagawa. Is zero electricity cost cryptocurrency mining possible? solar power bank on single board computers (research session). In *The 14th International Student Conference on Advanced Science and Technology (ICAST)*. Kumamoto University, 2019.

[7] Andreas M. Antonopoulos. Mining and consensus. In *Mastering Bitcoin (Second Edition, Second Print)*, chapter 10, pages 213–266. O'Reilly Media, 2017. Accessed on October 14, 2025.

[8] Coinhive. A crypto miner for your website, 2017. Accessed on October 14, 2025.

[9] Crypto webminer. Accessed on October 14, 2025.

[10] Coinimp, September 2023. Accessed on October 14, 2025.

[11] Yoad Lewenberg, Yoram Bachrach, Yonatan Sompolinsky, Aviv Zohar, and Jeffrey S Rosenschein. Bitcoin mining pools: A cooperative game theoretic analysis. In *Proceedings of the 2015 international conference on autonomous agents and multiagent systems*, pages 919–927, 2015.

[12] Jimmy Wales. Wikimedia foundation fundraising. Web Archive, March 2005. Accessed on October 14, 2025.

[13] Google adsense, September 2023. Accessed on October 14, 2025.

[14] Zeyan Kang. A review on javascript engine vulnerability mining. *Journal of Physics: Conference Series*, 1744(4):042197, feb 2021.

[15] Financial Action Task Force (FATF). *International Standards on Combating Money Laundering and the Financing of Terrorism & Proliferation: The FATF Recommendations*. Financial Action Task Force (FATF), February 2012. Updated on a rolling basis; most recently in June 2025.

[16] Matthieu Faou. Cryptocurrency web mining: In union there is profit, 2017. Accessed on October 14, 2025.

[17] Coinhive Documentation. Coinhive documentation: Captcha, 2019. Accessed on October 14, 2025.

[18] Electricity prices by country, 09 2023. Accessed on October 14, 2025.

[19] Alan Weissberger. 2022 study of broadband pricing in 220 countries reveals vast global disparities, 04 2022. Accessed on October 14, 2025.

[20] Andreas M. Antonopoulos. 8, mining difficulty. In *Mastering Bitcoin (Second Edition, Second Print)*, chapter 8, pages 171–192. O'Reilly Media, 2017. Accessed on October 14, 2025.

[21] sys 256. Duino-js: Javascript miner for duino-coin. https://github.com/sys-256/Duino-JS, 2024. Accessed: 2025-10-13.

[22] Ananth Vivekanand. Webgrlc.js: Browser miner using webassembly. https://github.com/AnanthVivekanand/WebGRLC.js, 2023. Accessed: 2025-10-13.

[23] FuriousTeam. Bloc javascript miner. https://github.com/furiousteam/BLOC-javascript-miner, 2022. Accessed: 2025-10-13.