

# Analysis of Cryptocurrency Mining in Gaming Consoles



E. Shanmuga Skandh Vinayak, N. Bhalaji, and Xiao-Zhi Gao

**Abstract** Ever since the invention of the bitcoin cryptocurrency in the year 2009, many blockchain ledgers have been initiated by several parties, offering over 1600 different types of cryptocurrencies all around the world by them. This increase in popularity has not only moved the masses toward performing trade using these currencies but also start earning them through mining with sophisticated computing hardware. In this article, an analysis is performed to estimate the performance and the profitability of mainstream gaming consoles, developed by the Sony Entertainment Company and Microsoft Corporation when subjected to mine five different types of cryptocurrencies (Bitcoin, Bitcoin Cash, Dogecoin, Litecoin, Dash). The article also provides real-time test results on the mining performance and profitability of the consoles under study. Although the Microsoft Corporation consoles can provide a monthly profit of 0.00096 and 0.00319% of the initial investment, an overall net loss of over 80% of the initial investment is observed in all the consoles.

**Keywords** Analysis · Cryptocurrency · Mining · Gaming consoles · Performance · Profitability

## 1 Introduction

The Bitcoin cryptocurrency has been increasingly gaining popularity since its initial release on January 3, 2009. Due to the immense hike in face value from ₹ 43,247.83 to ₹ 360,055.02 of Bitcoin by the year 2016 [1], the popularity peaked subsequently

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and has been growing ever since. According to Statista, Bitcoin is the most valued cryptocurrency with a face value of ₹ 731,424 in the year 2020. This gain in popularity ignited trade to be carried out using this newly accepted currency as a secure source of payment between two organizations over the Internet, without any third-party liability. The population that performs trades using the cryptocurrency extended the use of the same by also starting to earn them. This is done using cryptocurrency mining. Due to the immense success of Bitcoin in its trade and mining pools, many independent and organizational parties have started to introduce their cryptocurrency by maintaining a public ledger, with over 1600 different types of cryptocurrencies being used worldwide. With such an increase in the number of cryptocurrencies exchange available, the miners have started to mine them all over the world by combining their computing capacity to form mining pools. Out of these mined currencies, the Litecoin and the Bitcoin are mined in a majority in the Asia-Pacific subcontinents totalling up to 52 and 44% of the total mining pool population by the year 2018, according to Statista [2]. By the year 2020, the size of the Bitcoin blockchain has grown to a size of 280 gigabytes [3] and a length of 535 million [4]. These observations show that mining cryptocurrency can be highly profitable with the right investment in suitable hardware. Out of the hardware considered for mining, the least sought out by the users is the current mainstream gaming consoles due to their closed systems.

The gaming sector has been an ever-expanding and everimproving industry since the early 1960s. With exceptional significance in the improvement of hardware used in the gaming consoles, the gaming systems have improved in performance and efficiency. With the global gaming console market generating a revenue of ₹ 596,430 crores in the year 2020 [5], the popularity in the use of gaming consoles is at its peak. Hence, in this article, an analysis is performed to examine the viability of gaming consoles in mining operations and to examine whether they are capable of producing a profit, as the major use of these consoles by the users is only gaming and home entertainment.

## 2 Cryptocurrency Mining

Cryptocurrency mining is the process of obtaining cryptocurrency incentives for the successful validation of any transaction occurring in the target network. The network consists of a digital ledger known as the blockchain, that stores these transactions once they are successfully validated by the peers present in them. The validation operation refers to the calculation of each transaction's fingerprint (hash) and checking if it matches with the target fingerprint. The digital transaction records and the hash of the previous block are hashed along with a number only used once (nonce) and are propagated in the network to the users to be validated. The operation of determining the nonce and hashing them redundantly to obtain the hash that matches the target hash is known as mining. If a user is successful in determining the nonce before any other participant, then that user is incentivized with a certain amount of cryptocurrency based on the amount of work done by the peer. Based on the diffi-

culty, i.e., the difficulty to solve for the hash, the incentive amount of the currency varies. Because the solving of the hash algorithm is a tedious and repetitive process, computing power is utilized. Based on the user's hardware capability, the speed with which the hashes are calculated varies. The speed with which the hardware component can calculate these hashes is called the hash rate; i.e., higher the hash rate, better is the performance and profit. Since a stand-alone system may not be able to provide the hashing power to solve a single block, peers in a network form a combined unit of computation to solve each block. This is known as a mining pool. The incentive to each user is assigned based on the amount of computational power contributed to solving the block.

### 3 Related Works

James Clay et al. in their work "A Power Analysis of Cryptocurrency Mining: A Mobile Device Perspective" [8] analyze the impact of cryptocurrency mining systems on the power consumption of mobile devices. In their work, the authors analyze the ill effects of JavaScript-based web browser mining of websites such as CoinHive on mobile devices. The authors analyze the power consumption and the network usage of mobile devices, that is utilized by CoinHive to mine their network as an alternative for targeted advertisement. The authors show the impact of these mining operations on a low-powered device such as a mobile phone and how it can ultimately decrease its battery life. Similar to the approach of the author's work, this proposed experiment focuses on measuring the profitability of the mining operation in low-powered devices (locked gaming consoles that do not use extensive hashing peripherals to mine) and observing the impact of the performances of the native computation unit in solving block hashes. In the article "Goldstrike<sup>TM</sup>1: CoinTerra's First Generation Cryptocurrency Mining Processor for Bitcoin" [9], the authors Javed Barkatullah et al. analyze the performance and efficiency of the newly designed Goldstrike<sup>TM</sup>1 processor for Bitcoin mining. The processor is analyzed based on the power consumption efficiency during the mining process and its hash rate for a unit of power consumed. The architecture of the processor is studied to analyze and compare the hashing power and the power efficiency of the processor to application-specific integrated circuit (ASIC) miners. Similar to the mentioned work, this article analyzes the architecture of the low-powered processor in mainstream gaming consoles for performance and profitability. Authors S. G. Iyer et al. in their study "GPU and CPU Accelerated Mining of Cryptocurrencies and their Financial Analysis" [10] analyze and compare the performance and the profitability of central processing unit (CPU)-based and graphics processing unit (GPU)-based mining. In their study, it is evident that the hash rate of the CPU or the GPU is majorly dependent on the

hashing algorithm of the cryptocurrency mined. Their work also reveals that GPU the is dominant option in a mining system, as it is able to produce 103 times the hash rate of the CPU for the Ethereum cryptocurrency. Since their study was performed on Intel® CPU processor, this proposing study is aimed at analyzing the performance and the profitability of the Advanced Micro Devices, Inc. (AMD®) CPUs.

## 4 Experimental Analysis

In this article, we assess the usability of four mainstream gaming consoles, in mining cryptocurrency. The four consoles are, the PlayStation 4™, released on November 15, 2013 (USA) and the PlayStation 4 Pro™, released on November 10, 2016, developed by the Sony Computer Entertainment and the Xbox One™, released on November 22, 2013 (USA) and the Xbox One X™, released on November 7, 2017, developed by the Microsoft Corporation.

These consoles are selected based on the popularity of use in the overall gaming industry and their possession of the most sophisticated hardware in the console industry so far. According to Statista, over 112 million PlayStation 4 units and over 46 million Xbox One units have been installed and used all over the world, in the year 2019 [6].

The ultimate goal of estimating whether a gaming console can be used to mine cryptocurrencies and produce a profit (return on investment) is based on the following factors.

1. Price and Specifications.
2. Cryptocurrency to be mined.
3. Hash Rate.
4. Power Consumption.
5. Lifespan.

### 4.1 Price and Specifications

The price and the specifications of the console are one of the most preliminary aspects to be considered before selecting a console, as it plays an important role in determining the profit that the console produces on the invested capital. Although selecting the cheapest console appears to be the most prominent option, selecting the console based on the specifications that would comparatively produce the highest profit in a short time duration is essential. Tables 1, 2 and 3 describe the price (at the time of writing this article) in rupees (₹) and the specification of the consoles under study.

**Table 1** Console price

Console	Price (₹)
PlayStation 4	25,555
PlayStation 4 Pro	31,500
Xbox One	25,075
Xbox One X	41,999

**Table 2** Console specifications

Console	CPU	Clock rate (GHz)	Memory (RAM)
PlayStation 4	x86-64 AMD Jaguar (8 cores)	1.6	8 (DDR5)
PlayStation 4 Pro	x86-64 AMD Jaguar (8 cores)	2.13	8 (DDR5)
Xbox One	x86-64 Graphics Core Next (GCN) 2 AMD Jaguar (8 cores)	1.75	8 (DDR3)
Xbox One X	x86-64 GCN 4 AMD Jaguar (8 cores)	2.3	12 (DDR5)

**Table 3** Console properties

Console	Power consumption (W)	Max. temperature (°C)
PlayStation 4	165	5–35
PlayStation 4 Pro	310	5–35
Xbox One	120	15.5–48.9
Xbox One X	180	15.5–62.0

The specifications of the console that only aid in the cryptocurrency mining process are analyzed and specified in the following tables and sections; i.e., the internal memory, DVD drive, and I/O port specifications of the consoles are not analyzed.

One of the most significant components that enable profitable and worthwhile mining operations in a non-ASIC mining rig is the GPU. Although the GPU in the gaming consoles in this study has significantly improved when compared to its predecessor consoles (PlayStation 3 and Xbox 360), such as the use of DirectX-12 graphics in the Xbox One X consoles, unlike the predecessor consoles, these gaming consoles are locked by their respective manufacturing companies and cannot be hacked or modified to utilize the GPU directly. This prevents the GPU from being

used directly by a non-licensed third-party application. Although the PlayStation consoles possess the ability to install homebrew applications in its platform, no third-party mining application that can harness the GPU is available at the time of writing this article. This not only forces the console to an application less mining environment but also performs CPU mining. CPU mining is proven to be significantly lower in efficiency and profit when compared to GPU mining. The CPU core is capable of executing 4 32-bit instructions per clock (using a 128-bit SSE instruction) or 8 via Advanced Vector Extensions (AVX) (256-Bit), whereas a GPU like Radeon HD 5970 is capable of executing 3200 32-bit instructions per clock (using 3200 ALUs). The difference in their architectures allows us to understand that, although a multi-core CPU has a higher clock-rate allocated for each core, the GPU is superior in efficiency when performing redundant operations such as mining. Although the PlayStation 4 and PlayStation 4 Pro possess 1.84 and 4.20 Tera Floating Points (TFLOPS) AMD Radeon™GPUs, respectively, and the Xbox One and the Xbox One X possess 1.31 and 6.0 TFLOPS, respectively; they are unavailable for the utilization in these non-licensed mining operations.

Out of the configurations considered, the RAM specification can be considered as the least significant parameter in the analysis of mining performance. This is because all the consoles under study possess 8 times (12 for Xbox One X) the RAM requirement for any cryptocurrency to be mined. But this is also analyzed in this article, as the Operating System (OS) of the console depends on the RAM to optimize kernel operations that are performed along with the multi-threaded mining operations. The Orbis OS v7.51 (at the time of writing this article) of PlayStation 4 and the PlayStation 4 Pro is a Unix-based FreeBSD operating system that is highly capable of internal RAM optimization. This shows that the console may not freeze or crash due to a shortage of memory if the mining operation succeeds. But unlike the PlayStation consoles, the Xbox One and Xbox One X consoles possess a Windows 10, initially Windows 8 core as its operating system along with a modified version of the Hyper-Viridian hypervisor. This utilization of the hypervisor in the Xbox One consoles allows the consoles to be superior to the PlayStation consoles during the mining operation. Hyper-V implements and isolates virtual machine partition (logical unit of isolation, supported by the hypervisor, in which each guest operating system executes) that it creates in x86-64 Windows machines. The Hyper-V is capable of hardware accelerating the address translation of Guest Virtual Address-spaces, by using second-level address translation provided by the CPU (EPT), on AMD. The mining interface utilizes the child partition to perform a hypervisor-based hashing operation. The Hyper-V utilizes the simultaneous multithreading (SMT) technique that allows the processor's resources to be shared by separate, independent threads. SMT generally offers a modest performance boost to most workloads by parallelizing computations when possible, thereby increasing instruction throughput. This allows the Xbox One and Xbox One X consoles to perform multi-threaded mining, bottlenecked by the hashing capacity of the CPU.

## 4.2 Cryptocurrency

The cryptocurrency is the reward incentivized to the miner for verifying the transaction. Although an exchange face value is available for each cryptocurrency, with which government-regulated money can be obtained, the difficulty to obtain a substantial amount of cryptocurrency varies within each cryptocurrency. For this experiment, the console is subjected to mine five cryptocurrencies. The difficulty and the price of each cryptocurrency (at the time of writing this article) are given in Tables 4 and 5.

The difficulty rates are dependent on the consensus protocol the cryptocurrencies follow and the volume of participants of the network. Depending on the consensus rules and the size of the network, the difficulty range of the nonce varies, which is directly proportional to the amount and the value of the incentive obtained from the mining operation. The miners are rewarded with the cryptocurrency obtained from the fee the transaction initiators pay to the network (Table 6).

**Table 4** Cryptocurrency difficulties

Cryptocurrency	Difficulty
Bitcoin core	13,732,352,106,018.00
Bitcoin cash	363,666,388,375.33
Doge coin	2,644,822.07
Lite coin	8,671,505.36
Dash	156,499,539.48

**Table 5** Cryptocurrency prices

Cryptocurrency	Price (₹)
Bitcoin core	731,424
Bitcoin cash	19,377.89
Doge coin	0.19
Lite coin	3547.17
Dash	5930.85

**Table 6** Cryptocurrency consensus protocol

Cryptocurrency	Consensus protocol
Bitcoin core	Proof-of-work
Bitcoin cash	Proof-of-work
Doge coin	Proof-of-work
Lite coin	Proof-of-work
Dash	Proof-of-work

All the cryptocurrency mined for the purpose of this experiment follows the proof-of-work consensus protocol, that awards the participants of the network, based on the amount of computational resources contributed in solving the block hash. The architecture that follows describes the proof-of-work consensus and the pipeline of block verification in the network (Fig. 1).

### 4.3 Hash Rate

The hash rate of a mining rig is the most important aspect to be considered in calculating the profitability of the mining operation using the system under study. Any mining hardware is classified based on the rate at which hashes are calculated by them. The unit with which the hash rate is measured in hashes/second (H/s). The higher order of the unit is extended as kilo ( $10^3$ ) hashes/second (kH/s), mega ( $10^6$ ) hashes/second (MH/s), giga ( $10^9$ ) hashes/second (GH/s), tera ( $10^{12}$ ) hashes/second (TH/s), etc.

In this section, the expected and the actual hash rate of the consoles based on their CPU architecture is analyzed. Since the hash rate of the AMD x86-64 Jaguar processors is unavailable at the time of writing this article, the architecture of the CPU can be taken as a base consideration to be compared with the architecture of similar AMD CPUs to bring about an approximate hash rate for the consoles. But, unlike the other AMD CPUs available, the sole purpose of the Jaguar CPU is to provide low

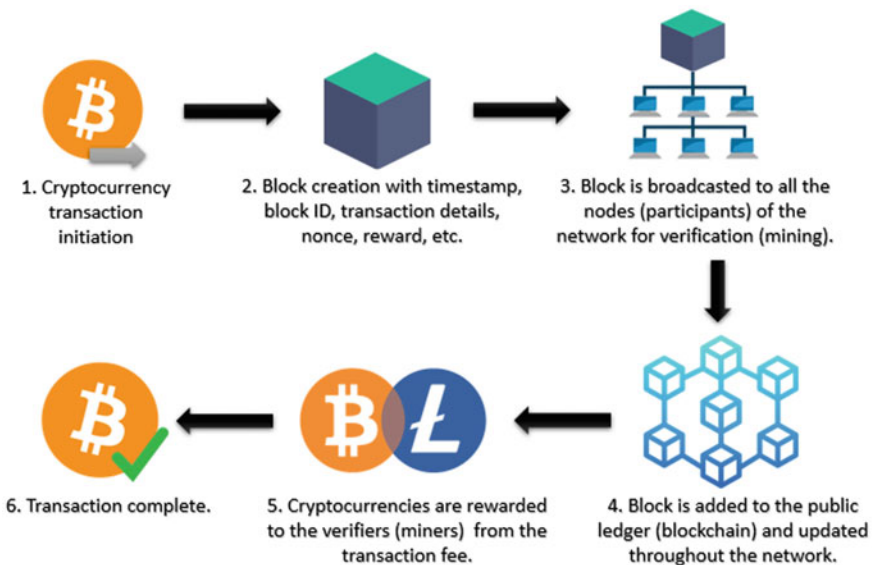


Fig. 1 Proof-of-work architecture



power accelerated processing unit (APU) for the I/O devices. The cat-line of the AMD processor that has AMD's Bobcat APU as the predecessor of the Jaguar APU, which exhibits 22% fewer instructions per cycle (IPC), like the Jaguar APU, it also does not possess a hash rate benchmark due to low power operation expected by it. One of the processors closest in comparison is the x86-64 Atom processor developed by Intel Corporation. The benchmark hash rate of Intel's Atom is 146.72 H/s for the XMR - RandomX (XMRig) algorithm. Although a direct comparison can be considered, Intel's Atom is superior in terms of performance due to the CPU configured to perform various tasks in a fully-fledged computer, whereas the AMD Jaguar in the gaming consoles is required to only render video and synchronize I/O operations. Hence, the AMD Jaguar of the PlayStation 4 and Xbox One is expected to perform significantly lower, with a much lower hash rate for the same algorithm. However, with an increase in performance of the AMD Jaguar APUs in the PlayStation 4 Pro and the Xbox One X consoles, the computing capacity of the video render is compared to the Core i5-3570K, developed by Intel corporation which has a base clock rate of 3.40 GHz boosted to 3.80 GHz. Although they are benchmarked to have similar performances in video rendering capability, they can have highly different performances in mining with the AMD Jaguar being much inferior. The hash rate of the Core i5-3570K processor is benchmarked as 1319.65 H/s for the XMRig algorithm. Similarly, the expected hash rate and performance of the PlayStation 4 Pro and the Xbox One X are expected to be significantly lower. For this experiment, the hash rate of the gaming consoles is observed by mining each of the five cryptocurrencies for a duration of 24 h. Unfortunately, the PlayStation 4 was unable to start the mining operation for any of the cryptocurrency. Hence, the average/net hash and income of the PlayStation 4 are considered as 0. Similarly, the PlayStation 4 Pro was unable to mine any cryptocurrency blockchain other than Dash. Figures 2, 3, and 4 show the observed hash rates for a 24 h duration in each console.

#### ***4.4 Power Consumption***

The only factor that determines whether the net mining operation would result in a profit or a loss is the power consumption cost of the consoles. The mining operation would result in a profit if the power consumption cost is less than the amount of equity earned in cryptocurrency, else it would result in a loss. Referring to Table 3, the power consumption values for each console are considered and the net consumption cost is calculated in this section. Table 7 shows the power consumption cost for each console, considering the user is under a domestic bimonthly tariff electricity billing system.

This cost comparison is further analyzed in the results section by determining whether a return on investment is possible with these gaming console with a consideration of the calculated life span.

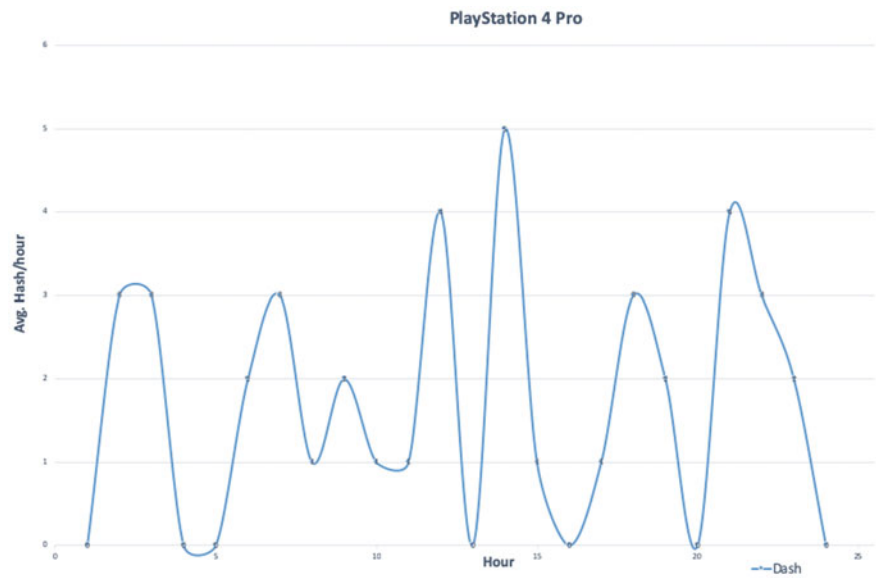


Fig. 2 PlayStation 4 Pro hash rate

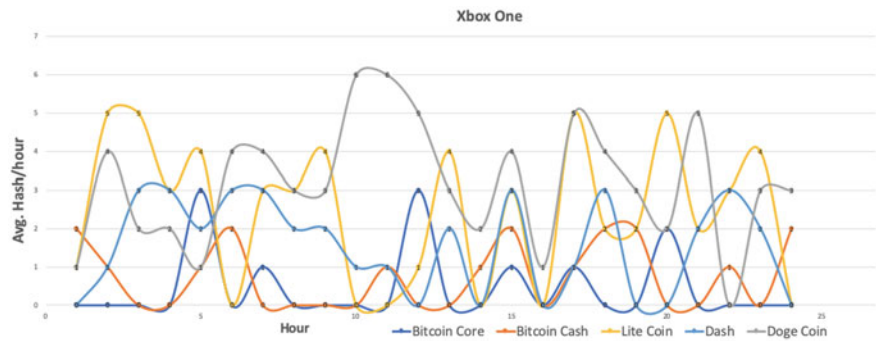


Fig. 3 Xbox One hash rate

4.5 Life Span

In this section, the functional working life span of the gaming consoles under study is analyzed and estimated based on the user reviews. This data is analyzed to estimate if the consoles can turn a profit before becoming faulty. Considering the average working temperature of the consoles, Table 8 shows the life span (prime working condition) of each console.

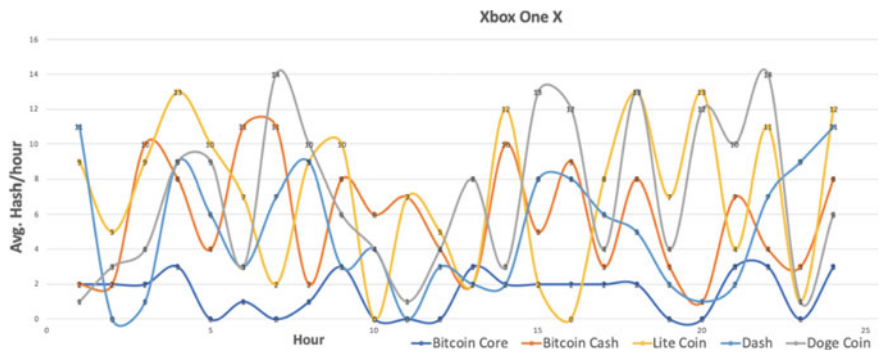


Fig. 4 Xbox One X hash rate

Table 7 Power consumption cost

Console	Power consumed/month (kWh)	Cost/month (₹)	Cost/year (₹)
PlayStation 4	118.8	51.0	18,615
PlayStation 4 Pro	223.2	291.0	1,06,215
Xbox One	86.4	0.0	0.0
Xbox One X	129.6	66.0	24,090

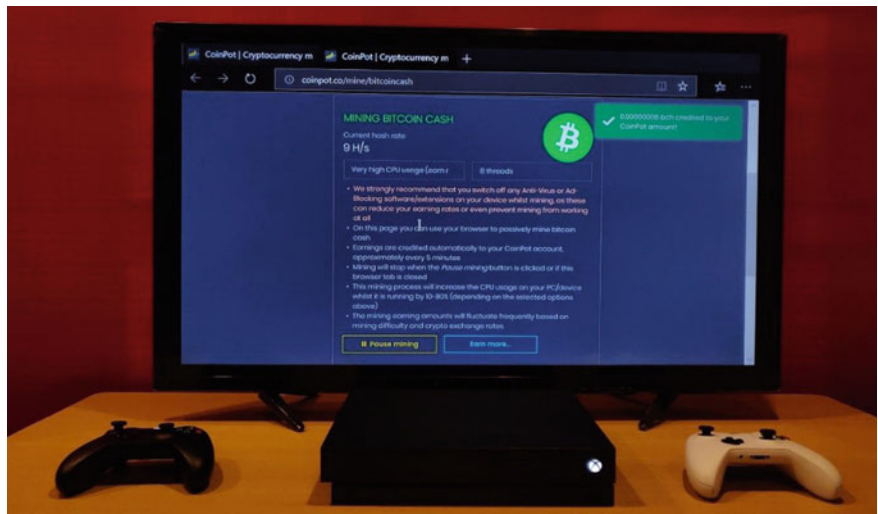
Table 8 Console life span

Console	Avg. life span
PlayStation 4	7
PlayStation 4 Pro	9 (considered)
Xbox One	5
Xbox One X	10 (considered)

Although these data are from users who primarily use the consoles for gaming, an estimate of half the duration is considered as the life span of the consoles when mining.

## 5 Results

Neither of the PlayStation consoles nor the Xbox consoles supports third-party cryptocurrency mining applications. To tackle this, a concept known as web mining is used. Web mining is a technology that utilizes a JavaScript-based interface between the host and the website to exchange mining information. Instead of the conven-



**Fig. 5** Bitcoin Cash mining in Xbox One X

tional application-based mining that involved the maintenance of the cryptocurrency blockchain in the local system, the website only uses the hashing power of the host system to solve the blockchain and award the user’s account with cryptocurrency based on the work done by the console. All the consoles under study possess native web browsers and support Wi-Fi standard IEEE 802.11 a/b/g/n/ac and an Ethernet speed of at least 100 Mbps. These requirements are sufficient to perform browser mining, as the block size is only 1 MB. Since web mining only allows the consoles to mine as a stand-alone system, the profitability of pool mining cannot be expected from this solution.

The website CoinPot [7] is used to mine cryptocurrency using the CPU of the host system. The website provides a user interface to configure the parameters of the mining such as CPU usage limit, thread limit. The website configurations are set to utilize high CPU usage and 1 thread per CPU core (Fig. 5). As the cryptocurrencies are mined, the obtained rewards are subsequently deposited to the account’s crypto wallet.

The following tables show the summary of expected profit/loss from the consoles when mined using them. All the income calculations are based on the currency values mentioned in Table 5. Since these values are subjected to change, the following calculations provide an approximate estimation.

## 5.1 PlayStation 4

Life span expectancy—**3.5 years**. The Profit/Loss estimation of PlayStation 4 is elaborated in Table 9.

## 5.2 PlayStation 4 Pro

Life span expectancy—**4.5 years**. The Profit/Loss estimation of PlayStation 4 Pro is elaborated in Table 10.

## 5.3 Xbox One

Life span expectancy—**2.5 years**. The Profit/Loss estimation of Xbox One is elaborated in Table 11.

**Table 9** PlayStation 4 profit/loss estimation

Crypto currency	Monthly income (₹)	Monthly profit (₹)	Monthly outcome (profit/loss)	Net profit (₹)	Net outcome (profit/loss)
Bitcoin core	0	0	NA	−25,555	Loss
Bitcoin cash	0	0	NA	−25,555	Loss
Doge coin	0	0	NA	−25,555	Loss
Lite coin	0	0	NA	−25,555	Loss
Dash	0	0	NA	−25,555	Loss

Monthly profit = monthly income − power consumption amount

Net profit = console price − income gained in the life span

**Table 10** PlayStation 4 Pro profit/loss estimation

Crypto currency	Monthly income (₹)	Monthly profit (₹)	Monthly outcome (profit/loss)	Net profit (₹)	Net outcome (profit/loss)
Bitcoin core	0	0	NA	−31,500	Loss
Bitcoin cash	0	0	NA	−31,500	Loss
Doge coin	0	0	NA	−31,500	Loss
Lite coin	0	0	NA	−31,500	Loss
Dash	29.9	−261.100	Loss	−45,596	Loss

Monthly profit = monthly income − power consumption amount

Net profit = console price − income gained in the life span

**Table 11** Xbox One profit/loss estimation

Crypto currency	Monthly income (₹)	Monthly profit (₹)	Monthly outcome (profit/loss)	Net profit (₹)	Net outcome (profit/loss)
Bitcoin core	0.0087	0.0087	Profit	−25,075	Loss
Bitcoin cash	1.9377	1.9377	Profit	−25,070	Loss
Doge coin	0.5254	0.5254	Profit	−25,060	Loss
Lite coin	20.0365	20.0365	Profit	−24,473	Loss
Dash	0.3903	0.3903	Profit	−25,063	Loss

Monthly profit = monthly income − power consumption amount

Net profit = console price − income gained in the life span

## 5.4 Xbox One X

Life span expectancy—**5 years**. The Profit/Loss estimation of Xbox One X is elaborated in Table 12.

From these observations, it can be seen that the Xbox One and the Xbox One X (for Lite Coin) console can provide a monthly profit. But when considering the life span expectancy of the consoles, all the gaming consoles provide only a loss to the investment. These gaming consoles are expected to only perform in their area of expertise, gaming. These losses can also be accounted for by their closed system-on-chips (SOCs) that only allow the utilization of the CPU rather than a combination of their CPU and GPU.

## 6 Conclusion

In this article, the performance of mainstream gaming consoles is tested and analyzed for cryptocurrency blockchain mining. The article also provides an analysis of the

**Table 12** Xbox One X profit/loss estimation

Crypto currency	Monthly income (₹)	Monthly profit (₹)	Monthly outcome (profit/loss)	Net profit (₹)	Net outcome (profit/loss)
Bitcoin core	1.4262	−64.5371	Loss	−45,839	Loss
Bitcoin cash	5.1902	−60.8098	Loss	−45,648	Loss
Doge coin	2.0234	−63.9765	Loss	−45,837	Loss
Lite coin	200.100	134.1484	Profit	−33,950	Loss
Dash	2.1646	−63.8353	Loss	−45,829	Loss

Monthly profit = monthly income − power consumption amount

Net profit = console price − income gained in the life span

approximate estimate of profit that can be expected from mining using the consoles. From the conducted experiment, the following conclusions can be drawn.

1. The gaming consoles are extremely poor performers when utilized to mine cryptocurrency.
2. The gaming console will ultimately produce a loss of the initial invested capital by a large margin.
3. This low performance and efficiency are characterized by the inability of the gaming consoles to utilize the GPU present in them to mine effectively.
4. The PlayStation 4 and the PlayStation 4 Pro consoles produce a loss of the initial as well as the periodic (electricity cost) investment.
5. If the initial investment is not considered, then the Xbox consoles produce a small margin monthly profit.
6. The Xbox One console produces its highest profit of approximately ₹ 20 every month and the Xbox One X produces its only and the highest profit of approximately ₹ 134.

## 7 Limitations

Although this article proposes an approximate estimate of the profits and losses, they are highly susceptible to change. This is because cryptocurrency exchange rates are highly correlated with the popularity among the masses that mine the particular cryptocurrency. This could result in the investment of time and money on the mining operation for a particular currency, only to produce a futile result with a minimal amount of low-value exchange rate. Another assumption made in this article is that the consoles are to perform mining operation every hour of every day. This could contradict the practicality of carrying out such an operation, considering external influencing factors such as electricity outage, overheating, system crash, and defective console.

## 8 Future Works

At the time of writing this article, the Sony Entertainment Company and Microsoft Corporation have already confirmed the future release of their next-generation gaming consoles, named PlayStation 5 and Xbox Series X. These consoles are expected to have extremely high gaming performances. Although they would be undoubtedly futile cryptocurrency miners, it is expected that they would perform better than the current consoles. Even though the Xbox consoles cannot be fully used to bring about better mining performance, the existence of homebrew in the PlayStation platform could be utilized in developing software that can take advantage of the highly sophisticated GPU present in them.

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