

Thesis Project Portfolio

Cryptocurrency Mining: Finding Efficiency Through Hardware and Algorithm Tweaks

(Technical Report)

Bitcoin as Legal Tender: An Early Analysis of Adoption and Perception in El Salvador

(STS Research Paper)

An Undergraduate Thesis

Presented to the Faculty of the School of Engineering and Applied Science

University of Virginia • Charlottesville, Virginia

In Fulfillment of the Requirements for the Degree

Bachelor of Science, School of Engineering

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Spring, 2023

Department of Computer Science

Contents of Portfolio

Executive Summary

Cryptocurrency Mining: Finding Efficiency Through Hardware and Algorithm Tweaks
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Bitcoin as Legal Tender: An Early Analysis of Adoption and Perception in El Salvador
(STS Research Paper)

Prospectus

Executive Summary

In 2008 Satoshi Nakamoto released the Bitcoin Whitepaper: his description of an innovative new technology called Bitcoin. Since then hundreds of billions of dollars of speculative investments have poured into Bitcoin. But the crucial question is how, if at all, can this new technology be adopted to have a net benefit on the world? Like any technology, there are benefits and drawbacks to Bitcoin. The technology enables individuals to transfer funds across the globe with significantly reduced fees and processing times compared to traditional systems, making it particularly advantageous for remittances to other countries. It also provides people with no access to banking a way to have self-custody over assets, simply by owning a smartphone. The range of assets users can own extends beyond Bitcoin, encompassing cryptocurrencies pegged to the USD (or any other fiat currency) and thousands of additional digital currencies. Bitcoin's drawbacks stem from its electricity usage and its prevalent use for illegal activities. Cryptocurrency mining accounts for an estimated 0.4% - 0.9% of global energy usage, which is higher than many countries including Argentina. Thus, it is important to investigate whether its benefits outweigh its drawbacks.

For my technical research project I built an Ethereum mining computer and optimized it to be as efficient as possible. The project was inspired by my interest in cryptocurrencies and desire to reduce the carbon footprint of mining them. By building and tweaking my own mining computer, I hoped to prove to other miners that making those software and hardware changes will benefit both them and the environment. Some examples of these tweaks included replacing the central processing unit (CPU) and reducing the power limit of the graphics processing unit (GPU). The changes outlined in my technical report led to a 23% increase in hashrate (mining

speed) while decreasing the energy consumption by 39%. Being able to increase its speed while simultaneously using less energy was not what I expected beginning this research.

For my STS research paper I looked in depth at the data surrounding El Salvador's decision to make Bitcoin legal tender in September 2021. This controversial decision was made by their current president Nayib Bukele who was elected in 2019. The questions that guided this research were: how has the general public responded to President Bukele's Bitcoin plan in El Salvador? Has there been real adoption of it by companies within El Salvador? Multiple surveys, statistical analysis of the Bitcoin price, and other data references all pointed to the fact that Salvadorians overwhelmingly prefer using US dollars in cash form rather than Bitcoin (or even credit cards). According to surveys conducted by Alvarez on 1800 Salvadorian households from various regions, 22% of business owners reported accepting Bitcoin and 26% credit or debit cards. 95% accepted cash. While impressive that Bitcoin is accepted almost as frequently as credit cards, 88% of those with businesses that accepted Bitcoin converted it into US dollars. Primarily it was converted into digital dollars and then to cash. In response to the survey question "Which is the main reason you did not download Chivo (the Bitcoin wallet)?", 79% responded saying they preferred using cash over Bitcoin and 38% viewed the technology as too complicated. Other surveys reported high amounts of Salvadorians also viewing the technology as "untrustworthy," which tended to be linked with those who did not understand it. In general, President Bukele's initiative has successfully prompted numerous businesses to adopt Bitcoin; however, Salvadorans remain apprehensive about its use, expressing a strong preference for cash transactions.

Through this research, I feel that I made significant strides in my understanding of cryptocurrencies and the public's view of them. I set out to get a deeper understanding of how

people feel about Bitcoin, and I believe my choice to study El Salvador was wise since it provided data from real people that are required to use this technology. My only disappointment during this process was being unable to find primary sources of Bitcoin in El Salvador. For anyone looking to expand on this research, I would suggest starting there. I am also satisfied with my technical research. Being able to save close to 40% of the electricity used to mine while increasing mining speed was shocking to me. If other miners did the same, there undoubtedly would be a significant decrease in the total energy consumption of cryptocurrencies.