# Applications of Blockchain in Different Fields: A Survey

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**ABSTRACT:** *Blockchains have drawn a lot of attention recently because they offer decentralised methods for managing and creating value. To increase the security, scalability, and efficiency of their services, numerous banks, Internet businesses, automakers, and even governments throughout the world have adopted or begun to examine blockchain technology. In this article, we examine blockchain applications across many industries. These industries include copyright protection, healthcare, insurance, advertising, insurance, energy, and societal applications. For individuals and organisations interested in blockchains, our work offers a timely summary. We hope that our research will inspire further blockchain applications.*

**Keywords:** *Blockchains; Cryptocurrency; Healthcare; Advertising; Energy*.

## I. INTRODUCTION

Today, blockchains are a hot topic in news outlets all over the world. They have already been adopted as decentralised methods for fraud-resistant computing without a reliable authority in numerous applications across many different disciplines. A distributed, append-only log of time-stamped records that is cryptographically shielded from alteration and amendment is known as a blockchain [1].

This study examines the use of blockchain technology across a variety of industries, including cryptocurrencies, healthcare, advertising, copyright protection, energy, and societal applications. Following the discussion of a few examples, more are provided in the section that follows. Numerous more blockchain-based cryptocurrencies, such as Litecoin, Namecoin, SwiftCoin, and Bytecoin, have appeared since the first cryptocurrency with a name like bitcoin was established in 2008 [1]. Blockchains are used to track individual health records by combining fragmented healthcare data [3]. Blockchain technology is used by MetaX [4] to combat fraud in online advertising. A blockchain-based insurance marketplace called InsureX [5] was created to increase the efficiency of the insurance sector.

Our paper offers a contemporary summary for those who are interested in blockchains, both personally and professionally. Additionally, our work will inspire additional blockchain applications. Prior survey studies on blockchains, in contrast to our work exploring applications in various fields, have either focused on technical problems like security [6] and consensus methods [7] or on specialised applications like the Internet of Things [8] and finance [9].

The remaining parts of the paper are arranged as follows. In Section 2, we describe various blockchain applications. The associated work is shown in Section 3. In Section 4, we wrap up the essay.

## II. BLOCKCHAIN APPLICATIONS

### II- A CRYPTOCURRENCY

Especially in the realm of cryptocurrencies, the financial industry is one of the most active uses of the blockchain. Numerous cryptocurrencies have appeared since the first carrier bitcoin entered the blockchain [1]. Because of characteristics like anonymity, verifiability, decentralisation, and consensus procedures, the price of one bitcoin has now risen to an astounding $6,300 [9]. The current thriving cryptocurrency industry is made up of a number of other cryptocurrencies that have arisen at the same time and have better functionality. Among these, Ethereum [10] developed a public blockchain platform that allowed the deployment of smart contracts in 2015. Contracts have made it possible to use blockchain technology in a larger range of commercial contexts, such as contract processing, ownership changes, the Internet of Things, and the sharing economy [11].

Beyond the world of cryptocurrencies, the blockchain is increasingly employed in financial services such as stock exchanges, international payments, repurchase agreements, and digital IDs. The Bank of England Santander [12] utilised the technology provided by the payment protocol and exchange network based on Ripple to send payments in real time using a mobile application by utilising the distributed transaction ledger of the blockchain. According to the Australian Securities Exchange [13], the current clearing system would be replaced with Bitcoin technology in order to lower transaction costs and speed up and secure transactions. The London-based trade company Oxygen [14] has announced the opening of its repos blockchain platform.

The bank and the borrower submit their respective funds and collateral to the pre-specified smart contract address when the repurchase agreement is started. This locks in the collateral's circulation, deposits the funds into the borrower's account, and keeps track of all transactions. Repurchase is now an automated clearing house because to the trend towards

electronic finance, which also makes the blockchain a logical fit. In recent years, numerous banks have started to make investments in blockchain technology. The first major bank to test with blockchain technology and virtual money is Fidor Bank [15], a German online bank. The trading of euros and bitcoins began in October 2013 thanks to a partnership with the San Francisco-based bitcoin exchange Karken. With the assistance of the other party's payment technology, Fidor Bank and Ripple Labs offer low-rate transfer services. The P2P Bitcoin Transfer Service was introduced in February 2015 as a result of a partnership between the bank and bitcoin.de. Internally, Citibank developed three separate systems based on distributed blockchain technology. Additionally, Citigroup highlighted five important areas of concentration in July 2015, with blockchain technology being one of them.

Although the issue of value exchange on a global scale can be better resolved by the decentralised trust mechanism of blockchain technology. The following components of the actual operation, however, still have certain restrictions. The blockchain's security comes first. The blockchain is distinct from conventional financial infrastructure. Traditional financial facilities are managed by an organisation, and the corresponding software and hardware resources are not accessible to the general public. However, the blockchain is an open programme, and all users have access to the system's code.

Therefore, compared to conventional financial facilities, blockchain-based apps are more open to assault. The second is how the blockchain protects personal information. Data is saved on a central server and is kept private according to the conventional financial company model. Data is publicly transparent in blockchain-based systems, and each user has access to a full data backup. Despite "pseudo-anonymous" being a feature of blockchains, this approach is too straightforward to meet the demands of complicated financial services, especially for financial institutions in specific financial business scenarios where confidentiality is required.

## II-B Healthcare

As new business cases develop, healthcare is also prepared to invest in blockchain technology. Healthcare organisations are very interested in the disintermediation, transparency, auditability, industry collaboration, and new business models that the blockchain offers [16]. Healthcare IT is now being hampered by the dispersed medical records that result from transfers between various medical facilities. The blockchain offers the chance to build a platform for trustworthy recording. Using the blockchain, it is possible to combine extremely fragmented healthcare records and track individual health records [3]. Access to medical records is a moral conundrum at the same time. Creating the framework for high integrity tracking is one of the main issues with this type of programme.

History-based diagnosis is expensive due to privacy issues, record fragmentation, and intrinsic complexity. Continuous tracking of the flow of services and money could be made possible with blockchain at a cheaper cost. According to Matthews [17], blockchain technology and artificial intelligence could help find solutions to healthcare issues. But in order to realise these fantastic dreams, there are obstacles from regulatory and privacy concerns in addition to technological ones like accessing and storing data on the blockchain.

## III-C Advertising

The digital advertising supply chain makes sense for the blockchain since it is a distributed, transparent, immutable record. Ineffectiveness, inefficiency, and lack of transparency in advertisements have  Blockchains enable us to greatly increase efficiency and transparency, lower costs, and stop fraud [18]. Globally, digital advertisers spent $209 billion [19] on the medium in 2017. Over the last two years, a lot of businesses have been working hard to develop blockchain-based advertising systems thanks to a significant inflow of venture money [20]. Blockchain technology is being used by the blockchain business MetaX [4] to address concerns with fraud and transparency that affect digital advertising. The public can test several applications that have been developed. One of these software programmes, known as Ads.txt Plus, is an open source tool created to weed out dishonest sellers and resellers along the programmatic supply chain. Leading over-the-top (OTT) advertising platform Premion [20], a division of TEGNA, has teamed up with tech firm MadHive to create a blockchain-based transaction platform for OTT.

MadHive established MAD Network at the same time with a much more ambitious idea for blockchain in OTT. MAD establishes trust as a decentralised application amongst all participants in the advertising value chain as blockchain nodes [20]. In order for marketers, programmers, and operators to use smart contracts to plan, target, and report on ad buys across digital, broadcast, and streaming, one of the biggest MVPDs (Multichannel Video Programming Distributors) will deploy blockchain platforms in premium digital channels and video supply chains.

The blockchain can enhance not just quantifiable measures but also user experience for the consumer. Marketers can now create customer profiles straight from customers and obtain all the information they are ready to offer in a single action thanks to the blockchain. Brands can communicate directly with customers and utilise their data when there is peer-to-peer interaction without any middlemen. Customers include those who pay with time and attention in addition to those who pay with actual money or tokens in exchange for goods or services. All of the aforementioned factors aid in enhancing any company's marketing strategy. Overall, a blockchain network that is distributed, decentralised, and Turing complete will tremendously aid the growth of the digital advertising industry.

## II-D Insurance

Traditional insurance contracts are frequently processed on paper, making claims and payments prone to error and frequently requiring human oversight. This is made worse by the intrinsic complexity of traditional insurance, which includes risk as well as customers, brokers, insurers, and reinsurers. It increases the efficiency of the insurance sector in four ways, including fraud prevention, claims automation, data analysis via the Internet of Things (IoT), and reinsurance [21]. With the inherent scalability of blockchain, the help of IoT, and the flow of all data, including personal historical credit information, accident environmental information, historical policy information, and more, in the blockchain network, the insurance industry that sells risk will undergo a significant revolution.

A few forerunners have begun to participate in this process. The top five insurance titans together established the Blockchain Insurance Industry Initiative (B3I) in October 2016 to research the viability of applying blockchain in the insurance sector and create blockchain-based proofs of concept for insurance [11]. The world's first alternative insurance marketplace powered by blockchain, InsureX [5], seeks to address inefficiencies in the current insurance sector. Aigang [22], a proposed blockchain-based insurance protocol, would allow communities, businesses, and developers to create insurance prediction markets and insurance products themselves. They will create a self-insurance platform with a smart contract and a risk-based tokenization method for any manufacturer or insurance provider.

## II-E Energy

Even the simplest energy and commodity trades include multiple participants playing a balanced game [23]. Both parties shall coordinate and confirm the transaction data from the execution through the conclusion of the transaction. A corporation may also have to communicate with other counterparties, exchanges, brokers, logistics companies, banks, regulators, and price reporters during the transaction lifecycle. In order to preserve manual procedures between various departments and ensure an accurate perspective of the entire transaction process, the verification process must also be properly coordinated not just between the two parties to the transaction but also within the firm. Based on blockchain technology, it is conceivable to streamline internal operations as well as those with external markets, which could fundamentally alter how energy transactions are organised. Additionally, streamlining the aforementioned procedures will result in significant cost savings (e.g., lowering labour expenses, manual and semiautomatic costs, lowering capital costs by accelerating settlements, and lowering technological efforts by decreasing reliance on several systems).

The energy trading applications that we found generally fit into the following broad categories:

**Energy trading markets:** Two groups have arisen within this category: some initiatives attempt to utilise blockchain to fundamentally reorganise the current energy system, while others seek to merely enhance it. For instance, peer-to-peer bitcoin transactions seem to organically impart a non-central aspect to the blockchain. Many researchers and developers take the concept of decentralisation for granted in other fields, such as the energy industry. Because they are attempting to undermine just centralised administration rather than a more effective method of managing complex systems, we are sceptical about this. Grid transactions provide another illustration. These initiatives involve reorganising current power wholesale markets using blockchain, where transactions will be confirmed more quickly and cheaply. The new distributed energy market will probably thrive and develop into a "power mining machine" while also altering the conventional electricity market. This type of modification to the complicated and large-scale power market would considerably advance the growth of the power sector and raise productivity.

**Energy Financing:** Numerous business concepts have sought to use blockchain technology, often focusing on the green energy sector and using cryptocurrencies to acquire finance. Because blockchain will connect more potential investors, it will be simpler to raise money for renewable energy initiatives. However, it is not yet clear whether creating a decentralised network is indeed necessary to speed up the fundraising process.

**Electric Vehicles:** Electric vehicles (EVs) still face significant barriers to widespread adoption, including a lack of charging infrastructure and a challenging deployment process. The simplicity of providing services to individuals who own these infrastructures is made possible by blockchain technology. Additionally, it helps streamline the procedure, lowering the charge expenses. Clearly, these benefits could bring us closer to a time when EVs are widely used. In addition, EVs can be used as batteries to stabilise the distribution of energy by analysing the electrical requirements and implementing smart contracts. Performance is currently blockchain's biggest barrier to adoption in the energy sector [24]. Applications using blockchain technology, like Bitcoin [1], can only process three transactions per second, with a maximum of seven. Critical mass is an additional restriction. Industry consensus on common standards is required before blockchain may be used as a common industrial infrastructure. Since there are so many parties involved, it will be extremely difficult to reach an agreement.

**II-F Society Applications:** Lending unconventionally: Smart contracts, the next-generation network infrastructure that is meant to address credit issues, have the power to dismantle conventional borrowing arrangements. In a traditional lending arrangement, the lender not only lends money but also assumes risk, which also results in high loan interest and the mortgage of commodities, the value of which is frequently greater than the loan amount. Borrowers can utilise virtual assets as collateral using smart contracts to avoid discounts on tangible goods as well as to lower the cost of lending. No

need to provide the lender with extensive documentation, an employment history, or your credit history. For everyone to use, the property is encoded in the blockchain.

**Car / smartphone:** For instance, you can only activate a car key with an anti-theft device when you click on the right protocol on the key. You must enter the right password in order for the smartphone to function. To preserve ownership, they are all committed to using encryption technology. The drawback of the original version of intellectual property is that it cannot be easily reproduced or transferred because the key is retained in a physical container. By enabling blockchain miners to replace and copy lost protocols, the blockchain ledger finds a solution to this issue.

**Blockchain music:** Music publishers have struggled with copyright issues throughout the record and digital music eras. By using a blockchain and smart contract to build a traceable music copyright database, this issue can be resolved. Additionally, you may even transfer money in real time as consumer behaviour changes to both the copyright holder and the performer. Music lovers can make payments with digital currency.

## III. RELATED WORK

Prior survey studies on blockchains have either addressed technical problems like security [6] and consensus protocols [7] or specialised applications like the Internet of Things [8] and banking [9], in contrast to our work that discusses applications in several fields. Blockchains have also been employed in the food supply chain [30], energy [27], transportation [28], charity [29], and education [32], in addition to the applications listed in this study. The inclusion of these applications in a more thorough study is a potential future step.

## IV. Conclusion

Blockchain technology has drawn a lot of interest globally. This study examines the use of blockchain technology across a variety of industries, including cryptocurrencies, healthcare, advertising, insurance, copyright protection, energy, and societal applications. Our article offers an up-to-date summary for organisations with a stake in blockchains. The conversation will also inspire blockchain uses in additional fields.

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