

Integration of Artificial Intelligence and the Internet of Things with Blockchain Technology



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Abstract Artificial intelligence (AI), blockchain, and the Internet of Things (IoT) give a unique opportunity to the public sector and enterprises. All institutions that leverage these innovations develop advanced goods and services for new customer generation by associating streamline and improving modern processes and building entirely new business models. The internet, mobile devices, and personal computing put a supercomputer in our hands. We have been exposed to distracting technology earlier and recognized that it changes the world as we know it. However, several of these examples from past times appeared in isolation steadily and objectively. Before the origination of the internet, we used personal computing, and the game changed again. We were internet-savvy lay before smartphones put the internet in our pocket. Several new developments are evolving at once: 5G broadband, 3D printing, virtual and augmented reality, plus more. As these technologies provide the business with exciting opportunities and major challenges, we consider three to be truly transformative: IoT, AI, and blockchain. All three alone would have the ability to alter industry, leisure, and culture as a whole. However, together they will have an unparalleled transformational effect. First time in civilized history, the very generation has created three revolutionary innovations; furthermore, it is a sight of what is coming. The digital revolution means technological transformation has shifted from a phenomenon once in a lifetime to a continuous phase. Now any company that falls behind will soon be able to close an insurmountable distance. In

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this paper, we will look into how you can develop your company for AI, IoT, and blockchain and enable your business to use them both forthwith and in the future. We will explore how the cloud functions as both an enabler and an accelerant—paving the way to adopt any new technology.

Keywords Internet of things (IoT) · Artificial intelligence (AI) · Blockchain · Digital revolution · Transformational technologies

1 Internet of Things: Sense the World

To understand AI, IoT, and blockchain, we accommodate to consider them as interconnected organic processes. IoT is similar to the human nervous system. It senses that a universe of new data recorded with billions of connected devices worldwide [1]. AI is like the brain’s imagining part. It thinks by a review of previously reserved data and decisions for humans [2]. Blockchain, furthermore, is like our memory—it provides a secure and persisting record of data transfers and transactions [3]. Figure 1 shows the synthesis of AI, blockchain, and IoT.

IoT transforms a world of things into a world of data. Everything practically from an intelligent look that tracks heart rate, blood pressure, and blood sugar levels to

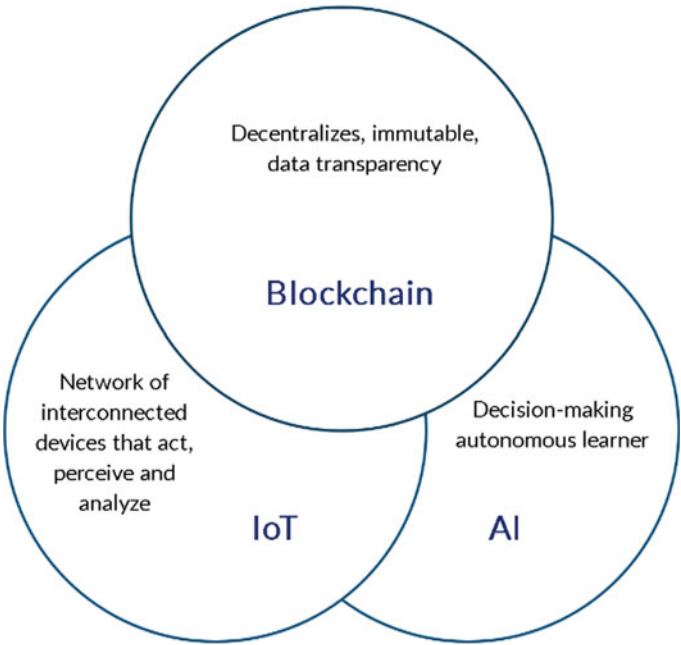


Fig. 1 Synthesis of AI, Blockchain, and IoT [4]

a connected plant that monitors all manufacturing stages can be equated with and made smart.

1.1 IoT in Action

IoT has a more comprehensive impact on some sectors than others [5]. When IoT considers public markets, transportation, manufacturing, consumer goods, automobiles, and healthcare are not identical. It enables collecting new information and enhancing current business processes, swift promotion of inventive goods and services, and collecting information on customer preferences and patterns.

It is easy to imagine IoT in and around the home for consumer applications. A host of personal electronic devices and smart home appliances will lead to consumer products' transformation to revolutionize customer experience and provide retailers with a spate of valuable knowledge. However, IoT's influence is felt far beyond the home.

In automotive manufacturing, IoT allows manufacturers to make connected, autonomous, shared, and electric (CASE) vehicles [6] a usable reality and secure. Data created by these connected vehicles, including numerous other items, to track their driving patterns, create custom coverage options, may be used by insurers, and claim process accurately. Moreover, manufacturers can produce connected, intelligent factories that track health equipment, reduce downtime, production cost, and optimize productivity.

1.2 Going There

In IoT, there is great potential. An estimated 20.4 billion IoT devices will be in circulation, offering higher than 14 zettabytes of data annually. However, both IoT initiatives have been hard to execute and underused; only a small part of the data deluge is processed and implemented.

To achieve the market advantages of IoT, the organization must [7]:

- Develop and adopt an IoT-enabled device ecosystem
- Source, handle, and store large quantities of data
- Introduce advanced analytics and learning capacities for machines
- Build innovative IoT applications using data perspicacity
- Incorporate IoT with current workflows and applications used
- End-to-end security implementation
- Track and control the whole chain of values

In IoT, there is a big chance. Nevertheless, the company's hurdle is to carry on existing infrastructure, technologies, and skills to increase time to assess and lessen

IoT implementation costs and complexity. The rewards for good people would also be important.

2 Artificial Intelligence: Thinking About Data

If IoT is the sensory portion of transformation technology, AI is the thinking component. In the wide field of artificial intelligence, machine learning is ready to have the greatest effect [8]. It has the potential to allow fast, smart decision-making, either to help or replace human intelligence. Businesses can assign mundane or complex tasks beyond workers' capacity to achieve a degree of precision and productivity.

However, it has significant legal, ethical, and even theological ramifications to bring decisions into the hands of smart machines. Whilst AI and machine learning are now conducting intelligent interventions on behalf of people.

2.1 Machine Learning in Action

The acumens of machine learning help the organization to recognize consumer choices better and market dynamics and enable automated, personalized commitments. These help to develop new products and services designed to meet modern customers' needs and efficiently reduce market gaps. Moreover, it will improve business operations with informative strategic feedback and guidance.

Machine learning can transform human capital through increased recruiting, retention of workers, and maximization of productivity. It is the driving force in the automotive industry behind autonomous vehicles. It recognizes and fixes network errors in the telecommunications industry and enables financial service institutions to make customers more accurate. Customer Service chatbots [9] include machine learning capabilities, marketing expertise, personalized products and services, and much more like recognizing cybersecurity vulnerabilities. It is not easy to imagine a technology with comprehensive transformational potential now or across the past.

2.2 Going There

There is little distrust that machine learning would have a profound effect on business. However, why are we not seeing more innovative machine learning products, services, and business models today on the market? Like IoT, the response is to optimize the company.

Machine learning advantages can be more complex than they seem. Implementation is not going to be a case of tossing and watching a turn come to life. It is a progressive operation.

To make use of the true value of machine learning in the real world, the enterprise must [7]:

- Identify opportunities for improved company or supply chain intelligence
- Accumulate and store huge quantities of data—internal and external, structured and unstructured
- Recruiting and maintaining the best talent to make machine learning work
- Fully incorporate machine learning into old and modern applications.
- Set up it over a range of functions alternative of narrow cases
- Use it for present-day infrastructure and capabilities rather than starting from scratch
- Consider legal and ethical concerns surrounding the introduction of AI

The initial challenge was to introduce and leverage machine learning in the business. However, the advantages of performing so are accessible. Enterprises have no alternative but to manage to incorporate machine learning into their business model processes or risk falling behind agile competitors.

3 Blockchain: Committing Transactions to Memory

Blockchain technology is regarded as the underlying Bitcoin and other cryptocurrencies, yet it is much, far more. Imagine blockchain as the framework for trustworthy computing, it provides all forms of data exchanges with reliability, transparency, security, financial transactions, legal and contractual arrangements, and ownership changes.

A blockchain adopts a categorized peer-to-peer network to register all the exchanges, eliminating the need for granted arbiter go-betweens in digital transactions. The result is faster operations, visibility of real-time transactions, and decreased costs in all sectors.

There are few places in which the transforming power of blockchain is not felt. Gartner predicts that by 2025, blockchain could generate \$176 billion in value-added revenue, revolutionize the supply chain, encourage new business models, and upset established models [10].

3.1 Blockchain in Action

Blockchain in many sectors and industries, including insurance, financial services, health, human resources, e-commerce, can prove itself a game-changer [11]. Typically, digital information is transmitted everywhere. Blockchain will provide transparency across the entire supply chain in the consumer goods industry by streamlining product recalls, asset monitoring, improving accountability, and improving

consumer confidence. It helps to ensure that intellectual property rights are safeguarded in science and education. Moreover, in banking, the rocket fuel that powers the revolution in fintech is blockchain.

3.2 *Getting There*

As with AI, blockchain and IoT would have embraced and applied more compressively by now, especially given new media speculation on cryptocurrencies and blockchain. However, it is still a comparative rareness outside these agile fintech startups. The issue is well known; perceived danger and uncertainty prevent extensive adoption.

Limits to adoption by blockchain comprise [7]:

- Cost and device resource availability.
- Failure to control blockchain miners.
- Anyone who enters must consent rules of the blockchain network.
- Currently, blockchain contracts are unchecked in court.
- Blockchain shall be compatible with current recording systems.
- Few cases of prevailing use offer a convincing or direct investment return.
- Conventional stakeholders continue to be risk-averse.

There is no question that blockchain is revolutionary. Much of its effect, even on a theoretical level, has yet to be investigated. However, these stumbling blocks must be solved before the organization can explore the blockchain potential's scope.

4 Making Transformation Real

In each of us, feeling, thinking, and remembering combine these three skills to allow all the human effort's wonderful possibilities. IoT, machine learning, and blockchain are both theoretically self-transforming but exponentially more efficient when combined. These three disruptive technologies will change the world together [7].

- **At home:** Even the new technology today is typically more reactive than constructive. Consider a virtual assistant like Alexa, Siri, or Cortana. Send them a command, and they will answer, order a product, say, or call on your behalf. However, these virtual assistants, powered by transformative technologies, become even more proactive. Shortly, your virtual helper might discover that you are using a specific product and recommend that it tell you how to find the best value by changing purchasing habits and places an order for you. Your refrigerator's IoT data will decide that your milk is inadequate. Machine learning

figures out where you get the favorite brand, cheapest, and distributor list. Moreover, blockchain ensures to get precisely what you paid for, and the transaction is safely processed.

- **Healthcare:** Consider a healthcare study in its current practice that depends on the patient today. You know when you have to see your doctor, usually only if there are noticeable signs, an accident has happened. Moreover, have to make an appointment. Moreover, they also have to recall the important specifics of medical history. Moreover, of course, human beings are frail and distracted. Alternately, assume a nation of patients with sensor equipment. Machine learning tracks IoT sensor information and can assess when something is wrong at an early level. The virtual assistant will reference your calendar with your physician and automatically schedule an appointment. Moreover, blockchain ensures that the doctor has a safe, precise digital medical history once the patient arrives.
- **Cyber protection:** Modern, more stringent laws, such as the GDPR (General Data Protection Regulation), the mutating threat of cybercrime, and the rising importance and proliferation of consumer data, made cybersecurity universally urgent. However, even here, AI, IoT, and blockchain can transform. These systems largely take the human factor out of cybersecurity processes and, thus, human error. In a centralized repository, log and audit data can be obtained when virtually everything is sensor-fitted. Machine learning can interpret these data much quicker and more reliably than any human being can, take rational decisions, and take autonomous action. Moreover, every critical proof is safely registered through blockchain. It is a system that effectively circumvents the most common reasons for carelessness, data violations, human error, and malicious interference.
- **In production:** Let us understand how the manufacturing industry reinvents these transformational innovations. Production managers obtain a remote digital view of any machine in each factory via a production management cloud solution. Using machine-learning proactive maintenance, they can see output data for each piece of equipment and predict malfunction in advance. The right technician may be allocated the right job at the appropriate time, a work order can be put, and replacement parts safely purchased via blockchain.

5 Realizing Tomorrow, Today

Disruptive technologies affect the change in our professional lives, personal lives, businesses, and society as a whole. However, their influence does not belong to an ambiguous and faraway future. Most of these features are currently available. So how you utilize the venerable perspective and enable companies to benefit from AI, IoT, and blockchain disruptive impacts? The solution is in the cloud. The truth is that it would be incredibly difficult to introduce any new technology without a cloud. It equalizes the field of play. Moreover, small businesses can reach the same computing power and resources as comprehensive companies via the cloud, while conventional companies can embrace the same versatility as agile technology startups. Cloud

facilitates creativity, minimizes IT investment, and speeds up introducing emerging innovations such as those three game-changers.

5.1 *Going There*

Things to remember in planning your company for technology transformation [7]:

- Focus on IoT, AI, and blockchain.
- Note that the playfield level is the cloud. Without it, you cannot get there.
- Recognize that massive volumes of data underpin these technologies.
- Appreciate that the use and realization of transformative technology can involve a change in business processes or models.

6 Conclusion

With IoT's intuitive ability, AI's and machine learning cognitive strength, and the unfailing blockchain memory, everyone can develop and restore business processes and standards. However, collectively, they are revolutionary, adapting all markets, sectors, and companies into their heads. There has been a technologically powered future. It is time to sculpt your niche. Start today with your transformation.

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