INTERNATIONAL JOURNAL FOR LEGAL RESEARCH AND ANALYSIS

Open Access, Refereed Journal Multi Disciplinary
Peer Reviewed

www.ijlra.com

 ISSN: 2582-6433

DISCLAIMER

 ISSN: 2582-6433

EDITORIAL TEAM

EDITORS

Dr. Samrat Datta

Dr. Samrat Datta Seedling School of Law and Governance, Jaipur National University, Jaipur. Dr. Samrat Datta is currently associated with Seedling School of Law and Governance, Jaipur National University, Jaipur. Dr. Datta has completed his graduation i.e., B.A.LL.B. from Law College Dehradun, Hemvati Nandan Bahuguna Garhwal University, Srinagar, Uttarakhand. He is an alumnus of KIIT University, Bhubaneswar where he pursued his post-graduation (LL.M.) in Criminal Law and subsequently completed his Ph.D. in Police Law and Information Technology from the Pacific Academy of Higher Education and Research University, Udaipur in 2020. His area of interest and research is Criminal and Police Law. Dr. Datta has a teaching experience of 7 years in various law schools across North India and has held administrative positions like Academic Coordinator, Centre Superintendent for Examinations, Deputy Controller of Examinations, Member of the Proctorial Board

Dr. Namita Jain

Head & Associate Professor

School of Law, JECRC University, Jaipur Ph.D. (Commercial Law) LL.M., UGC -NET Post Graduation Diploma in Taxation law and Practice, Bachelor of Commerce.

Teaching Experience: 12 years, AWARDS AND RECOGNITION of Dr. Namita Jain are - ICF Global Excellence Award 2020 in the category of educationalist by I Can Foundation, India.India Women Empowerment Award in the category of "Emerging Excellence in Academics by Prime Time & Utkrisht Bharat Foundation, New Delhi.(2020). Conferred in FL Book of Top 21 Record Holders in the category of education by Fashion Lifestyle Magazine, New Delhi. (2020).Certificate of Appreciation for organizing and managing the Professional Development Training Program on IPR in Collaboration with Trade Innovations Services, Jaipur on March 14th, 2019

 ISSN: 2582-6433

Mrs.S.Kalpana

Assistant professor of Law

Mrs.S.Kalpana, presently Assistant professor of Law, VelTech Rangarajan Dr. Sagunthala R & D Institute of Science and Technology, Avadi.Formerly Assistant professor of Law,Vels University in the year 2019 to 2020, Worked as Guest Faculty, Chennai Dr.Ambedkar Law College, Pudupakkam. Published one book. Published 8Articles in various reputed Law Journals. Conducted 1Moot court competition and participated in nearly 80 National and International seminars and webinars conducted on various subjects of Law. Did ML in Criminal Law and Criminal Justice Administration.10 paper presentations in various National and International seminars. Attended more than 10 FDP programs. Ph.D. in Law pursuing.

Avinash Kumar

Avinash Kumar has completed his Ph.D. in International Investment Law from the Dept. of Law & Governance, Central University of South Bihar. His research work is on "International Investment Agreement and State's right to regulate Foreign Investment." He qualified UGC-NET and has been selected for the prestigious ICSSR Doctoral Fellowship.He is an alumnus of the Faculty of Law, University of Delhi. Formerly he has been elected as Students Union President of Law Centre-1, University of Delhi.Moreover, he completed his LL.M. from the University of Delhi (2014-16), dissertation on "Cross-border Merger & Acquisition"; LL.B. from the University of Delhi (2011-14), and B.A. (Hons.) from Maharaja Agrasen College, University of Delhi. He has also obtained P.G. Diploma in IPR from the Indian Society of International Law, New Delhi.He has qualified UGC – NET examination and has been awarded ICSSR – Doctoral Fellowship. He has published six-plus articles and presented 9 plus papers in national and international seminars/conferences. He participated in several workshops on research methodology and teaching and learning.

 ISSN: 2582-6433

ABOUT US

INTERNATIONAL JOURNAL FOR LEGAL RESEARCH & ANLAYSIS ISSN

2582-6433 is an Online Journal is Monthly, Peer Review, Academic Journal, Published online, that seeks to provide an interactive platform for the publication of Short Articles, Long Articles, Book Review, Case Comments, Research Papers, Essay in the field of Law & Multidisciplinary issue. Our aim is to upgrade the level of interaction and discourse about contemporary issues of law. We are eager to become a highly cited academic publication, through quality contributions from students, academics, professionals from the industry, the bar and the bench. INTERNATIONAL JOURNAL FOR LEGAL RESEARCH & ANALYSIS ISSN 2582-6433 welcomes contributions from all legal branches, as long as the work is original, unpublished and is in consonance with the submission guidelines.

 ISSN: 2582-6433

BLOCKCHAIN TECHNOLOGY AND SMART CONTRACTS

AUTHORED BY: PRADNYA VIJAYKUMAR PATIL
Roll No. 6
LLM II Div:-A
Progressive Education Society's
Modern Law College, Pune
Savitribai Phule Pune University, Pune

INTRODUCTION

What Is Blockchain Technology?

Blockchain technology is a system for recording information in a way that makes it extremely difficult to alter, hack, or manipulate. A blockchain functions as a distributed ledger, which replicates and spreads transactions across a network of interconnected computers.

In essence, blockchain technology organizes transaction records, known as blocks, into a series of linked databases called the "chain." This network operates through peer-to-peer nodes and is commonly referred to as a 'digital ledger.'

Each transaction on this ledger is verified through the digital signature of the owner, ensuring its authenticity and protection against tampering. Consequently, the data within the digital ledger is highly secure.

To put it simply, think of the digital ledger as a shared Google spreadsheet accessible to multiple computers in the network. While anyone can view the data, they cannot alter or corrupt it.[1]

[1] https://www.simplilearn.com/tutorials/blockchain-tutorial/blockchain-technology

 ISSN: 2582-6433

Why Is Blockchain Popular?

Imagine you're transferring money to family or friends from your bank account. You would log into online banking, initiate the transfer using their account number, and then your bank updates the transaction records. It seems straightforward, but there's an underlying issue many overlook.

These transactions are susceptible to tampering, which makes people cautious about using traditional methods. This vulnerability is one of the primary reasons blockchain technology was developed.

Blockchain is a digital ledger gaining significant attention recently. So why has it become so popular? Let's explore its appeal.

Record-keeping for data and transactions is crucial in business. Traditionally, this information is managed internally or passed through intermediaries like brokers, bankers, or lawyers, which can increase both time and cost. Blockchain streamlines this process by enabling faster, more efficient transactions, thus saving time and money.

While many people mistakenly use Blockchain and Bitcoin interchangeably, they are not the same. Blockchain is a technology that supports a wide range of applications across various industries, such as finance, supply chain, and manufacturing. In contrast, Bitcoin is a currency that utilizes blockchain technology to ensure security.[2]

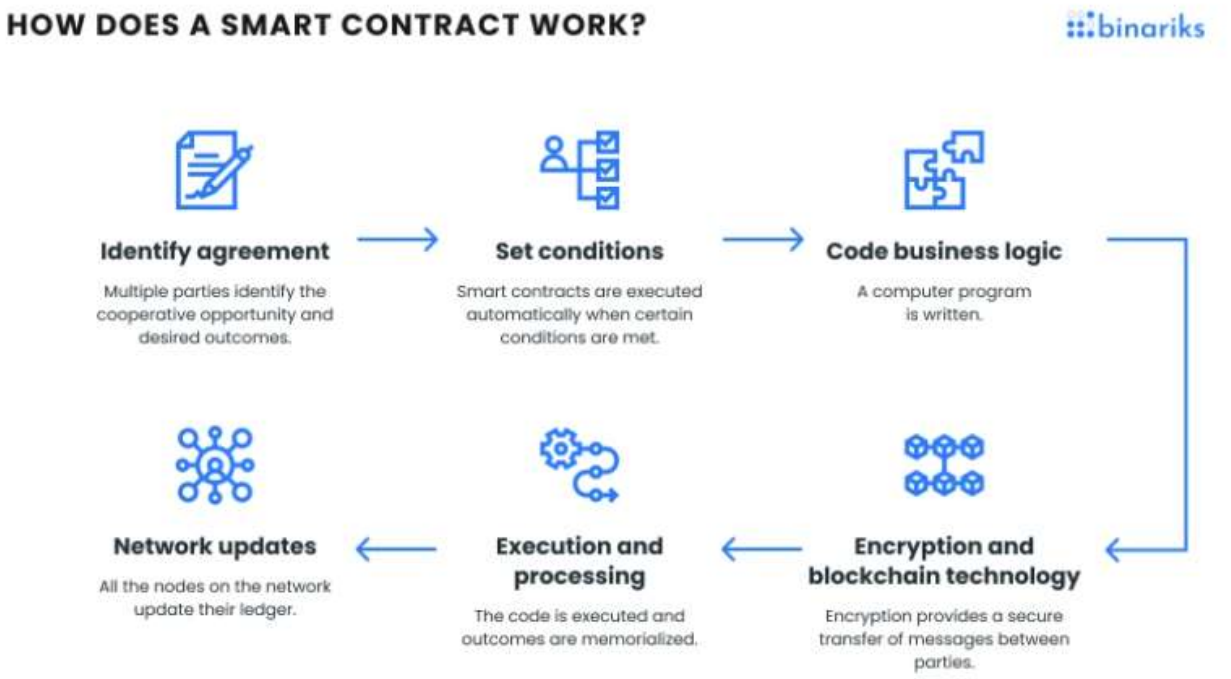
What Is a Smart Contract?

Smart contracts are digital protocols or programs designed for automating transactions, stored on a blockchain, and triggered when specific conditions are met. Essentially, these contracts facilitate the automatic execution of agreements, enabling all parties to verify the outcome immediately, without needing intermediaries or facing delays.

[2] ibn

 ISSN: 2582-6433

Smart contracts are self-executing agreements where the terms between buyer and seller are directly encoded into computer code. Nick Szabo, an American computer scientist who created the virtual currency "Bit Gold" in 1998, defines smart contracts as computerized protocols that implement contract terms. Their use ensures that transactions are traceable, transparent, and irreversible.



The History of Smart Contracts

In 1994, Nick Szabo, a U.S.-based computer scientist who later developed a virtual currency called “Bit Gold” in 1998 (predating Bitcoin by a decade), was the first to propose the concept of smart contracts. Szabo described smart contracts as digital tools designed to enforce the terms of a contract through automated processes.

Although many of Szabo’s predictions in his paper have become integrated into everyday life, this concept couldn't be realized at the time due to the absence of the required technology, particularly distributed ledger systems.

In 2008, Satoshi Nakamoto introduced blockchain technology in a groundbreaking whitepaper, which made it impossible for transactions to be altered once they were added to the blockchain. The arrival of advanced technologies spurred the development of smart contracts. Five years later, the Ethereum blockchain made smart contracts a practical reality, and Ethereum remains

 ISSN: 2582-6433

one of the leading platforms for implementing smart contracts today.

How Do Smart Contracts Work?

Like traditional contracts, a smart contract is a binding agreement between two parties. However, instead of paper, it relies on code to leverage the benefits of blockchain technology, offering greater efficiency, transparency, and security. Smart contracts operate based on simple "if/when…then…" statements embedded in the code on the blockchain.

Here are the key steps involved in how smart contracts function:

1. **Agreement:**
    - The involved parties must agree on the terms and conditions of the transaction or service.
    - They also need to define how the smart contract will work, including the criteria that must be met to fulfill the agreement.
2. **Contract Creation:**
    - Participants can create the smart contract themselves or work with a provider.
    - The contract terms are encoded using a programming language, and it's crucial to ensure the contract is secure during this phase.
3. **Deployment:**
    - Once the contract is finalized, it is published on the blockchain, similar to a regular cryptocurrency transaction.
    - The code is embedded in the transaction's data field, and after verification by the network, the contract becomes active and unchangeable.
4. **Monitoring Conditions:**
    - The smart contract continuously monitors the blockchain or an external trusted source for specific conditions or triggers, such as a payment or reaching a particular date.
    - These triggers must be digitally verifiable.
5. **Execution:**
    - When the predefined conditions are met, the smart contract is automatically executed according to the "if/when…then…" logic.
    - This can involve actions like transferring funds to a vendor or registering ownership of an asset.

 ISSN: 2582-6433

6. **Recording:**
    - The outcome of the contract execution is immediately recorded on the blockchain.
    - The blockchain verifies the actions, logs the completion as a transaction, and permanently stores the final agreement, accessible at any time.

Types of Smart Contracts

Smart contracts can be categorized into three main types: legal contracts, decentralized autonomous organizations (DAOs), and application logic contracts. Here's a closer look at each:

1. Smart Legal Contracts

   These smart contracts are legally binding and follow a structured "if-then" format, similar to traditional legal agreements. As they are stored on the blockchain and are immutable, they offer more transparency compared to conventional documents. Parties involved use digital signatures to execute these contracts, which can be carried out automatically if certain conditions are met, such as making a payment by a specific deadline. Failure to meet these conditions could result in serious legal consequences for the involved parties.
2. Decentralized Autonomous Organizations (DAOs)

   DAOs are governance structures that operate through smart contracts, granting voting rights to members. These organizations are managed collectively without traditional leadership roles like executives or presidents. Instead, the smart contract's code, which is based on blockchain principles, dictates the organization's operations and fund distribution. For example, VitaDAO utilizes this model to support scientific research through community governance.
3. Application Logic Contracts (ALCs)

   ALCs are coded agreements that interact with other blockchain contracts and often synchronize with various applications. They facilitate interactions between devices, such as those in the Internet of Things (IoT) or other blockchain-integrated systems. Unlike legal or DAO smart contracts, ALCs are not executed by people or organizations but by [3]machines and other contracts.[4]

[3] https://www.spiceworks.com/tech/innovation/articles/what-are-smart-contracts/
[4] https://www.geeksforgeeks.org/smart-contracts-in-blockchain/

 ISSN: 2582-6433

Benefits of Smart Contracts

Accuracy, Speed, and Efficiency

Smart contracts are executed instantly once a specified condition is met. Their digital and automated nature eliminates the need for paperwork, avoiding errors and time spent correcting manual documentation.

Trust and Transparency

With smart contracts, there is no risk of information being manipulated for personal gain, as no third party is involved. Encrypted transaction logs are shared directly among participants, ensuring transparency.

Security

Blockchain transaction records are encrypted, making them highly secure against hacking attempts. Additionally, since each entry on a distributed ledger is connected to previous and subsequent entries, altering one record would require changing the entire chain.

Savings

Smart contracts remove the need for transaction intermediaries, thus saving on both the time and fees associated with traditional methods.

Smart Contracts and Flight Insurance

Imagine a real-life scenario where smart contracts are applied. Rachel is at the airport, and her flight is delayed. AXA, an insurance company, offers flight delay insurance through Ethereum smart contracts, ensuring Rachel is compensated for such an event. How does this work? The smart contract is connected to a database that tracks flight statuses. It is designed based on specific terms and conditions.

In this case, the condition is that the flight must be delayed by two hours or more. The smart contract, written in code, holds AXA's funds until that condition is met. The contract is then submitted to nodes on the Ethereum Virtual Machine (EVM), a runtime environment that executes the smart contract's code. All network nodes run the code and must reach the same conclusion, which is then recorded on the distributed ledger. If Rachel's flight is delayed by over two hours, the smart contract automatically executes, and she is compensated. Since smart contracts are immutable, no one can modify the agreement.[5]

[5] https://www.simplilearn.com/tutorials/blockchain-tutorial/what-is-smart-contract

 ISSN: 2582-6433

Voting and Blockchain Implementation with Smart Contracts

The use of blockchain in voting systems can solve common issues such as identity fraud, miscounts, or bias from voting officials. By using smart contracts, voting systems can be designed with predefined terms and conditions. Voters can only cast ballots using their unique digital identity, ensuring that the counting process is foolproof. Every vote is recorded on a blockchain network and tallied automatically, without third-party intervention or reliance on manual processes. Each ID is linked to just one vote, and validation is carried out by the blockchain network users.

Voting can take place on a public blockchain or within a decentralized autonomous organization (DAO)--based blockchain system. This ensures that every vote is securely recorded on a ledger that cannot be altered, and the ledger remains publicly accessible for auditing and verification.

Smart contracts allow for flexible voting systems where members can be added or removed, voting rules can be adjusted, debate periods can be modified, and majority rules can be altered. For example, in a DAO, instead of a central authority making decisions, a smart contract-enabled voting mechanism allows members to collectively vote on proposals, determining whether they are approved or rejected.

Uses of Smart Contracts

1. **Royalty Payments in Media and Entertainment**
   Emerging artists often depend on streaming revenue. Smart contract applications can streamline royalty payments by defining the share payable to the artist and record company. The immediate execution of payments benefits all parties involved. Additionally, smart contracts can address the complexities of royalty distribution in over-the-top (OTT) platforms, allowing new artists and lesser-known actors to receive small, consistent payments.
2. **Decentralized Finance (DeFi) Applications**
   DeFi apps, powered by cryptocurrencies and smart contracts, enable financial services without intermediaries. DeFi has evolved beyond peer-to-peer transactions. Smart contracts facilitate complex processes such as borrowing, lending, and derivatives trading on DeFi platforms.

 ISSN: 2582-6433

3. **Conversion of Assets into Non-Fungible Tokens (NFTs)**

   Smart contracts have enabled the creation of non-fungible tokens (NFTs) by assigning ownership and managing the transferability of digital assets. These contracts can be customized with additional conditions like royalties or access rights. Essentially, smart contracts allow digital assets to be treated like physical ones, holding real-world value.

4. **B2B Data Marketplaces**

   In data marketplaces, users buy and sell datasets or data streams from various sources. Smart contracts help create dynamic, fast-evolving markets that automate secure transactions without human intervention. A prime example of this is Datapace, which uses smart contracts for such transactions.

5. **Supply Chain Management**

   Smart contracts can operate autonomously without third-party intervention, making them ideal for supply chain management. An organization can automate the entire supply chain process using smart contracts, reducing the need for constant oversight. If shipments are delayed, smart contracts can trigger escalation measures to ensure smooth operations.

6. **Digital Identity Cards**

   Smart contracts allow users to store reputational data and digital assets, creating digital identity cards. When linked to various online services, smart contracts let external parties access important information without revealing personal details. For example, credit scores stored on smart contracts can be shared with lenders for loan verification, minimizing demographic profiling. Similarly, job candidates can share resumes without risking bias.

7. **Electoral Polls**

   Voting can occur in a secure environment through smart contracts, reducing the risk of voter manipulation. Each vote is encrypted and stored on a ledger, making it nearly impossible to tamper with. Additionally, smart contracts may increase voter turnout by allowing people to vote online, eliminating the need to visit polling stations.

8. **Real Estate**

   Smart contracts can expedite property ownership transfers. Contracts can be autonomously created and executed, for instance, when a buyer pays a seller. The smart contract can automatically transfer property ownership, ensuring seamless transactions based on blockchain payment records.

 ISSN: 2582-6433

9. **Healthcare Data Management**

   In healthcare, smart contracts can revolutionize data management by improving transparency and efficiency. For instance, they can ensure the integrity of clinical trial data and help hospitals maintain accurate patient records. Additionally, smart contracts can be used for managing appointments and other administrative tasks.

10. **Civil Law**

    Smart contracts also have potential in the legal field, where they can create legally binding business and social agreements. In certain areas of North America, governments have started to authorize smart contracts for official documentation. For instance, California can issue digital birth and marriage certificates as smart contracts.

Blockchain Implementation of Smart Contracts and Crowdfunding

Ethereum-based smart contracts can be employed to create and manage digital tokens for transactions. You can design and issue your own digital currency, resulting in a tradable computerized token. These tokens utilize a standard coin API, such as Ethereum's ERC-20 standard, which allows the smart contract to interact with any wallet for automatic exchanges. This process enables the creation of a tradable token with a fixed supply, effectively turning the platform into a form of central bank issuing digital money.

Consider a scenario where you want to launch a business and need funding. Trust is a significant factor—people are often hesitant to lend money to strangers. Smart contracts offer a solution. With Ethereum, you can set up a smart contract to hold contributors' funds until a specific date or funding goal is reached. Based on the outcome, the funds are either transferred to the project owners or returned to the contributors. Traditional crowdfunding systems face challenges with management and trust. To address these issues, a Decentralized Autonomous Organization (DAO) can be used for crowdfunding. In this setup, the smart contract defines the terms and conditions, and each participant receives a token. All contributions are recorded on the blockchain, ensuring transparency and trust.

Limitations of Smart Contracts

Smart contracts are unable to send HTTP queries, which means they cannot access information about "real-world" events. This limitation is intentional to preserve consensus, which is crucial for maintaining security and decentralization.

 ISSN: 2582-6433

Use Cases of Smart Contracts

Smart contracts have a wide range of applications, from simple to complex tasks. They can handle straightforward economic transactions, such as transferring money between parties, and more advanced functions like smart access management in the sharing economy. Their potential to disrupt various industries is significant. Smart contracts could impact fields such as banking, insurance, energy, e-government, telecommunications, music, art, mobility, education, and beyond, offering innovative solutions and efficiencies across these sectors.

Challenges:

1. **Rigidity and Inconsistent Support**
   Modifying smart contracts is difficult and costly, and global legal adherence can be challenging.
2. **Difficulty in Capturing Unquantifiable Data**
   Smart contracts are better suited for quantifiable data, making them less effective for industries with subjective metrics.
3. **Conflict with GDPR**
   The right to be forgotten under GDPR conflicts with the immutability of blockchain records.
4. **Skills Shortage**
   Developing smart contracts requires specialized skills in software engineering and blockchain programming languages like Solidity.
5. **Scalability Issues**
   Current blockchain networks, such as Ethereum, face scalability challenges, processing far fewer transactions per second compared to traditional systems like Visa.

Conclusion

Blockchain technology is the foundation driving the advancement of smart contracts. Simplilearn's Full Stack Java Developer program is tailored for developers eager to understand the global excitement surrounding Blockchain, Bitcoin, and cryptocurrencies. This course covers the essential structures and technical mechanisms of major blockchain platforms such as Bitcoin, Ethereum, Hyperledger, Dogecoin, and Multichain. Simplilearn equips you with the latest tools to develop Blockchain applications, establish your private Blockchain, deploy smart contracts on Ethereum, and gain hands-on experience with real-world projects.