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Blockchain in Animal Health Care and their Records Maintenance

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ABSTRACT: Blockchain technology has emerged as a disruptive force in various sectors, and its application in animal health care has garnered increasing attention. This paper explores the integration of blockchain technology in the domain of animal health care and the maintenance of their records. By leveraging blockchain's decentralized and immutable ledger system, this approach ensures secure and transparent management of animal health data throughout their life cycle. This abstract discusses the potential benefits of blockchain in enhancing data integrity, interoperability, and traceability within the animal health care ecosystem. Furthermore, it examines the challenges and opportunities associated with implementing blockchain solutions in vet- erinary practice, including issues related to data privacy, scalability, and regulatory compliance. Through a comprehensive analysis, this paper sheds light on the transformative potential of blockchain technology in revolutionizing animal health care and its records maintenance, paving the way for improved health outcomes and streamlined management processes.

I. INTRODUCTION

BLOCK CHAIN is an open distributed ledger that can record transactions in an efficient, verifiable, permanent and transparent way. Blockchain is a peer to peer system of transaction of values with no trusted third parties in between. It is a shared, decentralized and open ledger of transactions. The ledger database is appended only and cannot be altered, this means that every entry is a permanent entry and a new entry on it gets reflected on copies of the database trusted on different nodes. There is no need for trusted third parties to serve as intermediaries to verify, secure and settle transaction.Block chain in another layer on top of the internet and can co-exist with other internet technology. Just the way TCP/IP was designed to achieve an open system,blockchain technology was designed to enable decentralization. Blockchain could be called a database, where the data is located in a network of computers with no central authority controlling the data. This technology started to spring up in many fields including medicine, science, education, food supply chain management, power grid, asset management and so on. The other aspiring sectors where we can use Blockchain Transparent Donation Platform. In gaming Industry for Securing In game assets and player Identity

1.1 What is centralization or decentralization?

For example When you want to spend your money you send the message to the bank, bank permits the transaction if you have money and updates the state (Records). The Problems with centralization is single point failure (Failure in bank server, you cannot complete transaction), concen- tration of authority (Bank can impose new condition Only 5 Deposits per month if exceed it charge you according to amount), bank server only visible or accessible to bank officials they may censor some transaction. In Decentral- ization no single person or group of people control the process rather than all people contribute to it.

1.2 Types of Blockchain

A. Public BlockChain
B. Private BlockChain
C. Permission based BlockChain

A. Public BlockChain

A disruptive technology in which anyone can join the network at any time and can do transactions. In this type of Blockchain, the transactions are transparent, that is the transactions are known to everyone (every node) in the network. Anyone in the network can audit the blockchain. To encourage user native token as reward or platform fees are given for example bitcoin. Code base is publicly available and the community maintains the code

B. Private BlockChain

These blockchains tend to be smaller in size and the members are limited and do not utilize any token. Private blockchain can be owned by individuals or organizations for maintaining organization data and transactions. People working under the organization can be part of Blockchain. This kind of blockchain is faster and more trusted than permission less blockchain as the number of users is limited and code is not publicly available. This type of blockchain is favored by consortiums that have trusted members and trade confidential information. Usually employed on 2 private networks of organization which makes it more safe.

C. Permission based BlockChain

Federated Block chain Federated or Consortium Blockchain are semi- permission blockchain in which a consortium of members are responsible to run a full node and make transactions. This blockchain provides more scalability and higher transaction privacy. Only selected members can review or audit transaction

Table -1: Comparison between types of Blockchain

Parameters	Public Blockchain	Private Blockchain	Consortium Blockchain
Access	Anyone	SingleOrganization	Multiple Nodes from Organization
Participants	Permissionless i.e. Anyone can access	Permissioned for Known Entities	Permissioned for Known Entities
Security	Consensus Mechanism	Pre-approved Participants	Pre-approved Participants
Transaction Speed	Slow	Fast	Moderate
Example	Bitcoin	Bankchain	Corda

1.2 Types of Nodes in Block chain

A. Light Nodes
B. Full Nodes
C. Mining Nodes

A. Light Nodes

Most nodes are of type Light Node, which typically only download blockchain data needed to process and verify new transactions. This minimal approach keeps light nodes running quickly and efficiently without requiring too much computation or storage resources.

B. Full Nodes

In contrast to light nodes, full nodes contain an entire copy of the blockchain in real-time. Every block of trans- actions, including blocks from the genesis block to the most recent block added to the blockchain, is stored on full nodes.

C. Mining Nodes

Some of the nodes on the blockchain network are specialized nodes called miners. Miners are the nodes who write blocks of new transactions to the blockchain.

II. BLOCKCHAIN IN ANIMAL HEALTH CARE AND THEIR RECORDS MAINTENANCE

2.1 Motivating factors for using Blockchain Technology

The following are some of the motivating factors for using Blockchain Technology:

1. No need to depend on huge servers.
2. Reduce the need for more trusted parties
3. Reduces redundant work
4. Reduces redundant work
5. Cost effective and fast.
6. Provides security, integrity and privacy of data

Health data presents the most sensitive data. Digitization helps to move the records on paper to digital format which could be easy to store and record. Digitizing data helps doctors to access,update and analyze the medical history of patients. It can be animal or human in our case, we are focused on animals as this sector is totally undermined, it reduces burdens on pet owners of carrying medical records . Sometimes pets get readopted and to maintain their health vaccine details have to be maintained for better health of animals.

2.2 Applications of BlockChain in various fields of healthcare

A. Veterinary Records Management

Blockchain can securely store and manage veterinary records, ensuring that data is immutable, transparent, and accessible only to authorized parties. This can include:

➢ Medical Histories: Complete and tamper-proof records of an animal's medical history, including vaccinations, treatments, and surgeries.
➢ Prescriptions: Secure management and tracking of prescriptions to prevent fraud and misuse.
➢ Health Certificates: Digital certificates that can be easily verified and are resistant to forgery.

B. Supply Chain Management for Veterinary Drugs

Blockchain can be used to track the entire supply chain of veterinary drugs, ensuring the authenticity and safety of medications. This includes-

➢ Provenance Tracking: Verifying the origin and journey of drugs from manufacturer to clinic.
➢ Counterfeit Prevention: Reducing the risk of counterfeit drugs entering the supply chain by ensuring all transactions are recorded on an immutable ledger.
➢ Regulatory Compliance: Simplifying compliance with regulations by providing transparent and accessible records.

C. Animal Identification and Registration

Blockchain can be used for the identification and registration of animals, providing a reliable and tamper-proof method to track ownership and history. Applications include-

➢ Microchip Data: Storing unique identification numbers from microchips in a blockchain to ensure they cannot be altered.
➢ Pedigree Tracking: Maintaining accurate and im- mutable records of an animal's lineage and breeding history.
➢ Ownership Transfer: Securely and transparently recording changes in ownership, reducing disputes and fraud.

D. Adoption and Rescue

Blockchain can enhance the adoption and rescue process by providing a transparent and secure method for recording the history of animals available for adoption. This includes: - Microchip Data: Storing unique identification numbers from microchips in a blockchain to ensure they cannot be altered.

➢ Adoption Records: Keeping a transparent and im- mutable record of adoption histories, including previous owners and health records.
➢ Shelter Management: Improving the efficiency of shelter operations by securely managing records of animals in care.
➢ Donor Transparency: Ensuring that donations to ani- mal shelters and rescue organizations are tracked and used as intended.

E. Disease Tracking and Prevention

Blockchain can play a crucial role in tracking the spread of diseases and coordinating responses. Applications include: -

➢ Epidemiological Data: Securely storing and sharing data on animal diseases, enabling better tracking and response.
➢ Vaccination Records: Maintaining tamper-proof records of vaccinations, ensuring that animals are properly immunized.
➢ Quarantine Management: Recording and tracking animals in quarantine to ensure compliance with health regulations.

F. Research and Clinical Trials:

Blockchain can be used to enhance the integrity and transparency of research and clinical trials involving animals. This includes: -

➢ Data Integrity: Ensuring that research data is im- mutable and can be audited.
➢ Participant Consent: Recording consent forms and ensuring that the participation of animals in trials is documented and transparent.

➢ Results Sharing: Facilitating secure and transparent sharing of research results with the scientific community.

G. Insurance

Blockchain can improve the insurance process for pets and livestock by providing a transparent and immutable record of an animal's health and treatment history. This includes-

➢ Claims Processing: Simplifying and speeding up the claims process by providing verifiable health records.
➢ Fraud Prevention: Reducing fraud by ensuring that all claims are based on accurate and tamper-proof records.
➢ Policy Management: Securely managing insurance policies and coverage details.

III. INTEGRATION OF BLOCKCHAIN IN ANIMAL HEALTHCARE

To implement a blockchain-based solution in animal healthcare, we use a permissioned blockchain platform such as Hyperledger Fabric. This platform is chosen for its modular architecture, which supports fine-grained access control and high transaction throughput.
The methodology involves the following steps:

3.1 System Design:

The blockchain network comprises multiple nodes, each representing an authorized entity. Nodes are categorized based on their roles, such as veterinary clinics, adop- tion centers, emergency services, and local authorities. Each node is authenticated through a Membership Service Provider (MSP), which issues digital certificates to verify identities. Transactions on the blockchain include various types of data, such as health records, adoption details, and ownership changes.

3.1 Smart Contracts:

Smart contracts are used to enforce business rules and access control policies. For instance, a smart contract can ensure that only veterinarians can update medical records, while shelters can only view adoption records. These contracts are deployed on the blockchain and executed automatically when predefined conditions are met.

IV. CONCLUSIONS

Integrating blockchain technology in animal health- care systems provides a secure, transparent, and efficient way to manage sensitive data. By using a permissioned blockchain, we can ensure that only authorized entities have access, thereby enhancing privacy and trust. Future research should focus on optimizing the system for scal- ability and exploring additional use cases such as disease tracking and wildlife conservation.

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