

PawPrints

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Introduction

In recent years, the pet medical industry has witnessed exponential growth, reflecting the increasing number of households embracing pets as valued members of their families. With this surge in pet ownership, the demand for efficient and reliable management of pet medical records has become more pronounced. Existing pet medical record management systems suffer from numerous drawbacks, including service delays, fragmented data, susceptibility to tampering, and restricted accessibility. These limitations pose significant challenges to veterinarians, pet owners, and other stakeholders involved in the care and well-being of pets. The purpose of this project is to introduce a blockchain-based platform that addresses the aforementioned challenges, thereby revolutionizing the way pet medical records are managed. By leveraging the inherent characteristics of blockchain technology, such as immutability, decentralization, and transparency, the platform aims to overcome the existing hurdles and establish a robust ecosystem for the efficient management of pet healthcare information.

Problem Statement:

The current landscape of pet medical record management systems presents several critical issues that impede the seamless flow of information and compromise the quality of pet healthcare. These challenges can be summarized as follows:

Delay of Services

Traditional pet medical record management systems often suffer from delays in accessing and updating critical information. Paper-based records, reliance on physical storage, and manual data entry processes contribute to inefficiencies and bottlenecks, resulting in prolonged wait times for pet owners and veterinarians. These delays can hinder timely diagnosis, treatment, and care, potentially compromising the well-being of pets.

Fragmented Data

Pet medical records are often fragmented and dispersed across various healthcare providers, making it difficult to maintain a holistic view of a pet's medical history. In the absence of a unified system, veterinarians and pet owners struggle to obtain a comprehensive understanding of a pet's health, leading to suboptimal decision-making and potential risks.

Vulnerability to Tampering

The current pet medical record management systems lack robust mechanisms to ensure the integrity and authenticity of the information stored. Paper records can be easily manipulated or lost, while digital systems may suffer from vulnerabilities that allow unauthorized access or data tampering. This susceptibility to tampering erodes trust and raises concerns about the accuracy and reliability of the recorded information.

Restricted Access

Access to pet medical records is often limited to specific healthcare providers or clinics, hindering the efficient exchange of information between different stakeholders involved

in the pet's care. This restricted access obstructs collaboration, impedes seamless transitions between veterinary practices, and restricts the ability of pet owners to make informed decisions about their pets' health.

Project Overview

Objective

The objective of our project is to provide a secure and reliable method for storing and sharing pet medical records, aiming to improve efficiency in the veterinary industry and enhance pet health management. By leveraging blockchain technology, we seek to revolutionize the way pet medical records are managed, ensuring trust, traceability, and accessibility throughout the entire process.

Why Blockchain

Blockchain technology presents a compelling solution to address the challenges prevalent in the existing pet medical record management systems. By utilizing blockchain, we can significantly improve the efficiency, security, and transparency of each pet owner's visit to the veterinarian. Through the utilization of blockchain technology, all transaction records, user and pet identification information, and record identifiers will be securely stored and linked to a private and tamper-resistant database, ensuring the integrity and immutability of the data.

Scope

The proposed platform will encompass a wide range of pet medical records, including vaccination records, diagnostic reports, surgical records, and other relevant documents. By digitizing and storing these records on the blockchain, we aim to streamline the management and retrieval processes, ensuring that veterinarians have access to comprehensive and up-to-date medical information for each pet under their care.

Target Audience

The primary target users for our platform include veterinarians, pet owners, and other relevant stakeholders in the pet healthcare ecosystem. Veterinarians will benefit from improved access to accurate and complete medical history, enabling them to make informed decisions and provide enhanced care to their patients. Pet owners will have

greater control and ownership of their pet's medical information, empowering them to actively participate in their pet's healthcare journey. Additionally, other stakeholders, such as pet insurance providers, animal shelters, and regulatory bodies, will also find value in the platform's ability to securely access and verify pet medical records.

Solution and Features

Detailed presentation of the solution offered by the blockchain-based pet medical records platform: establishing a decentralized, transparent, and verifiable storage and sharing platform for pet medical records.

Use Cases

1. **Account Creation & Pet Profile Setup:** After registering on our platform, pet owners are asked to create a profile for their pets. This includes essential details such as the pet's name, breed, date of birth, and color. Additionally, they also need to provide the name of their pet's healthcare provider (veterinary hospital) and the pet's insurance company. Once these details are filled in, our system generates unique identification numbers and stores them securely on the blockchain.
2. **Veterinary Visits & Access to Medical Records:** When the pet owner brings their pet to the vet, they no longer need to fill out any forms. The veterinary hospital can initiate a transaction with the pet owner through our platform to gain access to the pet's medical records. This streamlined process allows the vet to view past records and update the file with new medical data from the current visit.
3. **Insurance Claims & Reimbursement:** Following the vet's visit, the pet's insurance company can readily access the updated medical records through our platform. They can use this information to process any necessary insurance claims. As the records have been recently updated by the vet, the insurance company can refer to these for accurate and swift reimbursement. This ensures a hassle-free and efficient claims experience for the pet owner.
4. **Potential Buyers & Health Transparency:** Potential pet buyers also benefit significantly from our platform. With the pet owner's permission, they can access the relevant information about the pet they're interested in. This includes basic pet profile data, as well as detailed medical records. It gives them a comprehensive view of the pet's health, allowing them to confirm there are no hidden genetic defects or health issues. By ensuring full health transparency, our platform fosters trust and confidence in the pet acquisition process, thus making it more secure and reliable.

Key Features

- Traceability
 - All transaction and information exchange happened on chain can be traced
- Real-time access
 - Transaction and medical records will be synchronized to user end and insurance provider end in the form of pushed notification so that seamless information flow can be achieved.
- shared permission control
 - Besides pet owners, only hospitals and insurance companies that are given permission have the access to pets' data
- Security and Privacy Protection
 - use of encrypted database and access control mechanisms can safeguard privacy of pet medical records

Architecture and Design

Modifiers

```
modifier inState(State _state) {
    require(
        state == _state && state!= State.invalid,
        "Invalid or Out of State."
    );
    _;
}

modifier onlyOwner(){
    require(
        msg.sender != insuranceProvider && msg.sender != hospital,
        "Only PET OWNER can call this."
    );
    _;
}

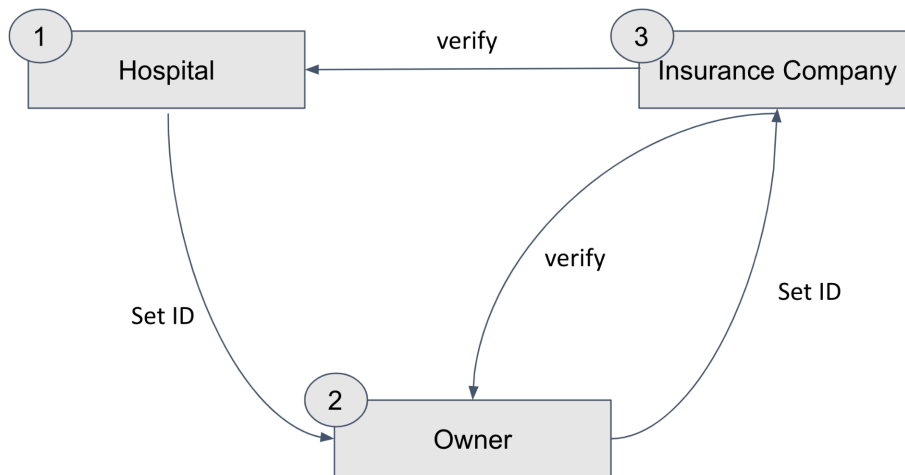
modifier onlyHospital(){
    require(
        msg.sender == hospital,
        "Only HOSPITAL can call this."
    );
    _;
}

modifier onlyInsuranceProvider(){
    require(
        msg.sender == insuranceProvider,
        "Only INSURANCE PROVIDER can call this."
    );
    _;
}
```

We implemented a few modifiers to ensure that some of the methods can be exclusively used by participants. There is also an inState modifier to track the current status of the contract.

Role of each party

Three parties will participate in the blockchain: pet owners, the hospital, and the insurance company.



When the pet owner visits the hospital, he/she will provide his/her account number. The hospital then initializes the contract, adding the owner to the contract. This triggers the next phase when the owner will select his insurance company. The insurance company will be notified when it is added to a new contract.

The insurance company will verify both whether the hospital is within its network and whether the owner is a valid insurance holder. We have provided a side contract to record the expiration date of the insurance to automate the process.

Verification

```

function verify (address insuranceAddress, bool validHospital, bool overR)
  external onlyInsuranceProvider inState(State.insuranceProvided) returns(bool)
{
  emit verified();

  if (overR){
    return true;
  }

  bool manualCheckPass = insurance(insuranceAddress).checkExpired();
  if(manualCheckPass && validHospital){
    state = State.insuranceVerified;
    return true;
  }
  return false;
}

```

The insurance company will be responsible for the verification of both the hospital and the pet owner. We provided two options for the insurance company, one is to verify on their own and return the result as `overR`, and the other is to use our side-contract `insurance.sol`.

```
function checkExpired() external returns(bool) {
    require(block.timestamp >= (insuranceRecord[address(this)] + duration),

    // If expired
    insuranceRecord[address(this)] = 0;
    return true;
}
```

This is a function inside `insurance.sol`. It records the expiration date of the insurance purchased. If the insurance is expired, it will return false, triggering the failure to verify.

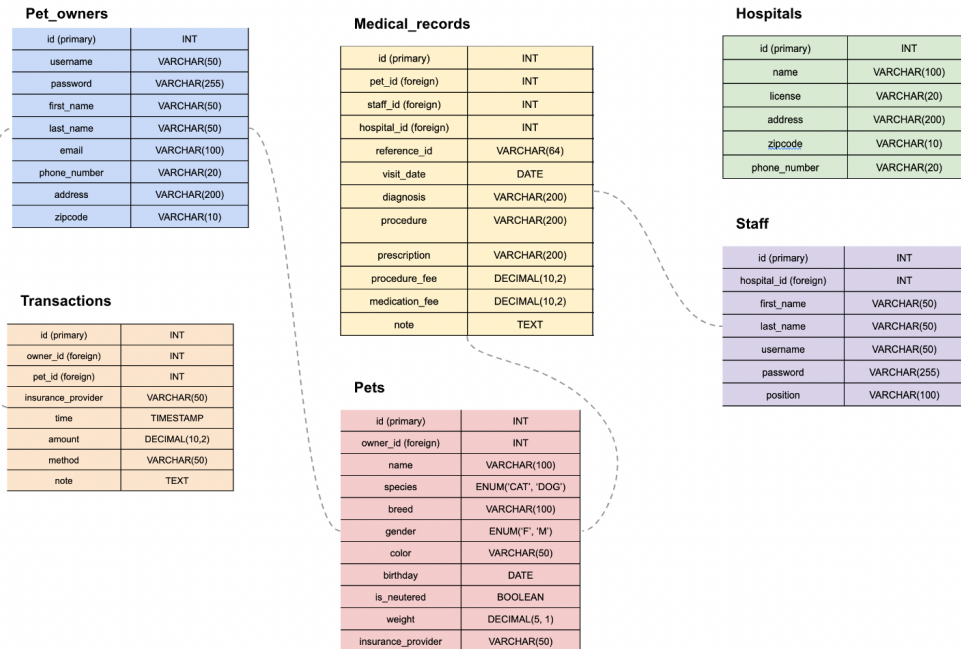
Database

The blockchain will not contain too much information, since it is expensive to retrieve and expensive for data storage. The majority of information will be stored in an encrypted database provided by PawPrints to ensure its security and sensitivity. Instead, The blockchain will only focus on storing activity summaries and essential metadata. For example, medical records will be presented as a `MedicalRecord` struct.

```
struct MedicalRecord {
    uint ownerId;
    uint petId;
    uint billAmount;
    uint recordId;
}
```

The `recordId` has no meaning to others who do not have access to the encrypted database, therefore it is safe to expose it to the public.

For the encrypted database, we implemented a robust relational database with MySQL with the following schema:



The database incorporates robust access control mechanisms and user permissions. Specifically, pet owners can access and modify personal information and pet's information. The medical records are viewed only for both pet owners and insurance companies. Plinics can access and modify internal data. They can also access the pet's information and modify (add only) medical records under the permission of pet owners.

Revenue Model

To ensure the sustainability and profitability of the blockchain-based platform for pet medical records, we have devised a comprehensive revenue model that includes specific pricing and marketing strategies for each service offering. The revenue model primarily focuses on partnerships with veterinarians and clinics, as well as integration with pet insurance companies. Additionally, data monetization and potential advertising opportunities are explored to maximize revenue generation.

Partnerships with Veterinarians and Clinics

By establishing partnerships with veterinarians and clinics, we offer them a more streamlined and efficient medical record management system, enabling them to access and update pet medical records seamlessly. Our revenue model for veterinarians and clinics includes a subscription-based pricing structure, tailored to accommodate different levels of usage and the size of the practice. Pricing tiers will be based on factors such as the number of veterinarians utilizing the platform, the volume of pet medical records managed, and additional value-added services availed by the veterinarians and clinics. The pricing will be competitive, ensuring affordability while reflecting the value and benefits delivered by the platform. Furthermore, we will implement targeted marketing campaigns to promote our platform to veterinarians and clinics. These campaigns will emphasize the advantages of using our system, such as improved efficiency, enhanced collaboration, and easy access to comprehensive pet medical records. We will leverage various channels, including industry conferences, professional networks, and online platforms, to raise awareness and acquire veterinary partnerships.

We plan to charge \$ 20 monthly for Pet owners & \$ 200 monthly for Vets

Integration with Pet Insurance Companies

To simplify the insurance claim process and provide added value to pet owners, we will seek partnerships with pet insurance providers. Through these partnerships, we will

integrate our platform with their systems, enabling seamless sharing of pet medical records for insurance claims. This integration will reduce paperwork, streamline the claims process, and ensure accurate and reliable information exchange. The revenue model for integration with pet insurance companies will involve a mutually agreed-upon fee structure, which may include transaction-based fees or a revenue-sharing model based on the volume of insurance claims facilitated through our platform. The pricing will be negotiated on a case-by-case basis, considering factors such as the size and reputation of the insurance provider and the potential value generated through streamlined claims processing.

Data Monetization and Potential Advertising

In addition to revenue generated from partnerships and integrations, there is potential for data monetization and advertising on the platform. With consent from pet owners, we can aggregate and anonymize pet health data to create valuable insights and trends. This aggregated data can be sold to downstream companies, such as pet food manufacturers, pet health product companies, or pharmaceutical companies, who are interested in analyzing pet health patterns for research and product development. The pricing for data monetization will be determined based on the value and demand for the data, as well as the privacy considerations and consent mechanisms in place. Furthermore, our platform can offer targeted advertising opportunities to relevant businesses within the pet industry. For example, we can provide advertising space to pet food companies, pet supply stores, or veterinary service providers, allowing them to reach a highly engaged and targeted audience of pet owners. The pricing for advertising will be based on various factors, including ad placement, duration, targeting options, and the size of the advertiser's business.

\$ 2 per click / \$ 5000 monthly

Roadmap

Our vision

Our vision is to create a secure ecosystem that revolutionizes the pet healthcare industry, connecting pet owners, pet clinics, and pet insurance companies using blockchain technology.

Specifically, through our platform, we aim to (1) enable more efficient pet care by providing a reliable, all-in-one repository of pet medical records to veterinarians; (2) streamline insurance processes by automating claim verification through the chain; (3) enhance collaboration between pet owners, clinics, and insurance companies via seamless information exchange; (4) ensure data security and integrity by using the combination of encrypted database and blockchain technology; (5) establish a trusted pet marketplace by giving pet breeders the possibility to offer verified and up-to-date information regarding the genetic health of their pet to potential buyers; (6) foster innovation and research in the field of pet healthcare through large-scale data analysis after secretly aggregating and anonymizing pet medical data.

Roadmap

- Phase 1: Platform development
 - Develop the foundational blockchain infrastructure and deploy it on Polygon.
 - Develop a database for data storage. Establish secure data storage protocols and encryption mechanisms on the database to protect sensitive data.
 - Build user-friendly web-interfaces tailored to the specific needs of pet owners, pet clinics and insurance companies.
- Phase 2: Demo period
 - Conduct rigorous testing and quality assurance to ensure the platform's stability and reliability.
 - Invite a select group of users, including pet owners, pet clinics, and insurance providers to participate in a demo period.
 - Experiment with additional functionalities including profile sharing, medication reminders, pet community and forums, etc.

- Analyze feedback received during the period and improve the platform based on user needs and preferences.
- Phase 3: User adoption and onboarding
 - Collaborate with pet clinics and insurance providers to onboard them into the platform.
 - Develop a marketing campaign and provide incentives to attract pet owners to join the platform.
 - Highlight the unique advantages of blockchain technology, including data immutability and enhanced security in building trust within the pet community.
- Phase 4: Expansion and partnerships
 - Foster alliances with blockchain experts to continuously enhance the scalability and performance of the platform.
 - Explore collaborations and partnerships with veterinary associations, pet associations like TICA to establish industry standards and promote the adoption of blockchain technology in pet healthcare.
 - Consider collaborating and connecting with pet breeders to provide them with verifiable proof of pet health and ownership through blockchain-secured medical records to facilitate trust among potential buyers.

We are currently at Phase 1, and we expect to move towards Phase 2 in June 2023.

Team and Advisors

Introduction of project team members and their relevant expertise, including technical personnel, veterinary experts, blockchain developers, etc.

Team:

Chi (Bruce) Cheng: Sophomore, Math-CS major. Backend Developer. Solidity contract and blockchain framework.

Guidong (Grey) Luo: Sophomore, Math-CS major. Front-end and API Developer.

Xueyan (Aaron) Shi: Sophomore, CS major. Backend Developer. Solidity contract and blockchain framework.

Yijun (Jack) Luo: Sophomore, Data Science Major. Backend Developer. Solidity contract and blockchain framework.

Yiting (Joy) Bu: Sophomore, Data Science major, Cognitive science major. UI/UX design and database developer.

Advisors:

Margaret King: Vice President, FinTech Partnerships & Corporate Strategic Investments

Sheffield Nolan: Enterprise Architect, FinTech Innovation

Michael Cody: Strategic Architect, Digital Assets Technology

Igor Natanzon: Strategic Architect, Digital Assets Technology