***<u>Project Name:</u>* Fauna Rescue Blockchain**

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<u>BCDV 1027</u>

Index/Topic Discussed:

Problem statement

Biodiversity on our planet faces a dual challenge: the perilous brink of extinction for certain species, and the inspiring resilience demonstrated by others with strategic human intervention. These scenarios underline the intricate relationship between human actions and the survival of species, often hinges on the effectiveness of our interventions.

Species That Failed to Survive Despite Human Intervention: Consider the plight of the Northern White Rhinoceros, a glaring example of how even well-intentioned human efforts can falter. In the last couple years, this subspecies teetered on the edge of extinction, its population reduced to just two individuals, both females. Recognizing the urgency, conservationists deployed advanced techniques such as in vitro fertilization to aid reproduction. However, the challenges proved daunting—advanced age and health issues of the remaining rhinos presented formidable obstacles. Despite earnest interventions, the population of the Northern White Rhinoceros remained precariously close to extinction. This instance serves as a stark reminder of the complexity of preserving species that are on the brink of oblivion, often requiring a holistic approach that extends beyond technology.

Species That Survived Due to Human Intervention: Conversely, the case of the California Condor exemplifies how strategic human intervention can transform the trajectory of a species on the verge of collapse. During the 1980s, the California Condor population plummeted due to habitat loss, lead poisoning, and other threats. Swift action was taken: conservationists launched a captive breeding program, rescuing the remaining wild condors for captive breeding efforts. This meticulous endeavor encompassed not only the reproduction of the species but also comprehensive management of the reintroduction process. Over time, the population rebounded impressively. In the last few years, the once-decimated population exceeded 400 individuals, and some were successfully reintroduced to their natural habitat. This triumph showcases the pivotal role that human intervention can play in reversing the course of species decline and reaffirms the value of our commitment to conservation.

In conclusion, these divergent scenarios underscore the urgency and complexity of preserving Earth's biodiversity. While challenges persist, innovative interventions and comprehensive approaches offer hope for endangered species. The balance between human intervention and the intrinsic resilience of nature represents an evolving narrative that holds the key to our shared future

Presented Solution:

The Fauna Rescue Blockchain!

Introducing the Fauna-Rescue-Blockchain, a groundbreaking system revolutionizing wildlife conservation through advanced blockchain technology!

Addressing Environmental Challenges through Innovation

- **Global Warming:** The planet faces a pressing challenge as rising temperatures disrupt ecosystems, impacting delicate balances and threatening countless species.

- **Alarming Species Loss:** Biodiversity decline accelerates, putting numerous plants and animals at risk of extinction, raising urgent calls for intervention.

- **Harnessing Blockchain:** Amidst these crises, technology emerges as a powerful ally. Blockchain, with its transparency and security, offers unprecedented possibilities for conservation efforts.

Join us as we delve into the intersection of environmental urgency and technological innovation, exploring how blockchain can play a pivotal role in preserving our planet's rich tapestry of life.

Features of the Blockchain Solution:

- **Self-Sovereign Identity (SSI) Access:** Unveiling a new era of security and privacy, the system employs SSI for personalized access to the blockchain, ensuring controlled and individualized engagement.

- **Provenance Tracking**: Every decision and directive is meticulously recorded, offering an unalterable trail of actions taken, including timing and specifics such as medication administration.

- **Immutable Action Records:** The blockchain establishes a transparent record of all involved parties, ensuring accountability and trust by documenting each contributor's actions, such as medication administration.

- **Tailored Records for Diverse Users:** From veterinarians to researchers, medical students to environmentalists, the system generates tailored records, catering to individual requirements for research, analysis, and holistic engagement.

- **Enhancing Survival Rates:** By providing a comprehensive digital ecosystem, the Fauna-Rescue-Blockchain significantly improves the survival rates of vulnerable species. Through precise data and accessible information, species that faced potential loss are now offered renewed hope for survival.

Experience the power of technology harnessed for a noble cause. The Fauna-Rescue-Blockchain redefines conservation by empowering stakeholders, fostering transparency, and bolstering the preservation of our precious biodiversity.

Features of the Supporting Monitored Terrarium - Prototype

Our prototype presents a holistic solution for maintaining and replicating ecosystems for rescued life forms. Key features include:

- **Ecosystem Replication:** Our system accurately mimics a range of environments, from humid-rainy to cold-dry, ensuring optimal conditions for diverse species.

- **Day/Night Cycle Control:** Monitors and regulates natural light cycles, fostering circadian rhythms crucial for the well-being of the organisms.

- **Recording and Analysis**: Equipped with cameras and microphones, data is gathered not only for record-keeping but also for veterinary diagnostics, research, and refining survival strategies.

- **Specialized Dispensers:** Automated water and food dispensers cater to species that require minimal human intervention for survival, aiding delicate ecosystems.

- **Enclosure Safety:** For species sensitive to isolation, our design emphasizes enclosure security, reducing stress and promoting longevity.

- **Efficient Waste Management:** Simplified waste collection systems and bedding provisions cater to reptilian species' unique needs, ensuring their survival.

- **IoT-Enabled and Blockchain Secured:** Incorporating IoT devices and a private blockchain, we enhance cost-effective safety and communication for tanks and enclosures.

- **Environmental Monitoring:** Beyond direct life form observation, our system indirectly monitors rescued organisms by vigilantly tracking surrounding conditions. Our prototype offers a comprehensive, adaptable, and cost-effective solution for conserving diverse life forms, addressing challenges with innovation and care.

Our prototype provides a comprehensive solution for replicating ecosystems and ensuring well-being. Features include environment replication, circadian rhythm regulation, data recording for diagnostics and research, automated dispensers, enclosure safety, waste management, IoT and blockchain integration, and vigilant environmental monitoring. It's an innovative and cost-effective approach for diverse species conservation.

Why Is Blockchain Necessary for this Solution?

Blockchain emerges as a critical tool in our conservation efforts, offering a range of advantages that directly address the challenges we face:

- **Transparency:** The hallmark of blockchain lies in its transparent, tamper-proof ledger. It ensures that all authorized stakeholders can access accurate and up-to-date information, fostering collaboration and accountability.

- **Decentralized Networking:** By distributing data across a network of nodes, blockchain reduces reliance on a single point of control. This robust networking solution minimizes the risk of data loss and system failure.

- **Enhanced Security:** Blockchain's cryptographic encryption and consensus mechanisms create a formidable defense against data manipulation and unauthorized access. This heightened security layer helps safeguard critical information and sensitive species data.

- **Resilience Against Attacks:** Distributed nature of blockchain means attackers would need an impractical amount of resources to breach the system. Its resistance to single points of failure makes it a tough target for malicious activities.

- **Efficiency and Uptime:** Blockchain's decentralized architecture inherently reduces downtime risks. With state-of-the-art networking, it ensures that our conservation efforts continue uninterrupted, maximizing the impact of our interventions.

- **Immutable Records:** Once data is recorded on the blockchain, it cannot be altered without consensus from the network. This immutability reinforces the integrity of crucial information, reinforcing decision-making.

- **Interoperability:** Blockchain facilitates secure data sharing across different organizations and systems, enabling collaborative research and holistic approaches to conservation.

In a world grappling with complex environmental challenges, blockchain emerges not just as a choice, but as a necessity. Its features directly align with our goals, fortifying our commitment to safeguarding biodiversity and addressing the urgent issues our planet faces.

Why Avalanche?

- **Scalability:** Since the project involves a large number of sensors, data points, and transactions, Avalanche's focus on scalability might be beneficial. The ability to handle a high transaction throughput can be advantageous in systems requiring real-time data collection and analysis.
- **Speed:** Avalanche aims to achieve fast transaction finality, which could be advantageous for applications that demand rapid response times, such as environmental monitoring and automated dispensing in the terrarium.
- **Decentralization:** Avalanche places an emphasis on maintaining decentralization even as the network scales. If maintaining a distributed and secure network of nodes is a critical requirement for your project, Avalanche's approach to consensus might align well.
- **Energy Efficiency:** Some newer blockchain platforms, including Avalanche, aim to be more energy-efficient compared to traditional Proof-of-Work systems. This could be important if sustainability and minimizing energy consumption are key considerations in your project.
- **Developer-Friendly:** Avalanche provides a platform for building custom blockchain applications. If you require flexibility in designing and implementing features specific to your project, Avalanche's developer tools could be beneficial.

There are many possible reasons to choose avalanche; from its consensus mechanism to its similarity to solidify for development to its overall ability to handle transactions at lightning fast pace.

Let us dig more into what makes its a good choice for the use case further below:

How will Its Consensus Mechanism Help?

Avalanche's consensus mechanism, known as the Avalanche consensus protocol, offers several potential benefits. Here's how the Avalanche consensus mechanism i believe may benefit this current use-case:

- **High Throughput:** Avalanche is designed to achieve high throughput, meaning it can process a large number of transactions per second. For your project, which involves real-time data collection, monitoring, and potentially numerous interactions (such as dispensing food and water), a high throughput can ensure that data is processed promptly. This is crucial for maintaining accurate and up-to-date information within the terrarium environment.

- **Low Latency:** Avalanche aims to provide low latency, which refers to the time it takes for a transaction to be confirmed and added to the blockchain. This feature can be advantageous for scenarios where timely responses are required, such as adjusting environmental conditions within the terrarium in response to changing conditions.

- **Quick Finality:** Avalanche offers quick transaction finality, meaning that once a transaction is added to the blockchain, it is considered confirmed and irreversible. In your project, where precise actions like dispensing food or medication need to be executed reliably, quick finality ensures that the instructions are carried out without delays or uncertainties.

- **Efficient Resource Utilization:** Avalanche's consensus mechanism is designed to be more energy-efficient compared to traditional Proof-of-Work (PoW) systems. This efficiency can be advantageous for projects that prioritize sustainability and want to minimize energy consumption, especially considering the long-term operation of a monitored terrarium.

- **Scalability:** If your project envisions a network of multiple terrariums or monitored environments, Avalanche's scalability can support the simultaneous management and monitoring of these units. As you scale up the deployment of terrariums, Avalanche's ability to maintain high throughput and low latency can ensure that the system remains responsive and effective.

- **Decentralization:** The Avalanche consensus protocol maintains decentralization by allowing nodes to reach consensus independently and participate in the network's decision-making process. This aligns well with projects like yours, where maintaining a decentralized network can enhance security, data integrity, and reliability.

Avalanche's consensus mechanism holds the potential to significantly benefit the current use-case: Swift Response to Changing Conditions, Efficiently Processes Real-time Data, Energy-efficient Sustainability & Seamless Scaling and Decentralization

Drawbacks and Solutions for the Supporting Monitored Terrarium - Prototype

- ***Limited Adaptability*** The prototype's predefined environmental ranges might not encompass all species' requirements. Some organisms may need highly specific conditions that fall outside the preset parameters.
  Solution: Incorporate modularity and customization. Implement adjustable components that allow users to fine-tune conditions based on species-specific needs, providing a wider range of environments.

- **Technological Dependency** Overreliance on automated systems could hinder the development of natural behaviors and instincts among the rescued life forms, potentially impacting their long-term survival in the wild.
  Solution: Introduce periodic manual interactions. Schedule supervised human engagements to encourage natural behaviors, minimize dependency, and maintain a balance between technology and instinct.

- **Privacy and Ethical Concerns** Continuous monitoring raises questions about privacy for the rescued organisms. Recording their activities and health data might infringe upon their natural rights.
  Solution: Implement privacy modes and data control. Design the system to activate monitoring only for research or health diagnostics, respecting the organisms' rights to privacy during routine activities.

By acknowledging and addressing these challenges, the envisioned solutions can be further enhanced to establish resilient, efficient, and ethically conscientious approaches towards the preservation of biodiversity and the conscientious handling of sensitive data.

Possible Drawbacks and Solutions for the Fauna-Rescue-Blockchain

- **Data Accessibility** SSI-based access might limit information availability to certain stakeholders, potentially hindering collaborative efforts or research involving a wider network.
  Solution: Establish tiered access levels. Allow varying degrees of data access based on roles and responsibilities, enabling collaboration while safeguarding sensitive information.

- **Learning Curve** Introducing a new blockchain-based system could pose challenges for less tech-savvy users, hindering adoption and effective utilization.
  Solution: Provide comprehensive training and user-friendly interfaces. Develop tutorials and intuitive interfaces to facilitate easy onboarding and ensure that even non-technical users can effectively engage with the system.

- **Data Accuracy and Manipulation** While blockchain ensures immutability, input errors or malicious intent during data entry could still lead to inaccurate records, compromising decision-making.
  Solution: Implement verification mechanisms. Integrate cross-referencing or validation steps to ensure data accuracy, and allow for oversight or corrections in case of unintentional errors.

By proactively addressing these potential drawbacks, the proposed solutions can be refined to create more robust, effective, and ethically sound approaches to wildlife conservation and data management.

How Will Scalability be handled? Is there a plan in place?

In order of how the techniques will be used; they are as follows:

- **Simplified and Advanced Data Compression Techniques:** From basic hashing mechanisms to exploring advanced data compression methods, the aim is to efficiently store and transmit data within the blockchain. These techniques involve condensing data, improving storage capacity, and reducing transaction costs. Through compression algorithms, redundant data is minimized, optimizing space utilization while ensuring data integrity. By leveraging various methods such as Huffman coding, delta encoding, and Run-Length Encoding, blockchain systems can achieve higher efficiency in data representation. Furthermore, adopting novel techniques like Merkle-Patricia Trie can offer a balance between simplicity and advanced data compression for different data types.

- **Pruning for Enhanced Efficiency:** Pruning involves the elimination of unnecessary data from nodes, making blockchain systems more efficient and compact. Older and redundant transaction data, which doesn't affect the current state, can be discarded while retaining only vital transaction history. By implementing pruning mechanisms, blockchain networks can drastically reduce storage requirements, making them more accessible to nodes with limited resources. This process of selective data retention maintains the integrity of the ledger while optimizing the operational efficiency of the blockchain. This practice becomes particularly relevant as blockchain networks grow in size and complexity, ensuring that historical data doesn't hinder network performance.

- **Leveraging Parallel Processing for Throughput:** Parallel processing entails breaking down tasks into smaller units that can be processed simultaneously, leading to increased throughput and reduced processing time. By utilizing concurrency, blockchain networks can handle more transactions simultaneously, improving the overall efficiency and scalability of the system. Implementing parallel processing can involve techniques like sharding and multi-threading, allowing different parts of the blockchain to process transactions in parallel. This approach enhances the network's capacity to handle higher transaction volumes, making it more adaptable to the demands of a growing user base.

- **Off-Chain Processing for Selective Data Handling:** Certain data processing tasks that don't require on-chain execution can be performed off the blockchain. Off-chain processing involves performing computations, validations, and storage operations outside the main blockchain, reducing the load on the blockchain itself. This can be achieved through sidechains, state channels, and other techniques. By segregating less critical processes off the main chain, blockchain networks can optimize resource utilization, enhance transaction speed, and minimize fees. This strategy is particularly beneficial for activities like microtransactions, where on-chain execution might be impractical due to associated costs and delays.

- **Hybrid Solutions for Versatility:** Hybrid solutions involve combining multiple techniques to address various aspects of blockchain scalability. By tailoring the solution to the specific use-case at a given time, blockchain networks can strike a balance between simplicity and advanced scalability mechanisms. For instance, a hybrid approach might involve utilizing sharding for improving throughput while also employing pruning and compression to manage storage requirements. This flexibility allows blockchain networks to adapt to different demands, ensuring optimal performance for a diverse range of applications.

To scale blockchain networks effectively, strategies ranging from data compression techniques to hybrid solutions are employed. Simplified and advanced data compression methods, such as hashing and compression algorithms, optimize storage and transaction costs. Pruning eliminates redundant data, enhancing efficiency and reducing storage requirements. Parallel processing, by breaking down tasks and enabling concurrent execution, boosts throughput and reduces processing time. Off-chain processing for non-essential tasks minimizes the load on the main blockchain. Hybrid solutions combine approaches like sharding, pruning, and compression, allowing networks to adapt and optimize based on specific use-cases. These techniques collectively enhance blockchain scalability and efficiency while accommodating diverse application needs.

What are the Long-Term Goals & Potential for Further Expansion ?

The long-term objectives of our project extend beyond immediate conservation efforts, aiming to establish comprehensive protocols that can effectively safeguard multiple species on the brink of extinction. Our mission is to refine and perfect the methods implemented in our prototype, fostering a higher success rate in preserving biodiversity. By continually iterating and learning from each case, we aspire to provide a fighting chance for an increasing number of species, ensuring that they are no longer on the brink of extinction.

- **Expansion into the Metaverse:** An exciting prospect lies in the integration of our conservation efforts with the metaverse. This innovative approach would enable engagement and interaction not only with experts and enthusiasts but also with young learners who can actively participate in the process of species preservation. By creating immersive experiences within virtual environments, we can raise awareness, educate, and promote collective responsibility for biodiversity conservation. This integration could potentially inspire the next generation of conservationists, fostering a deep connection with the natural world.

- **Augmented Reality (AR) Enhancement:** To further elevate the interactive experience, we envision incorporating AR modules that run on the server side. This technology would allow users to engage with the ecosystem through AR interfaces without causing any disturbance to the life forms. AR overlays could provide valuable insights and information about the organisms' behaviors, habitats, and ecological roles. This real-time augmented experience enhances the educational aspect of the project and encourages active participation from users without compromising the well-being of the species.

- **Towards Self-Sustenance:** A critical facet of our long-term strategy involves designing a self-sustaining model for the terrariums. We recognize that unforeseen events, such as extended power failures, could impact the functionality of the tanks. To address this, we aim to develop systems that enable the terrariums to operate autonomously for extended periods. Incorporating renewable energy sources, efficient water and resource management, and fail-safe mechanisms can ensure that the life forms within the tanks remain protected even in challenging situations. This self-sustaining approach aligns with our commitment to providing a stable environment for rescued organisms over the long term.

In conclusion, our long-term vision transcends the initial scope of conservation efforts. We aspire to evolve our methods, integrate cutting-edge technologies, and establish sustainable practices that not only rescue species from the brink of extinction but also engage a wider audience in the conservation journey. By venturing into the metaverse, enhancing interactions with AR, and pursuing self-sustaining models, we aim to create a holistic platform that bridges the gap between technology, education, and biodiversity preservation. Through these endeavors, we hope to contribute meaningfully to the protection and revival of delicate ecosystems, fostering a future where humans and nature coexist harmoniously. Our commitment to innovation and compassion drives us to continually push the boundaries of conservation and forge a path towards a more sustainable and interconnected world.

Other Uses of the Tech Stack:

- **Remote Medical Assistance:** The Fauna-Rescue-Blockchain and Supporting Monitored Terrarium tech stack presents an innovative solution beyond conservation efforts. In locations like ships and remote areas where consistent access to essential medical resources is limited, this technology can be adapted to monitor and sustain critical medical supplies. By integrating IoT devices and blockchain infrastructure, real-time monitoring of medicine conditions, supply levels, and environmental factors can ensure the availability of life-saving treatments. This adaptability bridges gaps in healthcare accessibility, particularly in scenarios where immediate medical assistance is challenging due to geographical isolation.

- **Biodiversity Preservation in Remote Areas:** The versatility of the tech stack extends to conserving species in areas devoid of established infrastructures. Remote regions often lack resources for protecting species from extinction. By implementing the Fauna-Rescue-Blockchain and Supporting Monitored Terrarium concept, a remote-friendly ecosystem can be created. This ecosystem safeguards species by replicating their natural habitats and employing IoT devices and blockchain technology for continuous monitoring. This solution is particularly valuable for remote locations with unique biodiversity, ensuring the survival of endangered species in regions where traditional conservation methods face limitations.

Beyond species conservation, the adaptable Fauna-Rescue-Blockchain and Supporting Monitored Terrarium tech stack holds immense potential in areas with limited medical access, enabling remote medical assistance, and addressing the preservation needs of species in remote locations. This multifaceted approach demonstrates the technology's wider impact on healthcare accessibility and biodiversity preservation in challenging and remote settings.

What is the Parts List Looking Like?

A small guide on whats needed for parts vs features and can be handled step by step as the product develops in multiple stages

Fauna-Rescue-Blockchain: (Parts List)
Self-Sovereign Identity (SSI) Access: ● SSI Software/Application ● SSI-Enabled Hardware (Biometric Scanners, Smart Cards) Provenance Tracking: ● RFID or QR Code Tags (for Physical Objects) ● Timestamping Modules Immutable Action Records: ● Blockchain Nodes (Computing Hardware) ● Smart Contracts (to Record Actions) Tailored User Records: ● User Access Management Software ● Access Control Hardware (Biometric Scanners, RFID Readers) Enhancing Survival Rates: ● Species-Specific Equipment (Habitat Replication Tools, Medical Supplies) Verification Mechanisms: ● Data Validation Software ● Cross-Referencing Modules Privacy Modes and Data Control: ● Privacy Management Software ● Encryption Modules Tiered Access Levels: ● Access Control Systems ● User Role Management Software

Supporting Monitored Terrarium:

Environmental Replication:

- Humidity Control System
- Temperature Control Unit
- Light Management System

Day/Night Cycle Control:

- Automated Lighting System
- Light Sensors

Recording and Analysis:

- Cameras (for Visual Recording)
- Microphones (for Audio Recording)

Specialized Dispensers:

- Automated Water Dispenser
- Automated Food Dispenser

Enclosure Safety:

- Secure Locking Mechanisms
- Temperature and Humidity Sensors

Efficient Waste Management:

- Waste Collection Trays
- Bedding Materials

IoT and Blockchain Integration:

- IoT Devices (Sensors, Connectivity Modules)
- Microcontrollers (for Data Collection and Transmission)
- Private Blockchain Infrastructure

Environmental Monitoring:

- Environmental Sensors (Light, Temperature, Humidity)

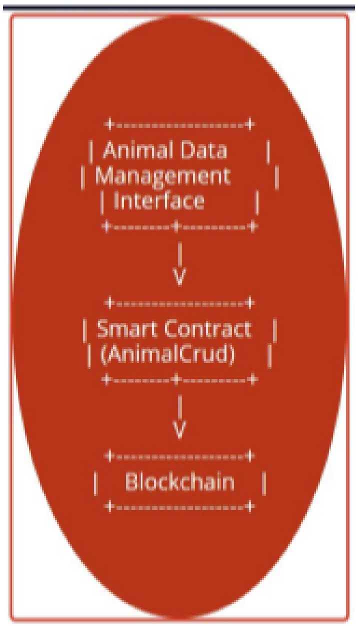
TERRAIN PARTS:
DHT22, ESP32 (CAM+MIC) + SD CARD, Heat Lamp - Arduino Controlled, Day and Night Lamps also arduino controlled. **Water food dispenser** - Tanks based, both are raspberry pi controlled, locking mechanism for the enclosure's safety - also pi controlled. **Sensors** (Like **HSM-04** for motion sensing, **DHT22** - for temp and humidity, food and water dispenser have empty or not sensors(weighing and motion sensors re-purposed), **L298M Motors, Piezo Unit**, Garbage Collection via specialized motors, etc.

OVERALL TYPES OF PARTS:
RFID, **BIOMETRIC SCANNER**, **SMART CARDS**, **QR CODES**, **ACCESS MANAGEMENT** SOFTWARE (Like INDY), 3rd Party/IN-House **Inventory Mangement** (as a feature), **ANTI VIRUS**, **PRIVACY ENHANCERS (BLOCKERS**, **PROXY**,etc.)

The comprehensive parts list encompasses a range of components tailored for the Fauna-Rescue-Blockchain and the Supporting Monitored Terrarium projects. It involves diverse elements, including cutting-edge technologies such as Self-Sovereign Identity (SSI) access tools, provenance tracking devices like RFID and QR code tags, and the integration of immutable action records through blockchain nodes and smart contracts. The Terrarium parts include various sensors, microcontrollers, and control mechanisms for maintaining optimal environmental conditions. Additionally, the use of biometric scanners, access control systems, and encryption modules ensures privacy and security. Overall, these parts collectively contribute to the creation of intricate ecosystems, blending hardware and software, to enhance survival rates, verify actions, and uphold privacy within a holistic framework of conservation and technology integration.

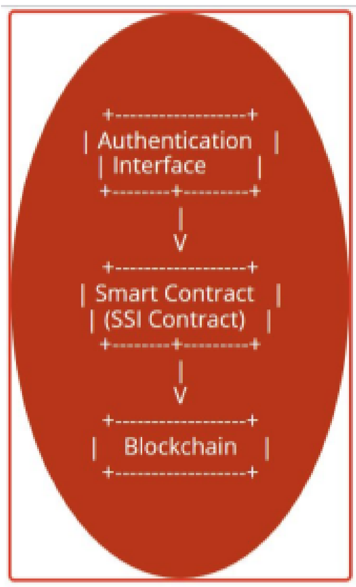
Data Flow Diagrams

Data Flow Diagram for Animal CRUD Operations:



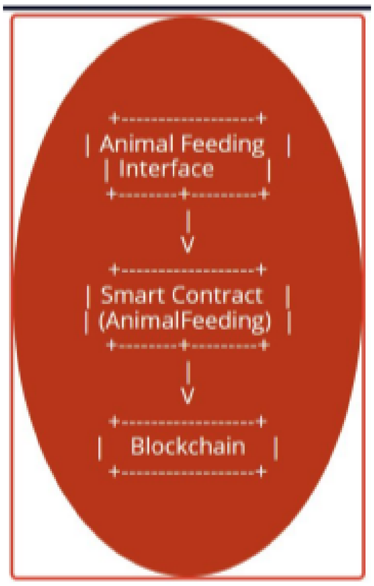
- Users interact with the "Animal Management Interface" to perform CRUD operations (Create, Read, Update, Delete) on animal data.
- The interface communicates with the "Smart Contract" deployed on the blockchain, which handles CRUD operations.
- The "Blockchain" contains the AnimalCrud smart contract to manage animal data operations.
- The smart contract processes transactions and updates the data in the blockchain.

Data Flow Diagram for User Authentication (SSI):



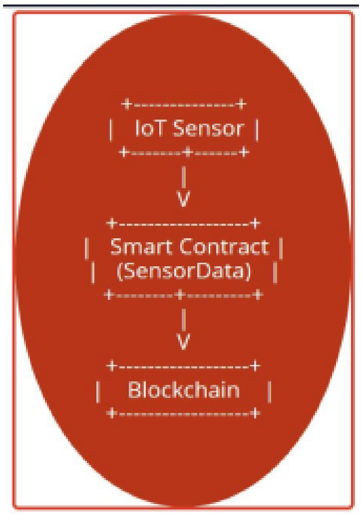
- Users interact with the "Authentication Interface" to initiate actions requiring authentication (e.g., feeding).
- The "Smart Contract" deployed on the blockchain manages the authentication process using SSI.
- The "Blockchain" contains the SSI-related smart contract to authenticate users.
- The smart contract verifies the user's identity through SSI and grants permission for specific actions.

Data Flow Diagram for Animal Feeding Authorization:



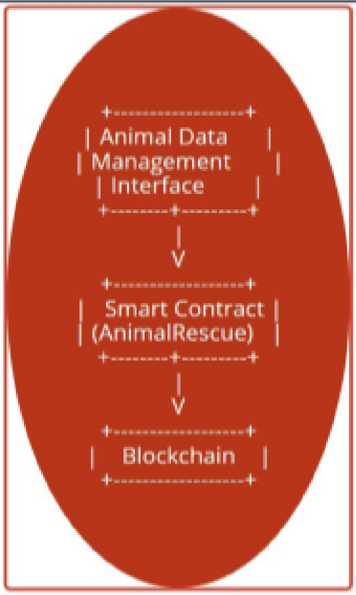
- The "Animal Feeding Interface" enables the owner to initiate feeding actions for the animal.
- The "Smart Contract" deployed on the blockchain manages the feeding authorization process.
- The "Blockchain" contains the AnimalFeeding smart contract to control feeding authorization.
- The smart contract verifies the owner's authorization and triggers the feeding process.

Data Flow Diagram for IoT Sensor Data:



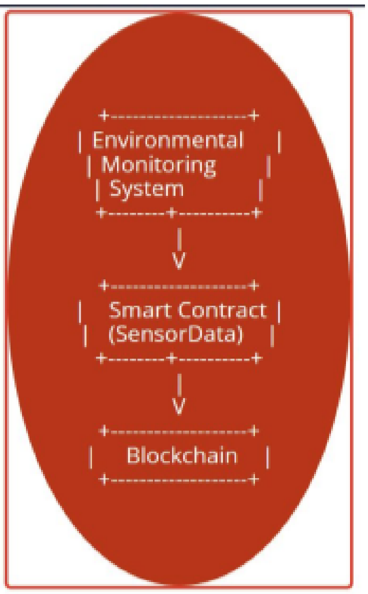
- The "IoT Sensor" periodically collects sensor readings (e.g., temperature, humidity) from the terrarium environment.
- The "Smart Contract" deployed on the blockchain receives sensor readings through a function call.
- The "Blockchain" contains the SensorData smart contract to store sensor readings and update times.
- The smart contract updates the sensor data and timestamps on the blockchain.

Data Flow Diagram for Animal Data Management:



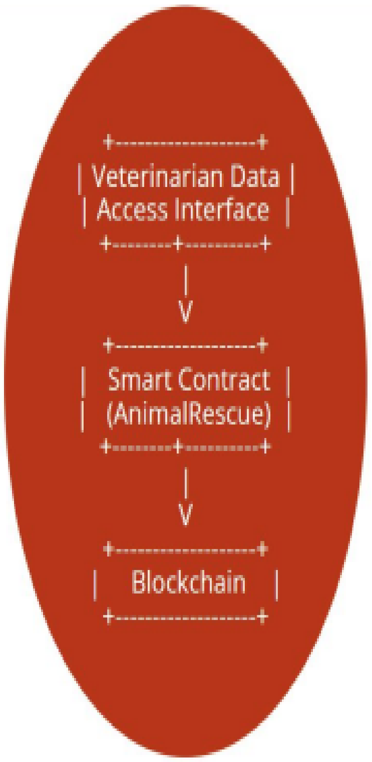
- Users interact with the "Animal Data Management Interface" to add, retrieve, and update animal data.
- The interface communicates with the "Smart Contract" deployed on the blockchain, which stores and manages animal data.
- The "Blockchain" contains the AnimalRescue smart contract to manage animal data.
- The smart contract processes transactions and updates the data in the blockchain.

Data Flow Diagram for Environmental Monitoring:



- The "Environmental Monitoring System" collects data from various sensors (temperature, humidity, light, etc.).
- The system communicates with the blockchain smart contract to update sensor readings.
- The "Smart Contract" updates sensor data on the blockchain, ensuring transparency and data integrity.

Data Flow Diagram for Veterinarian Data Access:



- The "Veterinarian Data Access Interface" allows authorized veterinarians to access animal health data.
- The interface communicates with the blockchain smart contract to retrieve relevant data.
- The "Smart Contract" validates access rights and provides the requested data securely from the blockchain.

CODE + Explanation

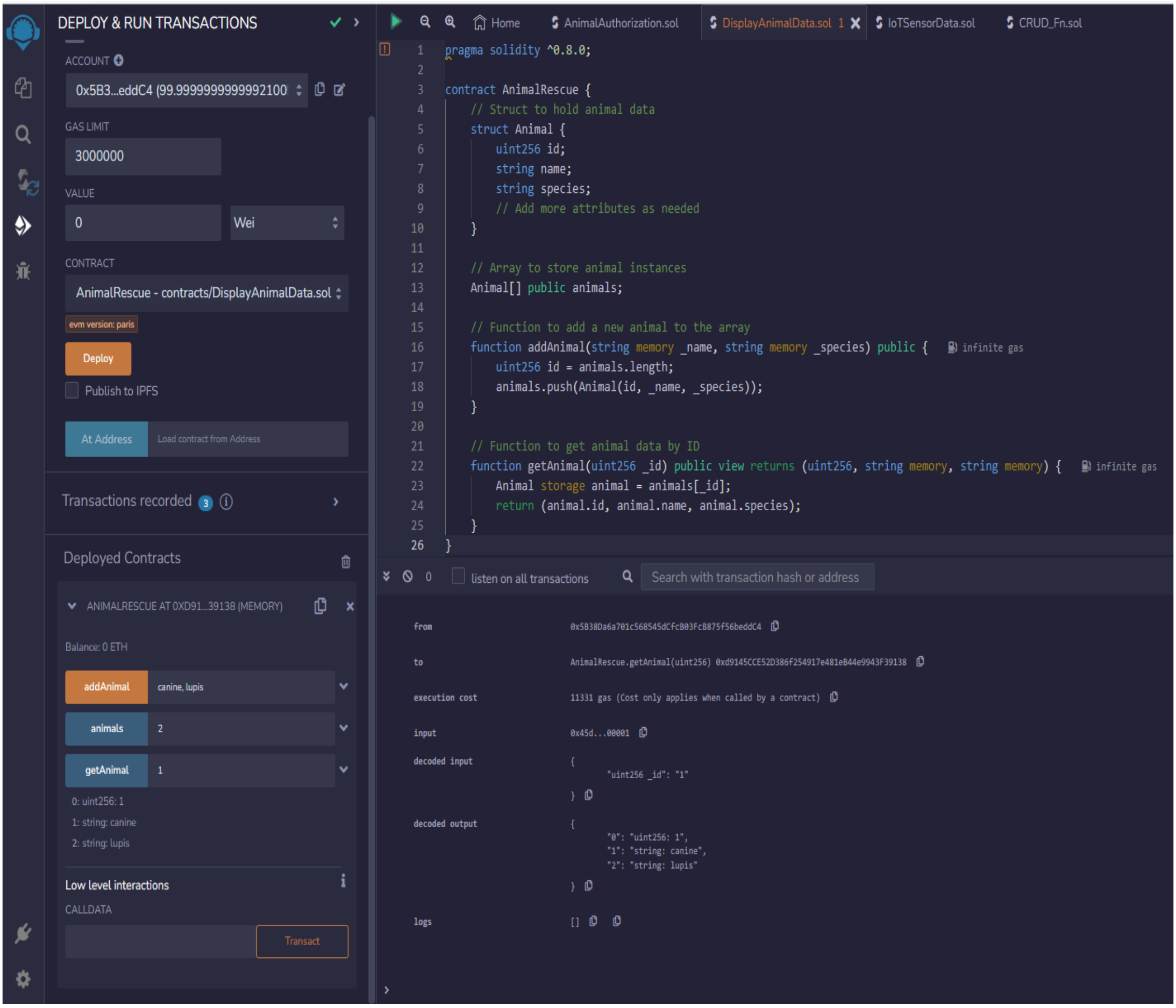


Image 1 - GetAnimalData.sol - also on github as Display Animal Data

In the Image Above; We see that Canine Lupis (Genus, Species) Is added; Their ID is 1; And that is being called by getAnimal.
So first we added the animal and now we are displaying the animal.

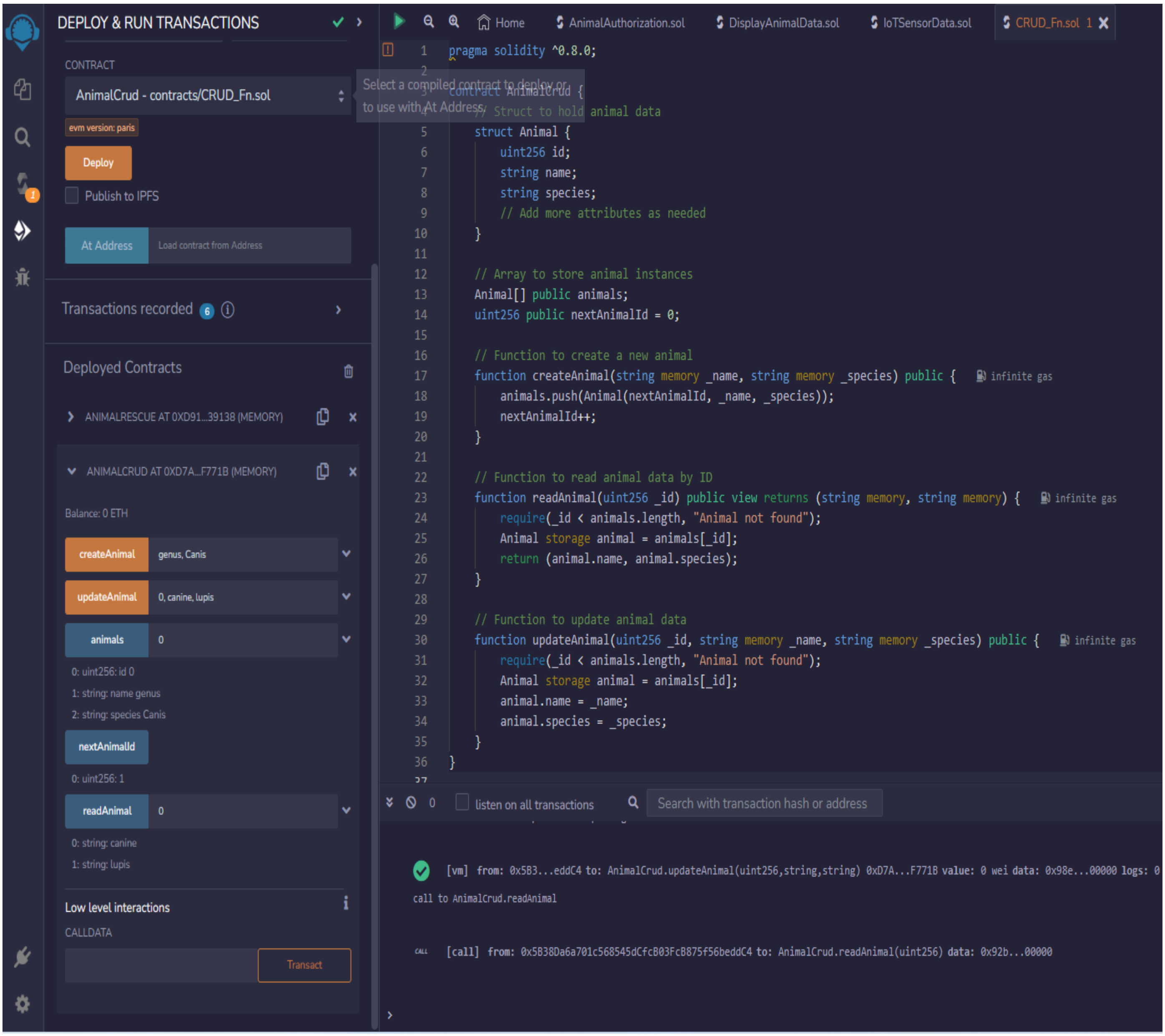


Image 2 - CRUD.Sol - *also on github titled CRUD 1*

Here we see the CRUD Functions
We have added Genus Canine with **create animal**
Then we called **next animal ID**
Then we called **animals** to view all animals
Then we called **read animal** to view value on the blockchain
Then we updated the value to canine lupus and we can see called into the next image.

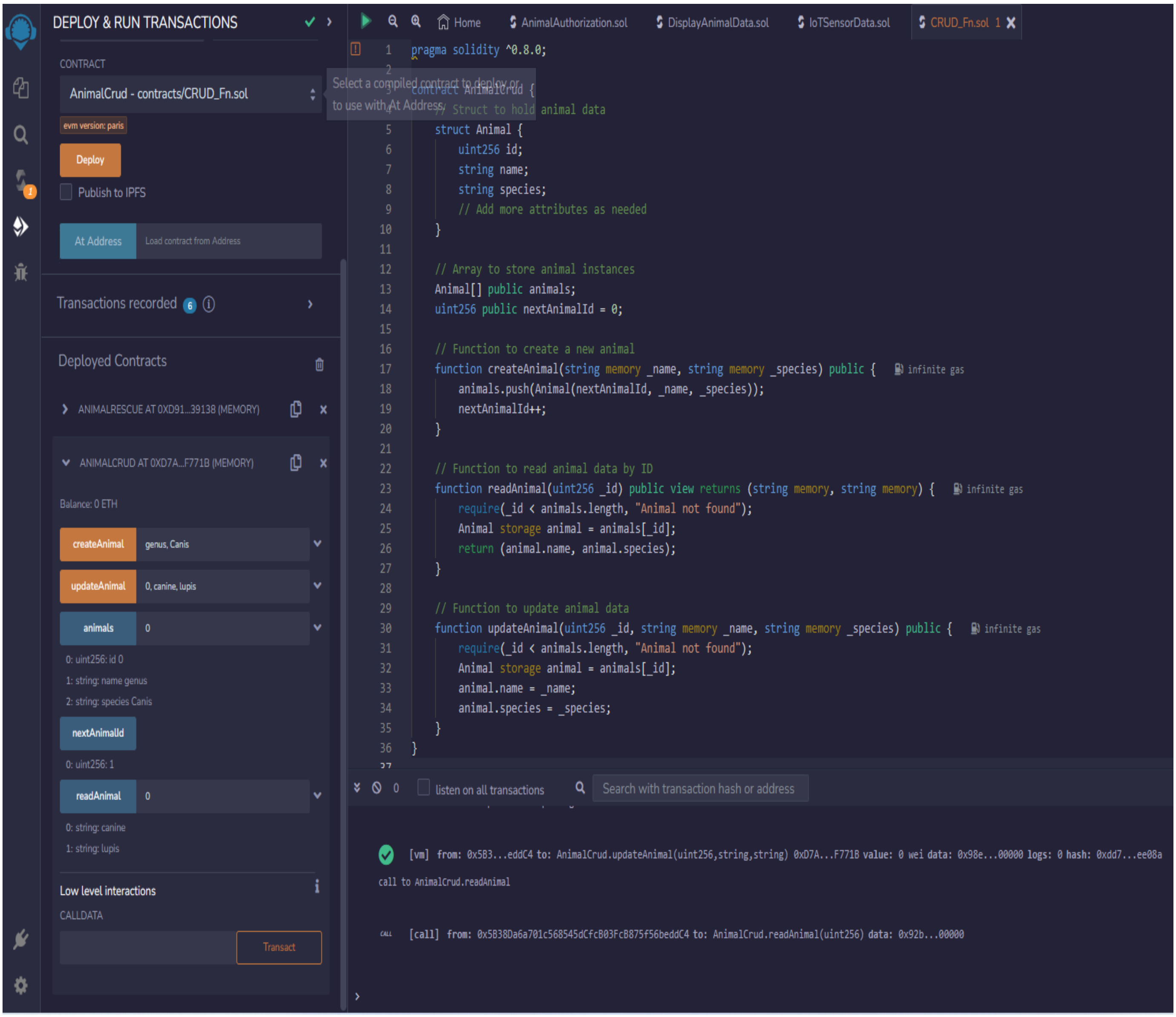


Image 3 - CRUD.Sol - also on github titled CRUD - 2.

Here we can see that the **read animal** gives the updated value
Therefore we can conclude that the **update animal** works!

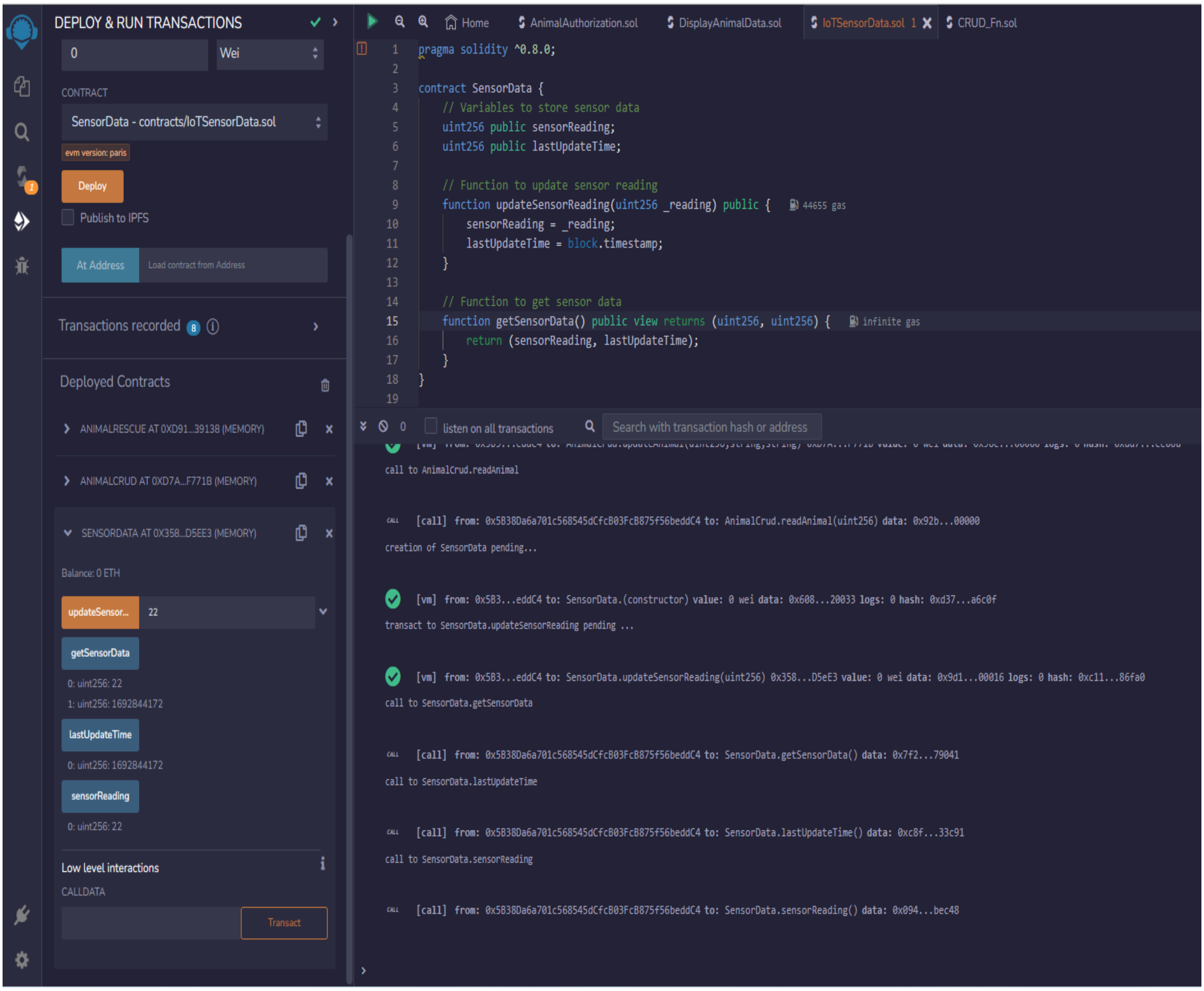


Image 4 - IoTSensorData.sol - also on github as IoT - Get Sensor Data

Here we can see that the IoT Communication takes place

Firstly we use **updateSensor** to update the value(will be called via IoT Device; Mock data for demo purposes)

Then we can see from **getsensordata** when the value was added and what it was

We can verify the getsensordata params by calling **lastUpdateTime** and check if the times match.

We can also use **sensorreading** as a param to get the value via ID

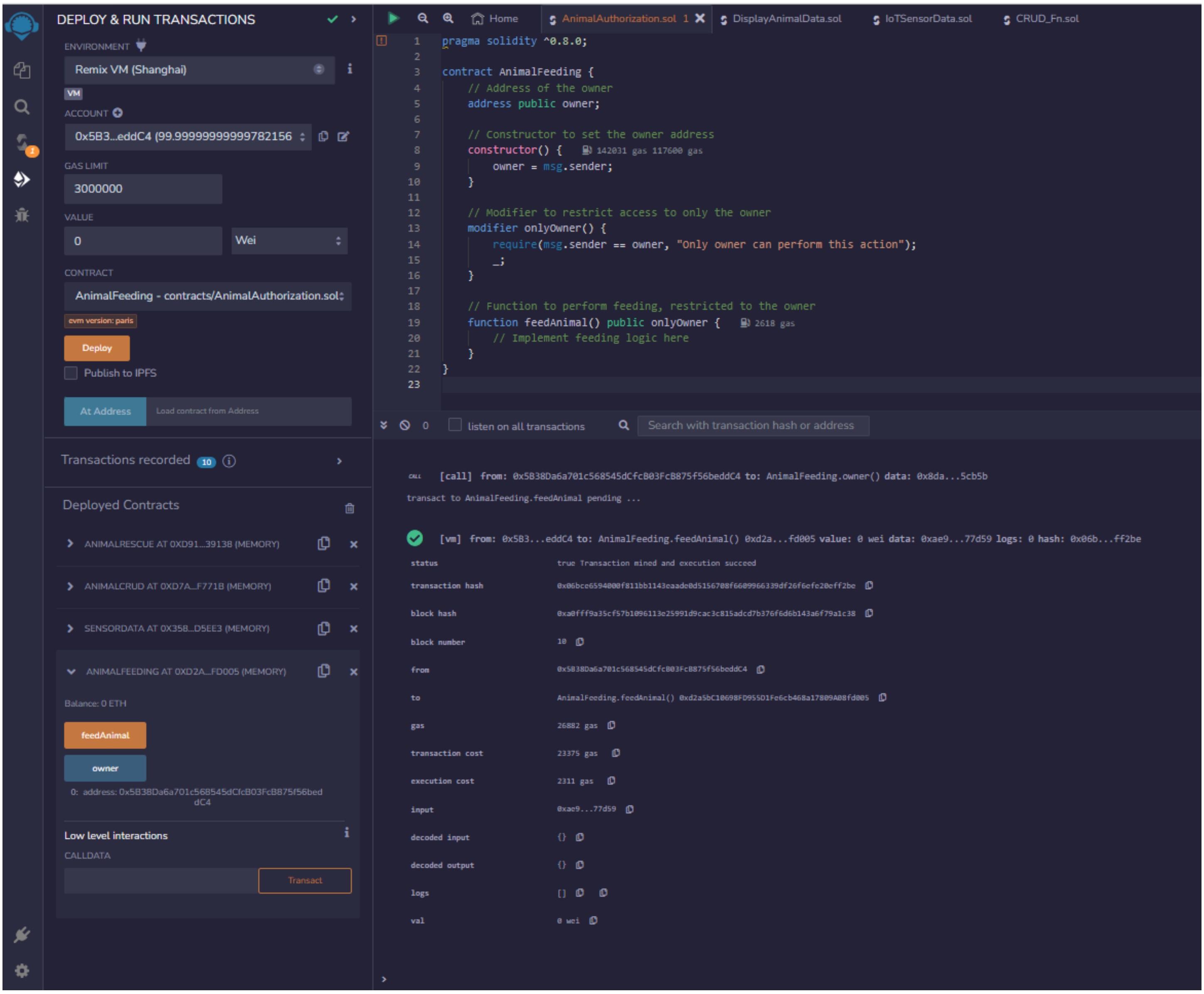


Image 5 - Animalfeed.sol - also on github as Successful When Owner Feeding Animal

Can only be successful when owner calls it; tested it; we can see owner account below.

We will now change the owner by changing the account and then bring it back to the same account to check feeding capabilities.

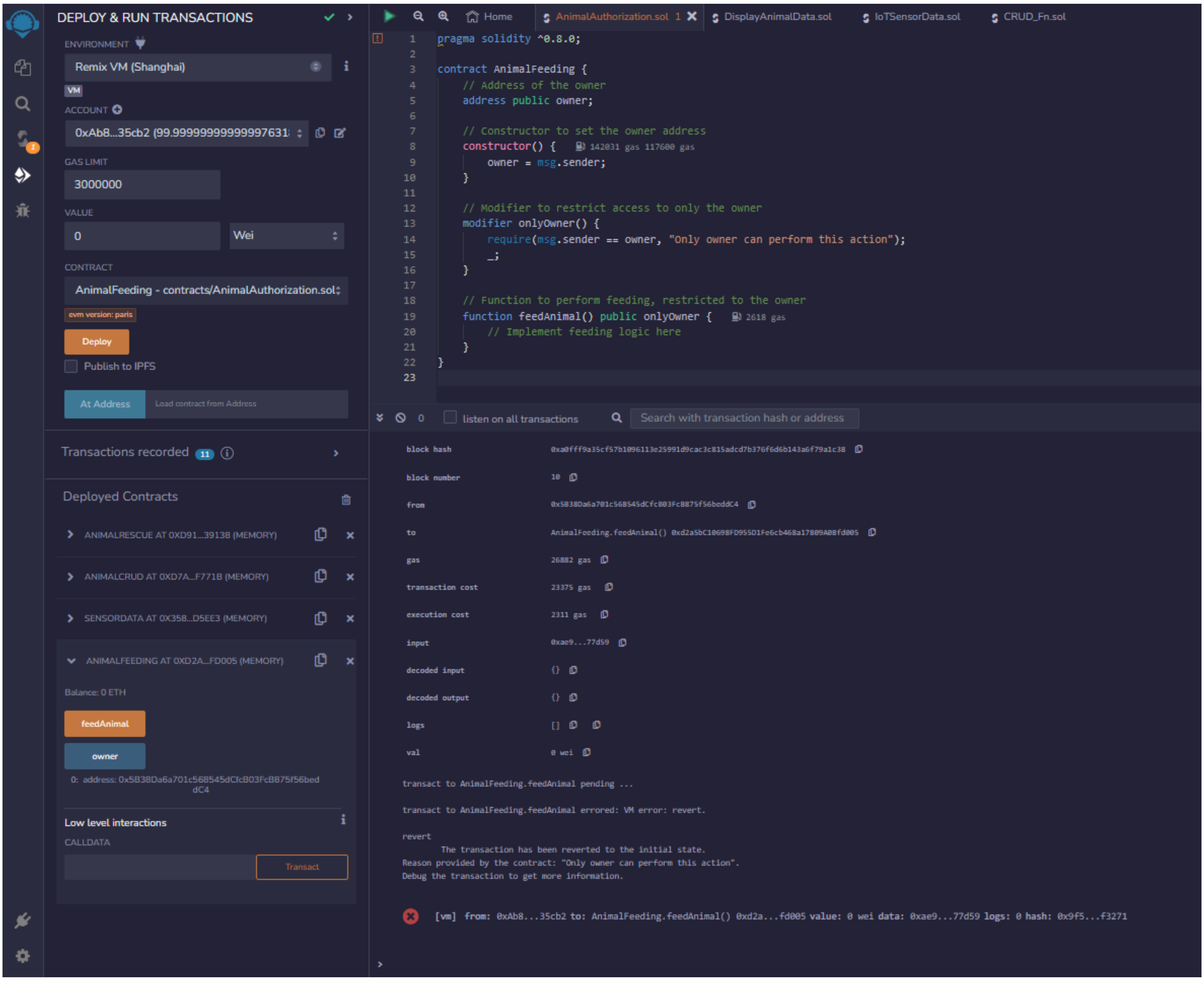


Image 6 - Animalfeed.sol - also on github as Unsuccessful upon changing owner

We can see changing the owner leads to a failed transaction

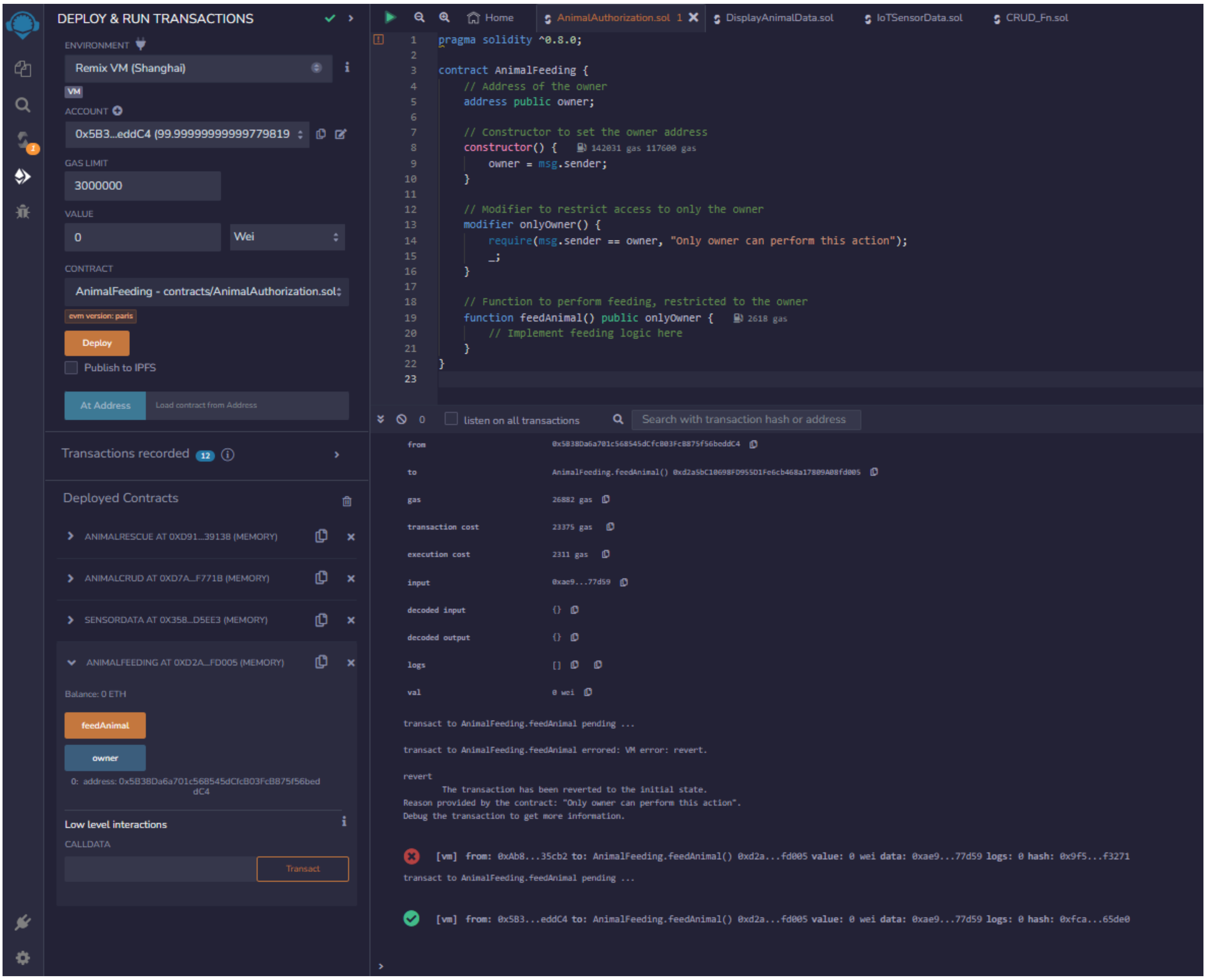


Image 7 - Animalfeed.sol - also on github as Rechanging to owner ac allows animal feeding

We can see here that we changed the account back to the owner account and we can see that the animal feed is successfully taking place again

Animal Rescue Web Application - Installation Guide

Thank you for choosing the Animal Rescue web application. Follow these instructions to set up and run the application on your local machine.

Prerequisites

Before you begin, ensure you have the following installed:

Node.js (includes npm)

Git (optional, for cloning the repository)

Installation

To install and run the Animal Rescue web application, follow these steps:

Clone the Repository (or Download ZIP)

If you have Git installed, open your terminal and run:

git clone <repository_url>

Alternatively, you can download the ZIP and extract it.

Install Server Dependencies

In the terminal within the server directory, run:

Here is the code below:

```
npm init -y
npm install express body-parser
npm install react-router-dom axios
npm install concurrently
```

In the terminal within the root directory, run:

```
npm start
```

This command will start both the server and the client simultaneously. Access the application by opening a web browser and navigating to http://localhost:3000.

Conclusion

Amidst a world grappling with declining species, the fusion of technology and compassion presents a unique opportunity to address the crisis of extinction. The Fauna-Rescue-Blockchain and Supporting Monitored Terrarium epitomize this amalgamation, offering innovative solutions to safeguard species on the brink of disappearance.

Our duty to rectify past mistakes is underscored by these initiatives, which utilize technology to reverse the course of extinction. Through the incorporation of sensors and advanced devices, we create an environment that nurtures and protects endangered species. Central to this endeavor is blockchain, a secure and unchangeable record-keeping system that fosters transparency and trust. This technology ensures that actions taken and decisions made are verifiable, enhancing cooperation and accountability among stakeholders.

Avalanche (AVAX) emerges as an optimal choice due to its efficiency and speed, aligning with the real-time demands of species conservation. Its energy-conscious design complements the ethical underpinning of our initiatives. The curated parts list and proposed solutions offer a practical approach, balancing technological advancement with practical application. By employing devices such as specialized cards and machines, we replicate natural habitats and minimize human interference.

To summarize, the Fauna-Rescue-Blockchain and Supporting Monitored Terrarium epitomize the harmony between technology and compassion. We employ innovation to mend the damage wrought by human actions, ensuring the coexistence of diverse species on our planet. This approach encapsulates our collective commitment to restore, protect, and sustain the delicate tapestry of life that enriches our world.

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