

# Research on Remote Regional Collaborative Intelligence Platform Based on Blockchain

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**Abstract:** The 19th and 20th National Congresses of the Communist Party of China continued to stress the need to vigorously promote coordinated development among regions, making it an important strategic task in building a great modern socialist country in the new era. At present, the economic circle vigorously developed is based on the traditional regional cooperation based on the geographical adjacency relationship, while the regional cooperation obstacles will make the cooperation fail. Therefore, this paper builds the remote regional cooperation platform based on the virtual and real integration of game subject mirroring technology, collaborative contract execution technology of smart contract and collaborative credit management technology of blockchain, so as to realize the remote regional cooperation.

**Keywords:** Remote regional collaboration, Blockchain, Intelligent platform.

## 1. Introduction

Due to geographical restrictions, traditional regional cooperation has certain synergy barriers, which makes it difficult to achieve the synergy goal of adjacent regions. Therefore, in order to break the geographical restrictions, emerging technologies can be used to build an intelligent platform based on blockchain, map the entity region to cyberspace, and realize the same behavior between the mirror region and the entity region, so as to realize the remote cooperation of the region. This will provide a new direction for regional cooperation.

## 2. Remote Regional Collaboration Concept and Supporting Platform and Technology

### 2.1. Concept and characteristics of remote regional collaboration

#### 2.1.1. The concept of remote regional collaboration

Remote regional cooperation refers to mapping all regions willing to participate in the cooperation into the network space in the form of digital twins based on the intelligent network platform, so that an infinite number of regions can implement mutual collaborative development across the spatial distance limit. The essence of remote regional cooperation is to eliminate the distance barrier between regions by using intelligent network platform, so that there is no difference between "distant relatives" and "near neighbors" of regional cooperation, so as to expand the number of participants in regional cooperation infinitely.

The intelligent network platform here refers to the digital twin network platform built based on intelligent technology. Currently available smart technologies mainly include 5G communication technology, iot sensing technology, digital twin technology, smart contract technology, blockchain credit technology, etc. With the continuous development and upgrading of intelligent technology, intelligent network platform will also continue to develop and improve, so that the network scene of remote regional cooperation is constantly approaching the real scene.

Traditional regional cooperation is a "neighborly" game based on geographical proximity, such as the Beijing-Tianjin-Hebei region, the Greater Bay Area, the Yangtze River Delta, Chengdu-Chongqing western regional cooperation. This kind of "neighborly" game relationship greatly limits the selection range of game objects. In principle, it is optional, which will lead to oligopoly characteristics of game players in quantity. The remote regional cooperation breaks the spatial distance limitation of game objects, so that the regional cooperation changes from oligopoly game form to perfect competition game form.

#### 2.1.2. Characteristics of remote regional collaboration

The characteristics of remote regional collaboration mainly include the following aspects:

##### (1) virtual-real integration

Virtual-real integration refers to the fact that, based on digital twin technology, the entity region and mirror region are a pair of "twins" that map to each other. The regional behavior between the two regions is consistent, and the two are highly similar, highly correlated and influence each other. The regional behavior of the entity area can be mapped to the network space, and the mirror area simultaneously adopts the same regional behavior, and in turn, the mirror area's regional behavior will be synchronized to the regional behavior of the entity area, creating a larger collaborative space for regional cooperation.

Virtual-real integration is an upgrade of the virtuality of the traditional network platform. Virtuality refers to the virtualization of the real scene, forming an imaginary scene divorced from the real scene. The virtual scene originates from the real scene, but it is separated from the real scene in operation. There is no real-time interaction between the virtual scene and the real scene. The virtual-real fusion of virtual scene and real scene is a twin mapping relationship, and the two scenes correspond to each other and interact in real time.

##### (2) Massive collaborative objects

The synergy of massive objects means that in cyberspace, the spatial barriers of regional cooperation can be eliminated, and the synergy objects are no longer subject to geographical restrictions. The traditional regional cooperation has only multiple cooperative players in a single region, but has

changed into an infinite number of game players in any region.

The large number of cooperative objects comes from the infinite expansion of the number of relational subjects in the network space. In principle, cyberspace can accommodate an infinite number of relational subjects, and is not restricted by physical attributes between relational subjects, including personal identity, close and distant relationships, subordinate units, spatial distance and many other factors.

(3) The spatio-temporal conversion of infinite repeated games

The spatio-temporal conversion of infinite repetitive game means that the time infinite repetitive game in the traditional region is transformed into space infinite repetitive game under the network space, and the space infinite repetitive game in any region can also be regarded as the time infinite repetitive game between the region and the cooperative platform.

The transformation of time and space includes two aspects: time for space and space for time. The space infinite repetition game is to exchange space for time, that is, the time infinite repetition game between fixed subjects is replaced by the space infinite repetition game between infinite many subjects.

(4) Free from policy interference

Policy intervention-free means that in order to achieve coordination in traditional limited games, there must be policy intervention, and policy intervention must produce cooperative costs. The way to eliminate policy intervention is to use infinite repeated games.

The traditional game generally relies heavily on policy intervention, without which it is easy to fall into the prisoner's dilemma. However, policy intervention will lead to the loss of game efficiency, such as the erosion effect brought by subsidies and penalties.

(5) Avoid cold strategy

Cold-free strategy means that regional cooperation in cyberspace is an infinite repeated game of abstract objects. Through objective credit constraints of the platform, the relative rationality of cooperative objects is guaranteed, and the "non-cooperative" decision does not affect the next cooperation.

Traditional regional cooperation is an infinite repeated game with fixed objects. Based on the strong rationality of "cold strategy", once a game subject first chooses the "non-cooperative" strategy, the game will end, making it difficult for the region with fixed subject to establish regional cooperative relationship again.

(6) run-in free

Non-running-in refers to regional collaboration based on remote collaboration platform. There are infinite collaborative subjects, no difference between old and new collaborative objects, no running-in period and running-in cost.

Traditional regional cooperation has fixed and limited cooperative subjects. Replacing new cooperative objects will produce running-in period, which will inevitably bring running-in cost, thus improving the overall regional cooperative cost.

### **3. Remote Regional Collaboration Platform Based on Blockchain**

#### **3.1. Platform Architecture**

In order to break the barriers of traditional regional cooperation, a blockchain-based remote regional cooperation platform is built by combining virtual-real and intelligent

network technology, smart contract and blockchain technology.

The remote regional cooperation platform of blockchain mainly includes foreground, middle layer and background. Among them, the foreground is the mirror domain of the game subject and the mirror of the cooperation between the exhibition areas. 5G communication technology, Internet of Things technology and digital twin technology provide the main technical basis for smart cities. The middle layer is the cooperative contract execution domain, which uses intelligent contract as the main technology to objectively complete intelligent judgment of contract execution and termination conditions, automatic execution of contract terms and contract termination management. The background is the cooperative credit management domain, which mainly uses time stamp, distributed ledger and consensus mechanism to record cooperative behavior, calculate credit score, credit rating and label display, so as to eliminate the dishonest region, retain the trustworthy region, and realize the limited rationality of regional decision-making through credit threat.

#### **3.2. Platform operation process**

All the behaviors of the region are recorded in the blockchain distributed ledger to realize the credit screening before regional collaboration, so that the collaborative records can be traced. The entity region logs in to the blockchain intelligent platform through real-name registration, and the intelligent platform conducts credit review for the region to judge whether the credit is up to the standard. For the region that is not up to the standard, it is forced to exit the platform. For the standard area, regional information verification is carried out to obtain the identity of the mirror area to enter the platform. The mirror region can send a cooperation request to the target cooperation region through the platform, and the other party will sign a smart contract after accepting it. Judging by the agreement of the smart contract, for invalid contract, the cooperation will terminate and return to the platform; for valid contract, the contract can be automatically executed and output the result. If the execution is abnormal during the process, the execution will stop and return to the platform. The synergy results will be recorded in the blockchain and the credit rating of the synergy area will be updated in a timely manner.

The whole platform is resistant to external interference. Through this platform, all regions can issue cooperation requests, eliminating the restrictions of geographical relations on regional cooperation, and each region has more choices for cooperation objects, thus forming an environment of free competition in the selection of regional cooperation.

### **4. The Main Technology of Remote Region Collaborative Intelligence Platform**

#### **4.1. Game subject mirroring technology based on virtual-real fusion**

Virtual-real fusion intelligent network technology is based on the fifth-generation mobile communication technology (5G communication technology for short), combined with the Internet of Things technology and digital twin technology, so that the entity and its image are a pair of "twins" that map to each other. The two are highly similar and highly correlated, forming a technical system of real-time dynamic blending

relationship.

#### (1) 5G communication technology

Featuring high speed, high capacity, high reliability, low delay and low power consumption, 5G communication technology, as a new mobile communication network, can provide more immersive extreme experience such as augmented reality, virtual reality, ultra-high-definition video, and is the basic network technology to realize the platform man-machine interconnection.

#### (2) Internet of Things technology

The Internet of Things technology connects any object in each region with the network through information sensing equipment, and each region exchanges and communicates with the information media to realize intelligent identification, positioning, tracking, monitoring and management. The Internet of Things technology realizes the connection between people and things in the remote regional cooperation platform, and the connection between things and things, so as to realize the interconnection of everything. Meanwhile, the information between things and things in the region and between people and things can be transmitted and controlled in real time, so as to realize the real-time information sharing and common communication between things in the region without space constraints.

#### (3) Digital twinning technology

Digital twin technology is a common technique to realize interactive mapping between physical space and network space. Based on the existing digital model of the entity region, the state of the entity region is perceived and diagnosed in real time through measurement, simulation and data analysis, and the behavior of the entity region is regulated through optimization and instruction, so as to improve the decision-making of stakeholders in the life cycle of the entity region. The digital twin of the physical region is not only the mirror image of the physical region, but also needs to receive real-time information of the physical region and drive the real time of the physical region in turn.

With the application of 5G communication technology as a sign, the Internet industry is no longer limited to virtual networks, but expands the network boundary to the real world, thus forming a virtual-real integration network. In other words, 5G technology is used to support the Internet of everything, and the essence of the Internet of everything is to map physical areas to cyberspace and realize the network connection between physical areas, thus forming a smart city.

### **4.2. Collaborative contract execution technology based on smart contract**

A smart contract is a self-validating, self-executing computer program. It automatically enforces pre-defined contract rules and terms based on trusted, immutable historical data recorded by the blockchain. It means that when two regional parties agree to carry out regional cooperation, they are allowed to carry out regional cooperation without any third party. Mutual trust is not required between them, and the contract is completely automatic and irreversible without external intervention. The use of remote regional cooperative contracts is generally standardized, and the contracts specify the rights and obligations of the game players.

After the game player signs the smart contract, the smart contract will judge the validity of the contract. If the contract is judged invalid, it will immediately stop the execution and return to the smart platform. If the contract is judged to be valid, but there is a regional breach in the execution process,

the contract will be immediately suspended and returned. If it is judged that the contract is valid and there is no regional default in the execution process, the contract will be automatically executed and the execution result will be recorded and stored in the blockchain for later call calculation. Throughout the execution of the contract, all regions can view the performance of the contract via the blockchain.

### **4.3. Collaborative credit management technology based on blockchain**

The collaborative credit management technology based on blockchain mainly includes time stamp technology, distributed ledger and consensus mechanism. Through the above technologies, the complete record of regional behaviors is realized to ensure no omission, good record and no tampering of records, and to ensure the authority of the blockchain intelligent platform for regional credit management.

#### (1) Timestamp technology

The timestamp technology of blockchain records and stores the regional behaviors in chronological order in the block, while the digital twinning technology realizes that the regional behaviors are recorded in the block as soon as they occur. In the blockchain system, when a node generates a new block, it will be stamped with time, and then broadcast to all nodes of the network, so that each node will store all the information of the block, and then connected to become a block chain according to the time sequence of block generation.

If one block data wants to tamper successfully, it must change all the block data behind the block at the same time, and the difficulty factor of changing the data increases exponentially with time. Time stamp technology can prove the sequence of all regional behaviors of game players in the process of regional cooperation, solidify the content and existence time of regional behaviors, prevent data from being forged and tampered, and provide fair, credible, comprehensive and complete protection for the recorded data.

#### (2) Distributed ledger

Distributed ledger technology uses a hash algorithm, and any tampering with the block will tamper with the stored data and undermine the integrity of the block. The distributed ledger technical structure diagram of blockchain is shown in Figure 4.

In essence, distributed ledger is a decentralized database in which multiple nodes and members jointly record the account data of regional behavior to realize the record of regional behavior data. Regional behavior recording is jointly completed by multiple nodes distributed in different places, and each node has equal recording authority, their data is stored independently, can record the complete regional behavior, no node can record the regional behavior alone, so as to ensure that the recorded data is not tampered with.

All areas in the collaborative platform can see the recording process, completely open and transparent. Each node is an independent ledger, and only when all nodes are destroyed will the regional behavior data be lost. The legitimacy of regional cooperation is supervised, and all nodes testify together to ensure the security of recorded data.

#### (3) Consensus mechanism

Consensus mechanism is the mechanism that nodes in different spatial locations of the blockchain reach consensus on the block information of the whole network, which can ensure the consistency of the completely dispersed ledger data

of each node and ensure that the real and effective information of regional behavior is accurately added to the blockchain after being verified, which not only makes the regional behavior information of nodes consistent without forks, but also can resist external malicious attacks.

Consensus mechanism can realize that without a central command and coordination, each node can grasp independent ledger data, and maintain synchronization and joint accounting. Once the regional collaborative information is verified and passed into the blockchain, it will be permanently stored. If you want to modify the data recorded by the blockchain, you must first control more than 51% of the nodes of the whole network, which is basically impossible to calculate from probability. Therefore, the data recorded by the blockchain cannot be tampered with and can be traced throughout the whole process, realizing the institutional tamper-proof.

Based on the collaborative credit management technology of blockchain, the intelligent platform can display credit score records, credit scores and credit labels on the results of the collaborative regions based on complete, real and effective data. The credit labels of all regions in cyberspace are open, transparent and visible at a glance, and their credit score accumulative situation and credit score grade can also be publicly checked. That is, the region can check the historical cooperation situation of any region in the network space, so as to realize the credit constraint on the game region and promote the game players to choose the cooperation strategy.

## 5. Summary

In this paper, the definition and characteristics of remote regional cooperation are described, and the intelligent technology system of remote regional cooperation is studied. In this paper, virtual and real intelligent network technology is integrated to map the physical region to the network space, and the geographical barrier of regional cooperation is eliminated. The remote credit constraint technology ensures the automatic execution of regional cooperation and the recording and calculation of regional cooperation information to constrain regional behavior. Outline the combined application diagram of two technical systems, and intuitively show their technical institutions. The architecture of remote regional cooperation platform based on block chain is built, and its specific structure and corresponding functions are

shown. The operation flow chart of intelligent platform is refined to visually show the game process of mirror region.

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