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A REWARD MECHANISM FOR MOBILE CROWD-SENSING BASED ON BLOCK CHAIN TECHNOLOGY

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Abstract: **MCS stands for "mobile crowd sensing" and is a new sensor situation for cyber-physical social systems. Smart cities, personal healthcare, and environmental monitoring all use MCS. By recruiting people and offering prizes, the MCS programme obtains sensory data from the target area. Participants must be encouraged to participate and sensory data must be provided through reward methods. While MCS apps provide Mechanisms of reward, sensory data, and personal data are vulnerable to malevolent task initiators/participants and hackers. This paper models the MCS situation as a sensory data market with two types of participants: monthly and instant payment participants, in order to offer a fair incentive mechanism. By evaluating two different types of players and task initiators, this research presents an incentive mechanism backed by a three-level Stackelberg game. Evaluation handles two issues through theoretical analysis and simulation. The MCS performance and reward scheme is based on block chain.**

Keywords: **Blockchain, MCS framework, mobile crowd sensing.**

I. INTRODUCTION

Mobile crowd sensing (MCS), the next-generation Internet of Things, has been made possible by advancements in network technology, sensor devices, and social networks (IoT). MCS is a new sensor architecture that incorporates human intelligence into a loop and includes a smartphone sensor. MCS is a typical application of Cyber-Physical and Social Systems (CPSS), which uses an interdisciplinary approach to provide answers for sensing challenges by combining knowledge from communications, computer science, computer networks, economics, psychology, and social research. When compared to other IoT frameworks, MCS has advantages such as wide detection range, spatiotemporal sensor data, deployment feasibility, and flexibility. Challenges studied at MCS include incentive mechanisms, sensory data transmission, etc. When compared to typical Stackelberg games, the proposed incentive method increases the utility of task starters by up to 10%. You can also achieve sustainable sensory data transmission while maintaining the market share required for monthly fee members. According to research of the blockchain-based MCS, as the number of participants grows, the delay becomes manageable. Finally, this essay discusses the potential issues with blockchain-based MCS.

II. LITERATURE SURVEY

Junqin Huang et.al [1]"mobile crowd sensing Based on Blockchain used in industrial systems" Smart factories are a key element in transforming traditional computerized industries into data-driven smart industries, but the cost-effectiveness and reliability of intelligent industrial systems. Gender, mobility, and scalability cannot be achieved. Sensor data acquired from statically mounted sensors is the foundation of data-driven industrial systems. However, due to high implementation and maintenance costs, Industrial sensor networks have a restricted spatial coverage. MCS (mobile crowd sensing) is a new sensor paradigm that combines cost-effectiveness, mobility, and scalability. Due to their centralised architecture, traditional MCS systems are vulnerable to malicious attacks and single points of failure. As a result, MCS will become a thing of the past. integrated into the industrial system without the need for additional dedicated devices. To overcome the shortcomings of conventional MCS systems. This propose an MCS system based on blockchain technology (BMCS). To eliminate imbalances in numerous sensory tasks, we employ miners to assess sensory data and build incentive mechanisms for dynamic reward ranking (DRR). In addition, we're working on a detecting the quality of sensory data technique to detect and minimise data anomalies. We build a BMCS prototype on Ethereum and then run extensive experiments in a genuine production environment. BMCS can help industrial systems be more secure and reliable, according to both experimental results and security assessments.

Tassos Dimitriou[2] "Fair and Private Bitcoin Rewards: Incentives to Participate in Cloud Sensing Applications" This task develops a rewarding framework that can be used as a component of cloud sensing applications. Our protocol allows users to send data and receive Bitcoin payments in a way that protects their privacy, preventing vendors who like it from tying data and payments to users. At the same time, it prevents malicious user behavior, such as duplicate redemption attempts by users to earn rewards by sending the same data multiple times. More importantly, ensuring the fairness of the exchange.

Peter Danielis, et.al [3"Urban Count: Mobile Crowd Counting in Urban Environments" This task introduces Urban Count, For high-density cities, a fully distributed crowd counting methodology has been developed. For mass quotes, UrbanCount uses mobile device-to-device connectivity. Every node gathers mass size estimates from other system participants and incorporates them into local estimations as soon as they are within range. Urban Count’s purpose is to generate a precise mapping of local estimates and predicted worldwide outcomes while maintaining node privacy. Extensive Synthetic and realistic mobility models are simulated using track-based simulations are used to evaluate the suggested approach. In addition, we looked into the accuracy and density dependencies and found that in a dense environment, the difference in local estimates was less than 2% in synthetic situations and less than 7% in realistic settings.

Phuong Nguyen et.al [4]"Context-aware crowd sensing in opportunistic mobile social networks". We investigate physical cloud sensing challenges and how they relate to graph theory vertex cover concerns in this study. We suggest utilising the terms node observability and coverage utility score to determine vertex coverage because finding the optimum solution for the vertex cover problem is NP-complete and existing approximation strategies do not work well in cloud sensing environments. Develop a new context-aware approximation technique specifically for cloud sensing applications. Furthermore, we develop a human-centric bootstrap technique for the first mapping of sensory devices into the physical set based on social knowledge about the user (interests, friendships, etc.). Experiments with real-world data traces reveal that the proposed approach has a far wider acquisition range than the baseline approximation algorithm.

Taewan You et.al [5] "Mobile crowd sensing based on CICN". We offer a mobile crowd sensing application based on Community Information-Centric Networking for collecting opportunistic sensor data in a constrained environment where the Bluetooth Low Energy beacon's radius is limited in this paper. When compared to traditional mobile crowd-sensing apps, this app has more useful capabilities. This programme will also support data integrity and employ a basic communication paradigm for IP less communication using standard CICN features. Then, using a name that includes the BLE beacon identifier, capture the sensor data. This programme is more concerned with user privacy and data security.

Leye Wang et.al [6] "A new mobile crowd sensing framework for energy-efficient and cost-effective data uploads". This article tells about effSense. It is a power-efficient and low-cost data upload framework that uses adaptive upload schemes within a fixed data upload cycle. EffSense provides users with a decentralised decision-making method to determine the best time and network to upload data at the start of each cycle. effSense lowers data costs for NDP users by offloading data as much as possible to Bluetooth / WiFi gateways or DP users. It will reduce the power consumption by using piggybacking data on the call By leveraging call predictability and user mobility, effSense chooses the right upload strategy for both user types. According to MIT's reality mining and Nodobo dataset analysis, effSense reduces DP user power consumption by 55% to 65% and NDP user data cost by 48% to 52% compared to traditional upload schemes. Reduce.

Haiming Jin, et.al [7]" Quality Awareness Incentive Mechanisms for Mobile crowd Sensing" This article explains about some key issues with MCS systems like incentives for worker participation etc. Unlike previous work, we offer Thanos, an incentive framework for the MCS system that includes a key metric termed Worker Information Quality (QoI). The quality of sensory data produced by individual workers varies greatly due to a variety of circumstances (sensor quality, ambient noise, etc.). Obtaining high-quality data is not a difficult task for the MCS platform. Thanos' concept is technically based on a reverse combinatorial auction. Consider a hybrid auction approach that caters to both single-minded and multi-minded individuals. We create a real, individually rational, and computationally efficient method that ensures near-optimal societal welfare in the first case. After that, we create a repeating descent mechanism that ensures tight ratios while meeting individual rationality and computing efficiency.

Dimitris Chatzopoulos et.al [8] "Privacy protection and cost-optimal mobile cloud sensing using smart contracts on the blockchain" In this work, mobile cloud sensing uses blockchain technology and smart contracts for the spatial cloud sensing required by mobile users. The best approach to coordinate is for the supplier and the mobile user to interact at a given area to complete the task. Smart contracts are used to secure user privacy and make payments by acting as a process operating on the blockchain. In addition, to assign cloud sensing jobs to mobile users, create a true, cost-effective auction. This reduces the amount of money paid by crowd sensing providers to mobile users. Extensive testing shows that the suggested privacy auction exceeds the present concept in terms of cost per big number of mobile users and workloads.

III. ISSUES IN THE EXISTING SYSTEM

In recent years, crowdsourcing systems that leverage human intelligence to tackle complicated problems have attracted a lot of attention and approval. Most contemporary crowdsourcing systems, on the other hand, rely on centralised servers, which are vulnerable to typical trust-based model flaws such single points of failure. Because malicious people are involved, it is also vulnerable to distributed denial of service (DDoS) and Sybil assaults. Furthermore, the expensive service costs charged by crowdsourcing sites may stymie the growth of crowdsourcing. It is scientific and valuable to figure out how to deal with these potential concerns.

IV. PROPOSED SYSTEM

This paper models three significant contributions. (1) Proposal of a blockchain-based MCS framework that uses new blockchain technology to provide participant privacy protection, a secure detection method, and a reward allocation mechanism. (2) Create a block chain-based MCS workflow as well as a collection of smart contracts to automate the execution of MCS discovery tasks. The steps to conduct the recognition task are activated once all of the participants' identities have been authenticated on the block chain. The reward allocation mechanism starts after the task initiator collects sensory input. Smart contracts can ensure the MCS framework's automation and security. (3) Research the sensory data market and the players' characteristics. Participants in this article are divided into three groups: monthly paying participants, immediate paying participants, and task initiators. It offers a method for examining incentive mechanisms that is based on economics. MCS can provide a fair and efficient market for sensory data by exploiting the three-tier Stackelberg game reward mechanism. Benefits: (1) As a result, individuals who pay on a monthly basis can be comfortable that sensory data will be delivered in the long run. (2) Long-term perception It is also possible to achieve data distribution while maintaining the required market share for monthly payment participants.

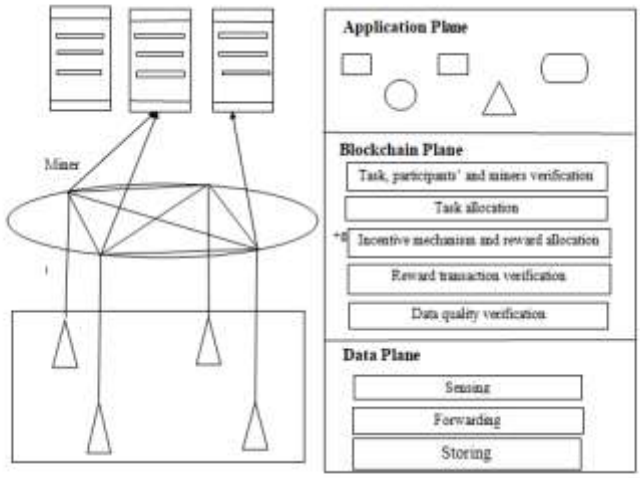

Figure 1: The Architecture of the block chain-based MCS.

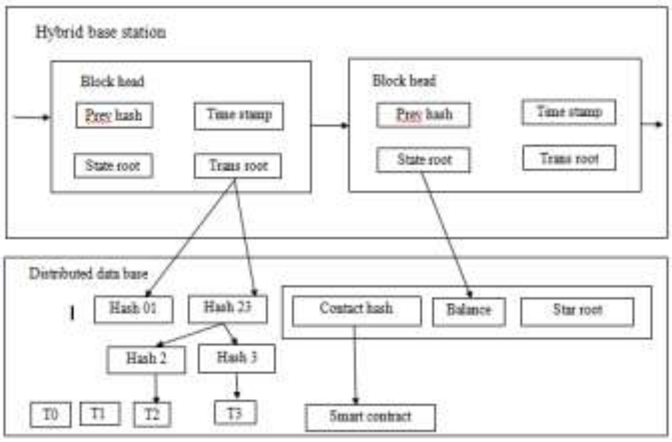

Figure 2. Structure of block in the blockchain-based MCS.

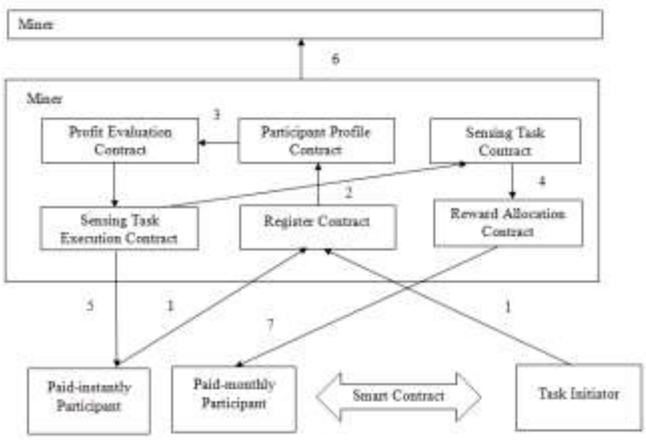

Figure 3. Workflow of the blockchain-based MCS.

This section explains the blockchain-based MCS workflow. Figure 3 depicts the smart contract workflow between each entity in a blockchain-based MCS. The task creator communicates with participants through a set of smart contracts that miners receive. After registering with the Certificate Authority (CA), the participant (including the task initiator) is assumed to have obtained the required cryptographic material for authentication at the start of the discovery task. (1) The system initialization includes both the MCS application task initiator and participant registration. To the nearest miner, send your ID, public / private key, certificate, and so on. Through a consensus method, the miner performs a "registration contract" and confirms the identities of participants and task initiators with other miners. The miner then sends a confirmation to the task initiator if the participant's ID is registered. The next process is started after the registration process is completed. The task initiator describes the sensing task to the appropriate miner. Before distributing the recognition task to all registered participants, the miner validates it. (2) Implementation of the incentive system (3-stage Stackelberg game): After the system is up and running, the function of each ID becomes clear and initialised. As a result, the "Participant Profile Contract" and the "Capture Task Contract" are used to process the incentive mechanism. This process is thoroughly discussed.

(3) Token distribution: after the incentive process has been completed, all participants will receive a reward message as well as the magnitude of the sensory data. You must first confirm that the message is correct, and then complete the discovery task in accordance with the prize. A token representing the perceptual task and reward is given to each participant. (4) Upload sensory data: After finishing the sensor task, each participant will undoubtedly receive a reward, therefore use the miner to send the promised sensory data to the task initiator. (5) Create a new block: The miner uses all transactions from the capture job in the chain to process the proof of work (PoW) and create a new block. The new block will be verified and published to the network later.(6) Token Redemption and Task Completion: After all of the blocks have been added, the token is distributed to all participants, and once the recognition task has been completed, the tokens can be redeemed anytime and wherever they are needed.

A smart contract is a contract that specifies how each party should behave when they have mutual trust. Prior to deployment, all smart contracts are believed to have been accepted.

V. RESULT

The proposed MCS architecture is built around a new set of smart contracts for transaction manipulation and validation. We get several sets of smart contracts by following the blockchain-based MCS methodology. (1) Registration Agreement: As stated in Table I, all participants, including the Task Initiator Registry, sign a registration agreement. In a secure communication channel, all parties confirm their identities by sending the miner their address and role. Participants will be accepted without a formal signature after the miners' agreement is completed. The technical intricacies of the blockchain encryption algorithm are not covered in this article. It employs an asymmetric encryption approach to establish a secure communication channel. (2) Contract for Participant Profiles: Once the miner has received all of the information from a participant, a profile is created to help with participant selection, detection task execution, and reward distribution. Subscriber profiles feature information such as subscriber reputation, projected incentives for performing activities, subscriber status, and more, as illustrated in Table II. (3) Sensible task agreement: A sensing task is a contract that includes sensing ID, execution status, deposit, and bounty scheme. A binary variable is used to represent the collection task's execution state. A status of 0 indicates that the discovery process is still ongoing, and vice versa. There are also variables like B.A reward plan that provides direction on cognitive task deposits and reward allocations in order to ensure that participants receive the promised benefits.

(4) Profit Valuation Contract: When a new participant joins the chain, the miner runs the profit valuation contract to get all of the information needed to value the reward allocation schemes. I have a contract for evaluation. The profit function of a participant is shown as U () in Table IV's detection scheme. (5) Perceptual task contract: When a participant calculates the highest profit based on details such as perceptual task, reward, and so on, the result is as follows: A perceptual plan that takes into account the sensory data's quality as well as its size. The perceptual task contracts outlined in Table V are followed by the participants when doing perceptual tasks. As a result, the execution contract for the sensing task is activated. (6) Contracts for Reward Allocation: The core algorithms discussed in this article have been extended to include collection job contracts based on subscriber profile contracts. The programme returns the reward scheme for the capture task. Meanwhile, incentives are assigned to participants as tokens and triggered by the reward system during this procedure allocation contract in Table VI.

TABLE 1
REGISTRATION CONTRACT

ID	Address	Type
P1	Addr{P1}	Initiator
P2	Addr{P2}	Instant-pay participant
P3	Addr{P3}	Monthly-pay participant
P4	Addr{P4}	Miner

TABLE 2
PARTICIPANT PROFILE CONTRACT

Address	Profile	Sensing Task ID	Reward of Task
Addr{P1}	Profile{P1}	T1	R1
Addr{P2}	Profile{P2}	t1	r1
Addr{P3}	Profile{P3}	t2	r2
Addr{P4}	Profile{P4}	t2	0

TABLE 3
SENSING TASK CONTRACT

Sensing Task ID	Status	Deposit	Reward Plan
T1	0	D1	R1
T2	1	D2	R2

TABLE 4
PROFIT EVALUATION CONTRACT

ID	Expecting reward	Sensing Task ID	Device Ability	Profit *U*(.)
P1	r1	T1	D(P1)	*U1* (.)
P2	r2	T2	D(P2)	*U2* (.)

TABLE 5
SENSING TASK EXECUTION CONTRACT

ID	Profit *U* (.)	Sensing Task ID	Status
P1	*U1*(.)	T1	0
P2	*U2*(.)	T2	1

TABLE 6
REWARD ALLOCATION CONTRACT

Sensing Task ID	Status	Participants ID	Token
T1	0	P1	Token1
T2	1	P2	Token2

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