iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 5 **Issue:** XI **Month of publication:** November 2017

DOI:

www.ijraset.com

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor:6.887
Volume 5 Issue XI November 2017- Available at www.ijraset.com

Blockchain for Artificial Intelligence

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Abstract: ***Recent advancements in artificial intelligence systems can be justified by the success in the field of machine learning. This is due to increase in knowledge (data) which leads to increase in intelligence. Similarly, the blockchain has a power to transform the artificial intelligence systems. The blockchain can be defined as a peer-to-peer transaction database which maintains the integrity of information through the distributed open ledger. It is a decentralized way to store value transactions across the nodes in the network. Every node in the network has access to the ledger. The blockchain has a wide range of applications including digital currency or crypto-currencies, smart assets, contracts, voting, etc. When it comes to artificial intelligence, the smart contract can be used to create an artificial intelligence system or it can be helpful in reaching a consensus during a dilemma through voting. A peer-to-peer model training can also be implemented using a blockchain network. The blockchain database can be helpful in improving the quantity and quality of data.***
Keywords: Peer-to-Peer (P2P), Blockchain, ledger, Smart Contract, Model training.

I. INTRODUCTION

The internet protocol suite defines a conceptual model and set of protocols for transmitting a message over the Internet. The link layer facilitates a medium for exchanging data between nodes by putting the data on the network and by receiving the data from the network. The internet layer is used for routing packets of data (datagrams), from source to destination. The transportation layer provides an end-to-end service that includes end-to-end message transfer, error control, congestion control, etc. The services to the end-user is provided by application layer. It includes user interface and support for the services such as email, shared database management and other distributed information services. But there is a missing protocol for exchanging values in the internet protocol suite. This can be facilitated by blockchain.

In a traditional system transaction system, during a transaction, a centralized authority is required to process the transaction. The information of a transaction is processed through a gateway, and then the gateway encrypts the information and sends it to the approved processors for the authorization. Then the transaction is acknowledged. This traditional transaction method can have some vulnerability like:

A. It has a certain risk of fraud
B. It leverages the power to a centralized authority which can be dangerous.
C. Also, the cost of mediation increases the transactional costs.

The blockchain can solve these problems. The blockchain is a decentralized, distributed database that stores all the value transactions. Every transaction is stored in a distributed hash table in a block. A block is like a page in the ledger which records the recent transactions. Instead of a centralized ledger held by a single authority, every person on the network has access to the ledger. The ledger is distributed across the network. All nodes are inter-connected via peer-to-peer (P2P) client, which is used to synchronize the data across the network. Each block in a network consisting of a group of transactions, is sent into the network. Once the block has been validated it is added to the end of the ledger. Based on consensus the blockchain can be permission-less (all the nodes participate in consensus procedure) or permission (only trusted nodes can participate in consensus) blockchain. [1]

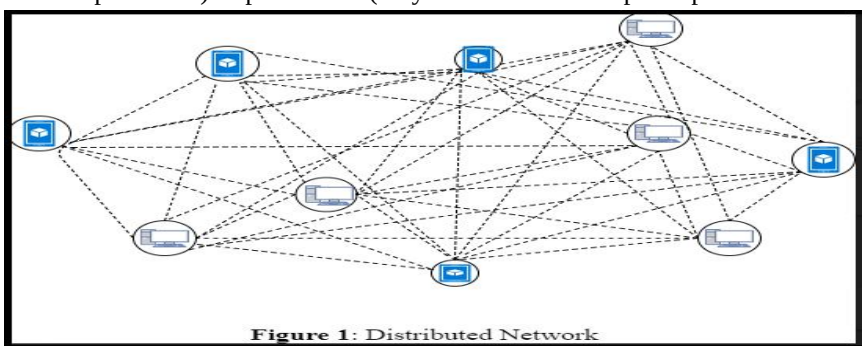


Figure 1: Distributed Network

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II. APPLICATION OF BLOCKCHAIN INAI

Blockchain can have a wide range of applications. It can be applied to almost every domain like in financial systems, e-voting, electronic records, creating digital identities and various other organizational uses. Similarly, the blockchain also has a large potential to transform the domain of artificial intelligence.

A. Smart Contract

Smart contracts are self-executing contracts for exchanging values. Smart contracts allow different kinds of transactions like financial exchanges, insurance contracts and another kind of transactions. The agreement on which all the consent parties agreed upon is implemented into the code and is distributed across the decentralized blockchain network. The contract is public on the ledger. As the code is on the blockchain there is no need for a third party to enforce the contract it gets executed automatically. Every operation in the transaction is executed simultaneously by the nodes in the network. The work done is calculated for each node, this helps in evaluating the price for the computation the node has done; like in an ethereum transaction the price is calculated by gas. [2]

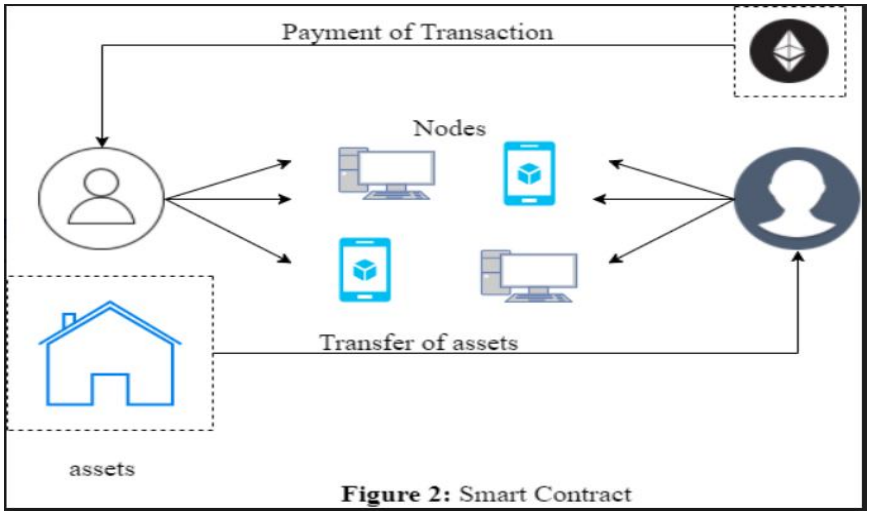


Figure 2: Smart Contract

Smart contracts can be used to create a self-sustaining artificial intelligence system. A smart contract for an artificial intelligence system can be implemented by defining only the initial set of rules like how to extract the raw data, how to gain insights from raw data, paying for services it will use, etc. This system will be independent and can operate on their own. And, it can live on the network for eternity.

B. Advantage

1) The entire process is transparent and every node in the network can access it. This eliminates any possibility of a fraud in the whole process.

2) The integrity of data can be maintained by declaring Intellectual Property (IP) assets.

C. Disadvantage

However, such system on a blockchain network that can live on their own might be impossible to stop.

Smart contracts can be helpful while solving complex problems in the field of robotics. Smart contracts for robots can simply be implemented by defining the scope and responsibilities of human endeavour in the contract. There will be strict regulations, certain actions need to be performed under certain situations. The system will be fully autonomous but less flexible. Once an action is recorded it can't be undone. Smart contracts enable a better coordination between hardware and software; and it also provides a mechanism for error detection.

When it comes to artificial intelligence in robotics smart contracts can help in better management and decision making in some situations. At present the robots can't be fully autonomous due to the difference in policies and difference in public opinions. There is no such a general protocol to follow in these type of sitituations. This problem can be solved by creating a smart contract for voting in these situations which will help in robotics to reaching a consensus. [3]

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D. Peer to Peer Model Training

The huge success of artificial intelligence in recent years can be justified by the advancements in the fields of machine learning and deep learning. The machine learning algorithms are the mathematical algorithms in the form of computer programs that can teach the computers how to learn with explicitly programming them. Deep learning is the domain of machine learning that makes the use of neural networks to do that. It can have many layers and requires more computation. In recent times, there is a sharp increase in data and there is an increase the computational power. Hence, more knowledge more intelligence.

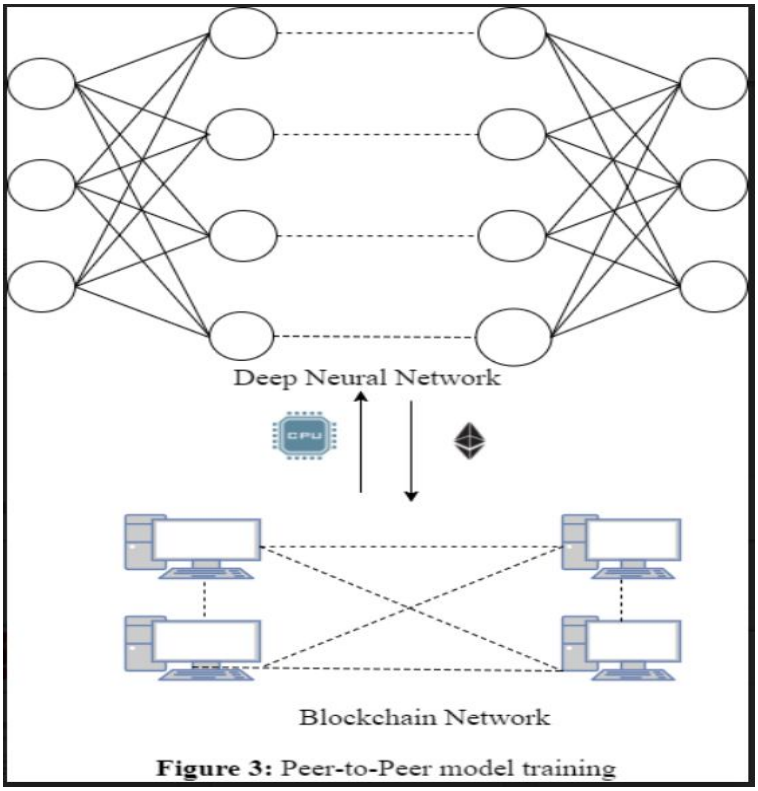


Figure 3: Peer-to-Peer model training

These are the memory-based learnings which require huge datasets to train model. The more the instance of our data has, the better the model will be trained. For training big amount of data, along with efficient algorithms we also require a lot of computational power which can prove to be quite expensive. The concept of blockchain can be applied to create an artificial intelligence system that can help in reducing costs and making the process more scalable. Instead of renting a computing platform on cloud or elsewhere, the load of computation can be distributed across the nodes in the blockchain network. Each node in the network can contribute in training the model by sharing its computational power. The price of every node in the network is calculated and paid accordingly in exchange for the computation it has provided. [4]

E. Advantages

1) It will reduce the cost of computation.
2) It is highly scalable. The nodes are paid only according to the work done by it.

F. Disadvantages

1) There will be a risk related to usage of nodes without the consent of the owner of the nodes.
2) Building a model on the top of blockchain might not be any faster than building a model on the top of the present computation (GPU's).

G. Blockchain Databases

The data in the artificial intelligent systems play a major role. It is not necessary that the good quantity of data will train better model, good quality of data has as much importance. The blockchain databases can have some advantages over traditional databases when it comes to improving the quality of the data:

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1) As blockchain is a decentralized database, it encourages the sharing of data within the network, which enables to increase the quality of data.

2) The data can occur from heterogenous sources. So, training a model on the traditional database can be a tedious task. IPDB makes the use of the decentralized system to collect the datasets of a common goal for training model.

Another advantage of using the blockchain database can be data scalability and querying, which can be implemented with the help of technologies like BigchainDB. In blockchain database, intellectual property (IP) asset is useful for better control of our data. [5]

III. CONCLUSIONS

This paper presents an overview of the blockchain database and how blockchain can be used to leverage the artificial intelligent systems. Various ideas related to implementing blockchain in artificial intelligent systems are discussed that includes an artificial intelligent system governed by a smart-contract, a method for peer-to-peer model training and using blockchain database instead of a traditional database. The smart contracts can be used to create a fully autonomous artificial intelligence system, but it can have some risk too. The smart contract can also help in better decision making in autonomous robots. The peer-to-peer model training can be very effective in cutting the computational costs while training a model but it might make the computation slower. The use of blockchain database can make the exchange of data very efficient and productive. The conjunction of blockchain and artificial intelligence would be a huge upgradation in the present technology.

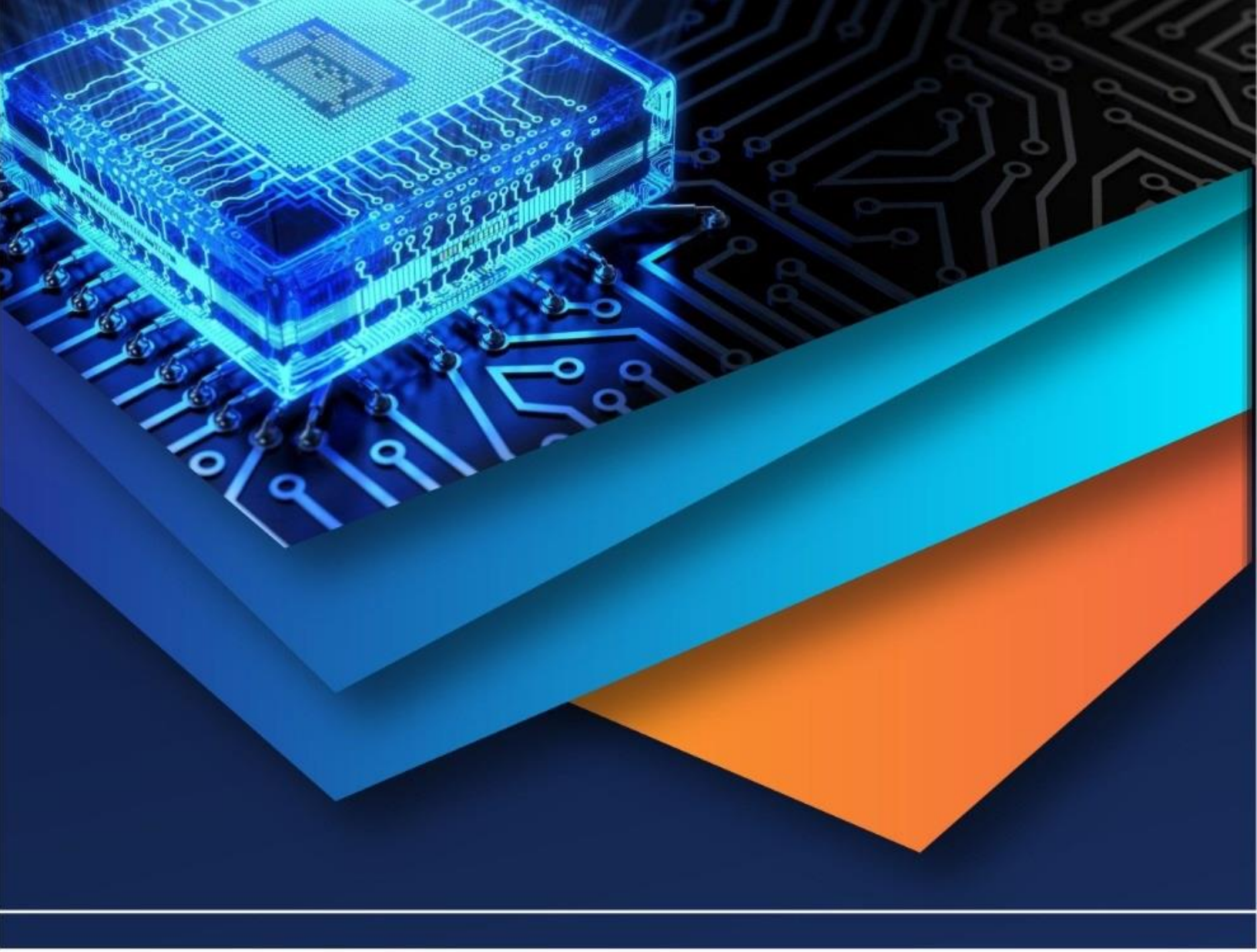
IV. ACKNOWLEDGMENT

We would like to thank our mentors from Jecrc University and Poornima College of Engineering for guiding us and we are also grateful to Siraj Raval for providing his insights on this research topic. We are grateful to our family who encouraged us to write this paper. This paper would not have been completed without them.

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