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Digital Medical Record System using Blockchain Technology: A Survey

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Abstract: ***In these modern times where diseases, viral flu, and infections are too common for the human being, to tackle this problem sometimes it gets hard, as the patient has incomplete documents of their diagnostics in case the document get lost for certain reason or patient left some important reports at home, and carrying a file every single time when patients visit a doctor is quite a burden, and some doctors give fake medication to the patients, and as patient migrate to a new place and visits a doctor then that particular doctor would need all patients previous medication and hereditary diseases information if any, doctor has to go through the whole check-up in order to get any allergies for certain medication or any lab reports if there are missing any.***
Keywords: Blockchain, Hyperledger Fabric, Medical Records, Orderers, Radiologist, Tester, Patient, Doctor.

I. INTRODUCTION

In these modern times where diseases, viral flu, and infections are too common for the human being, to tackle this problem sometimes it gets difficult, as the patient does not have complete documents of their diagnostics in case the document get lost for certain reason or patient left some important reports at home, and carrying a file every single time when patients visit a doctor is quite a burden, and some doctors give fake medication to the patients, and as patient migrate to a new place and visits a doctor then that particular doctor would need all patients previous medication and hereditary diseases information if any, doctor has to go through the whole check-ups in order to get any allergies for certain medication or any lab reports if there are missing any.

So, we have come up with a "Digital Medical Record System Using Blockchain Technology " where the medical records of the patients will be digitally updated by a doctor which is currently diagnosing that patient, the burden to carry a file will be vanished as we have our complete medical record at the touch of our fingertips, the doctor will upload our reports of our prescriptions and allergies if we have any and lab reports will also be uploaded as it plays a crucial role in diagnostics. With this system, fraud medication will not be done by any doctors as all the doctors can have access to our reports with patient's permission. All the prescriptions of any diseases given by any doctor; all this complete information will be there in one place using this. There will be a message system where patients get the message every time his or her reports get updated or viewed by any other doctors.

II. LITERATURE SURVEY

The latest emergence in technology is influencing all components of human life and is converting the way we apply and discover things preceding. Just like the alchemize technology has provided in many other divisions of life, it is supplementary finding paths for progress in healthcare sector. The vital advantage is that progress in technology is contributing to evolve safety, utilizer experience and different aspects of healthcare sector. Digital Health Data (DHD) and Digital Medical Data (DMD) systems provided such advantages. Although, they still have few problems concerning the safety of medical data, holding of data to user, data probity etc. The answer to such problems may be the usage of a novel technology, i-e; Blockchain. This method provides a secure, tamper-proof stage where it cannot be interfered for keeping medical data and other healthcare associated details.

Before the arrival of new technology, medical field used print based arrangement to keep the medical records, i.e., using handwritten process. This print-based medical data process was incompetent, uncertain, untidy and was not tamper-proof (cannot be interfered). Also faced the problem of data- imitation and repetition as all the foundation that patient visited had different copies of patient's medical data. The medical sector faced a movement shift about DHD systems that were planned to collaborate print-based and Digital medical data (DMD). This type of systems was used to store clinical notes and laboratory outcomes in its numerous parts. They were told to strengthen the security aspect of the patients by preventing errors and adding information access. The aim of DHD systems was to solve the difficulties faced by the print-based medical data and to provide an accurate system that would transform the state of medical field. The DHD systems have been performed in many hospitals throughout the world due the advantages it provides, mainly the development in security and its cost-ability.

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They are recognized as a important part of medical field as it provides much functionality to the medical. These functionalities are digital storage of medical data, patient's arrangement management, billing and accounts, and lab tests. They are present in many of the DHD system being used in the medical field. The basic aim is to give secure, tamper-proof, and allocatable medical data across various platforms. In spite of the fact that idea behind usage of DHD systems in the hospitals or medical was to enhance the quality of healthcare, these systems faced certain difficulties and didn't meet the expectations associated with them. A study was executed in Finland to find the experiences of nursing staff with the DHD, it was told that DHD systems faced the difficulties related to them being irresponsible and having a bad state of user-friendliness.

Catalini and Gordon organized a study that aims on the processes by which technology of blockchain would smooth the medical field. They recognized, that medical field is controlled by hospitals, pharmaceutical companies and third parties involved in it. They define data sharing as the vital reason why blockchains should be used in medical. This study also figured four factors due to which medical field needs to shift for usage of blockchain technology. These comprise way for trafficking of digital access rights, data accessibility, and easy access to clinical data and patient's recognition. It also expresses the on & off chain storage of record. The learning also involved the problems faced by use of blockchain technology these were vast size of clinical data, security , patient consultation.

Tai and Ebarhardt managed a study to understand feasible approaches to solve the accessibility problem of blockchain and also to identify this projects that expect to solve this problem. They explain blockchain as form of different numerical and economical concepts constructed on peer-to-peer system. The aim of this study was to find which record should be stored on-chain and what could be stored off-chain. This study showed five design for off-chain storage of record and also has the basic ideas and execution framework of these design. The writer tells us that on-chain data is the data that is kept on the blockchain by executing transactions on it. And off-chain data storage is to place the data away on any different storage method but not on-chain and also it won't have any agreement.

Vujičić implemented the survey of blockchain technology, Ethereum and bitcoin. The writers define that the information technology landscape is persistently changing and technology of is profiting the information systems. Writers describe the bitcoin a peer to peer dispersed network used for executing bitcoin transactions. Also told that proof-of work consensus algorithm through mining of blockchain concept. The writers highlight on the study that scalability is a major problem faced by blockchain and hence answers are suggested for solution of scalability issue which includes Lightning and Segwit, Bitcoin Gold and Cash. This also explained that Ethereum and its provinces and it also segregates Ethereum blockchain from bitcoins blockchain.

Wang supervised a study that concentrates on smart contracts and its application in technology of blockchain. Firstly, they introduce the smart contracts then their working framework with operating systems and other vital concepts attached with them. The writers also talk about that how the smart contracts would be used for the new method of parallel blockchains. They recognized that cause of using smart contracts method in blockchain is because of the decentralization which is provided through the programming language code taken down in them. After knowing the fundamentals of smart contract, the writer said that the various layers of blockchain combines together to keep system functioning. Layers are named as network, data, contract, incentive and application layer. This paper not only talks about the construction and framework followed by smart contracts which also provides an insight on its challenges and applications. The paper also discusses a major future shift of parallel blockchain that plans to create such blockchain that can boost two various but important modules. Kuo presented a review that talks about various applications of blockchain in biomedical and medical field. The writers recognized that using blockchains in this domain gives us many benefits and few of them are decentralization, resolution of clinical or medical data, data pedigree, and unbroken accessibility to data and lastly store information being attainable to biomedical or healthcare stakeholders. The restrictions of blockchain technology were recognized to be, confidentiality, speed, scalability and warning of malicious attack, i.e- 51% attack. The writers recognized these restrictions to be critical for medical or biomedical field as they are used for storing careful medical or clinical data. The answer to such issues were presented by writers to store careful medical data off-chain, encryption of data to make sure of confidentiality, and lastly to use (Virtual Private Networks) VPNs to make sure of safety from malicious attacks.

III. METHODOLOGY

Firstly, let us understand the method of our system which will help us to understand our concept very much in-depth. Admin will generate the certificate for every entity in the system. Our main entities are the patient and the medical staff, as a patient visit any clinic/hospital the doctor will diagnose the patient, and after diagnosing doctor will ask the patient for his unique ID and then the doctor will ask permission to the patient in our system, as soon as the patient grant permission to the doctor, all the endorsing peers will check and verify the certificate and after verification, the data will be forwarded to ordering services and in ordering service consensus will play an important role and which will arrange the data in a specific order using raft algorithm. And the data will be forwarded to committing peers and endorsing peers, the data will be get saved into blockchain with specific hash values.

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The data that is validated will be further added to the world state database. We will be using Couch database to retrieve and add data as it supports complex queries with will help us in retrieving data in specific manner

In our system doctor can view any data and can upload prescriptions, side effects and allergies of our system and radiologist can upload CT scans and MRI in pdf format, tester will upload their report in image format in our system. For uploading data permission has been asked by the patient.

Only the doctor and patient will have the right to view medical data. Radiologists, tester, and doctors will provide input to the system and only doctors and patients can view the output.

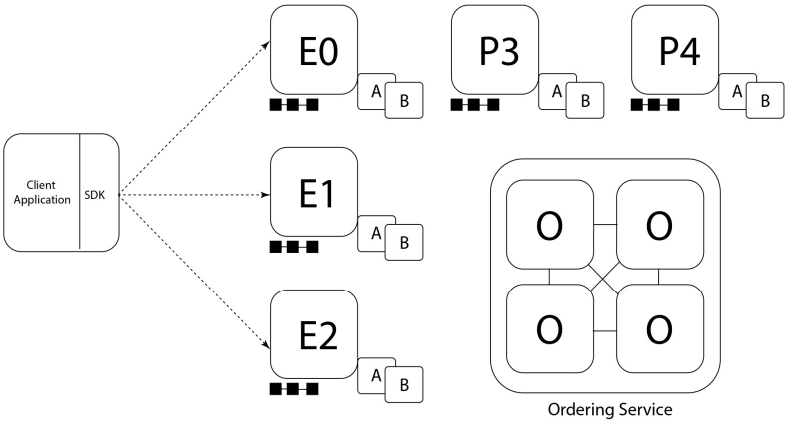


Fig -1: Hyperledger Architecture

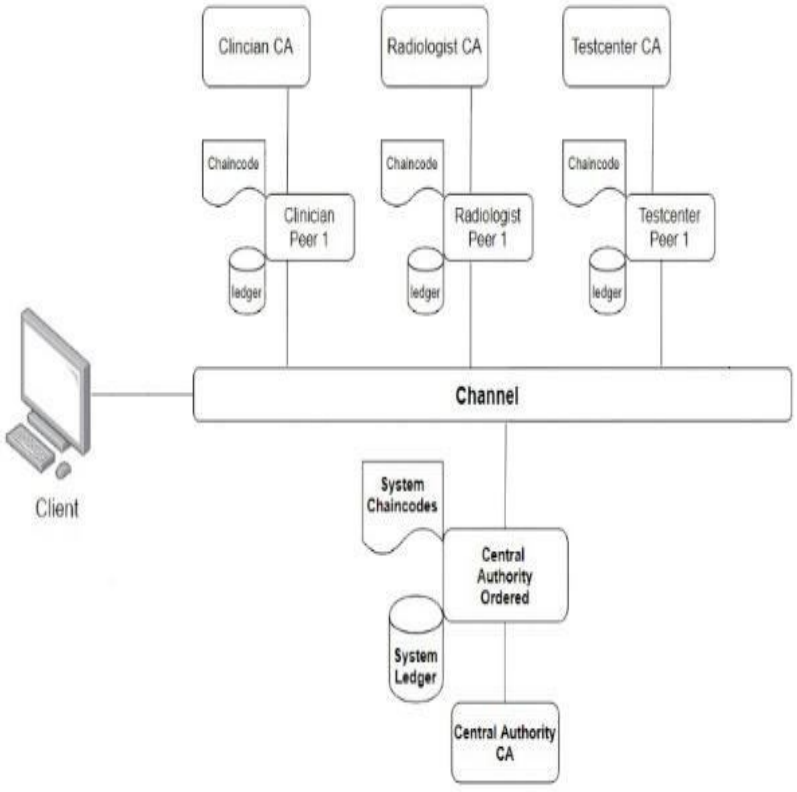


Fig -2: System Architecture

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IV. DESIGN

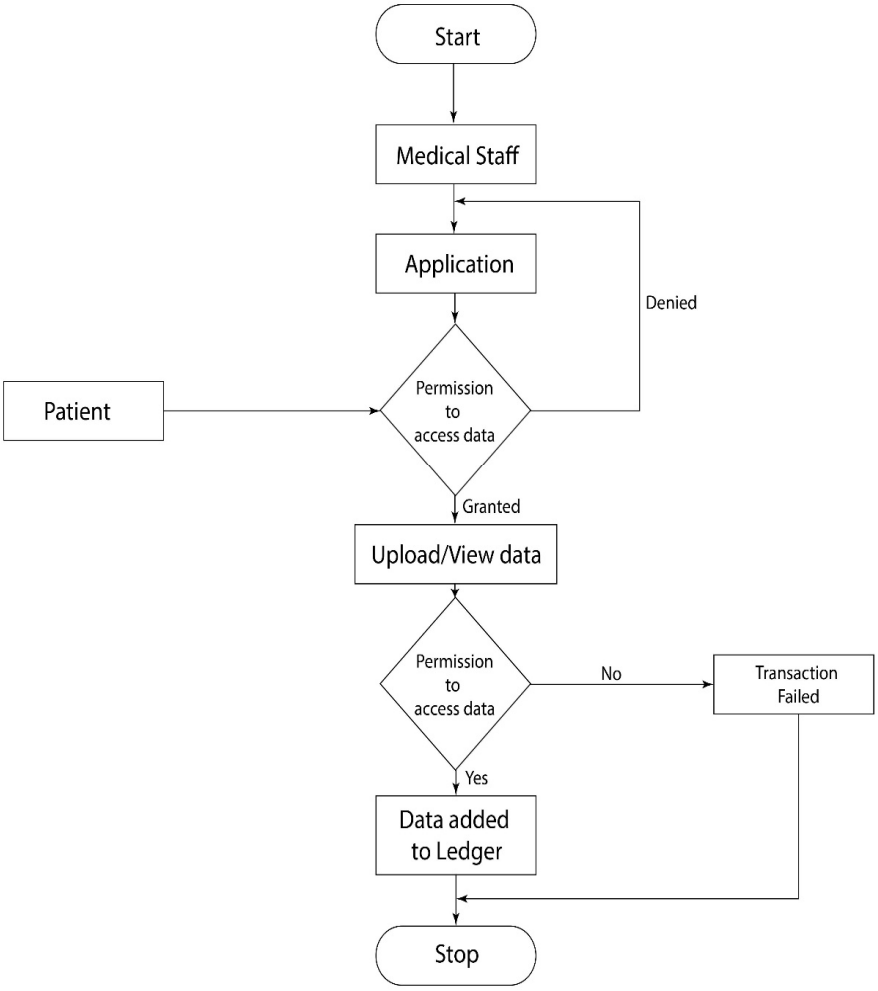


Fig -3: Basic Flowchart

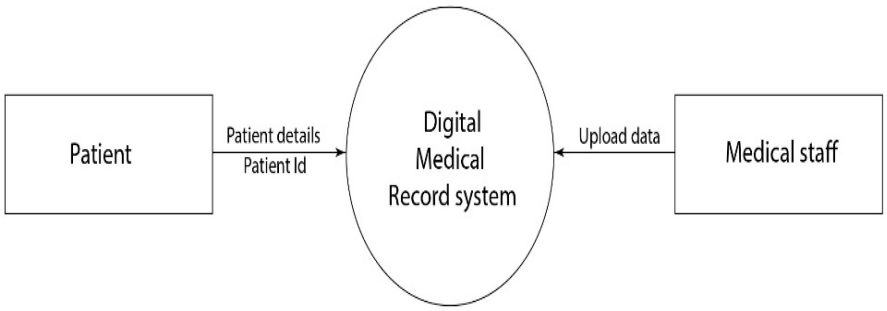


Fig – 4: Level 0 DFD

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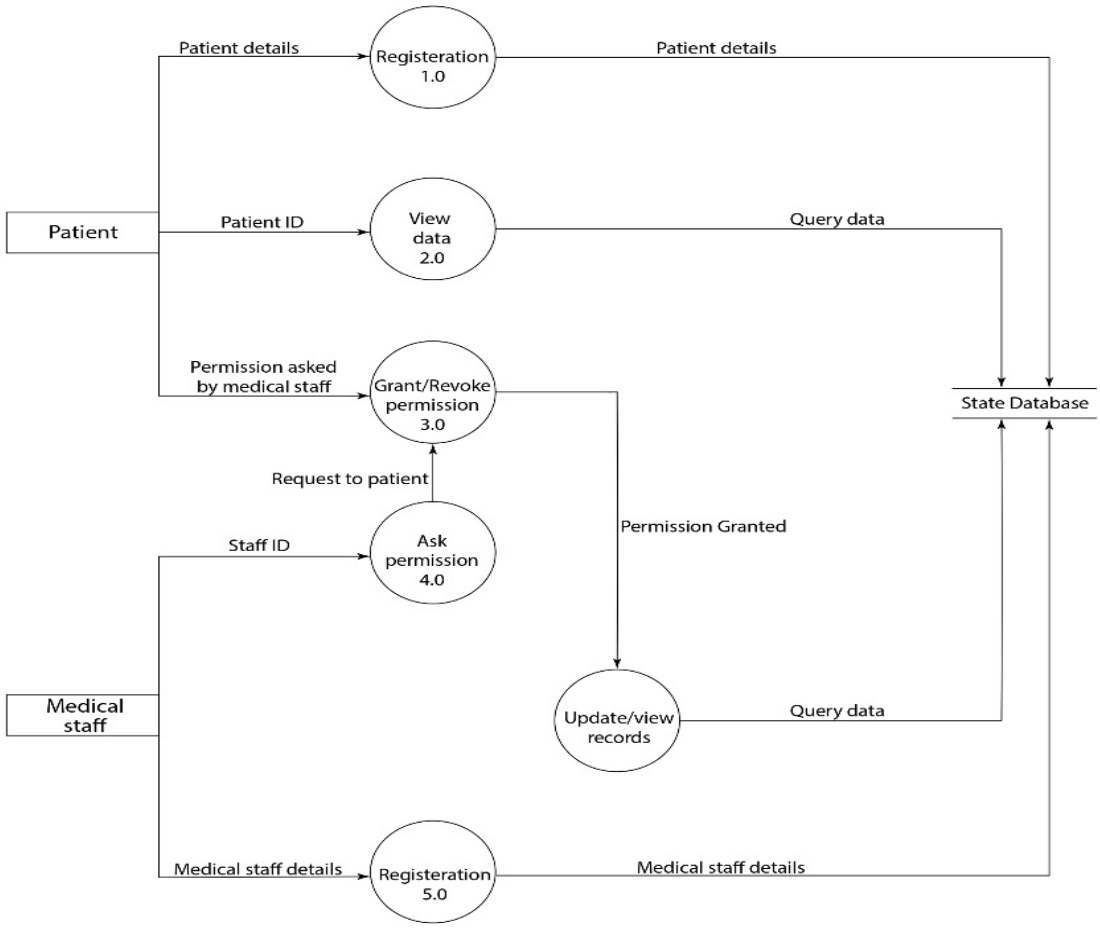


Fig -5 Level 1 DFD

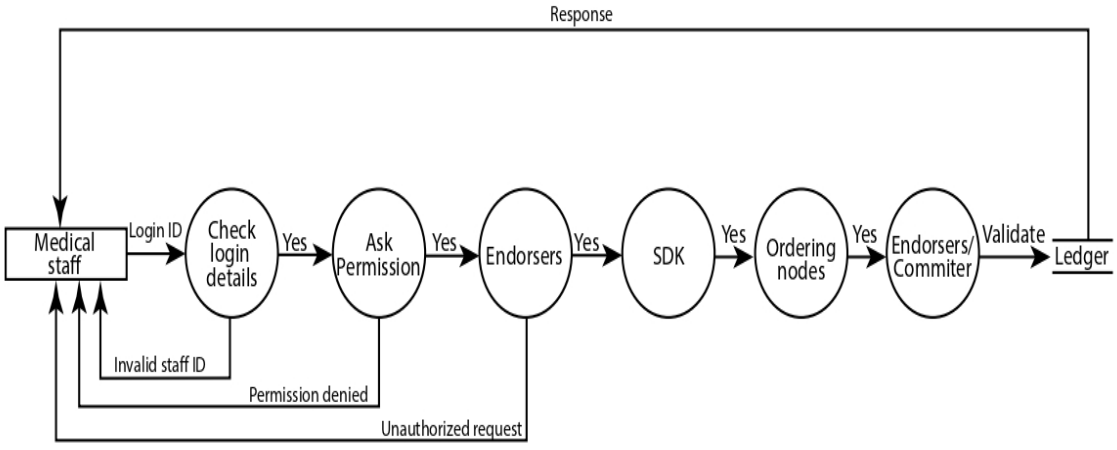


Fig -6: Level 2 DFD for 4.0

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V. CONCLUSIONS

A. Using private blockchain network,

B. Hyperledger fabric, we can make many private systems which can help our society in several ways and make our work very convenient and also considering the privacy of our volatile data.

C. We use Hyperledger fabric to make Digital medical record system as this technology is very convenient to use and has a wide scope in upcoming future.

D. Many systems can be made using blockchain technology using both private and public blockchain, depending on the issue we are facing.

E. Very secure system can be obtain using this technology.

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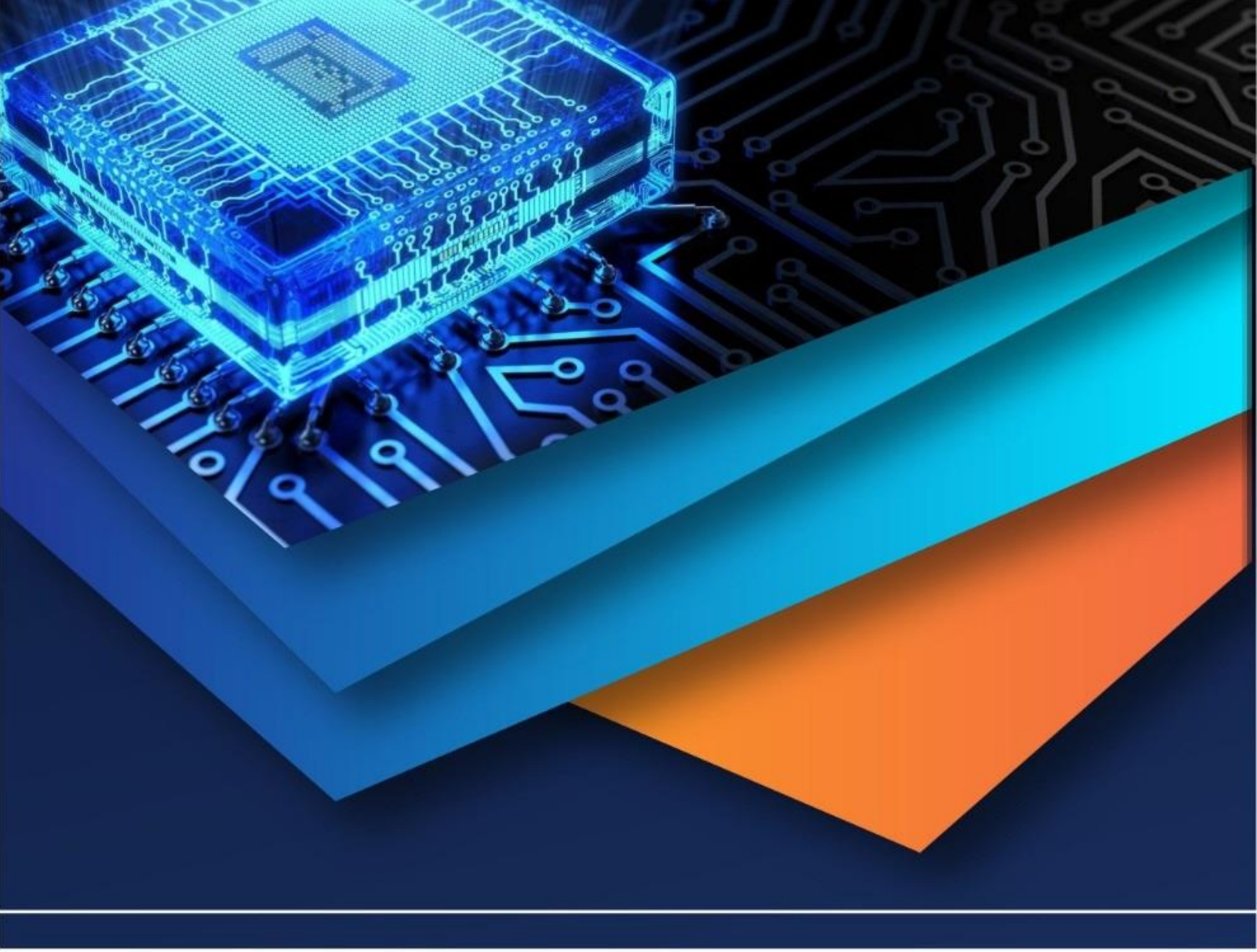
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