



Emerging challenges in IoT, Blockchain and Data Mining for effective treatment of Covid and flu diseases through Telemedicine process

Kireet Muppavaram^{1*}, Kiran Kumar Mamidi², Manyam Thaila³, Bhaskar .T⁴

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¹ Department of CSE, GITAM School of Technology, GITAM University(DU),Hyderabad, India.
² Department of AIML, Gokaraju Rangaraju Institute of Engineering and Technology,Hyderabad, India.
³ Department of CSE, Malla Reddy Engineering College, Secunderabad, India.
⁴ Department of CSE, CMR College of Engineering and Technology, India

Corresponding Author Email: kmuppava@gitam.edu

Abstract –

In this present era of 21st Century due to the dangerous infected disease Covid-19 all over the world telemedicine has played a major role in many parts of the world for remote monitoring of the covid-19 patients. Still there are many gaps in online remote monitoring in telemedicine process and as a result effective monitoring of the patients is not possible in many areas in the world. The detection of patients from remote place is considered as need of the day. This study presents the new challenges in the area of telemedicine or e-healthcare system. In this study we carefully analysed the present telemedicine process and we found that effective application of IoT, blockchain technologies and data mining can enhance the telemedicine process. This paper presents the new challenges in IoT, blockchain technologies and data mining where the researchers can work to fill the gaps in telemedicine process.

Index Terms – Telemedicine, e-healthcare, IoT, blockchain ,data mining, remote monitoring, covid-19

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1 INTRODUCTION

ONE of the major challenges in this century is to provide quality of health services to people all over the world.

The World Health Organization (WHO) has expressed the vision of health for all strategy in this 21st century. The population all over the globe is vastly expanding and the number of physical checkups for the mankind are not at all the solution to reach the motto of “Health for all”. From more than 30 years of research in the area of providing the quality of health services researchers came up with a solution of Telemedicine which is accepted globally. Telemedicine is a process of using electronic information and communication technology to diagnose the patients who are at distance places. The health analysts after observing this Covid situation all over the world confirmed that telemedicine plays a major role in near future to diagnose the patients from remote place all over the world.

Telemedicine is medicine offered to the people who are at a distance. The World Health Organization (WHO) defines the

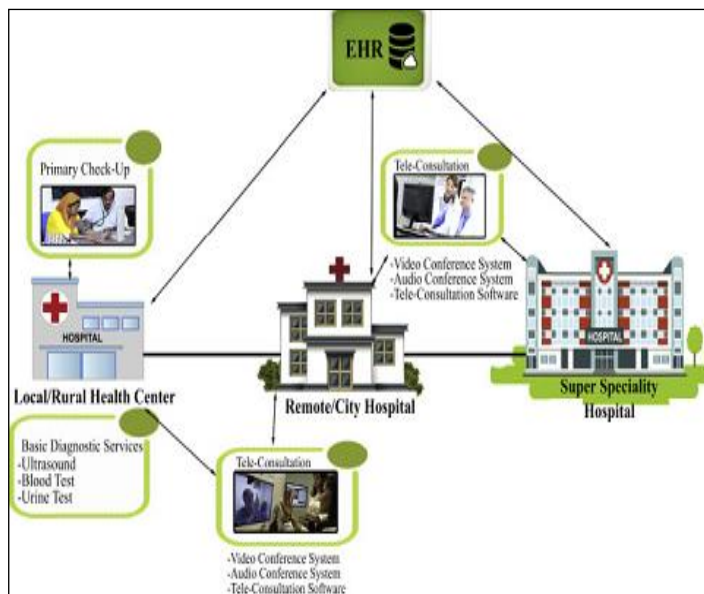


Figure 1 Effective Telemedicine Process



telemedicine as the “delivery of health care services” when the distance is the major factor for the patient. Telemedicine includes the usage of Information communication technology (ICT) devices for the remote monitoring of the patient. The remote monitoring includes several diagnoses through online by using video consultations, e-mail consultation,

smartphones, wireless tools etc. There are several treatments that can be done using Telemedicine like diagnosis of injuries, head ache, back pain enquiries about health issues, post treatment checkups.

The success of telemedicine in the last thirty years is dependent on the technologies that were used in implementing the system between the people and analysts or doctors. The history of telemedicine says that the concept of telemedicine initially started using telephones by tele-consultations. Slowly the way of consultations has been

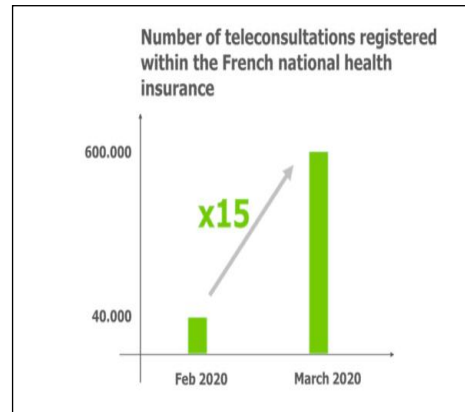


Figure3: Tele-consultations in 2020

providing the major reports to the analysts. In this paper we analysed the role played by these mentioned three technologies and presented their role in expanding the telemedicine services.

2 RELATED WORK

Castro, D et al [1] worked on IoT solutions applied to Healthcare. This paper talks about the solutions provided by IoT to the health care industry. The scenario in the below figure shows that how IoT wearables are used on the patient body and how they were transmitted to the analysts or doctors at remote place.

G. Subramanian and A. Sreekantan Thampy [2] worked on implementation of blockchain in providing healthcare s diabetics patients in pandemic situations. This worked focused on designing and implementation of the blockchain consortium. This can help in providing telemedicine to the patients with diabetics in pandemic situations.

A. A. Mazlan et al [3] worked on usage of blockchain technology in healthcare. This paper shows that traditional way of exchanging the Electronic health records in the process of remote monitoring in telemedicine have limitations in the form of attackpoints. This paper also shows that how blockchain is used in addressing the limitations of exchange of Electronic health records(EHR) in the process of e-healthcare or telemedicine.

T.T. Kuo et al [4] worked on adapting the blockchain technology for the privacy preserving machine learning. They built a model which does not reveal any kind of patients information during the health information exchange in remote monitoring. This model also discusses about the issues in applying blockchain technology for privacy preserving machine learning.

A. Yassine, et al [5] worked on extracting the patterns of human activities from smart home big data. They proposed human activity pattern mining model based on the variations in smart homes. They used the association algorithms of FP-growth for recognizing the patterns and applied clustering algorithms.

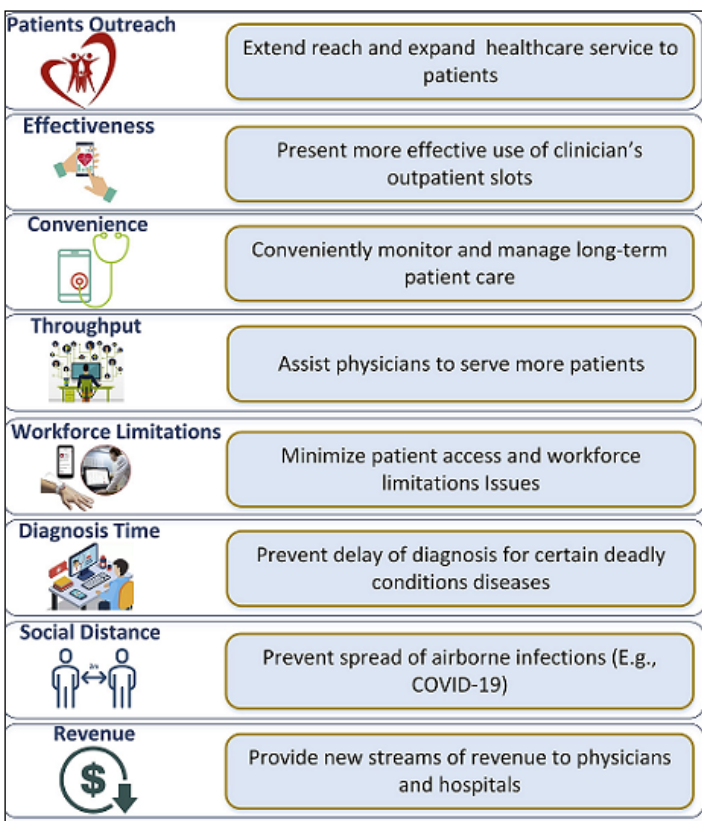


Figure 2 : Advantages of Telemedicine services

enhanced by using ICT devices. The Information Technology has played a big role in expanding and implementing the easiest way of providing healthcare to the people.

During this Covid period all over the world telemedicine is playing a major role in providing the health services to the people. There were number of computational applications which were used in expanding the telemedicine services. In this Internet era, Internet of things(IoT), Blockchain Technologies and Data mining applications are playing a major role in diagnosing the several diseases by



B. Alkouz, et al [6] worked on predicting the spread of flu using the twitter data. They considered the physical data from the hospitals and reporting data from the reports of twitter. Based on the data from the twitter they classified the reported data and non reported data. They developed a model which uses the no of Influenza related visits to hospitals which can predict the spread of the flu in future.

Muhammad Mahtab Alam et all [8] worked on role of communication technology in IoT helathcare. This paper shows how IoT devices are used in diagnosing the infectious diseases, cardiovascular diseases, Musculoskeletal disorders (MSDs), Neuromuscular disorders. The devices like LOC(Lab-on-chip) device which uses Point of Care Testing (POCT) for detecting the infectious diseases play a major role in detecting the skin diseases, spreading diseases. These type of IoT devices are much helpful in detecting the diseases like covid which is a need of the day.

X. Xiang et al [9] worked on authentication factors of E-health systems. This work focused on designing and implementation of authentication to health care systems and resolved the problems related to the privacy concerns on patients health records. This method is light weight computation method in order to verify the identity.

Wong Kok Seng et al[10] worked on collaborative support for medical datamining in telemedicine. This worked focused on how data mining techniques are used to extract the confidential information of patient health record. The main work focused on when two different hospitals required collaborative operations. This method clearly specifies how the patient data can be extracted when the patients full record passes to different levels.

The existing methods using IoT, blockchain and data mining techniques gave directions in providing solutions to the telemedicine process. Though existing solutions are providing the solutions to the problems that come in telemedicine process, there are many challenges in protecting the privacy issues, patients data by using these technologies. To provide the effective telemedicine process there are different challenges in Blockchain, IoT and data mining. In this paper we carefully investigated the challenges which are required to provide the solutions to the effective telemedicine process.

3. NEW CHALLENGES IN APPLYING IOT, BLOCKCHAIN AND DATA MINING TO ENHANCE TELEMEDICINE/ E-HEALTHCARE

3.1 Challenges in applying IoT to E-healthcare

3.1.1 Confidentiality of EHR records

In 2020, during this covid attack all over the world telemedicine has become a major platform for diagnosing many patients all over the world. The diseases like covid, flu which spreads easily need a time-to-time analysis of the patients which is not possible by treating the patients

physically everytime. The previous IoT or smart devices helped in knowing the spread of the disease across various locations. The biggest challenge through this IoT devices is providing confidentiality to the patients data. Most of the EHR records, patients information is exchanged using wireless communication which may have a chance of eavesdropping. There are no relevant and safer solutions where the confidentiality of patients record is preserved.

3.1.2 Enhanced report generation

Another issue through IoT devices is not having proper extraction of patients information. The existing wearable devices are much concentrated towards heart rate, BP etc and then the information is sent through online or application services. In this particular area there are different challenges where more enhanced way of patients reports are to be generated. In order to get efficient results 'accupoint detector' is to be embedded into IoT devices.

3.1.3 Device Provisioning

The device provisioning is the process of configuring each and every device which is involved in the process of patients information exchange. The device might be a sensor, mobile devices, tags, desktop computer, laptop, smart watches or any other hand held devices. The biggest challenge here is to configure the devices involved in patients information exchange. This provisioning of IoT devices used in the process of telemedicine involves allocation of Device ID, patients ID ,storage etc. In order to ensure the security to electronic heath records of the patients device provisioning all over the network is the need of the day.

3.1.4 Device management

The device management for patients information exchange between different analysts is one more challenge in IoT in telemedicine. Considering the scenario where a patients whose record is maintained by one of the hospital and due to need in more expert treatment analysis patient wants to change his hospital. In that scenario if the device management is done by third trusted third party patient can directly exchange his Device ID, patients ID to the other hospital, by which patients condition can be completely known to new hospital doctors. Most of the existing IoT device management is done by hospitals which may not allow the patient to exchange his information to other hospital due to their competative problems. The challenge here if the device management is done by trusted third party it resolves most of the problems.

3.2 Challenges in applying blockchain technology in Telemedicine or e-healthcare sector

The blockchain technology is slowly applied to many domains and it has become a huge buzzword in many applications all over the world. The applications from banking sector to the supply chain logistics and it is ready for the disruption. The blockchain revolution in this digital



transformation has a greater impact in the healthcare industry applications of telemedicine. There are many opportunities in the area of telemedicine where blockchain has expanded its services in maintenance of medical records to the pharmaceutical supply chains to smart contracts for the payment distribution. We carefully investigated and found that there are three different ways where the blockchain can enhance the telemedicine process

3.2.1. Protected Health records

In telemedicine process the EHR records are the major area, the maintenance of electronic health records securely is one of the difficult tasks in healthcare system. The patients electronic health record size increases by the number of visits to the doctor. The reason for growth of records is every doctor in every hospital has different way of health record storage and as a result it is not easy for healthcare providers to obtain them. For example if the patient needs to check up for covid or any flu checkup initially every doctor asks few previous history of the patient to get to know about the patients condition. There will be different problems faced by the common man in his lifetime he may visit an orthopedician, ophthalmologist, etc different specialists in different times, every time the patient visits a new specialist he needs to submit the previous history to the new specialist. There should be a common health information exchange system in order to solve this problem where the doctors can share the previous history of the patient to analyse the patient's condition in much more efficient way. There are only few companies which came up to solve this problem but it is still a challenge for blockchain researchers. The primary objective is to provide the patient an authority over his complete medical history and to provide the one stop access to the patients and as well as doctors. Blockchain by enabling the data security provides more efficient required access to the patients as well as doctors or analysts.

3.2.2. Medicinal product quality-authentication

The pharmaceutical industry has high standards in terms of medical products maintenance, product security and safety. Still there are many gaps in this area due to the miscommunication between healthcare professionals. There are different medical products which needs product quality authentication. There are different companies working on the authenticity of the product, the biggest challenge in this area is to prove the quality of the specific medicinal products whether they have been maintained in the mentioned environment conditions or not. For example some medicinal products specifically needs to be kept in low temperatures to maintain their medicinal power, proving this medicinal products kept in mentioned temperature conditions which proves quality of the medicinal product is the biggest challenge.in blockchain in healthcare.



Figure 3 :Blockchain in E-healthcare or Telemedicine

3.3.3 Genomic Blockchain Network

In the Healthcare industry the blockchain platforms are built by different companies like Nebula Genomics , EncrypGen by which the people can share their genomic data efficiently in a secure way. The analysts say that there are different opportunities in personal genome sequencing which will create an area of expanding data market in worth of millions of dollars . In this particular area the main challenges are to protect from the MITM(man-in-the middle attacks), solve the security related issues and ensuring or proving the source of the data from its end user. One of the biggest challenge here is to improve the genomic data protection and ensure the buyers can acquire protected genomic data and also should address the mining duplications issues in genomic big data.

3.3.4 Security vulnerabilities of smart contracts

The medical history of the patient reports can be disrupted, tampered by the suspected bugs and vulnerabilities in the smart contracts. For example considering an attack like reentrancy Vulnerability attack[] can be occurred if the smart contract has privileges to collude with the other smart contract which can later have chances of modifying the patients health record. The reentrancy vulnerability attacks are one of the primary attacks where they can extract the funds of the authorized users from their wallets. There are many solutions and methods proposed by the scientists and researchers, but still there are inadequate to detect the reentrancy vulnerability attacks. It is therefore important to take precautionary and preventive measures in order to test the smart contracts for protecting patient health records.

3.3 Challenges in Data Mining in Telemedicine or Healthcare

Data mining is one of the effective areas which played a major role in building the telemedicine system. Data mining is used in prediction of medical industry needs which helped in decreasing the cost and effective diagnosis for patients by using the pattern generation. There are different challenges in the area of data mining for the effective building of telemedicine system which are as follows



3.3.1 Report generations in flu diseases

The treatments in telemedicine involves effective report generation of patients. The existing devices have solutions to heart-attacks and BP checkups by using data mining predictions but there are no proper prediction systems for flu diseases. The flu diseases like covid, influenza etc requires the report generation on daily basis through out the cycle of detection i.e covid requires the analysis and generation of patients reports for 14-15 days by which the doctors or physicians can check the condition of patient online.

3.3.2 Fraud detection

The online frauds have been increased these days. Telemedicine is also one of the area where many fraudsters have targeted. There is no proper sytem which predicts these fraud detections. The online doctors profiles need to be analysed and produced in online which predicts the actual doctors identity. There is a research challenge in this area by using data mining to predict the identity and associate the doctor to the patients online requirement.

3.3.3 Symptoms- Treatment- Association

There are certain new diseases where the actual symptoms of the disease are unknown. Considering Covid as one of the disease where this disease does not have a common pattern, in general the treatments or diagnosis can be given to the patients based on the symptoms and spread of the disease. In case of covid the pattern is still in research. To analyse the new diseases there are new challenges in the area of data mining in healthcare whether any graph mining techniques can be used to associate the common symptoms of the disease.

The analysis of role of IoT, blockchain and data mining in the area of telemedicine made us to get the challenges for future researches. In order to address some of the challenges in telemedicine we further analysed different reports and found that there is a peculiar need in the area of patients treatment matching with previous history. We developed an algorithm where patients health history is stored and compared with previous treatments in order to give effective diagnosis to the patient

5 CONCLUSION

The World health organization says that health services should be provided for all in an easier and effective way. The present covid-19 situation all over the world made the analysts to use the telemedicine system in more effective way. The telemedicine has become need of the day to provide healthcare and to reach the diagnosis for the infective diseases all the people over the world In this study we carefully analysed the roles played by IoT, blockchain technology and data mining to enhance the telemedicine process. We presented the new challenges where the reasearchers can concentrate in applying IoT, blockchain technology and data

mining to enhance the telemedicine system to reach the healthcare services to many people.

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