A REVIEW ON IOT BASED MEDICAL IMAGING TECHNOLOGY FOR HEALTHCARE APPLICATIONS

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Abstract: With the automation and resource optimization it offers, IOT technology is used in healthcare applications to guarantee that the quality of care is improved while costs are kept to a minimum. With the convenience of auto- analyzing the imaging apparatus characteristics, IOT in medical imaging enables identification and corrective steps to be conducted in real time. The monitoring and control of medical equipment has also been made possible by digitization, which has spread to many sectors of medical technology. The internet of things in medical imaging will lessen waiting times and frustration for both patients and doctors.

Keywords: Internet of Things**,** Medical Imaging**,** Health Care, Automation and Resource Optimization.

1. INTRODUCTION

Among a wide range of applications that are enabled using the internet of things the health care applications involving the IOT have become more significant [7] as they minimize the cost and the weariness caused for the patients along with the concurrent improvements in the outcomes. The Internet of things incorporated into the health care industry would also allow having an efficient and an easy management and monitoring. The author Sapna et al

[8] from her view describes the internet of things as the revolution in the healthcare avoiding the lack or the delay in the diagnosis, failures in the appropriate testing or the initiation in the follow up, the insufficiency to access the medical history of the patients, misconception and the wrong prescriptions, lack of knowledge about the person previous medical records. The author S. Smys et al

in his paper [15] and [16] elaborates the topology of WSN in the IOT, and the applications and the protocols of the IOT. The latest development in the sensors also plays a significant role in internet of things for the medical industry; as they are enable an easy access and the analyses of medical records that were difficult to access before. The fig.1 below shows the IOT in the health care.

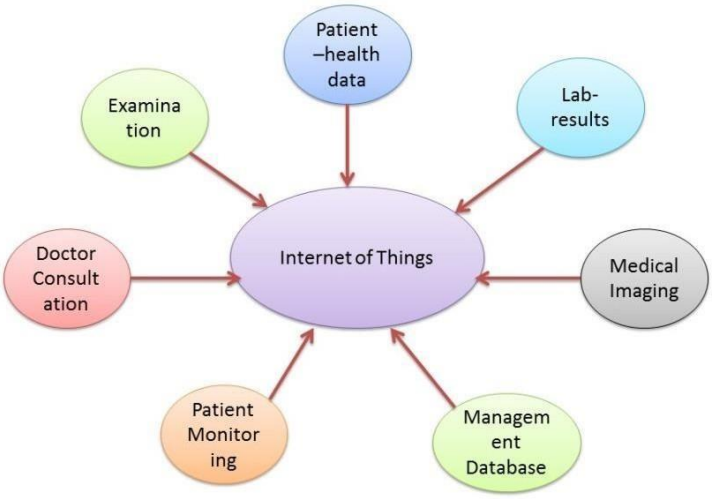

Fig .1 Internet of Things in Health Care

The report focuses in particular on a review of the use of IOT in medical imaging. Medical imaging is the process of obtaining inside images of the human body for the purpose of diagnosing a condition, treating it, or doing research. One of the essential necessities in a hospital is the use of medical imaging. The use of the internet of things in medical imaging eliminates the need for repeated exams, complicated consultations, and incorrect diagnoses by enabling real-time information exchange, diagnosis, and retrieval.

The research elaborates on the review of integrating Internet of Things with medical imaging equipment for the simple online picture sharing result in more precise diagnosis and real-time therapy.

The rest of the paper is arranged with the review in 2 sources of the medical imaging for the diagnosing of various diseases and involvement of the IOT in the medical imaging in 3 and the significance of the IOT in the health care industry 4. And conclusion in 5.

2. DIFFERENT SOURCES OF MEDICAL IMAGING

The internet of things' machine-to-machine connectivity let medical imaging equipment operate more efficiently and more effectively while reducing costs. This section discusses the various sources of medical imaging as well as how IOT is used to aid with illness diagnosis.

The few sources of medical imaging used in the medical field to diagnose diseases are described in this section.

MRI (MAGNETIC RESONANCE IMAGING)

The Magnetic Resonance imaging utilizes the computer the powerful magnetic field, and the radio frequency pulses to generate clarified pictures of the organs in the human body, such as bones, soft tissues and the structure of the internal body. Khoo et al [12] in his research has put forward the usage for the magnetic resonance imaging its consideration and its application in the radiotherapy treatment. It is also referred as the nuclear MRI or the magnetic resonance tomography and is used in the diagnosis for the brain tumors, trauma to the head or brain, problems in spine, heart joints and bones, abnormalities in the liver, uterine, abdomen and the brain. The MRI enables one to have the superior images of our internal body. The fig.2 below is the image of the MRI scanner.

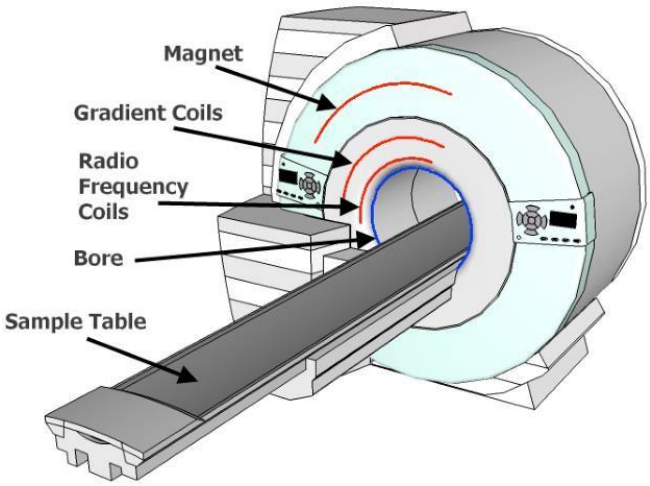

Fig .2 MRI Scanners

X-RAY (X-RADIATION)

The X-Ray are used for the capturing clear and the accurate images of the using the radiation. They use the electromagnetic radiation to penetrate into the structure to create images of the structure and found helpful in the diagnosing and detecting the abnormalities within the body. Kieffer et al [10] in his paper provides the utilization of the X-Rays in the medical imaging The fig.3 below shows the image of the X-Ray.

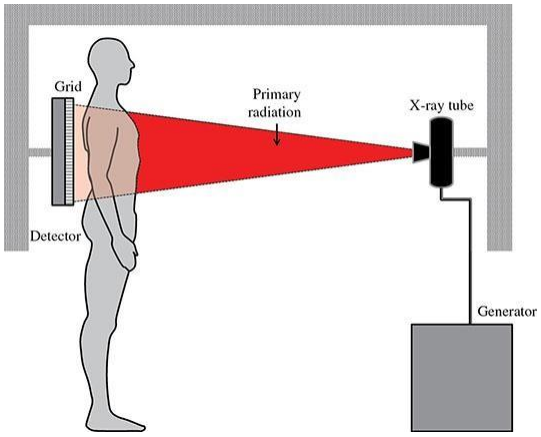

Fig.3 X-Radiation

CT (COMPUTED TOMOGRAPHY)

The CT utilizes the X-Rays to have a detailed picture of the organs of the human body in very thin slices. The author Zinreich et al [13] describes the essentiality of the computed tomography in the medical imaging he particularly concentrated on the medical imaging through the CT for the endoscopic surgery. The fig. 4 below shows the CT scan that is utilized in the medical imaging.

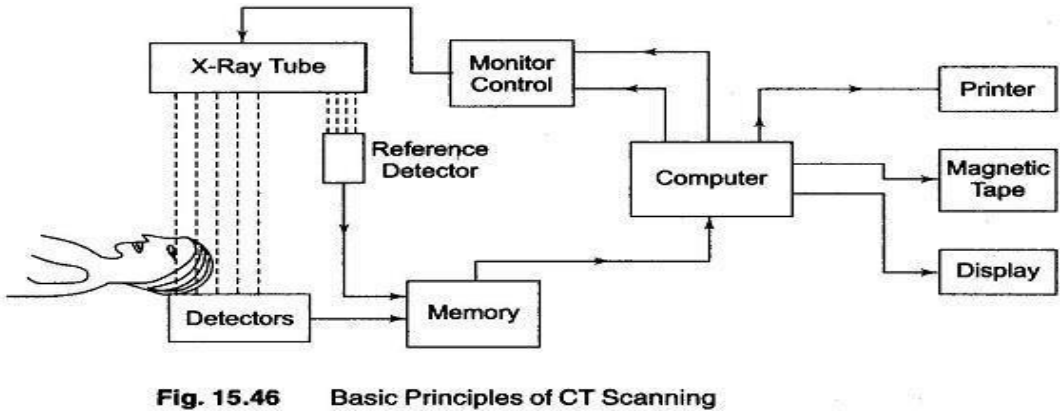

Fig.4 CT Scan

ULTRA SOUND

The ultra sound scans are the medical imaging equipment utilized for the having a look on the inside of the body. They are the acoustic energy in the form of the waves with the frequency higher than the human hearing range and used in the analyzing the inside of the human body as proffered by the Nikolov, et al [11] it finds its necessity in the medical imaging of the abdominal problems, uterus, the kidney problems and in the identifying the status of the baby in the fetus etc. the fig.5 below shows the ultra sound scanner equipment.

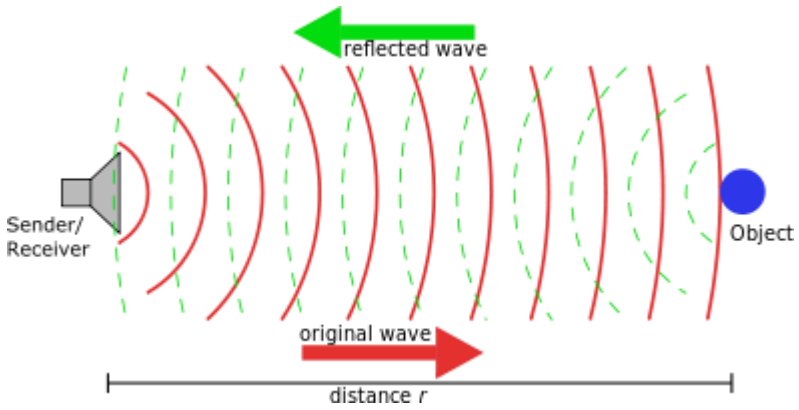

Fig .5 Ultra Sounds

The equipment used for diagnosing or identifying impairments, anomalies, or diseases in the human body is illustrated in the section above. Although the equipment appears to be very effective at diagnosing diseases, the main issue currently facing doctors and patients is the growing number of patients and reports, which can cause confusion, lost records, and incorrect treatments. To avoid this, the equipment can be embedded with the ability to connect to the internet, allowing the reports to be transferred instantly to the doctor and patient who need them over the internet. By doing so, it would be possible to avoid giving the wrong patient the wrong treatment and cut down on patient waiting times and annoyance.

3. IOT INVOLVEMENT IN MEDICAL IMAGING TECHNOLOGY

Krishna, et al [1], the author proposes an "FPGA based computer aided diagram, internet of things enabled portable ultrasound imaging system for diagnosing the abnormalities in the kidney. The system architecture includes a wireless unit in it to transfer the

diagnosis over the internet to the cloud for the storage and the further process. Chiuchisan et al [2] the real time configurable medical imaging equipment based on the Verilog is utilized to have enhanced medical images that are easily understandable Lu et al [3] the paper illustrates the "technology of the IOT utilized in the medical field, in all its areas such as the management, monitoring, medical imaging, in patient, out patient's database etc. and its efficiency in the providing the information simultaneously to the physician, patient and the radiologist. The fig.6 below shows the IOT efficiency in concurrently delivering the reportto the entire group and the patient involved in the diagnosing.

Fig .6 IOT enabled Medical Imaging [3]

Al-Majeed et al [4] a home based health care is made possible with a real time remote monitoring by integrating the internet of things with the medical systems. This would be very helpful for the physicians in monitoring the ECG, EEG etc. of the aged people without causing any weariness to them. Borovska, et al [5] the author presents the "experimental frame work of the investigating the importance of the internet of things in the medical imaging system. Hassanalieragh et al [7],Tyagi et al [8] and Plamenka, et al [9] they all elaborate the utilization of the IOT in the medical imaging to provide fast and the early diagnosis and the remote monitoring of the disease with the immediate suggestion on the precautions to be taken.

4. SIGNIFICANCE AND THE LIMITATIONS OF THE IOT IN THE MEDICAL FIELD

The internets of things are becoming more common in the medical field. The IOT in the health care industry fundamentally provides a "visualization of the material management, digitization of the medical information and the digitization of the medical process. The internet of things with the radio frequency identification ensures the eluding of the health care problems by supporting the production, distribution, and tracking of the medicines as well as the medical devices with the increase in the quality of the treatment and decrease in the cost of the management [14].

The incorporation of the RFID with the internet of things would enable multitude of advantages such as the pharmaceutical anti-counterfeiting, medical waste and emergency management, in the identification of the drug,medical record, and the medical equipment, drug storage etc. The IOT in the medical field enables the physicians tohave an immediate monitoring of the disease progression and provide a real time suggestion and the precautions tobe taken [1] it also allows a faster access of the patient data by the physician. The internet of things in the medicalfield enables us to have a smarter, healthier environment and a remote real time monitoring [3]. "The IOT enabled inthe medical imaging systems provides a potential impact for the clinicians as well as the diagnostic approaches byenabling the individuals to understand the changes in the health in the real time"[5]. Despite the significance in the IOT enabled medical field, especially in the medical imaging there are certain limitations still prevailing in it

causing difficulties in the real time monitoring. They are the "complications in the large scale dynamic networking and the node mobility management, data completeness, data compression and data security". So these limitations necessitates the "appropriate network mobility management methods and the network topology management structure" along with the perfect compression and the encryption algorithms to have an improved management, data compression and security respectively.

5. CONCLUSION

The study of IOT-enabled medical imaging is presented in the paper, along with a thorough analysis of the sources of medical imaging and a discussion of IoT's role in medical imaging technology. The study also discusses the importance and drawbacks of managing and monitoring medical imaging using IOT, as well as solutions to these problems. The research article hypothesises that the IOT in medical imaging would improve service quality, lower service costs, and cut down on the stress, fatigue, and time required for disease diagnosis. So the success of the IOT- enabled medical industry would depend on good design, ideal management, compression, and encryption technologies.

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