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Analysis of Several Technology used in Medical Field

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ABSTRACT: ***Humans' primary priority has always been their health. As the saying goes, "Health is Wealth" which indicates that nothing is more essential than staying well. But, in today's world, individuals have grown so reckless with their health that many people's lives have become entirely reliant on medications and diagnostic devices. Every day, a slew of new ailments emerge, some of which physicians are still working to treat. Some illnesses, such as cancer, are treatable yet decrease the patient's life expectancy. Many technical breakthroughs have been made in the medical profession to solve many of these difficulties. Many different equipment and gadgets have been developed to combat various illnesses in different ways. This paper has covered all of these achievements and inventions. This article describes how different technologies are utilised in the medical sector, how they operate, and how they have radically revolutionised the medical industry. It describes how, in the future, technology such as Machine Learning, Artificial Intelligence, and the Internet of Things will strengthen the medical sector and make it more broad and advanced than it is now. All of these technologies, together with their applications, are predicted to transform the medical sector's future and make it more successful.***

KEYWORDS: ***Disease, Health, Humans, Medical Field, Technology.***

1. INTRODUCTION

The medical industry has made the greatest contribution to human development. It is the most essential area for preserving people's lives who are afflicted with various ailments. It gives assistance to individuals who require curative treatment. The healthcare sector has grown to be one of the largest and fastest-growing in the world. In the medical profession, dramatic changes are occurring on a daily basis[1]. Diseases like cancer have wreaked havoc on people's lives. Doctors and medical technologies are the only hope people have to save their lives in such situations. Doctors, nurses, and other medical they are use every available technologies in order to save as many people as possible. This paper discusses a variety of such technologies that are utilised in the healthcare industry.

Technology has proven to be the most valuable gift of our time. In a variety of ways, technology has fundamentally altered human life. There have been several technical breakthroughs and inventions in a variety of disciplines. Every industry is today surrounded by technology. It has become a key contributor to every single activity taking place throughout the planet. It has a significant impact on how people live, talk, work, travel, and interact in today's society. There have also been several breakthroughs and improvements in the medical profession. All of these have been discussed in this article[2].

2. VARIOUS TECHNOLOGY USED IN MEDICAL FIELD

2.1.Mobile Technology:

Portable gadgets such as cell phones, iPads, tablets, and e-readers are examples of mobile technology. Personal digital assistants were formerly the most widely utilised technologies in healthcare, but smart phones have already surpassed them. Mobile devices may be used in healthcare for a variety of purposes, including data collection, connecting to various smart wearable's through Bluetooth, and monitoring various health characteristics such as pulse rate, calories burnt, walking distance, and a variety of other activities. Smart phones may be used to

order drugs and other health-monitoring equipment such as blood pressure monitors, sugar level monitors for diabetic patients, and a variety of other gadgets. Online consultation is now available via mobile phones, computers, and tablets. Online appointments with highly skilled doctors who can provide appropriate medical recommendations and ideas can be booked. There are a number of software programmes available via which different doctors may be contacted for various reasons. As a result, smart phones are becoming increasingly crucial in the medical profession[3].

2.2.Smart Devices:

In the healthcare system, smart gadgets have shown to be quite useful and successful. Smart gadgets have been quickly advancing in terms of functionality and efficiency throughout time. Smart devices are IoT apps that combine numerous smart characteristics. Physician productivity, efficiency, and accuracy have all increased as a result of their use of these smart devices. It also enhanced patients' access to medical care by reducing hospital congestion, improving medical care access, and lowering medical care expenditures. Smart gadgets are proven to be advantageous to both doctors and patients. Patients can use them to monitor a variety of bodily metrics while sitting at home[4].

Smart wearable's are technological gadgets based on the Internet of Things (IoT) and Artificial Intelligence (AI) that are portable and worn by people. Smart watches and fitness bands can track heart rate, oxygen saturation, step count, calories burnt, body temperature, sleep quality, blood pressure, heart rate, and a variety of other health metrics. Nowadays, it is critical for people to maintain their own health, which may be accomplished by keeping track of different health-related parameters such as temperature, oxygen level, blood pressure, and a variety of other factors. As a result, smart wearable's have become an integral part of people's life[5].

2.3.Wireless Communication:

Wireless communications are now being used by healthcare organisations to exchange, send, retrieve, and transfer data. Healthcare workers increasingly use wirelessly linked laptops or tablets to enter data and use mobile phones or wireless video cameras to monitor patients and patient data. Telemedicine is carried out using a range of wireless gadgets that allow patients and healthcare practitioners to communicate with one another. Patients and providers are interacting in new ways thanks to radios, cell phones, telephones, computers, and the Internet of Things (IoT).Various wireless technologies used for communication are:

a) *Wi-Fi (Wireless Fidelity):* It is a wireless technology that uses radio frequencies to transmit data. Data may be sent at a rapid pace via Wi-Fi without the use of cables or wires. It enables the operation of local area networks without the need of cables or wires.
b) *Voice over Internet Protocol (VOIP):* It is an IP-enabled service that lets users to make voice calls over the internet rather than using traditional phones. It transforms the user's speech into a digital signal that may be transmitted via the internet. Before it reaches its destination, it is transformed into a conventional telephone signal. A VoIP phone, a special VoIP phone, or a regular phone linked to a special adapter can be used to make a call straight from a computer, a special VoIP phone, or a traditional phone connected to a special adapter. Furthermore, wireless "hot spots" at places like airports, parks, and cafés allow users to connect to the Internet and perhaps use VoIP services while on the go.
c) *Bluetooth:* It's a short-range wireless technology that uses UHF radio waves to transfer data between stationary and mobile devices across short distances. Data is sent via

wavelength. Bluetooth-enabled devices are usually secure and resistant to hacking since they operate on a variety of frequencies.

d) *Z-wave:* Z-Wave is a wireless communication technology that allows smart devices to connect and exchange control instructions and data in healthcare networks. Z-wave technology produces a wireless mesh network, which is a collection of connected devices that interact without the use of cables. Devices "mesh" together with Z-wave technology by transmitting signals through low-energy radio waves on a certain frequency.
e) *Wireless Wide Area Network (WWAN):* It's a wireless network in its most basic form. It is a network in which cell towers send a radio signal to a moving or stationary device across a distance of many kilometres.

2.4.Smart Inhalers:

People who have breathing difficulties utilise inhalers. These are the primary treatment options for persons suffering from diseases such as Asthma. If utilised correctly, they are 90 percent efficient. However, it has been shown that it is totally successful in 50% of patients simply because the rest of the population does not utilise it correctly. Bluetooth-enabled smart inhalers have been launched to assist asthma patients. The inhaler has a tiny gadget connected to it that records the date and time of each dose as well as whether it was successfully delivered. This information is subsequently delivered to the patients' cell phones, allowing them to monitor and regulate their health. Clinical trials revealed that those who used the smart inhaler gadget needed less relief medication and had longer days without taking it.

2.5.Robotic Surgery:

Robotic surgery refers to surgical operations carried out by robots rather than humans. It enables surgeons to conduct difficult operations with greater accuracy, flexibility, and control than traditional methods offer. Surgeons can conduct delicate and sophisticated treatments that would be difficult or impossible with traditional methods using robotic surgery. There is less blood loss, less discomfort, fewer problems, and extremely tiny and barely visible scars when robots do operations instead of people. Robotic surgery is not for everyone; you must first visit with a doctor, go over all of the details, and then make your decision. A camera arm and mechanical arms with surgical tools are included in the most frequently used clinical robotic surgical system. While seated at a computer station beside the operating table, the surgeon controls the arms. The console provides the surgeon with a magnified, high-definition 3-D image of the operative site. Other team members that help throughout the surgery are led by the surgeon.

2.6.Wireless Brain Sensors:

Wireless brain sensors are sensors or devices that detect pressure inside the human brain, temperature, pH, and brain activity in the form of 'brain waves,' which represent electrical transmission within the brain. Patients with sleep problems, Parkinson's disease, traumatic brain injury, dementia, and other brain-related diseases are commonly treated with wireless brain sensors. These sensors aid in the monitoring of neurological changes as well as the improvement of cognitive abilities. These sensors are wireless and may be accessed through wireless networking with the aid of a smartphone, tablet, or computer, making the device more cost-effective. The primary goal of this wireless brain sensor is to protect the user from dangerous circumstances.

2.7. 3-D(Three Dimensional) Printing:

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Three-dimensional (3D) printing technology is one of the most popular study topics today, and it has affected medical treatment approaches. Due to their capacity to print desired designs with great dimensional precision, several three-dimensional (3D) printing processes are rapidly being utilised to create medical apparatus. The ability of this technology to prepare patient-matched devices owing to the restrictions of traditional manufacturing processes, such as inefficiency and several stages processing for complicated geometries is its primary purpose or role. Any method in which three-dimensional items are created by fusing layers in a row in a two-dimensional cross-section is known as 3D printing[6]. 3D printing technology can manufacture implanted medical devices with any complicated shape without having to address processing issues, and it can handle difficult implantable medical device design and production issues. Because of its capacity to print and shape most materials, accuracy, personalised and other customised needs, and high material utilisation rate in the printing process, 3D printing technology is becoming increasingly essential in implantable medical devices[7].

Additive manufacturing is another name for 3D printing. Stereo Lithography Apparatus (SLA), Laminated Object Production Selective laser Sintering, Fused Deposition Modelling, and Three-Dimensional Printing are all common 3D printing manufacturing methods. 3D printing is a collection of methods that combine regulated components to create a three-dimensional item[8]. This procedure is usually carried out layer by layer. Because this technique relies on "computer-aided design," having a computer is required. There are various steps involved in 3D printing process. These are:

2.7.1. Steps involved in 3D Process:

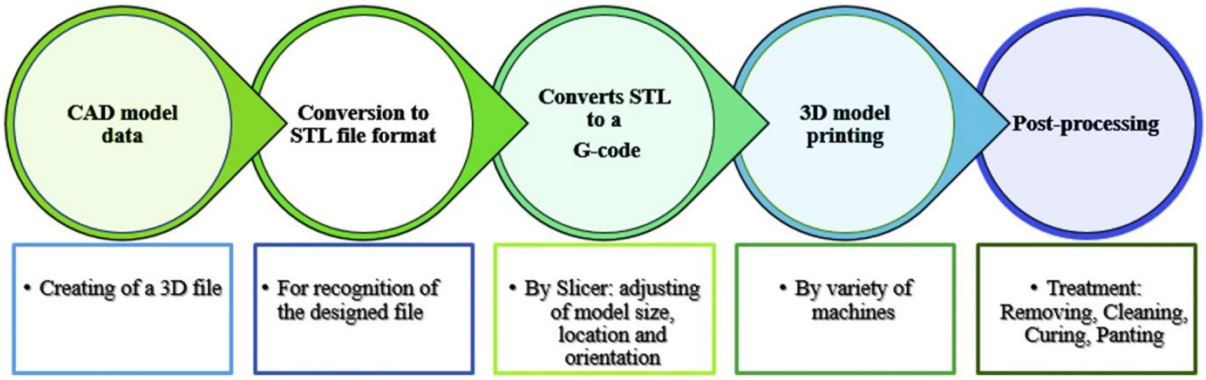

Figure 1: Steps involved in 3D Printing Process in Medical Field.

Figure 1 explains all the steps which are involved in the 3D printing process in medical field. These steps are explained below in detail.

- The first step in 3D printing is to create a 3D model on a computer. This is carried out with a 3D or CAD modelling software. Reverse engineering and 3D scanning of an available part can be also used in some cases.
- The second step is to create an STL model file. The model has to be converted to a format that can be readable to the printer. To this end, the file needs to be converted to STL. The 3D printing and OBJ formats are less popular in comparison to other formats. STL format uses polygons or triangles to introduce a model to the printer. The STL file is imported to a program that slices file layers and is called slicer. The slicer receives the model and converts it to a G-code that contains instructions for CNC machines and 3D printers.

- The third step is related to model printing. There are a variety of machines that each utilizes a different mechanism to print a model piece.
- In fourth step printed parts are removed. In some devices, removing parts is fairly simple and without any problem. However, in more industrialized models, this process is quite technical and precise.
- In the last step post-processing is done. This process varies in different technologies.

2.8. D printed implantable medical devices:

2.8.1. Vascular stents:

Cardiovascular illnesses, often known as heart diseases, are becoming increasingly frequent among individuals. People are having heart attacks and dying as a result. Cardiovascular disease (CAD) is a condition that affects the myocardial, heart valves, and blood arteries, and it is on the rise. Every year, a large number of individuals die from cardiovascular disease. For the treatment of cardiac problems, many techniques have been devised. Drug treatment, external surgical treatment, and vascular stent interventional treatment are some of the options[9].

As a result, among all of these, the vascular stent has shown to be the most effective and is currently recommended. Stents are tiny, inflatable tubes that are used to treat obstructed arteries in the human body. When arteries become narrowed or obstructed, stents are utilised. These stents unblock constricted arteries, decrease symptoms like chest discomfort, and aid in the treatment of heart attacks in individuals who have heart disease caused by plaque development. A copolymer of lactide, glycolide, -caprolactone, and lovastatin is used to make the vascular stent. In addition to providing support, the vascular stent distributes medicines into the body that can be utilised to repair damaged endothelium and prevent thrombosis in the stent.

2.8.2. Prosthetic Valve:

The purpose of cardiac valves in the human body is to keep blood flowing in the proper direction. If the valves do not function properly, blood flow in the body is restricted, disrupting the normal functioning of the human body. This condition is known as valve narrowing. This can place additional strain on the heart, causing it to work harder to push blood through the constriction. If the valve does not shut properly, blood will leak backwards, causing a problem. Human health will be jeopardised by heart valve illness, which will have a negative impact on people's regular quality of life. In the elderly, myocardial infarction and senile valve disease are frequent. Hyperlipidaemia, hypertension, and chronic renal disease are all examples of chronic kidney disease[10].

Drug treatment, external surgical surgery, and interventional treatment are the three options for treating heart valve disorders. External surgical therapy refers to the use of artificial heart valve replacement, also known as valvuloplasty, as a therapeutic option for high-risk patients. It is also a radical cure for heart valve disease. Artificial valves called prosthetic valves are used to replace a non-functioning valve in the human heart. These valves function similarly to standard valves. The 3D printed heart valve may be tailored for individual patients to enhance precision and stability, minimise the patient's body's rejection reaction, and improve the patient's health.

2.9.Machine Learning in Medical field:

Machine Learning, like Artificial Intelligence and the Internet of Things, has played an important part in the development of many new sophisticated technologies. It has given rise to a slew of new agricultural prospects. Farm management systems have grown easier to handle

thanks to machine learning algorithms applied to different technologies such as sensors and trackers, and have evolved into real-time artificial intelligence enabled applications that give the farmer with the best solution and recommendations. In most cases, machine learning models are trained using a set of data known as training data. After the model has analysed and learned from the training data, it is given another batch of data called test data. Whatever the model learns from the training data is applied to the testing data, and the results are based on which the model's accuracy level is assessed. The model is tested using several algorithms such as logistic regression, random decision making, and decision trees, and it is determined whether or not the model is capable of being utilised in real-time applications based on its performance in these algorithms.

The use of human genetics in machine learning applications includes the prediction of disease and the discovery of disease causes. The attempt to discern meaningful information about how genetics may affect human health is now at the forefront of many research endeavours, thanks to the advent of next-generation sequencing (NGS) techniques and the explosion of genetic data, including large databases of population-wide genetic information. Understanding how complicated diseases appear and how genetics might raise or decrease a person's risk can help with preventative healthcare. This might provide doctors additional information about how to customise a patient's care plan to decrease the risk of infection.

3. DISCUSSION

Medicines have become one of humanity's most important survival elements in recent years. Every day, new life-threatening illnesses emerge. People used to use Ayurveda as their sole therapy option back in the day. There were no surgeries, organ transplants, or other equipment available to carry out these operations and save people's lives. However, numerous technological breakthroughs and innovations have been introduced over time. People today rely on a variety of technical devices or gadgets to help them live their lives. Many tiny, portable gadgets have been created to aid in the measurement of characteristics like as temperature, blood pressure, heart rate, calories burned, and a variety of other factors. These aid in the monitoring of people's health. As soon as a symptom appears, the person should contact a doctor and seek appropriate therapy. In the medical area, a variety of such technologies and devices have been produced. All of these technologies have been discussed in this article in terms of how they function and how they have radically revolutionised the medical sector.

4. CONCLUSION

The health sector is critical to the social and economic development of people since human survival is entirely dependent on it. Hospitals, medical equipment, clinical procedures, telecommunications, and information technology for the medical industry make up one of the major service sectors. During the last century, the health or medical sector has experienced significant changes as a result of the use of contemporary technology. These technologies are resulting in the development of new apparatus and process techniques for the treatment of a variety of ailments using diverse approaches. Doctors are finding it easier to monitor and handle their patients as new technologies emerge.

In this study, several technologies that are being applied in the medical profession and are used by both doctors and patients have been addressed. Oximeters, blood pressure monitoring devices, sugar level testing devices, and fitness bands are just some of the tools and gadgets that have made it easier for people to keep track of their bodily health. Everyone's primary worry is their health. As a result, a large number of individuals are purchasing these devices. In today's world, most homes have an Oximeter, a steam blower, a thermometer, and a variety

of additional gadgets. As a result, the use of these smart gadgets and sophisticated technologies is rising day by day, expanding the future reach of these technologies.

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