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An Overview of Wireless Power Transfer Devices for Medical Devices that Can be Installed

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ABSTRACT
Wireless transmission (WPT) systems are becoming increasingly suitable for power supply to multi-computing devices such as those used for modern biomedical implants. WPT systems with great power transmission, are difficult, but design and implementation. The size of the WPT system, the distance between the external environment and the location of the implanted medical device, frequency of operation, and tissue protection due to energy depletion are all important factors in the design of the WPT system. This article presents a comprehensive analysis of the wide range of WPT programs that have been studied to increase program efficiency over the past two decades. Powerful integration, dynamic integration, magnetic resonance integration, and, more recently, acoustic and optical power systems have been reviewed as wireless power transfer devices for non-installed medical devices (IMDs). We concluded that Diagnostic devices are one of the most important asset of our Healthcare systems as they facilitate a lot to the healthcare provider and patient and they had triggered the development of our Healthcare system and they had provided ease to patient by providing them techniques such as noninvasive devices for detection of various diseases.

KEY WORDS: WIRELESS TRANSMISSION, MEDICAL DEVICES, EXTERNAL ENVIRONMENT, MULTI-COMPUTING DEVICES AND MAGNETIC RESONANCE INTEGRATION.

INTRODUCTION

A Diagnostic device is a device, instrument, and machine, apparatus which is intended to be used for diagnostic purposes for detection, observing, treatment or mitigation of a disease. The term itself offset a wide array of health and medical instruments used in the treatment or avoidance of disease. Diagnostic devices benefits subject by helping healthcare professionals identify and treat patients and it also provides ease to the patients to overcome sickness or disease, Overall we can say that it is improving quality of life and it has become one of important component of our health care system around the globe (Khan SR et al., 2020).

Wireless Medical Devices: The introduction of wireless machinery in health care systems has outstandingly changed the medical industry in recent years. Wireless medical devices had spread on commercial market just like flood in recent years. There is huge demand for wireless medical apparatus, most significantly in the regions where there is need of patient's monitoring and personal healthcare. This wireless diagnostic devices are making tele-health a actuality. This includes distant monitoring of patients at their homes as well as it is helpful in monitoring patients while they perform their routine activities. The project growth shows that there will be millions of wireless medical devices all over the

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world improvise and facilitate in health care system. The reason why we are shifting towards wireless technologies is to provide and expand patient's versatility. It enhance overall regulation by allowing medical apparatus to be authorized and monitored by single terminal device (Ferguson JE et al., 2011).

Nowadays there are many wireless devices which are being used to monitor patients like

1. Wireless blood pressure monitoring systems: It can be used in medical setting, in roving monitoring, or for personal health monitoring. Wireless blood pressure cuff was designed by Suntech and the Hardvard sensor network labs.
2. Wireless oximeters: It can be used to measure blood oxygen level and heart rate of the patient. It gives continues monitoring up-to 5 days from completely charged battery.
3. Wireless electrocardiogram (ECG): Wearable ECG smart sensor had been designed for continuous monitoring of patients at probability of life threatening cardiac arrhythmias. This can monitor patient's health up-to three days on fully charged battery.
4. Wireless electroencephalogram (EEG): Wireless EEG sensors compute the brain's electrical activity, or brainwaves. Wireless EEG allows readings to be done completely noninvasively at the home. They are powered be AAA battery (Park YG et al., 2019).

Like this there are many commercial systems or technologies like respiratory, integrated cardiac, temperature monitoring, etc Many wireless diagnostic devices are available markedly and which can be helpful in measuring different types of biological signals.

Ongoing study on medical devices are more focused on merging biosensors and wireless capabilities into small and low powered factory system. In recent years many companies has involved in Health care system and have contributed a lot in it (So-Ketola et al., 2008).

1. Iso-Ketola et al. had designed wireless diagnostic devices that is used to monitor patient's pose after complete Hip Replacement Surgery(Patel, S et al., 2009)
2. Patel et al. had developed a wireless diagnostic devise to monitor and diagnose the seriousness of Parkinson's Disease(Pal K et al., 2013).

Non Invasive Diagnostic Devices For Diabetes: As we know that we are using commercial blood sugar sensors since 1970s so millions of subjects have to prick their fingers for 4-6 times daily to check their blood glucose level. So, there was a need to help patients to monitor their glucose level not by painful way but through easy and painless way by using Noninvasive Diagnostic device. This is done by using Nanostructured lens based sensor which is replaceable biosensor for detection of ocular glucose. According to WHO 220 million people are living with diabetes and over 1.2 million have died in 2005 and the death are guessed to double by 2030. So early diagnosis and continues monitoring are important (Lewis, J. D et al., 1995).

There are many techniques for measuring glucose levels like:

1. Infrared Spectroscopy.
2. Raman Spectroscopy.
3. Fluorescence Spectroscopy.
4. Photoacoustic Probes.
5. Surface Plasmon resonance.
6. Optical Polarization Rotation measurement.

Table 1. Record of frequently used POC techniques for observation of some extremely infectious diseases

Pathogen	Spotting Platform	Spotting Device	Type of test used
SARS-CoV-2i	LFIA	Visual read	RT-LAMP and CRISPR
H1N1	Microfluidics	Amperometry	Electrochemical
HIV	LFIA Microfluidics	Smartphone Electric Sensing	RT-LAMP Immunoassay
Hep. B	Barcoded chip	Smartphone	Isothermal amplification
Zika, Dengue, and Chikungunya	Reaction Tubes	Smartphone	LAMP
S. aureus	Contact lens	Holographic Microscope	Immunoassay
M. Tuberculosis	Microfluidic	Amperometry	Electrochemical ELISA

But as this all are invasive techniques we can approach to noninvasive techniques by measuring the amount of glucose in the accessible body fluids, like saliva, urine, and ocular fluid, So one can use Noninvasive techniques. Since 1930s there has been many studies to determine the glucose level in tears and interconnection between blood glucose and tear glucose.

1. Lewis and Stephens examined ocular fluids in diabetic and non-diabetic patients by using supreme

blood test tools and concluded that tear glucose can be monitored for diagnosis of diabetes in subject (Lee SH et al., 2019). Contact Lens Sensors for Diabetes: Contact lens sensor can be used to constantly and noninvasively monitor the amount of glucose in tear. Like Fluorescent contact lens based sensors can be used in diagnosing diabetes as there are no electric circuits. We have designed many nanostructured optical sensor implanted in contact lens to detect the glucose in tears constantly and quantitatively.

The key procedures in making such contact lens sensor are mentioned below:

1. Encapsulation of FRET pair-labelled protein within mesoporous nanoparticles.
2. Synthesis of nanostructured optical sensor by encapsulation of FRET pair-labelled protein within mesoporous nanoparticles.
3. Fabrication and characteristics of nanostructured optical probe embedded in hydrophilic hydrogel contact lens.
4. Detection of Fluorescence intensity and resonance energy transfer as a function of aqueous glucose.

By this article I am clear that examining ocular (tear) glucose has greater capability for noninvasive detection of diabetes. However I noticed that there is deviation in ocular glucose levels with different methods. So, still more efforts are required to develop noninvasive diagnostic devices for testing tear glucose and hope it will be safe, delicate, accurate and noninvasive technique for monitoring glucose level in patients (Seokheun Choi et al., 2016).

Photonic Point-of-Care Devices: This devices are useful in detecting the presence of Bacterial or Viral infection and it is also helpful in quick recovery of subjects and helps prevent spread of infection. Thus remarkable efforts has been conducted towards Point-of-care (POC) devices which enables quick diagnosis of viral and bacterial infections. Most of the POC devices are based on plasmonics, microfluidics based platforms merged with mobile readers and radioscopy systems. There are many additional benefits of POC devices like inexpensive, quick results, and movability, which allows us to do on-the-scene testing anywhere in the world.

As we know that our world has undergone through several pandemics and epidemics due to the emergence or re-emergence of bacteria or viruses like HIV (Human Immunodeficiency Virus), SARS (Severe Acute Respiratory Syndrome), COVID-19 (Corona Virus Disease 2019) caused byiSARS-CoV-i2, Ebola, Spanish flu, Swine flu, etc. So we need a proper device to identify and cure the infection in subject and to decrease the spread of infection. So in this situation there is harsh need of POC devices to overcome through such situation (Pande et al., 2020).

Mobile Diagnostic Devices: According to the Mobile Diagnostic devices are useful for automated modification in customized Healthcare and this gadgets have become a crucial part of our Healthcare system. As it is noticeable in the current scenario of iCOVID-19, nowadays we all know how much it is getting important for the devices to be mobile for testing of these viral infection which enables us to get quick testing and remarkably increase the rate of screening. Thus, the work of such Diagnostic devices will have a crucial role during such epidemics mainly by stopping the propagation of disease and reducing fatality rates. Other related studies to advanced health technology were reviewed.

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