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ASIAN JOURNAL OF SCIENCE AND TECHNOLOGY

ISSN: 0976-3376

Asian Journal of Science and Technology
Vol. 11, Issue, 11, pp.11341-11344, November, 2020

RESEARCH ARTICLE

SENSORS AND HEALTH MONITORING

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ARTICLE INFO

Article History:
Received 17th August, 2020
Received in revised form
09th September, 2020
Accepted 18th October, 2020
Published online 30th November, 2020

Keywords
Remote Sensors,
Healthcare Technology.

ABSTRACT

This paper presents a review of the remote sensing technique, capabilities of sensors for healthcare, several studies of applications of remote sensing. The sensor technologies and data processing techniques have achieved much progress. Varieties of high precision sensors have been become available for multipurpose application. Remote sensing is considered a primary means of acquiring spatial data. Such sensors, when combined with data processing techniques, can make a huge impact on healthcare technologies. Sensors will change the site of health care. This emerging field of technology is making significant impact on the society as well as the research community. A wearable health monitoring system is to allow people to lead independent and active lives. We should put effort into future planning, not once, but continuously. As the technology advances, the outcomes are also increased.

Citation: ***Swati Kimothi, Y.S. Dhaliwal and Rajni Modgil.*** **2020.** "Sensors and Health monitoring", *Asian Journal of Science and Technology*, 11, 11, 11341-11344.

INTRODUCTION

Every day there is a new future to plan, and new discoveries that will change our minds about what is possible and likely. We are still far from being able to accurately predict future disease events on the basis of existing environmental conditions. Corona virus (Covid-19) is the most recent pandemic; all countries across the globe have been affected by the virus both socially and economically. The Covid-19 outbreak is not only about health care, but also businesses, livelihoods, wellbeing, innovation. The situation is even worse for the people residing in remote areas far from medical facilities as delay in diagnosis and treatment may lead to death. future technological innovations is going to keep transforming healthcare, yet while technologies like new drugs treatments and devices, social media support for healthcare etc will drive innovation, human factors will remain one of the stable limitations of breakthrough. Patient satisfaction is an important measure of healthcare quality. The Remote Sensing is a multi-disciplinary science. Remote sensing uses the entire electromagnetic spectrum, ranging from short wavelengths (for example, ultraviolet) to long wavelengths (microwaves). Remote sensing (RS) is the process of acquiring information about an object, area or phenomenon from a distance.

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Microwave sensors sense electromagnetic radiations in the microwave region of the em spectrum. Microwave sensors work in any weather condition and at any time. Microwave sensing and imaging have various medical applications. This is because the technique is strong, requires low power, has high sensitivity and has a good penetration depth in terms of material analysis. The microwave sensing technique is a possible and attractive alternative modality to standard x-rays, magnetic resonance imaging, and computed tomography methods for medical diagnostic applications. Sensors are devices that detect physical, chemical, and biological signals and provide a way for those signals to be measured and recorded. Sensor technology will move the place at which health care is delivered in the future, changing the roles of hospitals, outpatient sites and ambulatory programmes outside the home. Sensors play an important role in medical technology with the aim of making medical devices even more effective and safer. The sensors used to diagnose, monitor or treat diseases in medical domain are known as medical sensors. The advancements in wireless communications and wearable sensor technology open up the opportunity of real-time. No predictions can satisfy everybody. Continuous monitoring of health status, timely diagnosis can provide comprehensive information about individual's health status over a period of time.

Literature Review: Several investigators have carried out health related study by using advances in the field of sensors is reviewed in this paper. Timothy E. Ford et al.

demonstrated remote sensing technology which can be used for disease prediction, the utility of remote satellite imaging, and infectious disease events may be closely linked to environmental and global change. Environmental parameters measured by remote satellite imaging show the greatest promise for providing global coverage of changing environmental conditions (1). Rama Krishna Reddy Kummitha, highlighted many aspect and discussed how China and Western democracies differ in their approaches to adopting smart technologies to control the transmission of the Covid-19 pandemic (2). The recent advances in remote healthcare and monitoring in both with-contact and contactless methods were Reported by Lakmini P and Co-Authors. Then, the remaining discussion of the paper has been focused to Sensors for monitoring essential vital signs such as electrocardiogram reading, heart rate, respiration rate, blood pressure, temperature, blood glucose levels and neural system activity are available today. Range of remote healthcare varies from monitoring chronically ill patients, elders, premature children to victims of accidents. These new technologies can monitor patients based on the illness or based on the situation. The technology varies from sensors attached to body to ambient sensors attached to the environment and new breakthroughs show contactless monitoring which requires only the patient to be present within a few meters from the sensor (3).

Lingli Zhu and co-authors investigated remote sensing sensor technology both broadly and in depth and reviewed some fundamental knowledge about the electromagnetic spectrum and the interaction of objects and the spectrum. It helps to understand that when a sensor is operated in a certain wavelength how environmental objects will react to it. Remote sensors were presented in terms of imaging sensors and non-imaging sensors. Optical imaging sensors and thermal imaging sensors, radar imaging sensors, and laser scanning were highlighted (4). Dr. K.Venugopalan and Coauthor highlighted the technological advancement in biomedical applications and biological effects of microwaves and associated issues. The emphasis is placed on newer emerging diagnostic and therapeutic applications, such as microwave breast cancer detection, separation of red cells, bio-detection devices, hyperthermia treatment of tumors, and treatment with localized high power used in ablation of the heart, and liver and others (5). A microwave sensing technique to analyze the variations in biological tissue thickness, considering the effects of physiological and biological properties on microwave signals.

Syaiful Redzwan Mohd Shah et. al. Studied the microwave sensing technique to understand the geometrical distribution of a multi-layered tissue by calculating the signal loss while the signal is propagating through tissues. Microwave propagation is then investigated based on tissue dielectric properties in terms of reflection, signal loss, attenuation, and penetration depth. The feasibility of the microwave sensing technique is examined using micro strip split ring resonators (SRRS) to estimate the EM signal loss through biological tissues. Two prototypes consisting of three layers of tissue thicknesses (skin, fat, and muscle) are presented primarily for the measuring conditions and personal characteristics of human tissues. A validation was achieved between the electric field and penetration depth and their associated effects on signal loss due to the variation in thickness and distance. The fundamental principle behind its operation is that variations in the human tissues will produce variations in the effective permittivity of the microstrip resonator and, hence, a variation in its resonance. Therefore, it will provide a potential correlation between a resonance state and a state of a particular change in the dielectric properties of tissues. Each tissue is characterized by the differences in dielectric properties, focusing primarily on relative permittivity, ϵ_r, and conductivity, σ. In particular, the conductivity of skin and muscle tissues at high frequencies is much higher than the conductivity of the fat tissue. This is because of the high water content in the skin and muscle compared to the low content of water in fat and bone. Therefore, the sensor's performance is strongly determined by the dielectric properties of the tissues and the structure of the human body. The variation of muscle thickness does not improve much on the reflection and signal loss, which is considered as a result of the losses in dielectric properties of this layer. The included numerical and experimental validations proved the thicknesses of the fat and muscle tissues give a correlation of resonance frequency and signal loss responses. The proposed sensor and measurement methods can be extensively applied to many practical medical applications (6).

Harold Thimbleby discussed some issues available in most systems and pointed out that it is now routine to make a careful trade-off between the benefits and risks (7). Within the medical world there is a broadening intersection between information technology and biotechnology, and increasingly the role of sensors and micro machines will broaden too. Charles B Wilson pointed out Sensor technology will move the place at which health care is delivered in the future, changing the roles of hospitals, outpatient sites, homes, and ambulatory programmes outside the home. Smart blood pressure sensors will manage the drugs for patients with hypertension, sending an immediate alert to the central monitoring unit when integrated sensors for cardiac function and vital signs indicate an unexpected problem (8).

Remote healthcare monitoring, which is based on non-invasive and wearable sensors, actuators and modern communication and information technologies offers efficient solutions that allows people to live in their comfortable home environment, being somehow protected. George Vasilev Angelov and co-authors presented, the recent advances in electronics and microelectronics allow the development of low-cost devices that are widely used by many people as monitoring tools for well-being or preventive purposes. Many wearable devices of different types that have been proven in medical and home environments as being helpful in quality of life enhancement of elder adults. This article also explores, the remote systems can monitor very important physiological parameters of the patients in real time, observe health conditions, assessing them, and most important, provide feedback. Sensors are used in electronics, medical and non-medical equipment and convert various forms of vital signs into electrical signals and concluded an important step toward the wider adoption of identification and sensing technologies would be the implementation of techniques, methodologies, and approaches that are mature enough to be used in a wide range of applications. Nevertheless, it is important to take into account the restrictions posed by the available resources when deploying these tools methods and standards.

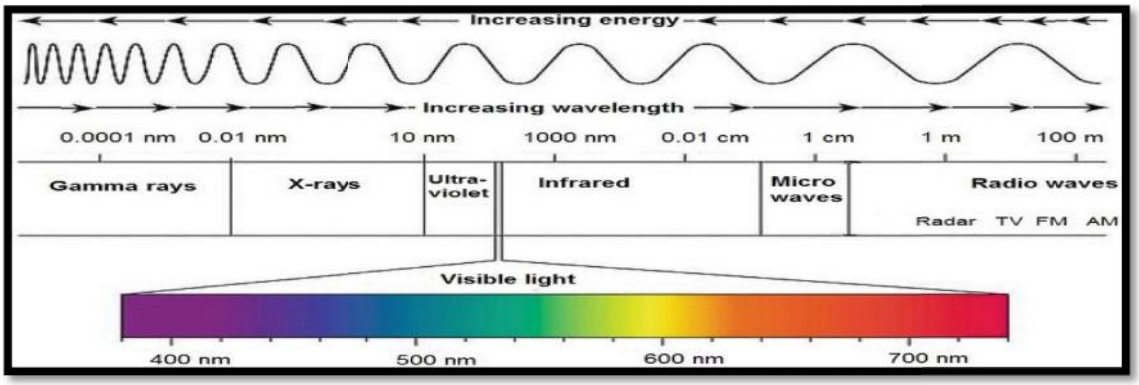

Figure 1. The EMS range from gamma rays to radio waves

In addition, it is desirable that the developed solutions would allow their evolvement into technical standards and future integrated platforms (9). Web application processes received data to show medical status of the patient along with personal information such as age, gender, address, and location on web interface. The proposed system has the ability to generate emergency alerts on the basis of predefined values by comparing patient's data to inform the doctor if there is a requirement of checkup or investigation. The developed system is comprised of wearable sensors, android handheld device, and web interface. The system is adaptable and has the ability to extract several cardiac parameters such as heart rate, blood pressure, and temperature of multiple patients simultaneously. The extracted data is being transmitted to android handheld device using bluetooth low energy which is then transmitted to web application for further processing. Priyanka Kakria et al. has been proposed in the study a real time heart monitoring system for heart patients located in remote areas.. Furthermore, various types of sensors have been used and results are compared to identify the most promising sensor providing most accurate results close to the conventional systems (10).

Rohit Chandra et al presents a comprehensive overview of the active MSI for various medical applications, for which the motivation, challenges, possible solutions, and future directions. Medical imaging systems currently used in medical care facilities usually rely on x-rays, magnetic resonance imaging (MSI), computed tomography (CT), ultrasound (US), and positron emission tomography (PET). Microwave sensing and imaging (MSI) is an alternative method based on nonionizing electromagnetic (EM) signals operating over the frequency range covering hundreds of megahertz to tens of gigahertz. MSI has been used for tumor detection, blood clot/stroke detection, heart imaging, bone imaging, cancer detection, and localization of in-body RF sources. The fundamental notion of MSI is that it exploits the tissue-dependent dielectric contrast to reconstruct signals and images using radar-based or tomographic imaging techniques (11). Wearable devices can monitor and record real-time information about one's physiological condition and motion activities. Wearable sensor-based health monitoring systems may comprise different types of flexible sensors that can be integrated into textile fiber, clothes, and elastic bands or directly attached to the human body. The sensors are capable of measuring physiological signs such as electrocardiogram (ecg), electromyogram (emg), heart rate (hr), body temperature, electro dermal activity (eda), arterial oxygen saturation (spo_2), blood pressure (bp) and respiration rate (RR). In addition, micro-electro-mechanical system (mems) based miniature motion sensors such as accelerometers, gyroscopes, and magnetic field sensors are widely used for measuring activity related signals. Continuous monitoring of physiological signals could help to detect and diagnose several cardiovascular, neurological and pulmonary diseases at their early onset. Also, real-time monitoring of an individual's motion activities could be useful in fall detection, gait pattern and posture analysis, or in sleep assessment. The wearable health monitoring systems are usually equipped with a variety of electronic and mems sensors, actuators, wireless communication modules and signal processing units. Sumit Majumder et al. discussed and compared various wireless technologies and assessed their feasibility in wearable health monitoring systems. Generally, the systems measure several physiological parameters from the human body and transmit them to a central node or main gateway (12).

RESULTS AND DISCUSSION

Microwave sensing is a technology that has demonstrated enormous potential in a variety of industrial and medical fields and has various medical applications. The advantages of using EM signals are ease of use, low health risk, low cost implementation, low operational cost. Advancements made in microwave sensors embedded systems make it possible for integration into portable, handheld, mobile devices with networking capability. Many technologies that are both critical and exciting, before moving to completely contactless systems, some combination of both with-contact and contactless types can be more reliable. Wearable sensors have diagnostic, as well as monitoring applications. Remote patient monitoring systems are designed to obtain a number of physiological data from patients. Traditional systems collect data using sensors attached to the body. But these systems create difficulty in terms of mobility for the patient and a patient's activities in daily living. As new technologies will improve things, we humans will still make error. How existing and emerging sensing technologies can be either adapted or enhanced to quickly tackle current situations of Health related issues. Identify awareness, attitudes, knowledge and practices regarding diagnosis and management.

Conclusion

From this review, we can summarize a few approaches on the data analysis; system integration of sensors for health monitoring that can be useful for systems with higher accuracy and usability.

Sensors are intended for the use of diagnosis, treatment and prevention of diseases. Timely diagnosis and treatment can solve health issues to a great extent. The knowledge obtained from this study can contribute to the development of a prevention program and early system warning methods. Recent technological advances in remote sensing have helped to overcome the limitation of conventional medical facilities and providing a new outlook for health care. Even with our best activities, we have a growing awareness of worrying and complex side-effects.

REFERENCES

Emerging Infectious Diseases, Timothy E. Ford, Rita R. Colwell, Joan B. Rose, Stephen S. Morse, David J. Rogersand Terry L. Yates,15(9): 1341–1346, 2009

Smart technologies for fighting pandemics: The techno- and human- driven approaches in controlling the virus transmission, Rama Krishna Reddy Kummitha, Elsevier public health Emergency Collection, PMC7167562, : 101481,2020

Remote Patient Monitoring: A Comprehensive Study, Lakmini P. Malasinghe, Naeem Ramzan & Keshav Dahal , Journal Of Ambient Intelligence And Humanized Computing , Volume 10, Pp. 57–76, 2019

A Review: Remote Sensing Sensors, Lingli Zhu, Juha Suomalainen, Jingbin Liu, Juha Hyyppä, Harri Kaartinen And Henrik Haggren, Open Access Peer Reviewed Chapter, 2017

Applications Of Microwave Sensors In Medicines, Dr. K.Venugopalan , Navneet Agrawal , O. Dössel And W.C. Schlegel (Eds.): WC 2009, IFMBE Proceedings 25/XI, Pp. 6– 8, 2009

Analysis Of Thickness Variation In Biological Tissues Using Microwave Sensors For Health Monitoring Applications, Syaiful Redzwan Mohd Shah ; Noor Badariah Asan ; Jacob Velander ; Javad Ebrahimizadeh ; Mauricio D. Perez ; Viktor Mattsson ; Taco Blokhuis ; Robin Augustine, IEEE Access (Volume: 7), 156033 – 156043, 2019

Technology And The Future Of Healthcare, Harold Thimbleby, J Of Public Research,2(3), 2013

Sensors In Medicine, Charles B Wilson, BMJ, 319(7220):1288,1999.

Healthcare Sensing And Monitoring, George Vasilev Angelov, Dimitar Petrov Nikolakov, Ivelina Nikolaeva Ruskova, Elitsa Emilova Gieva, Maria Liubomirova Spasova, Open Access Chapter First Online: Part Of The (LNCS, Volume 11369),Pp 226-262,2019

A Real-Time Health Monitoring System For Remote Cardiacpatients Using Smartphone And Wearable Sensors, Priyanka Kakria, N. K. Tripathi, And Peerapong Kitipawang, International Journal Of Telemedicine And Applications, Pp. 1-11, 2015

On The Opportunities And Challenges In Microwave Medical Sensing And Imaging, Rohit Chandra ; Huiyuan Zhou ; Ilangko Balasingham ; Ram M. Narayanan, IEEE Transactions On Biomedical Engineering, Volume: 62 , Issue: 7 , 2015

Wearable Sensors For Remote Health Monitoring, Sumit Majumder,Tapas Mondal Andm. Jamal Deen 17(1), 130; Sensors 2017

An Overview Of Remote Sensing And Geodesy For Epidemiology And Public Health Application, S.I. Hay, Adv Parasitol.; 47: 1–35, 2000.

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