Chapter 3
Recent Trends in Internet of Medical Things:
Challenges and Opportunities

Kannadhasan S.
https://orcid.org/0000-0001-6443-9993
Study World College of Engineering, India

Kanagaraj Venusamy
Rajalakshmi Engineering College, India

Nagarajan R.
https://orcid.org/0000-0002-4990-5869
Gnanamani College of Technology, India

ABSTRACT

Ultrashort pulses with exceptionally broad bandwidth and low power are transmitted and received by ultrawideband radar systems. While these features make UWB radars safe for use around people and compatible with other equipment, they also make it more difficult to detect the echo signal they produce. As a result, the radar antenna is crucial in UWB systems; in fact, it must be able to meet the broad band of frequency response and directivity requirements simultaneously. It is suggested that a radiated beam or gadgets worn on the body be used to minimize "losses" to the surroundings. In UWB imaging devices, a very narrow pulse is broadcast from a UWB antenna to penetrate the body. When the pulse travels through several tissues, reflections and scattering take place at the interfaces. Special attention should be paid to the diffused signal from a tumor-initiating small-tissue sample.

DOI: 10.4018/978-1-6684-5741-2.ch003

INTRODUCTION

Horn and Vivaldi antennas, for example, have strong directivity. Despite this, all of these radiators have the greatest directivity in the direction of the antenna's maximal size. A wearable radar system necessitates directivity in a direction perpendicular to the antenna's maximal size. Spiral antennas and other new sorts of equipment must be tested as a result. Two coplanar spirals form the antennas, which unwind at a fixed rate. When it comes to antenna design, spiral antennas have two opposing directions of emitted beams that are particularly stable with frequency. One version of this antenna uses a PEC ground plane at a specific distance below the antenna to generate a unidirectional beam. Copolarized reflections can be detected using any of the antennas listed above in a UWB radar. Cross-polarized antennas may be useful in monitoring heart activity. Conversely, asymmetric features like the heart's asymmetrical symmetry increase backscattering from cross-polarized antennas whereas flat surfaces like the chest wall are reduced by cross-polarized antennas. Ultrawideband (UWB) (3.1–10.6GHz) microwave imaging has outstanding penetration and resolution properties, making it a suitable tool for biological applications like cancer diagnostics. Dielectric differences between normal and malignant tissue are projected to be larger than 2: 1. This is the underlying principle of UWB cancer diagnostics. Promising results have been achieved in the early detection of breast cancer by using UWB imaging devices. Numerous small UWB antennas feature omnidirectional radiation patterns with low gains and obvious impulse response distortion. These UWB antennas are perfect for short-range communication both indoors and out. On the other hand, radar systems that use a UWB microwave imaging system to identify a tumor in a woman's breast benefit from an antenna with a moderate gain. The UWB antenna must also be able to transmit extremely brief pulses with little distortion in addition to a minimum return loss of 10 dB. This is a must for accurate imaging with no ghost targets. The bandwidth, gain, and impulse response specifications for imaging systems are met by the unipolar and antipodal Vivaldi antennas described in the literature. However, the huge size, which spans numerous wavelengths, comes at a price. As a result, the challenge is to reduce their physical dimensions while maintaining their broadband, high-gain, and distortionless performance in a tiny microwave image detecting system (ENISA, 2016; Gubbi et al., 2013; Ren et al., 2017; Stellios et al., 2018; Sundmaeker et al., 2010).

Numerous UWB antenna designs with low distortion have been proposed for medical imaging applications. Advantages and disadvantages can be found in all of them. Others have low gain and/or radiation efficiency, while others have a nonplanar structure. The imaging system's poor radiation efficiency limits the dynamic range, making it difficult to detect a tumor's modest backscatter. UWB antennas of the 5cm x 5cm variety are discussed in this study. For each of the antenna's numerous design aspects, a step-by-step tutorial is provided. Adding resistive layers to the antenna's radiating components improved the antenna's directivity and reduced any backward radiation that would affect the imaging system's accuracy. Using observed and simulated results, the proposed antenna exhibits ultrawideband behavior with a modest gain and distortion-free pulse transmission and reception.

In a microwave imaging system for the detection of breast cancer, the antenna presented here will be used. The imaging system uses a circular array of the intended ultrawideband antenna. The dispersed signal is picked up by the array's other antennas, while one of the system's antennas is used to broadcast a microwave signal. When all of the data has been collected, the measuring procedure is repeated, this time with a second transmitter and several receivers receiving a dispersed signal. This process is repeated until the array's antennas are all transmitting at the desired frequency. The antenna array can be moved up and down by a computer-controlled linear actuator. Planar data collection for 3D object