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Breast Cancer Detection Using Flexible Microstrip Antenna

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Abstract

Women's across the world are influenced by Breast cancer and conclude on a fatal note if it doesn't cure correctly. When the cases of Breast cancer gaining its pace among young age group the recent technology asks for advance early detection methods apart from the available methods as MRI & breast imaging system, Mammography. Keeping in mind the principles of our society and to bring on a feasible environment the technology can be developed with precise detection of the type of breast tumor cells with help of an antenna among the young age group while still, the age limit for diagnosis by mammography remains at 35 years. Developing a breast cancer exposure system that helps us predict the type of tumor cell present in the breast volume will ease the patients from initial clinical diagnosis..

Keywords— Breast cancer, Flexible antenna, Imaging mammography

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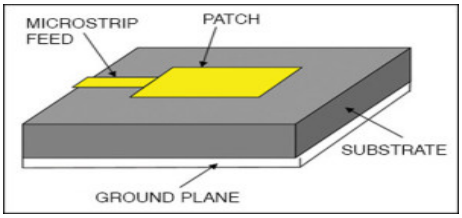
1 INTRODUCTION

In according to Official data from official Indian registers which are Subset of national cancer registry program [1], India registered an increasing number of Breast Cancer in the younger age group in the decade. Almost 48% patients of Breast Cancer belong to the age group of 25-40years.

In past 25 years only 2% patients were in the age group of 20-30 years and now the statistics stand alarming at 4%in the year 2014.
Among all female cancers registered in India, Breast cancer stands on the top of the list in Indian cities. A lot of women suffer from Breast cancer and initial detection is the best way out.
There are many ways of Breast cancer identification such as Mammogram, X-ray, ultrasound, tomography and MRI. However, this technique has some undesired results and is not preferred by younger age group. These techniques were overcome to some extent by recent growing techniques and technologies such as microwave imaging, wireless monitoring system, and medical implants [2][3][4][5][6].
But in the recent medical practice, the above-mentioned technologies and techniques use bulky communication system or antenna system [7]. In recent times where comfort level of patients is the utmost priority in diagnosis system with efforts in the way of communication plays a important role in wireless monitoring systems and is most relied on making antenna systems more readily available for the structure to run. An antenna is a specialized transducer that converts radio-frequency (RF) fields into alternating current (AC) or vice-versa. A Transmitter is a set of equipment used to generate and transmit electromagnetic waves carrying messages or signals, especially those of radio or television. In the medication of malignant tumor, Hyperthermia can be induced by using microwaves energy in an effective way. For this purpose the radiator used must be easy to handle, light-weight and rough. With a tight impedance controlled design being a flexible low cost substrate Kapton Polymide could make up a substantial part in the system design.. The Kapton Polymide substrate has a unique property to retain its electrical and mechanical properties even in Dry or Humid weather conditions [17][18]. These requirements can be fulfilled by a patch radiator as shown in figure 2. The design was based on printed dipoles and annular rings that were designed on ISM-band [2-4 GHz]. Later , the design was improvised and based on a circular micro strip disk at L-band [1-2 GHz].To measure temperature of the body , two coupled micro strip lines with a flexible separation is used inside the human body . [15].



[Fig.1].Schematic diagram of Microstrip Antenna
(source:http://lib.znate.ru/docs/index-149720.html?page=4)

3 RESEARCH GAP

Detection systems as discussed in the previous sections involve a wide system for initial detection of Breast Cancer. A skin contact application that can be comfortably handled & operated for detection without clinical procedure is the need of the time. A system that focuses on the detection of different types of Tumor cells rather than the imaging system can be the utmost sustainable movement in the Bio-medical instrumentation.

The available technologies that are for breast cancer detection are imaging systems. The need for the early detection includes a differentiation diagnosis of Benign and malignant cells inside the breast volume. The usage of Flexible micro strip antenna allows us to fit into any part of our body structure and that makes flexible antenna more applicable in recent medical application.

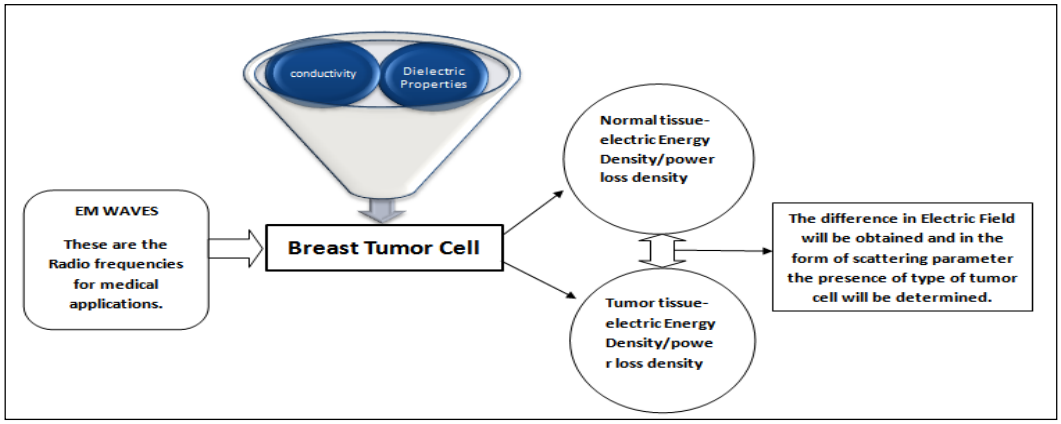
Micro strip antennas that are best operated at microwave frequency range than any other antenna lets us use the theory of Flexible micro strip antenna with the application on breast cancer identification. The work will focus on developing a flexible micro strip antenna making it cost efficient that will work in the given microwave frequency range. The design will be used to identify the type of tumor cell inside the breast. All the detection process in the recent applications require clinical test for detection of type of polyp cells and add on to the discomfort of the patients. So, by defining the algorithm the flexible micro strip antenna will be used to identify the type of tumor cells using primary parameters of tumor cells like relative permittivity, dielectric constant.

4 MOTIVATION

When you have less space availability to implement any antenna structure and also when the conventional antennas are quite rigid enough, the device complexities can be much more intense based on the nature of the design. For Investigation while we prefer ISM band, we can attain better results from a single micro strip antenna by changing to flexible substrates and its ground planes because these kind of antenna provide a better shielding of the system from stay radiations and can be rolled up anywhere. Breast tumor cells are of two types, one Benign and Malignant tumor cells. The benign cells are non cancerous and they consist of more water content than malignant cells.

The benign cells are lumps that do not affect the surrounding cells and have a low growth rate and they do not posses treat to life but have the possibility to turn into cancerous in near future. The malignant cells grow in a fast rate than its other type and posses life threat.

Thus the recent proposed research and work will focus on identifying the type of tumor cell without clinical diagnostics. A simple micro strip flexible antenna can be designed which operates in the ISM band and is made to identify the Benign or malignant tumor cells in its early phase with ease keeping the society and its principles in mind.



The antenna will be designed keeping in mind the dielectric properties and the relative permittivity with the result being produced in the form of return loss.

With pace in low cost effective antenna system, an antenna with Kapton Polymide substrate can be proposed and can be easily simulated using CAD tools like HFSS with change in EM radiations as shown in the block diagram showing a good argument between simulation and measurement. the system can call into many designs like breast light or duo laser detector for identifying .

4 ANTENNA DESIGN

As the proposed system revolves around flexible antenna, the antenna is designed using the following Equations as showed in fig 3. The antenna is designed to work in the frequency range of 2.4ghz(ISM BAND) as shown in fig4.

$$W = \frac{v_o}{2f_r}\sqrt{\frac{2}{\varepsilon_r + 1}}$$

$$L = \frac{v_o}{2f_r\sqrt{\varepsilon_{reff}}} - 2\Delta L$$

$$\varepsilon_{reff} = \frac{\varepsilon_r + 1}{2} + \frac{\varepsilon_r - 1}{2}\left[1 + 12\frac{h}{W}\right]^{-1/2}$$

$$\Delta L = 0.412h\frac{(\varepsilon_{reff} + 0.3)(W/h + 0.264)}{(\varepsilon_{reff} - 0.258)(W/h + 0.8)}$$

[Fig3]: Equations for antenna design,(source: http://www.raymaps.com/index.php/patch-antenna-design-using-transmission-line-model/path-

The simulation results were obtained as desired with -29dB return loss and high gain as shown below in the simulation results below in fig5, fig6 and fig7.

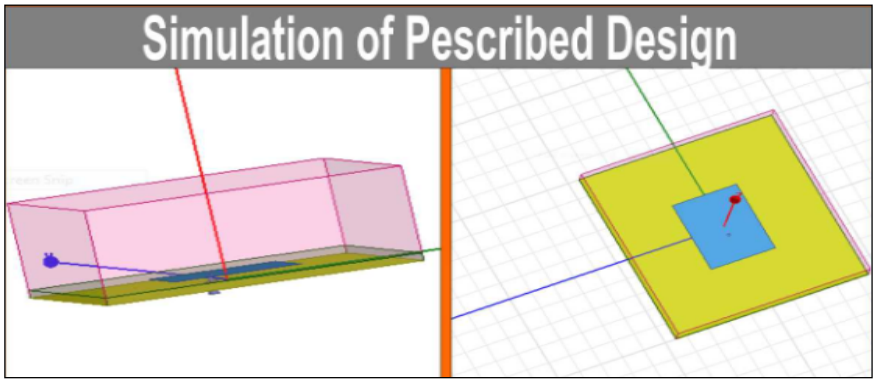


Fig4:Simulation of Antenna Design Using ANSYS HFSS

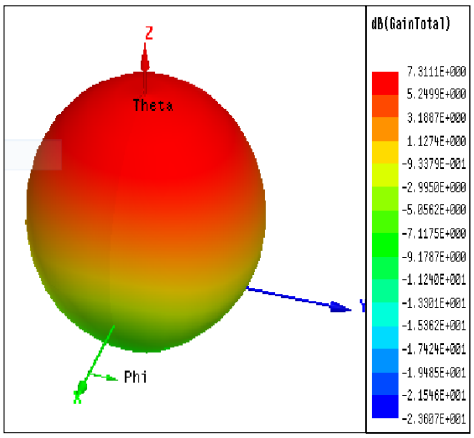


Fig5:3D Gain pattern as obtained from HFSS simulation tool

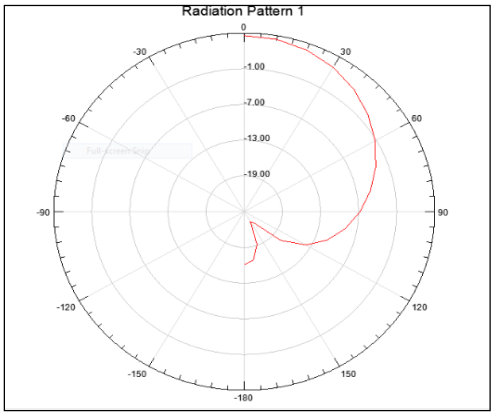


Fig6: Radiation Pattern as obtained after simulation.

The flexible substrate that we are going to use is kapton Polymide substrate- Type HN which is known to retain its di electric properties under any circumstances and is water resistant. So, as our application goes where there is possibility of humidity, sudden change in temperature Kapton Polymide stands best for the substrate in our design. The Substrate carries the following properties as: Dielectric Constant- 3.4; Thickness- 1MIL; Loss Tangent- 0.002.

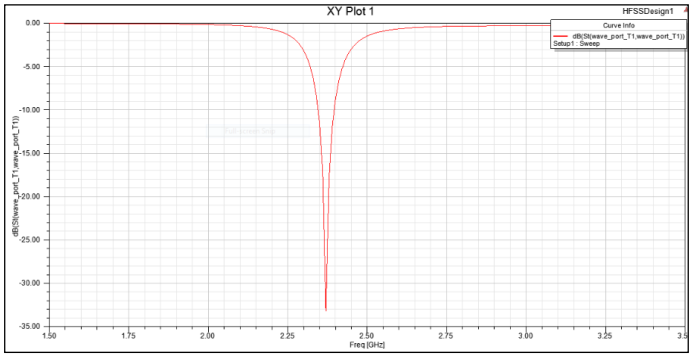


Fig7: Return loss obtained from simulation

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