**CHAPTER 2**

**LITERATURE REVIEW**

**2.1 INTRODUCTION**

Literature review is an assignment of previous task done by various authors and collection of information or data from research papers published in journals to progress our task. There are lot of literatures published before on the same task. Some papers are taken into consideration from which idea of the project is taken.

**2.2 WORK PROPOSED BY VARIOUS AUTHORS**

* **Microwave System for Head Imaging**

A wideband microwave system for head imaging is presented. The system includes an array of 16 corrugated tapered slot antennas that are installed on an adjustable platform. A switching device is used to enable the antennas to sequentially send a wideband 1–4 GHz microwave signal and capture the backscattered signals. Those signals are recorded using suitably designed virtual instrument software architecture. To test the capability of the system to detect brain injuries, a low-cost mix- ture of materials that emulate the frequency-dispersive electrical properties of the major brain tissues across the frequency band 1–4 GHz are used to construct a realistic-shape head phantom. A target that emulates a realistic haemorrhage stroke is fabricated and inserted in two different locations inside the fabricated head phantom. A pre-processing algorithm that utilizes the symmetry of the two halves of human head is used to extract the target response from the background reﬂections. A post-processing confocal algorithm is used to get an image of the phantom and to accurately detect the presence and location of the stroke.

* **Dual-Polarized, Broadside, Thin Dielectric Resonator Antenna for Microwave Imaging**

We present a design for a dielectric resonator antenna (DRA) with dual-polarization characteristics. This antenna is de- signed for use in a three-dimensional (3-D) microwave to mography system to collect co-polar and cross-polar responses. The broadside radiation and dual polarization are achieved by exciting the fundamental mode of the DRA as well as by using two elements of the DRA that are perpendicular to each other. Compared to the conventional rectangular DRA, the proposed antenna is reduced in size by a factor of 6.7. The proposed DRA offers a measured bandwidth of 72% (2.6–5.52 GHz). The performance and radiation characteristics of the antenna are veriﬁed experimentally.

* **A Compact Double-Layer On-Body Matched Bowtie Antenna for Medical Diagnosis**

A compact double-layer Bowtie antenna optimized for medical diagnosis is presented in this paper. This on-body antenna is matched to the human body to allow more energy to be radiated into the human body to obtain stronger reﬂections for image processing. By using a Bowtie antenna with double layers as well as a folded structure and meandered micro strip lines at the bottom of the antenna, a small size of 30 30 mm with a size reduction of 40% is achieved, compared to the reference antenna of 50 50 mm within the same operational frequency range. After the optimization of the antenna parameters, the antenna is characterized from 0.5 to2 GHz, where the low frequencies enable a high penetration into human body and the large frequency range contributes to a high bandwidth and hence a ﬁne range resolution. The simulated and measured results are shown with respect to the impedance matching, near-ﬁeld pattern, gain and SAR distributions. With features such as a very small size, very low operational frequency, high front-to-back ratio, this design shows a high potential for use in medical diagnosis of stroke, breast cancer and water accumulation detection in the human body.

* **Bandwidth Enhancement of a Microstrip-Line-Fed Printed Wide-Slot Antenna with a Fractal-Shaped Slot**

Microstrip-line-fed printed wide-slot antenna with a fractal- shaped slot for bandwidth enhancement is proposed and experimentally studied. By etching the wides lot as fractal shapes, it is experimentally found that the operating bandwidth can be signiﬁcantly enhanced, and the relation between the bandwidth and the iteration order (IO) and iteration factor (IF) of the fractal shapes is experimentally studied. Experimental results indicate that the impedance bandwidth, deﬁned by 10 dB reﬂection coefﬁcient, of the proposed fractal slot antenna can reach an operating bandwidth of 2.4 GHz at operating frequencies around 4 GHz, which is about 3.5 times that of a conventional microstrip-line-fed printed wide-slot antenna. It also achieved a 2-dB gain bandwidth of at least 1.59 GHz.

* **Wideband Unidirectional Antenna of Folded Structure in Microwave System for Early Detection of Congestive Heart Failure**

A three-dimensional antenna based on a combination of loop and dual mono pole structures with parasitic elements is presented. The antenna is speciﬁcally designed for a microwave system aimed at the early detection of congestive heart failure. The antenna is ﬁrst designed as a planar structure and then folded over optimally deﬁned folding lines to properly alter the path and phase of the surface currents for a unidirectional radiation and compact size as needed for the detection system. A prototype antenna of size (where, is the wavelength of the lowest resonant frequency) is developed to cover the band required in the targeted application. The measured results indicate 53% fractional bandwidth (580 – 1000 MHz), 6-8 dB front to back ratio, and 3-5 dBi gain. The antenna is then used to build a heart failure detection system, which also includes a compact microwave transceiver, a processing and image re- constructionalgorithmbasedonthesyntheticaperturefocusingtechnique, and a display unit. The system is used to successfully detect an early case of congestive heart failure in an artiﬁcial torso phantom that includes the main torso organs.