Information and Brokerage Event
Horizon Europe 2023 Call
Co-Funded by the DBT, Government of India

Call HORIZON-HLTH-2024-DISEASE-03-13-two-stage: Validation of fluid-derived biomarkers for the prediction and prevention of brain disorders

Date: 31-05-2023

STROKE DETECTION USING MICROSTRIP PATCH ANTENNA WITH MICROWAVE IMAGING

PRESENTED BY

Mr. Ramakrishna Mahapatra

[PG(M.Tech.)-STUDENT]

Specialization: Communication System Engg.

Dept. of Electronics and Telecommunication Engg.

Veer Surendra Sai University of Technology, Burla, Odisha, India

E-mail: ramakrishnamtech22@vssut.ac.in

Phone No.: +919778831605/+91801848248

Project Overview

- Detecting Strokes using Microstrip Patch Antenna with Microwave imaging.
- Identifying Strokes based on SAR values and variations in electrical properties of the antenna.
- Detecting and identifying strokes in their early stage.

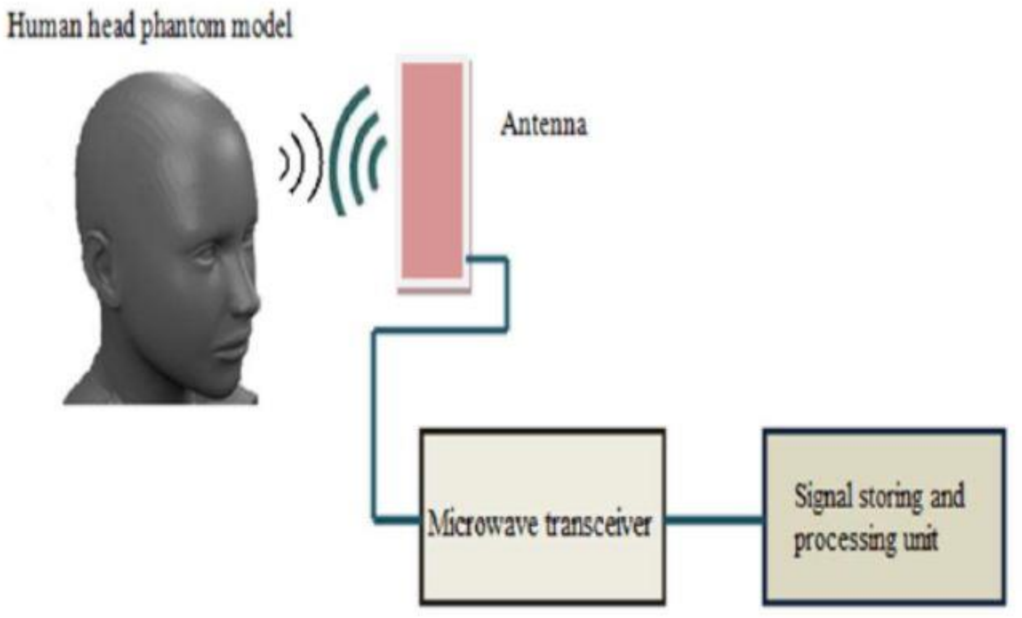


Fig. 1. Microwave brain imaging system model

Current Scenario

- In the past decade, the WHO declared cerebrovascular accidents (stroke) as the first reason for neurological dysfunction in the Western world and based on worldwide statistics second most critical reason for mortality and the third rising reason for disability.

- Every year globally almost 5 million people die and the other 5 million are rendered disabled due to such stroke-related accidents.

- Though the major impact is seen in the low and middle-income group countries, wherein 70% of the total stroke cases are reported and 87% of the total deaths and disability-adjusted life years occurs.

- Currently, the guidelines for stroke management are to undergo a series of treatments as per the resulting diagnosis. But there are relatively only two widely used methods available for stroke diagnosis i.e. X-ray based computer tomography (CT) and magnetic resonance imaging (MRI). Both are only available in the most advanced health centers and involve a huge cost of setup establishment, hence very scarcely available for the ongoing demand of diagnosis.

- If strokes can be identified at a very early stage, then accompanied by suitable remedial measures and prevention strategies the rate of stroke mortality can be effectively reduced.

Stroke Detection

- Considering the emerging demands stroke monitoring and detection have become a focus for developing more cost-effective and easily implementable techniques. Of which the Microwave Imaging (MWI) seems very promising due to its ease of setup and operation; with the capability to give a quick diagnosis as a complementary tool for the prehospital record on the type, size, shape, in some cases the number of blood blockages and as a harmless setup for continuous monitoring of the effect due to ongoing treatment since no harmful irradiations are involved herein.

- MWI takes the concept of variable reflections from surfaces with different permittivity and conductivity and helps build a 3D mapping of the model under study.

- This concept is now explicitly applied for mapping the human head phantom with the idea to locate the stroke at early stages with clear visualization of its shape, size, and most importantly their numbers with each one's precise location.

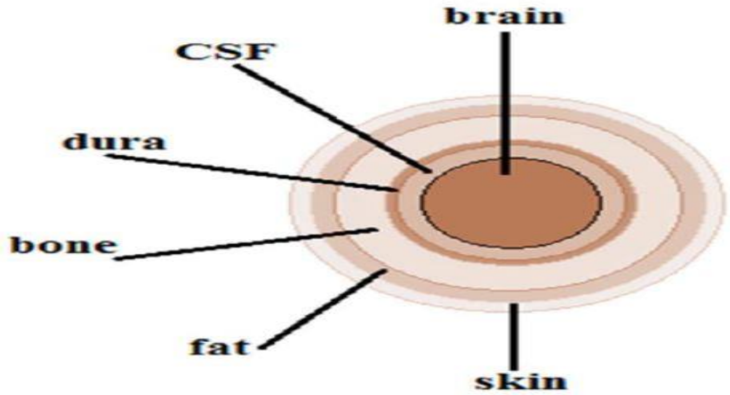


Fig.2 Six layers of the Human head Phantom model

Stroke Detection

- For this variable antenna designs were chosen for comparing their performances in terms of suitability for stroke identification.
- The working frequency was chosen as 2.45 GHz as the general norm for on-body and in-body applications stated by industrial, scientific, and medical (ISM) bandwidth is in the range of 2.4 – 2.5 GHz.

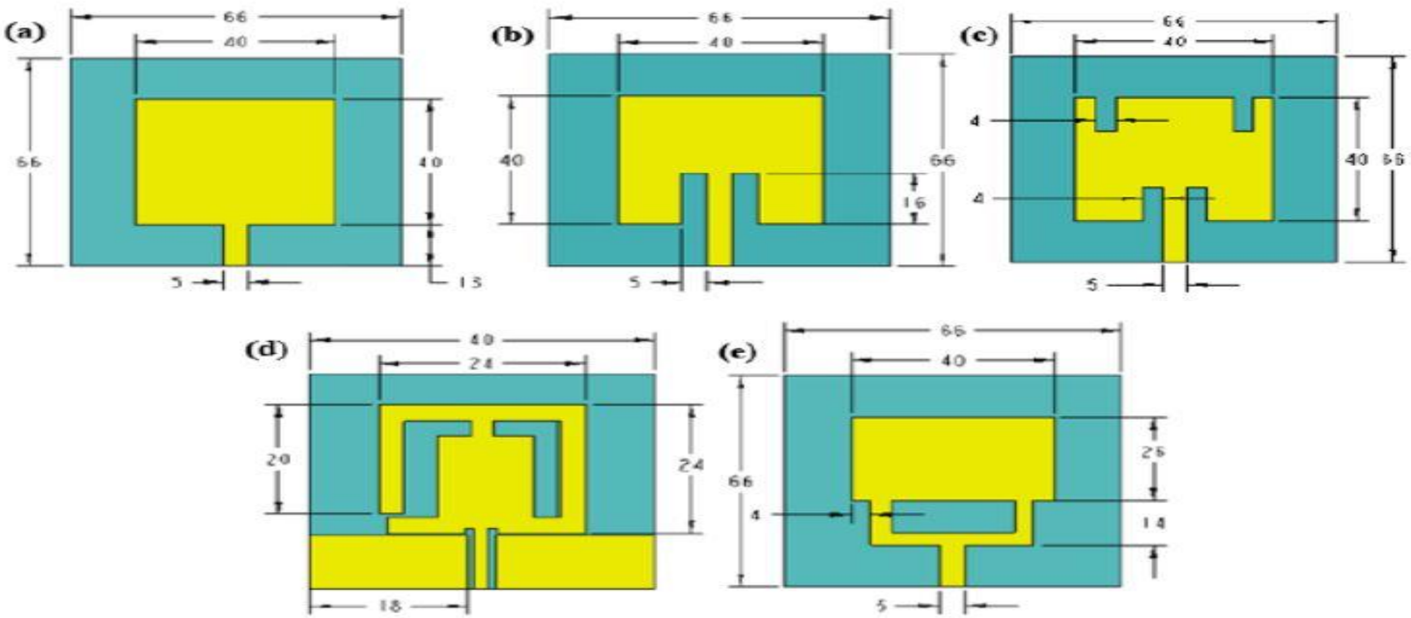


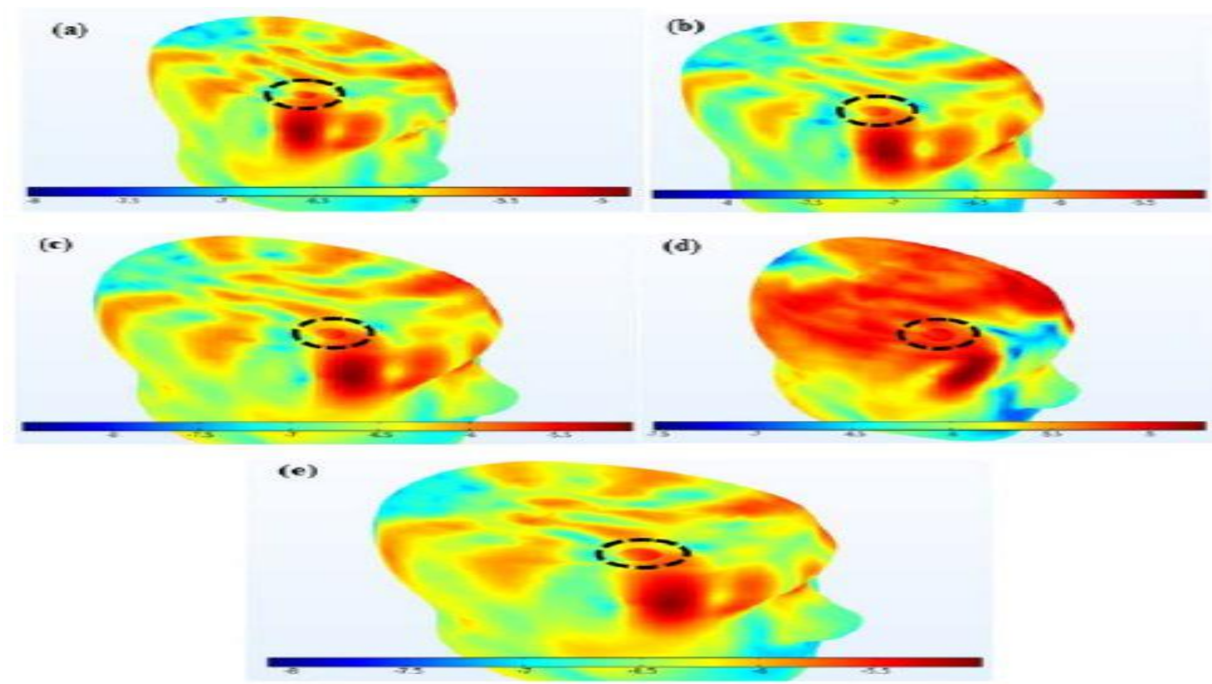
Fig.3. The Different Antenna Layouts Study for the Human Head Stroke Detection by Potable Setup Application Application

Stroke Detection

- The specific absorption rate (SAR) is calculated which represents the RF energy absorbed by tissue in per unit time and is calculated from the tissue density and the electromagnetic dissipation density. This is important to estimate the usability of such setup from the safety point of view, which is done by comparing the maximum exposure values with the prescribed limits.
- It is estimated by applying the following Equation

$$\mathrm{SAR} = \sigma \frac{|E|^2}{\rho}$$

where σ represents the tissues electric conductivity, $|E|$ is the electric field (RMS) norm, and ρ is the tissue density. The SAR value is calculated herein in watts per kilogram (W/kg).



- ***Fig. 4. Horizontal Cross-Sectional Layout of the SAR (Volumetric) Log-Scale Plot Showing the Exact Stroke Location in the Top View (the Exact Positioning of the Stroke Location in Horizontal Plane and its Shape is Indicated Herein) by various Antenna Designs viz. (a) Antenna-A, (b) Antenna-B, (c) Antenna-C, (d) Antenna-D, and (e) Antenna-E.***

Contact Details

- Name: Mr. Ramakrishna Mahapatra
- Designation: [PG(M.Tech.)-STUDENT]
- Specialization: Communication System Engg.
- Research Area: ***THz Antenna and their application in 6G communication***
- Department of Electronics and Telecommunication Engg.
- Name of the Institute: Veer Surendra Sai University of Technology, Burla, Sambalpur, Odisha, India 768018
- Nature: Academic Institution(State Govt.).
- E-mail: ramakrishnamtech22@vssut.ac.in / ramakrishnamahapatra6@gmail.com
- Phone No.: +919778831605/+918018482487

UNDER THE GUIDANCE OF

- Name: Dr. Hrudananda Pradhan
- Designation: Assistant Professor
- Department of Electronics and Telecommunication Engg.
- Name of the Institute: Veer Surendra Sai University of Technology, Burla, Sambalpur, Odisha, India 768018
- Nature: Academic Institution(State Govt.).
- E-mail: hpradhan_etc@vssut.ac.in
- Phone No.: +919778189596