Bio-Impedance based tongue cancer detection

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Abstract- Oral cancer is most common type of cancer found worldwide. In order to detect in early stage the method of bioimpedance of tongue will be measured at different frequencies. The impedance of tongue of patient will be measured by using disposable probes made up of silver. By using values of four electrical parameters are measured namely impedance, phase angle, real part of impedance and imaginary part of impedance at different applied frequencies.

Keywords: Bio-impedance, Tongue, Cancer detection, Probes

I. INTRODUCTION

The number of deaths occurring due to oral cancer are occurring due to oral cancer are higher in proportion than that due to breast cancer or cervical cancer. The only reason for this is late detection of oral cancer. In order to detect oral cancer at any early stage the method of measurement of bio-impedance can be used.

Bio-impedance is a term which describes the response of living organisms to an externally applied current. It is measure of opposition to the flow of the applied current through tissues. The measurement of bio-impedance of a living organism is non-invasive method for measuring cancer or body composition. A bio-impedance signal can be used for characterizing the tissue. The electrical properties of tissue vary with different applied frequencies.

In this experiment, a prototype has been implemented. Here instead of measuring the impedance of cancerous tongue tissue (CTT) impedance of capacitor has been measured. The probes used for the measurement of impedance of capacitor made up of copper. In the practical implementation of this system, cancerous tongue tissue (CTT) and its surroundings normal tissue (NTT) can be used for impedance measurement. For this purpose disposable probes made up of silver can be used.

Bio-impedance is well established method in detecting breast cancer and cervical cancer but at present very few studies using bio-impedance for the detection of tongue cancer have been reported. The studies showed that there are large differences in electrical impedance between normal tissues.

The main aim of this experiment is to investigate the electrical properties of tongue tissue. Depending upon electrical properties obtained the aim of detecting tongue cancer at an early stage can be achieved in reliable, low cost and noninvasive way.

II. BLOCK DIAGRAM

- PC application is written in Visual Basic
- uC side coding is done using Embedded C
- User selects START operation on PC
- A command is sent to microcontroller over RS232 using serial port.
- Once the command is received, the microcontroller will start communication with AD5934 network analyzer.
- uC will set the initial frequency, final frequency and steps for increment and send start.
- The communication between uC and network analyzer is done over I2C protocol.
Once the sweep is complete, the microcontroller will read the values (real and imaginary) from registers and send it to PC one by one.

On PC, the received values will be stored in files (patient records) and a graph will be plotted for analysis.

User can load multiple graphs (ones stored earlier) to analyse the dielectric material under test (tissue / metal / etc.)

III. MEASUREMENT STEPS

Two capacitors of values 2.2pF, 100μF respectively were used for impedance measurement. In real time application the electrical properties of tongue tissues of patients can be used. The disposable probes were placed on two different capacitors were measured at 5 different frequencies, 10kHz, 15kHz, 20kHz, 25kHz, 30kHz with amplitude of applied voltage 200 mv.

In real time application the electrical properties of tongue tissues of different patients at different frequencies can be measured with the same applied input voltage, also, while implementing the procedure practically oral temperature of every patient should be measured using body temperature thermometer.

IV. RESULT

The above diagram shows the process of loading the files for comparison of the four parameters of the two capacitors. The four parameters namely the impedance, phase angle, real value and imaginary value are measured of the capacitors of 2.2 pF, and 100 μF and the graph are plotted in visual basic. The red colored bars in the graphs represent the different values for the capacitor of value 2.2 pF and the green colored bars represent the different values of the capacitor of value 100 μF.

In practical implementation similar graphs will be plotted and values of four parameters for the cancerous tongue tissue and surrounding normal tongue tissue will be compared.
REFERENCES


