NOTIFICATION NO: F.NO.COE/Ph.D./(Notification)/538/2023 on Dated: 17-05-2023

Student's Name: Durga Nand Mahaseth

Supervisor's Name: Prof. Tarikul Islam

Name of Department: Electrical Engineering

Name of Topic: Design and Development of Surface Acoustic Wave (SAW) Physical Sensor with Necessary Signal Conditioning

Keywords: Signal Conditioning, Surface Acoustic Wave, Sensors, Resonators, Thermistor, Humidity sensor

Objective of the Thesis

The focus of the work being done right now is on alternative sensor configurations as a means of overcoming restrictions posed by previously implemented arrangements. The following are the primary aims of this thesis:

- Literature survey and finding the research gaps to develop SAW sensors to measure physical parameters such as humidity, temperature.
- Design, modeling, fabrication and studying the responses of the SAW sensor for humidity measurement.
- Design, modeling, fabrication and studying the responses of the SAW devices for temperature measurement.
- To develop interfacing electronic circuit for the SAW sensors.
- To design the signal conditioning circuit for compensating the nonlinearity of the sensors.

Contribution of the Thesis

Seven different chapters make up the overall structure of the thesis as follows.

Chapter 1.

This section provides an introduction to surface acoustic wave (SAW) systems and high frequency microstripline based resonator. Details on their background, advantages, and various forms of technology have also been provided.

Chapter 2.

In this section, we will discuss the background reading and theory that informed our investigation. Works presenting high frequency SAW sensors and microstripline sensors in the detection of humidity and temperature have been reported.

Chapter 3.

This chapter describes the design and development of SAW based ultrafast humidity sensor. The titanium dioxide is used for preparing solution for humidity detection. Titanium oxide (TiO_2) is prepared by the sol gel technique. Solution was coated through drop casting method on the surface of the piezoelectric substrate of the SAW resonator.

Chapter 4.

This chapter describes design and fabrication of high frequency microwave device for humidity measurement. Microstripline structure is designed and used with a resonating stub for humidity sensing.

Chapter 5.

We examine the usage of a SAW sensor for temperature measuring in this chapter. Saw device is the extremely precise resonator. It is shown in this chapter that a SAW device coated with PDMS can be used for temperature sensing, and that this is just one of the many advantages of employing such a device. It evaluates the performance of several SAW substrate materials in the context of temperature measuring applications and makes recommendations for further research.

Chapter 6.

This chapter will focus on nonlinearity compensation of the output of the sensor as well as a novel construction of interfacing circuits. The advantages of using a thermistor as a temperature detecting device are discussed in this chapter. In order to compensate for the nonlinearity of the temperature sensor output and the GO-based humidity sensor, a mixed signal condition circuit is being built. In addition, an illustration of a method for producing an IDT structure on glass slide and a sensitive coating of GO for humidity sensing is shown.

Chapter 7.

The summary of the research done for the thesis, the contribution of this research, and the potential future application of the suggested research are the main topics of this chapter.