

Simulating an IDC-Bio-Sensor to Detect Diabetics

Shobha Bawiskar¹, Dr. Ramesh R. Manza², Dr. B. N. Dhole³

¹Government institute of Forensic Science, Aurangabad

²Department of CS & IT, Dr. BAMU Aurangabad

³Department of Physics- MEMS Lab, Dr. BAMU, Aurangabad

Abstract: *This Research article focuses on one of nanotech application i.e Bio-Sensor .Aim is to create a design for non invasive biosensor to detect diabetics from blood flow pattern. To severe this purpose- use of COMSOL 4.3 simulating tool is used for designing in which 3-D geometry depicting human environment. AC/DC physics is applied. Varying voltage is applied and its effect is seen on blood. If this technique is successful then commercially it will be used widely.*

Keywords: Biosensor, Interdigital (IDC) Sensor, electrostatic force, Capacitance, diabetics.

1. Introduction

Nanotechnology ("nanotech") is the manipulation of matter on an atomic, molecular, and supramolecular scale. The earliest, widespread description of nanotechnology[1,2] referred to the particular technological goal of precisely manipulating atoms and molecules for fabrication of macroscale products, also now referred to as molecular nanotechnology.

BIO-Sensors: - are any biological, chemical, or surgical sensory points used to convey information about nanoparticles or microparticles to the macroscopic world. Their use mainly includes various medicinal purposes and as gateways to building other Nano/Micro products.

1. Past condition:-

Previously nearly about 15 years ago, all the laboratory test used to carry out manually by using the lab equipments (test tubes, slides, microscopes, various chemical solutions...) which naturally very time consuming to give the test reports (result).

2. Present Condition :

- 1)Every common man currently spend hundreds and thousands of rupees on healthcare outside the formal medical establishment, which they find difficult, expensive, and painful to access..
- 2)Now hospitals and Pathological Lab are using invasive Glucometres for detecting Diabetics..
- 3)Few Drawbacks that are faced :-
 - a. Failure to store glucose strips properly;
 - b. Failure to set glucose meter codes to match strip codes;
 - c. Failure to apply sufficient blood on the meter's strip;
 - d. Failure to use control solutions;
 - e. Use of date-expired control solutions;
 - f. Use of date-expired strips; and
 - g. Failure to wash hands properly.
 - h. Expensive,
 - i. inaccurate, does not work in most patients,
 - j. very difficult to use (not user friendly)
- 4)An Ideal Glucose meter should be accurate, easy to use, minimize, convenient, in short use of painless glucose

meter which will provide or eliminate all above drawbacks.

5)At Present state research is going on to develop non-invasive Glucometer to detect diabetics so that everyone is self cautious about its health by continuous monitoring.

Interdigital electrodes are among the most commonly used periodic electrode structures. Recent advances in such fields as nondestructive testing (NDT), microelectromechanical systems (MEMS), telecommunications, chemical sensing, piezoacoustics, and biotechnology involve interdigital electrodes in very different ways.[3]

Using A simulating tool COMSOL Multiphysics Design the **Interdigital-Bio-Gluco-sensor**. That shows when electric force is applied to sensor there is change in Capacitance of blood flow, which is the vital parameters to detect glucose in blood.

2. Methodology

Used in this research is Design Creation / Experimental based on the simulating software tool COMSOL-Multiphysics 4.3---Following algorithm is used for the implementation purpose:

- Step 1. Start
- Step 2. Select space Dimension.
- Step 3. Add Physics that is desired
- Step 4.select desired study to be made.
- Step 5. Built the Geometry of the BIO Sensor.
- Step 6. Accordingly respective material and material properties are selected.
- Step 7. Meshing.
- Step 8. Study setting is done.
- Step 9. Compute the results.
- Step 10. End

Note: if any change as describe in above steps is possible to be made.

3. Design Creation / Experimental

Using above steps following Inter Digital Model (IDC) is built.

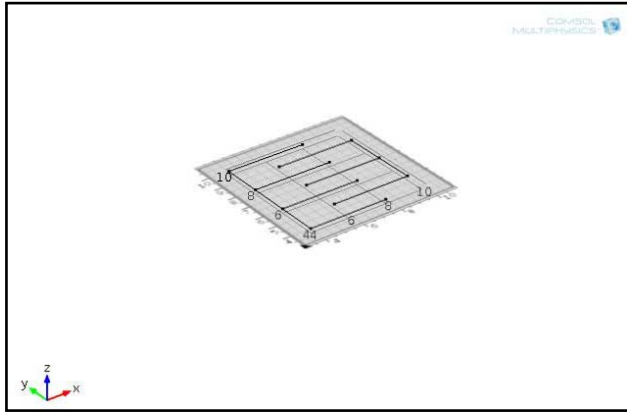


Figure 1: IDC

IDC and human environment is shown in 3-D Space

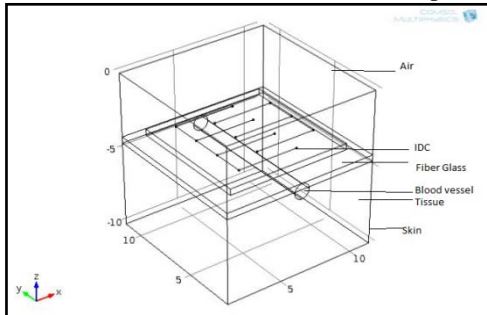


Figure 2: IDC and Human Environment

4. Results

IDC sensor is placed on silicon (IC Chip), Bio-IDC sensor-IC as shown in fig 3. Silicon material is selected because it is not effect by electrical force applied and is easily available and affordable too.

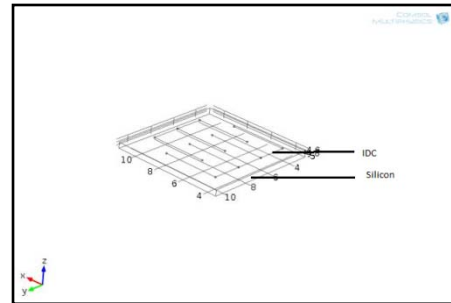


Figure 3: Bio-IDC-Sensor-IC

The influence of electrical force on blood is shown in fig 4. Results are very good. When electrostatic force is applied to the human tissues and its dependency on capacitance. As it can be seen in Fig.4. Electrical field penetrates deep enough into tissues and reaches a vessel which also affects the flow of blood.[4,5]

Voltage Applied	Fig-1— Multislice: Electrical potential (V)	Fig-2— Multislice: Electrical potential (V) Surface: Electrical potential (V)	Fig-3— Multislice: Electrical potential (V) Surface: Electrical potential (V) Arrow Surface: Electrical field	Capacitance (pF) Evaluated
0V				NaN
1V				-8.42659e-22
10V				-3.38389e-22

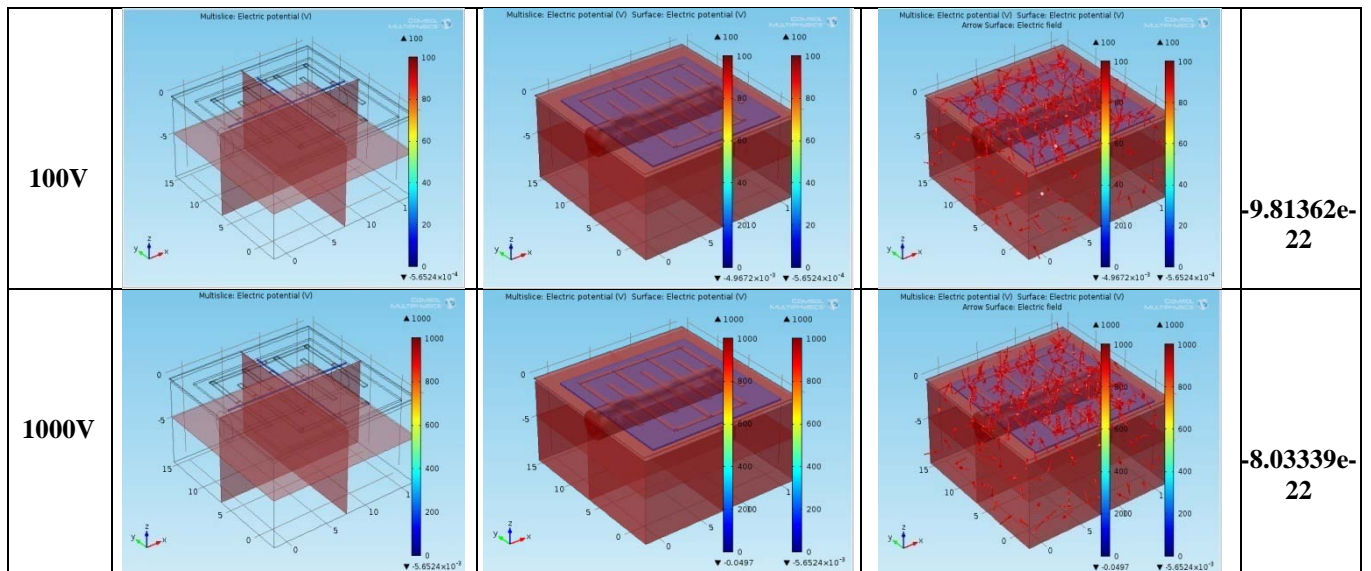


Figure 4: Experimental Analysis re

5. Conclusion

Using this Design it is clear that in normal blood flow thought the various electrical parameters are applied the electrical force is reached to blood as shown in fig: 4. In this article only stationary study is done and capacitance estimated is approximately stable as the blood is normal. As this work is limited to design Further the results with hypo or hyper diabetic may be analyzed after its manufacturing only.

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