Abstract:

Blood glucose monitoring is a way used for testing the concentration of glucose in the blood (glycemia). Practically important to measure the levels of blood glucose in the care of diabetes mellitus patients. A blood glucose test is performed by piercing the skin (typically on the finger) to draw blood, then applying the blood to a chemically active disposable "test stripe".

The main idea for the design of the circuit is by using a variable capacitor consist of two passive terminal or plates and by changing the density of the insulator between the two plates of the capacitor. The changing in capacitance results of the capacitor which is a part of a (frequency generator circuit) for that the output frequency of the circuit will be change, and if we used that frequency as an input to counter circuit we can read out the concentration of the glucose in the sample and then we display the result on a LCD monitor.

The present study includes a comparison between the present system and the conventional glucose serum measurement systems, and the result approximately the same.

Introduction:

Two major methods have been used to measure glucose. The first, is a chemical method exploiting the "nonspecific reducing" property of glucose in a reaction with an indicator substance that changes color when reduced. Since other blood compounds also have reducing properties (e.g., urea, which can be abnormally high in uremic patients), this technique can produce erroneous readings in some situations (5 to 15 mg/dl has been reported). The more recent technique, using enzymes specific to glucose, are less susceptible to this kind of error.

The two most common employed enzymes are glucose oxidase and hexokinase. In either case, the chemical system is commonly contained on a test strip, to which a blood sample is applied, and which is then inserted into the meter for reading [1]. This blood monitoring equipment contains software that allows the user to download meter results [2].

In last few years, "glucose sensing bio-implants" was produced: This kind of equipment is known to be the long term solution of continuous monitoring, used a long-lasting bio-implant, help in minimi-
null
Results:

We used three different samples in our testing and the samples were: Water, Water and sugar, Blood. The result of water sample as shown in Fig.(7) and (8) which are illustrated frequency and time domain respectively for water sample. While the result of water and sugar is shown in Fig.(9) and (10) which are illustrated frequency and time domain respectively for water and sugar sample. In blood sample frequency and time domain is shown in Fig. (11) and (12) respectively.

Another result after some calibration tests was as shown in Fig. (13) and (14) which is include comparison between the result for each blood sample by using ACCU CHECK device (conventional glucose meter) with the one result from our prototype circuit and the result was almost matched, and this is what we aim to in this project by getting the best result close to the real one.
Figure-7: Frequency Domain for Water Sample

Figure-8: Time Domain for Water Sample

Figure-9: Frequency Domain for Water and Sugar Sample

Figure-10: Time Domain for Water and Sugar Sample

Figure-11: Frequency Domain for Blood Sample

Figure-12: Time Domain for Blood Sample

Figure-13: The Result for the First Blood Sample by Using Accu-Check

Figure-14: The Result for the First Blood Sample by Using the Prototype Circuit
Discussion:

The present design considers the most important glucose meter devices in our medical and engineering laboratories based on educational approaches especially in electrical, electronical, and biomedical engineering departments. The previous studies in this field include design a glucose meter system based on spectrometric instrument for example. The basic idea for this research is designing a system to measure glucose concentration in different samples includes water, water and sugar and blood.

The most difficult part in designing the circuit was the sensing part because in most commercial devices they use a test strip which is a consumable element containing chemicals that react with glucose in the drop of blood is used for each measurement. For some models this element is a plastic test strip with a small spot impregnated with glucose oxides, in this design instead of using the chemical reaction for sensing the concentration of the glucose we manufactured the sensing part which is a variable capacitor (the density of the insulator is changing according to the concentration of the glucose in the sample that will result in changing the capacitor) which is connecting to a clock or frequency generator circuit. The result we got it for the three samples were different slightly from each other according to the glucose concentration in each sample because each sample will change the frequency of the clock generator circuit and result in changing the input to the counter.

References:

6- Fraser, R. and Bert, M. Merck Manual of Medical Information; Merck & Co., Inc.; 2007.