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A NOVEL NON INVASIVE GLUCO METER

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ABSTRATCT

Diabetes is one of the most life-threatening disease prevalent in human beings. To control Diabetes, the blood sugar level of the individual must be checked regularly. The present methods available in the market to measure blood sugar makes use of invasive techniques, a prick is done on the finger and blood sample is taken for measurement. This process is painful and is not cost effective. Non-invasive method can be used which facilitates frequent testing, relieves pain and discomfort caused by frequent finger pricks. A Non-invasive method of glucose level measurement is proposed. The variation in the intensity of NIR light received from the photo detector after passing through the finger is used to determine the glucose level of blood. The measured glucose level is displayed in LCD display and also transmitted to the android application which is created in the mobile phone to display and store data via Bluetooth.

I.INTRODUCTION

Measurement of glucose concentration in human blood is an essential requirement for the medical treatment of any person by a physician. The existing measurement techniques may be of three types namely, invasive, minimally invasive and non-invasive. In the conventional biochemical invasive technique, a certain volume of blood is drawn from the human body to determine the glucose content in the blood sample through biochemical analysis of the sample. This technique is very painful for a person. At present, a less painful minimally invasive portable glucometer technique is being used to measure blood glucose where only a drop of blood is used by pricking any finger with a pricking device.

The minimum invasive methods like micro dialysis probe method, fluorescent sensor method, glucowatch method etc. are also painful methods. So painless non-invasive techniques with good reliability and accuracy is the recent trends in blood glucose monitoring. These techniques may be of various types such as near-infrared (NIR) light spectroscopy type, mid-infrared (MIR) light spectroscopy type, far-infrared (FIR) spectroscopy type, Raman spectroscopy type, polarized light rotation type, impedance spectroscopy type etc.

In this analysis, the glucose present in blood in organs like fingertip, finger web, cuticle, forearm, earlobe etc.changes the spectrum of light passing through the organ and from the spectroscopic analysis of this light, the glucose content of the blood is estimated.

II.BLOCK DIAGRAM

The block diagram of the proposed system has been shown in Fig.1,

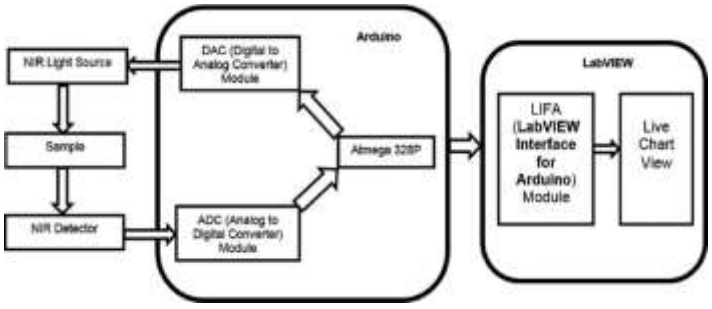

Fig.1.Block Diagram

The proposed block diagram was converted into circuit as shown in Fig.2.

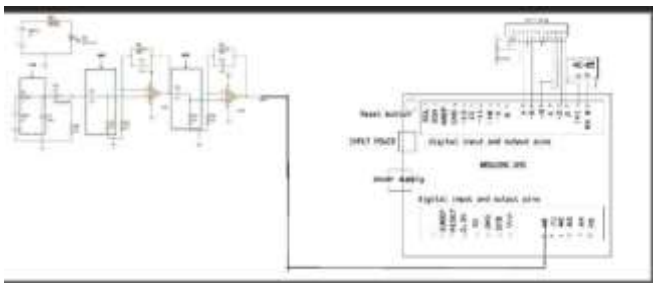

Fig.2.Circuit Diagram-Schematic

The non-invasive glucose measurement schematic design above describes how each component interfaces with the microcontroller.As seen in the picture, the filtering stage and the amplification stage make up the circuit schematic of the intended system. By inserting the load resistance R4=50kΩ at the anode side of the photodiode, the electrical current received from the photo detector is transformed into a voltage. Both the high pass and low pass filters have cut-off frequencies of 2.34 Hz and 1.59 kHz, respectively.

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In order to transform the analog signal into digital numbers, the Arduino microcontroller's analog pin A0 receives the amplified output voltage. The glucose level is represented by this digital figure. Using the polynomial regression algorithm, the actual glucose level is calculated from this digital value. The glucose levels measured invasively in the lab are used to create this equation.

The amplified output voltage is sent to the analog pin A0 of the Arduino microcontroller, which converts the analog signal into digital integers. This digital figure represents the glucose level. This digital number is used to compute the actual glucose level using the polynomial regression algorithm. This equation is derived from the invasively detected glucose levels in the laboratory.

III HARDWARE

The prototype of the hardware of the project has been shown in fig.3.

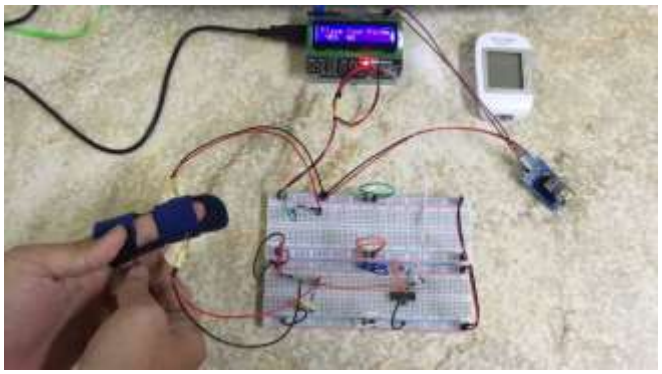

Fig.3.Hardware Prototype

The Arduino Pro Micro is the microcontroller being used here. The Arduino's primary responsibility is to ensure that the LED portion operates as intended. There are four LEDs in the LED section: red, green, infrared, and near-infrared. The LEDs' ability to glow is managed by the LED drivers. The LEDs light up in response to commands sent to the microcontroller. We can place our finger in the gap between the LEDs and the photodiode. A person's finger transmits light from the LEDs, and the photodiode receives the refracted light after it has passed.

After being transformed into its electrical equivalent, this optical signal is sent to the analog acquisition system, which transforms it into a digital format. The microcontroller receives this output and processes it further before displaying the values on the LCD panel.

IV.CONCLUSION

It has been created with features that integrate all of the hardware components used. Each module's inclusion has been thoughtfully considered and positioned to maximize the unit's functionality. Second, the project has been successfully executed with the aid of developing technology and very sophisticated ICs.
Consequently, the project's design and testing were successful.

The invasive glucose measurement approach is uncomfortable, expensive, and painful. It is not used for ongoing monitoring and has an infection risk. This study suggests a noninvasive technique for measuring blood glucose utilizing near-infrared LEDs in order to get over the aforementioned drawbacks. Both the built mobile app and the LCD display show the blood glucose level that was determined by the photodetector. This portable noninvasive blood glucose monitor offers a very efficient way to support diabetes patients' medical care management. Both at home and in medical facilities, this can be used to track patients' blood glucose levels.
The design has following advantages:

1. Minimal power consumption,
2. Effective design, and ease of use.
3. Cheap

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