iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 10 **Issue:** IV **Month of publication:** April 2022

DOI: https://doi.org/10.22214/ijraset.2022.41221

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 10 Issue IV Apr 2022- Available at www.ijraset.com

Intense Study on Measuring Blood Glucose Level of Humans using Non-Invasive Method v.0

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Abstract: ***Diabetes mellitus, additionally referred to as Hyperglycemia, is one of the most common disorders in the world. It happens because of the excess amount of glucose present in the blood. It impacts about 422 million humans worldwide, with the bulk residing in low- and middle-profits countries, and diabetes is at once accountable for 1.5 million deaths every year. Regular tracking of glucose is important for the management of diabetes. The current proposal involves an aggregated method of using an array of Near-infrared LEDs to non-invasively measure the concentration of glucose in the body. An array of NIR led & Laser is fitted into a wearable device, manufactured from thermoplastic polyurethane (TPU) and the light of appropriate wavelength could be absorbed with the help of glucose found in blood and the attenuated light could be sensed with the aid of using the photodiode that's used to transform the light energy into a voltage signal. This signal could then be amplified and fed as an input to the microcontroller in which the glucose level is calculated using regression analysis. The calculated value of glucose could be displayed on the output display unit and the data is transferred through Bluetooth to an android application for storage and display in application. They do not produce any medical waste, limit the danger of infection, and enhance pain management.***

I. INTRODUCTION

Diabetes has been steadily increasing in both a variety of instances and the superiority over the last few decades. The early detection of Diabetes may be a leap forward in today's life-style. The detection of diabetes with traditional strategies of glucose monitoring is invasive and consists of spectroscopy and electrochemical method, however the most important drawback of such a way is that it calls for extracting blood, and doing chemical evaluation which makes use of check strips. This technique makes the people now no longer take check-ups regularly and without following the standard strategies to take check-ups. Nowadays people have an awareness about fitness control to comply with the right weight-reduction plan to preserve a healthful life-style. The first-rate and accuracy of the glucose value may be received in numerous strategies via means of the usage of QCL and absorption co-green strategies. NIR utilizes light from the near-infrared region ranging from 780-2500 nm to study the interaction of matter and electromagnetic radiation. The light produced from the fingertip, the flow rate of blood, and the oxygenation hemoglobin are the parameters responsible for measuring the glucose concentration of blood.

II. LITERATURE SURVEY

Author name	Paper title	Approach
Parag et al.	NIR Based Non-Invasive Blood Glucose Measurement	In this study, a non-invasive method for measuring blood glucose concentration utilizing a near-infrared optical method is described. The finger is exposed to light with a wavelength of 980 nm, and the signals reflected by the phototransistor are used to calculate the glucose level concentration.
Vega et al.	Wearable-band type visible-near infrared optical biosensor for non-invasive blood glucose monitoring	Sweat, saliva, and tears have all been used in studies to test blood glucose noninvasively. However, because of the expense and other unresolved concerns, this proposal presented a new approach for measuring glucose levels that are both cost-effective and wearable. The glucose level is determined using visible near-infrared spectroscopy.

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Hari et al.	Non-Invasive Glucose Monitoring using Machine Learning	Provided wavelengths of 525 nm, 660 nm, and 950 nm, this paper uses a plethysmography-based approach to monitor blood glucose levels. The detected signal from the photodetector is sent to the Arduino UNO microcontroller and then processed using an algorithm from machine learning technique. The proposed method is a typical way for monitoring glucose levels. The traditional intrusive procedures cause people anguish and make them more uncomfortable. Using wavelengths of 525 nm, 660 nm, and 950 nm, this paper uses a plethysmography-based approach to monitor blood glucose levels. The output signal is sent to the Arduino UNO microcontroller, which is then processed using a machine learning technique. The recommended method appears to be more effective compared to invasive methods.
Jiamei et al.	Review of non-invasive continuous glucose monitoring based on impedance spectroscopy	Diabetes is on the rise, and the intrusive treatment procedure is inconvenient for patients. The use of electrical impedance spectroscopy for noninvasive glucose monitoring is discussed in this article. The disadvantages of intrusive methods as well as the benefits of non-invasive approaches have been explored.
Duc et al.	Non-invasive Glucose Monitoring System Utilizing Near-Infrared Technology	NIR light, which monitors the quantity of glucose in the blood, is used to do non-invasive glucose concentration measurements. The calculation of glucose level concentration is done using R programming and an artificial neural network (ANN).
Stephanie et al	Non-Invasive Blood Glucose Measurement Using Temperature-based Approach	Based on the approach known as Metabolic Heat Conformation, this research proposed how temperature could alter blood glucose levels.

III. LIMITATIONS

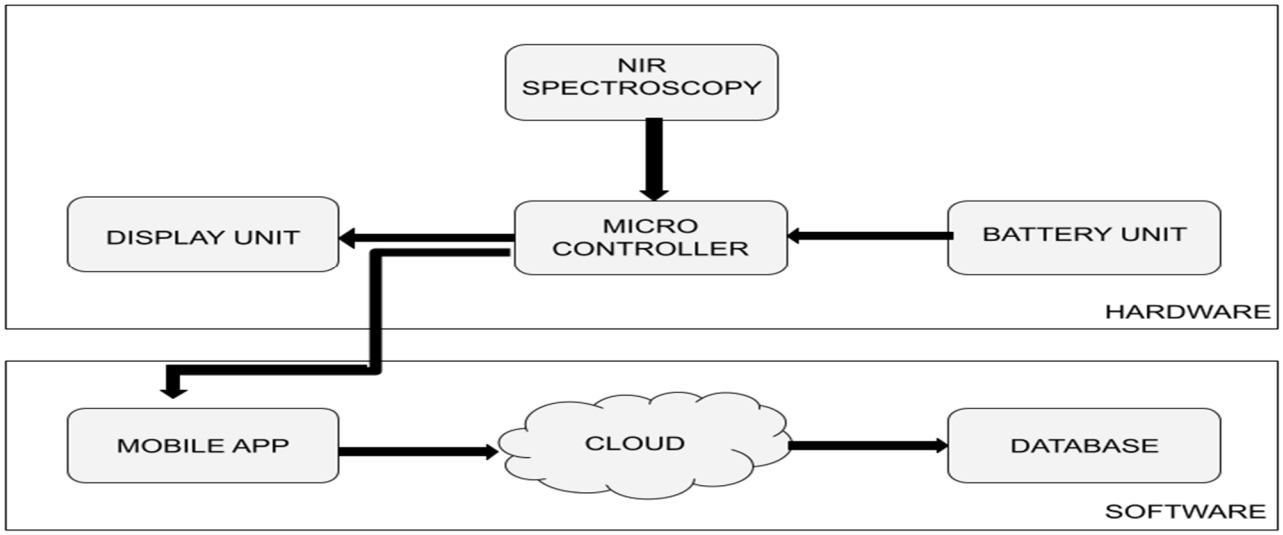
A. Accuracy of Non invasive testing is less than invasive method.
B. Medication interferences.
C. Absorption Level of Blood.
D. High Cost.

IV. PROPOSED SYSTEM

We have conducted numerous studies in order to develop a non-invasive glucose monitoring system that allows effective and quick analysis of glucose. One of the most effective and painless methods for measuring glucose is the optical approach. We reviewed many studies that have employed NIR Spectroscopy and it has been said that it is one of the best non-invasive methods available. Hence in this research, an array of Near Infrared LED's are placed to obtain an accurate result with absolute repeatability.

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A. Block Diagram



B. Hardware Description

S.No	Hardware Component	Working	Image Reference
1	NIR LED Array	To Analyze the Blood Glucose Level by using Near Infrared LED	
2	ESP 32	Microcontroller	

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3	Battery	Power Supply	
4	LCD Display	To Display the value	

C. Software Description

1) Mobile Application - To view data from anywhere.
2) Cloud DataBase - To store the data records.

V. DISCUSSIONS

Though we prefer Non-Invasive methodology to measure Blood Glucose level we come up with certain factors leading to limitations such as,

1) Blood intensity level differs from person to person.
2) Fat composition of the human body also plays a vital role in measuring the Glucose value.
3) NIR absorbance also varies by the distance between the skin and LED.
4) Thermal analysis approach can be followed up.

VI. CONCLUSION

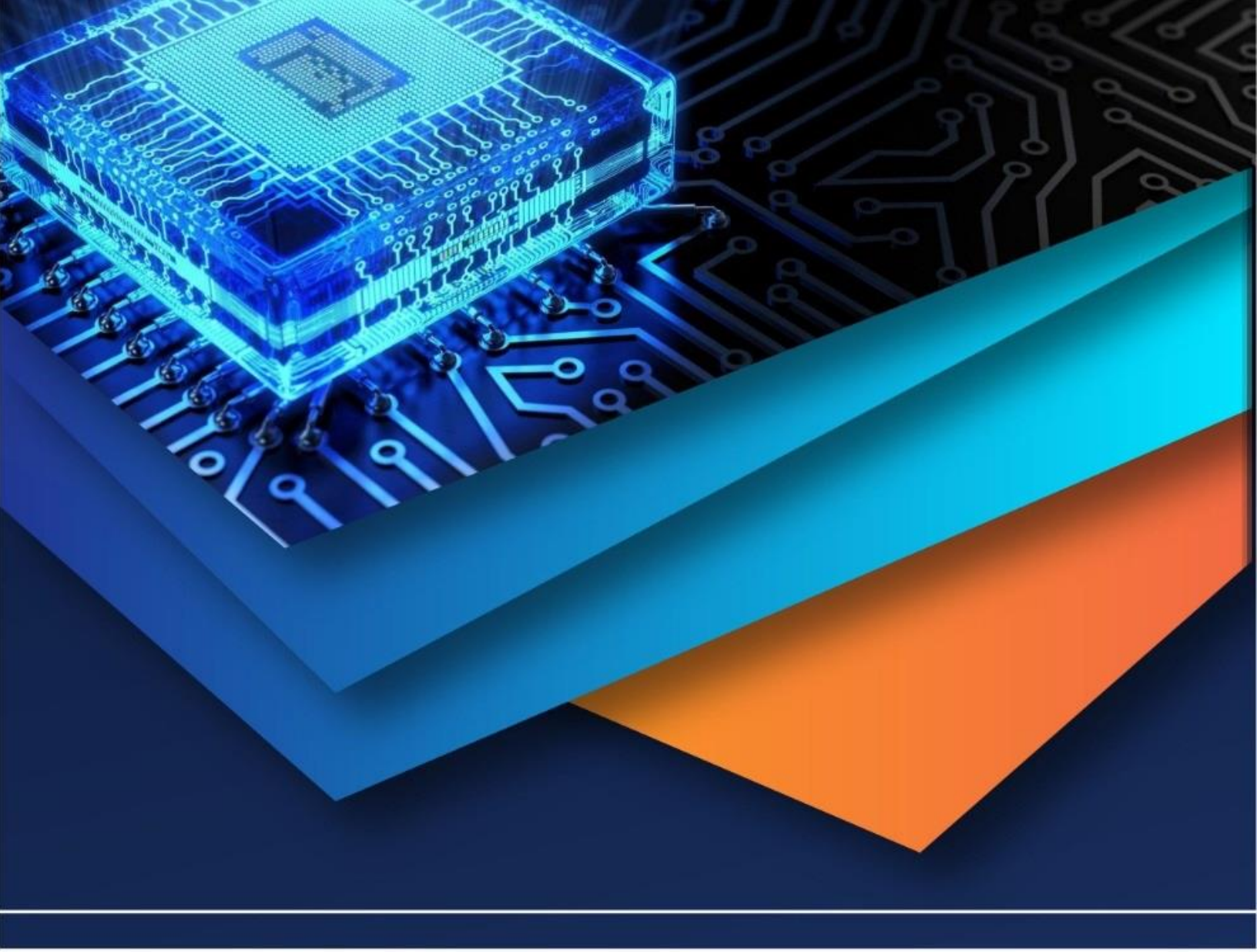
In order to avoid diabetes issues in the future, it is necessary to monitor glucose levels on a regular basis. There are a variety of methods available, and we have suggested a non-invasive method using an Array on Near infrared LEDs. Continuous monitoring allows one to lead a healthy life free of potentially fatal diabetic complications. The proposed product could detect the value of glucose concentration without requiring any invasive procedures, allowing one's sugar level to be kept at a predetermined level. If this type of non-invasive product is released onto the market, it will be easier to use and also be used for patient education, in hospitals to monitor and make them aware of their own body.

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10.22214/IJRASET

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