Non-Invasive Glucometer

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Abstract–If not treated properly, the metabolic condition diabetes mellitus (DM) can have significant adverse effects on one's health. Traditional blood glucose monitors are painful and uncomfortable for individuals since they are intrusive. As a result, the study's objective was to measure blood glucose using a machine-learning technique non-invasively. This project involves using almost-infrared light to measure the glucose concentration in the blood's fingertips by absorbing and dispersing the light through the blood process. The procedure can also provide painless, convenient, and economical alternatives to these devices.

Keywords–*Diabetes Mellitus, Machine-Learning, Infrared Light, Absorption, Dispersion.*

I. INTRODUCTION

According to the World Health Organization (WHO), around 400 million people worldwide live with diabetes and the rate is only projected to continue to increase if existing trends persist. The main adverse effects for diabetics are fatal injury, blindness, insufficient renal function, heart problem, stroke and lower limb amputation. It was the 7th leading cause of death in 2016.

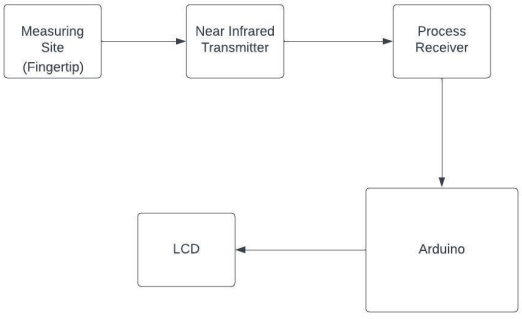
The standard invasive method that exists today must take a blood sample from the patient or subject by pricking the fingertip, where the procedure causes pain in the patient and can damage the finger's cells or tissue

II. LITERATURE SURVEY

Non-invasive blood glucose monitoring, as its name implies, refers to the detection of human blood glucose without causing damage to human tissues. There are lots of methods for non-invasive blood glucose detection, which can be generally divided into optical methods, microwave methods and electrochemical methods. Optical methods include near-infrared reflectance spectroscopy (NIRS), polarized optical rotation, Raman spectroscopy, fluorescence, optical coherence tomography (OCT) and so on.

Frequent and regular blood glucose testing is crucial for diabetics, who need regular insulin injections to maintain their blood glucose balance. Therefore, the development and breakthrough of the new painless and stress-free non-invasive blood glucose monitoring technology and precise closed-loop drug delivery system can directly benefit hundreds of millions of patients by avoiding the pain of blood collection, which is very promising and practical research at present.

III. PROPOSED SYSTEM ARCHITECTURE



A. ARDUINO UNO

This Arduino board is an open-source microcontroller board based on the ATmega328P microcontroller and developed by Arduino. It is used to interface sensors

and the use of Arduino software and program code is for the required format of the output.

B. PHOTODIODE

Photodiodes are often used for accurate measurement of light intensity in science and industry. They generally have a more linear response than photoconductors. Photodiodes are a class of diodes that converts light energy to electricity.

C. NEAR-INFRARED TRANSMITTER

IR Transmitter and IR Receiver are commonly used to control electronic devices wirelessly, mainly through a remote

D. LCD

LCD (Liquid Crystal Display) is a type of flat panel display which uses liquid crystals in its primary form of operation. LCDs allowed displays to be much thinner than cathode ray tube (CRT) technology. LCDs consume much less power than LED and gas-display displays because they work on the principle of blocking light rather than emitting it.

IV. ALGORITHMS AND EXPERIMENTAL RESULTS

When the tip of the finger is placed at the measuring site, IR says sent by the transmitter are refracted which is then received by the receiver. Fingertips are preferred due to the presence of multiple capillaries through which glucose flows. This way it is easier to get an accurate reading of blood glucose levels. The output of the transmitter is in milliVolts. During the testing stages of the project, we mapped mV to g/dL by making our project detect the amount of sugar dissolved in water.

sugar mg/dL	**mV**
1000	70
2000	68
3000	67
4000	64
5000	59
6000	51
7000	48
8000	46
9000	48
10000	44

With this we used linear regression to form the equation

$$Y = -23.302 * X + 15779.363 \quad (1)$$

Where,

Y = sugar level in water
X = voltage level given by the transmitter

V. PERFORMANCE ANALYSIS

Values obtained from the experiments may differ due to several factors, including the results of the calibration curve test obtained from the measurement of glucose solutions that do not contain other substances such as in the blood. Furthermore, factor from users also tends to affect the glucose measurements because each individual has various skin thickness which influences the absorption of the infrared signal. Finally, the environmental factor could be due to the dispersion of the infrared signal into the environment, which makes the photodiode less able to receive the effect.

VI. CONCLUSION

Overall, a non-invasive blood glucose monitoring device that is a pain-free glucose measuring system using Near-Infrared Spectroscopy. Data from the glucose meter is sent via Wi-Fi to their smartphone and displayed on a user-friendly Android app. It can help patients remotely without the need to come to the hospital, saving time, and cost. This device is not only useful for individuals that have diabetes but also for all individuals to maintain their glucose levels at normal levels in order to ensure a healthy lifestyle.

VII. REFERENCES

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