NON INVASIVE GLUCOMETER

A PROJECT REPORT

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ABSTRACT

If not treated properly, the metabolic condition diabetes mellitus (DM) can have major negative 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 non-invasively measure blood glucose using a machine learning technique. This project involves using almost-infrared light to measure the glucose concentration in the blood fingertips by absorbing and disperse the light through the blood process. The procedure can also provide painless, convenient, and economical alternatives to these devices

KEYWORDS

- **Glucose**
- **Photodiode**
- **NIR Tramsmittor**
- **Node MCU wifi module**
- **Regression Analysis**

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INTRODUCTION

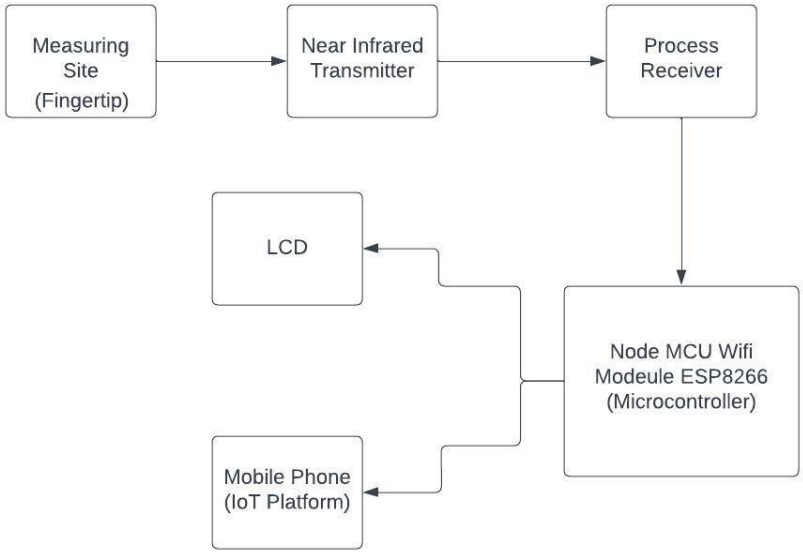
According to the World Health Organization (WHO), around 400 million people worldwide live with diabetes and the rate is only projected to continue to increase if existing trends persist. The main adverse effects for diabetics are fatal injury, blindness, insufficient renal function, heart problem, stroke 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 this procedure causes pain in the patient and can damage the finger's cells or tissue

LITERATURE SURVEY

[1] Glucose screening measurements and noninvasive glucose monitor methods by Hui
Zheng et al in is paper compared seven non-invasive techniques for blood glucose monitoring
methods. Mid-infrared spectroscopy and near-infrared spectroscopy are the most useful
technology to screen blood glucose no-invasively[13].
[2] Wearable-band type visible-near infrared optical biosensor for non-invasive blood glucose
monitoring by Vega Pradana Rachim, Wan-Young Chung aimed to design biosensor using
multiple LED[10].
[3] PbFG: Physique-based fuzzy granular modeling for non-invasive blood glucose
monitoring by Weijie Liu et al paper is used fuzzy granular modeling for non-invasive
glucose monitoring and compared various machine learning model for non-invasive glucose
monitoring[14].
[4] Non-Invasive Blood Glucose Monitoring Using Near Infrared Spectroscopy by Gayathri
B, Sruthi K, and K. A Unnikrishna Menon is used in linear regression for machine learning[15].
[5] Eyeglasses-based tear biosensing system: Non-invasive detection of alcohol, vitamins,
and glucose by Juliane R. et al in his paper detected glucose using tear[16].
[6] Hydrogel optical fibers for continuous glucose monitoring by Mohamed Elsherifa,
Muhammad Umair Hassan C, Ali K. Yetisend, Haider Butte in is paper used optical fibers
for monitoring[17].
[7] The Evolution of Non-invasive Blood Glucose Monitoring System for Personal
Application Nurul Akmal Binti Abd Salam et al in is paper reviewed the evolution of non-
invasive techniques for glucose monitoring[18].
[8] Noninvasive Glucose Monitoring by Reverse Iontophoresis in Vivo: Application of the
Internal Standard Concept by Anke Sieg, Richard H. Guy and M. Begon a Delgado-Charro in
is paper used iontophoresis method for non-invasive monitoring of glucose[19]

PROPOSED SYSTEM ARCHITECTURE



- ARDUINO UNO (MICRO CONTROLLER UNIT):

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.

- 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.

- NEAR INFRARED TRANSMITTER

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

- 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.

ALGO AND EXPERIMENT RESULTS

The transmitter sends out a signal which is then converted to a voltage value by the receiver. This is then directly mapped to glucose levels through the code. The relationship between the concentration of glucose and the voltage was calculated from the findings by applying regression analysis.

$$y = -36.895x + 92.191$$

The value of the regression analysis obtained from the graph in Figure 3.2 is 0.9999. The value is also called a coefficient of determination. The result means that the value is closely approaching 1. This indicates a strong linear relationship between both the voltage-dependent variable (x) and the glucose concentration (y).

```
#include <Wire.h>

#include <LiquidCrystal_I2C.h>


// Initialize the LCD object

LiquidCrystal_I2C lcd(0x27, 16, 2);  // Replace the address (0x27) with your LCD's I2C address


const int irLedPin = 9;          // IR LED pin
```

```
const int irSensorPin = A0;      // IR sensor analog pin


void setup() {
  lcd.begin(16, 2);              // Initialize the LCD display
  lcd.backlight();               // Turn on the backlight

  pinMode(irLedPin, OUTPUT);     // Set the IR LED pin as output

  // Other setup code
}

void loop() {
  // Read IR sensor data
  int sensorValue = analogRead(irSensorPin);

  // Perform necessary calculations or signal processing

  // Display the output on the LCD
```

```
  lcd.clear();
  lcd.setCursor(0, 0);
  lcd.print("Glucose: ");
  lcd.print(sensorValue);       // Replace with your calculated glucose value
  lcd.print(" mg/dL");


  // Other loop code
}
```

PERFORMANCE ANALYSIS

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, save 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.

REFERENCES