

# Detecting Glucose Level using IR Sensor

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## Abstract

*Diabetes Mellitus ubiquity has been spiked and it has grown as a major World Wide problem. As per report by the Indian Diabetic Association, about 63 million people suffer from diabetes, and this is likely to go up to 80 million by 2025. It is a very serious problem which even leads to death. Diabetes is a chronic disease which leads to hyperglycemia, which leads to a serious problem by affecting the blood and other body parts, causes even death. Diabetes could be identified by blood glucose level measurement. The main goal of this paper is to monitor the glucose level continuously by non invasive method. The existing Blood pricking method is used to detect the glucose level which is harmful and inconvenient to the patients which leads to Loss of Blood and mental illness. Smart Device is proposed to monitor the Blood Glucose of a person without harming. The IR pair sensor is used to sense the Glucose level of the patient by the IR transmitter and the IR receiver. It senses the blood glucose level every 7 seconds. The Smart Device for glucose monitoring is mainly based on IR Sensor, Node MCU, Arduino IDE, LCD, Cloud and Mobile Application. The result will be displayed in the LCD and mobile application and the device can be used at any time and at any place using Internet.*

**Keywords** - Diabetes Mellitus, Glucose, Blood pricking, Cloud, Chronic disease, IR sensor, Node MCU, Arduino IDE, LCD, Mobile application.

## I. INTRODUCTION

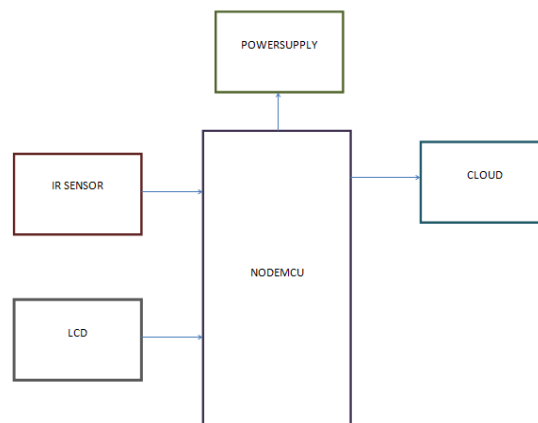
Diabetes is major challenge of this current decade. It is a non-communicable disease. As per report by the Indian Diabetic Association, about 63 million people suffer from diabetes, and this is likely to go up to 80 million by 2025. Diabetes people check blood glucose level more than two times per day. Hence they are inconvenienced every time. They are suffering from the danger of infection by pricking blood in the finger. Also this method may expenses associated with strips and Lancets are more because each test requires a new test-strip and Lancets. Diabetes Mellitus is considered as one of the major death contributors in non-contagious diseases. The current method uses the self-monitoring glucose meter. These methods are invasive. The disadvantage this method is that, extracting the blood from the

body and doing chemical analysis. It also gives pain and discomfort due to the frequent finger pricks to the patients. Non-invasive techniques are more useful and user friendly. It reduces the costs and other difficulty includes both mental and physical pain which involved in invasive method of glucose determination. Researchers are still not able to overcome many drawbacks of invasive glucose monitoring method. The problem includes the scanning pressure that must be applied, physiological differences such as width of tissues, correlation error, hardware sensitivity and stability [2]. The proposed technique uses a near infrared sensor for transmission and reception of rays from forearm. By analysing the intensity variation in received signal by using photo-detector at another side, level of glucose can be predicted. Then the data can be transmitted to remote android device for further analysis. An easy and pain-free method of measuring blood glucose concentrations will give the information to the doctors and patients by monitoring the glucose level.

## II. METHODOLOGY

To develop a non-invasive method for measuring blood glucose concentration levels. Such a method would be pain-free and therefore possibly more desirable amongst a larger population for use with continuous health monitoring. The solution would be using near-infrared light to measure blood glucose concentration levels [5]. Hence it would not require tedious amounts of test strips for each measurement. It may be easily recommended and used by the common people to monitor their day-to-day health.

### A. Block Diagram



### B. Hardware's

### 1) *IR Sensor*

Sensors are the electric device which is used to sense the changes that occur in the body and in the environment. The change includes the pigmentation colour, temperature, humidity, sound etc. They sense the changes that occurred and notify accordingly. In IR sensor, there is an emitter and detector. Emitter emits the IR rays and detector detects it [5]. The IR sensor basically consists of three components for its function it includes.

- IR LED (emitter)
- Photodiode (detector)
- Op-Amp

**1(a) IR Led:**

It is the light emitting diode which emits IR radiations. The function of the emitter is to convert the electricity energy into light energy. It works by the principle of recombination of the electron-hole pair.

### 1 (b) Photodiode:

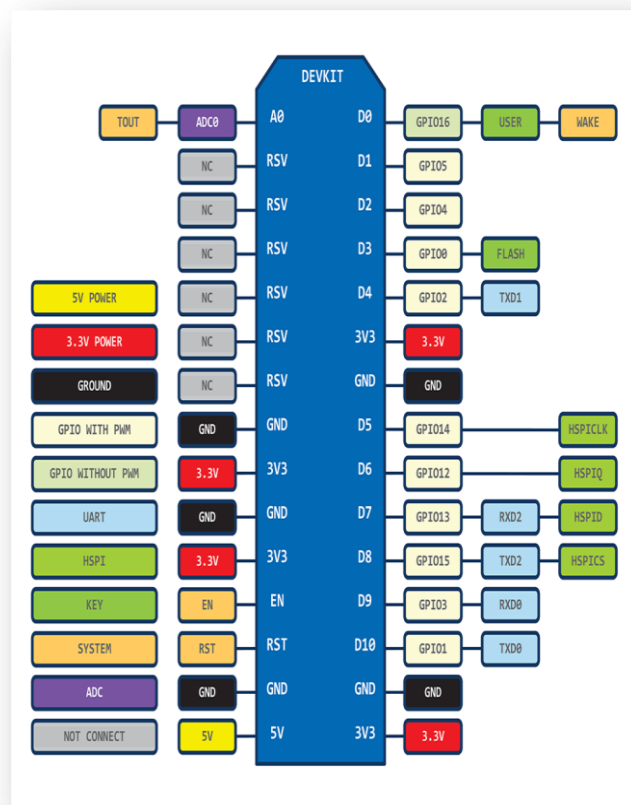
It is a p-n junction diode, connected in reverse bias direction. The function of this detector is to convert the light into electricity energy. It works effectively only when the certain amount of light or photon falls on it. If there is no falling of light on the photodiode then it has an infinite resistance and it act as an open switch.

### 1(c) Op-Amp:

Op-Amp Operational amplifier is the simplified form of Op-Amp. It performs many operations such as addition, subtraction, multiplication, division, etc. The Op-Amp is a DC-coupled high gain amplifier with two inputs and single output.

## 2) Node MCU

The Node MCU is open source software and hardware development environments which contain the ESP8266 Wi-Fi Module that can give any microcontroller access to the Wi-Fi network. The embedded C code is inserted into the node MCU using port connection. The diagrammatic representation of Node MCU with Pin connections and its descriptions are given below.



### 3) LCD

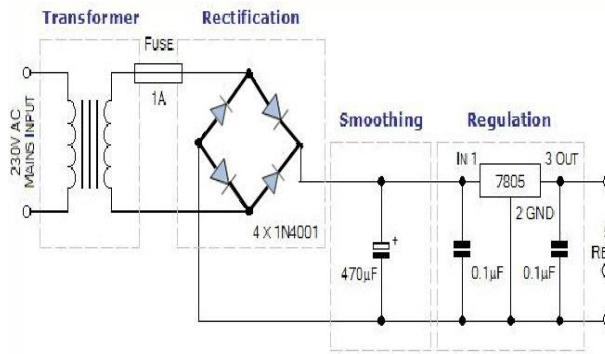
LCD stands for Liquid Crystal Display.

It is a small thin, flat panel (normally 16\*2) used for electronically displaying information. LCD screen consists of two lines with 16 characters each. Each character consists of 5\*7 matrix. Contrast on display depends on the power supply voltage and whether messages are displayed in one or two lines. The below diagram is a sample display of a LCD display board.



#### 4) Power supply

A rectifier's job is to convert an Alternating Current (AC) to Direct Current (DC) and gives the desired output. Rectifiers are used in the power supplies to provide necessary DC voltage for the electric components or the devices. They are made with four or more diodes or other controlled solid switches. The below diagram describes the working function of the rectifier when connected to power supply.



### C. Softwares

#### 1) Arduino IDE

The Arduino IDE is an open source hardware design and software SDK. It functions similarly to the Node MCU. The Arduino hardware includes the micro-controller board with a ready USB connector pins, LED lights, and the standard data pins. It also defines a standard interfaces to interact with sensors or other boards. The Arduino board also has types of CPU chips (ARM or Intel x 86 chips) with memory chips, and a various programming environments. In fact, there is an Arduino reference design for the ESP8266 chip as well. However, the flexibility of Arduino also means significant variations across different vendors. Here Arduino IDE is used to embed the C program into Node MCU by using port connection.

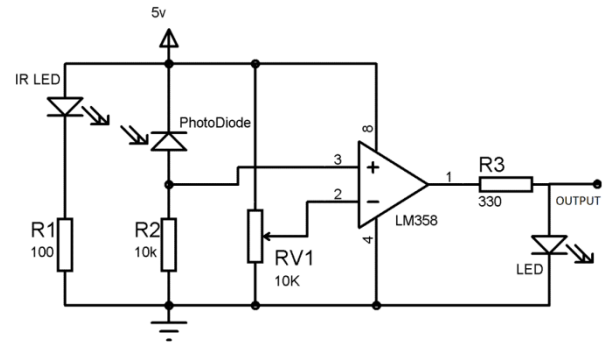
#### 2) Application

The Mobile application is made with the help of PHP and MySQL using Xampp and then it is converted into application using Android studio. The cloud is used for storing the data values and it also shows a graphical view of the data's

### III. WORKING

When the supply is given to IR sensor via the transformer, resistor, capacitor and diodes, the LED starts emitting light radiations. If the surface is of white colour then it reflects all the radiations. The white surface reflects all the radiations falls on it whereas the black colour absorbs them. As these radiations starts falling on the photodiode which is connected in reverse bias, the resistance of the photodiode starts decreasing rapidly and the voltage drop across the diode also decreases. The voltage at Pin 3 starts increases, as it reaches just beyond the voltage of Pin 2 the comparator gives high output. In the black surface, even though the LED emits light but it is not reflected, hence the photodiode doesn't detects anything and its resistance will be infinity. So the comparator will give the low output. Here for every seven seconds the IR sensor emits the light and the readings are calculated and displayed in both

LCD and Mobile Applications. The diagram shows the working strategy of IR sensor and Photo diode.



### IV. RESULT AND DISCUSSION

The desired prototype system is designed and developed for the detection of blood glucose level using Non-invasive IR technique. The result was approximate when compared with pricking methodology.

### V. OUTPUT

#### A. LCD Output



#### B. Mobile Application Output

##### 1) READINGS

Health Readings		
S.NO	GLUCOSE	DATE
1	70	2019/03/02
2	70	2019/03/02
3	85	2019/03/02
4	85	2019/03/02
5	74	2019/03/02
6	77	2019/03/02
7	85	2019/03/02
8	82	2019/03/02

## 2) CHART



### Highest Value

85

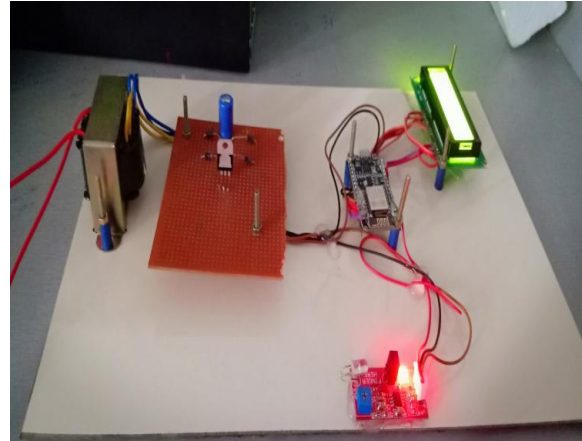
### Lowest value

0

## 3) Comparison Result (Pricking & Device Oututs)

Patients Name	Glucose Analysis	
	Pricking Method	Device
MANI S	102	87
VELMURUGAN K	94	73
SUMITHA R	97	75
ESWARAN N	105	87
KASI M	80	70

## C. Device



## VI CONCLUSION

Early detection of glucose level and control of disease is necessary. Our approach for monitoring glucose level is healthier than the invasive approach. The obtained result shows the glucose level in blood by non invasive method. Glucose level is analysed and results were obtained approximately. Also this information can be sent to doctor for the further analysis.

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