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Non-Invasive Glucose Levels and Temperature Levels Stored on Cloud Using ESP8266

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ABSTRACT: This research aims to monitor and store the data of diabetic patients who are critical and can be fatal due to sudden rise in their blood sugar levels and temperature levels of the patients. All the collected data is stored over the cloud for future reference as a medical history of the patient for the doctors to examine the patients.

For getting the data about glucose levels and temperature we are using an IR module and LM35. Here we are using ESP8266 for the transmission of data and this data is stored on the Thingspeak cloud platform which is an open-source platform.

We receive the data which is in Analog form is converted to properly calibrated values using the Infrared light absorbance property of the Glucose molecule and the temperature of the human body is inversely proportional to the voltage which will provide us the approximate values of required parameters of glucose levels and the temperature levels of the patients.

This can be of great use in the medical sector, mainly for diabetic patients. It will be easy for the doctors to treat those patients as this data can be available at one click on their desks using cloud services. By adding more components which will monitor various other parameters and we can digitalize the medical history of patients with various kinds of diseases.

KEYWORDS: Arduino, Node MCU, LM35, IR transmitter, Glucose, Cloud, ThingSpeak, Temperature, Photodiode.

I. INTRODUCTION

The main purpose of Non-Invasive Glucose Levels is to use the IR sensor and LM35 sensor as input for the system, the data is then calibrated and converted into the form of digital data which is then transmitted to Thingspeak cloud services via Node MCU.

Non-Invasive Glucose Level Monitoring is the method of glucose level monitoring in which we can monitor blood sugar levels without blood contact.

This system serves as a better option as the existing method requires blood pricking and it's a quite painful and complex process to carry out by the patient or the family of the patient.

This method is cost-effective and is easy to use and has a major advantage as data will be stored once we take the reading just by placing a finger over the sensors so no fear of losing the medical data of the particular patient.

II. SYSTEM ARCHETECTURE

Present System:

The glucometers which are available in market are of invasive type. It uses electromechanical strips which contains an enzyme called glucose oxidase to determine concentration of glucose molecules in the blood. In this method patient's blood is pickeered, when this blood is comes in contact with the glucometer strip, enzyme present in that strip gives concentration of glucose molecule and displayed using digital display.

Proposed System:

Our proposed model has the capability to overcome the flaws of the existing system. Our System is based on Infrared light absorbance property of the Glucose molecule and the temperature of the human body which is inversely proportional to the voltage.

2. Hardware Implementation:

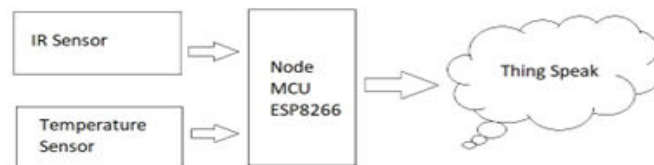


Fig. Block Diagram of System

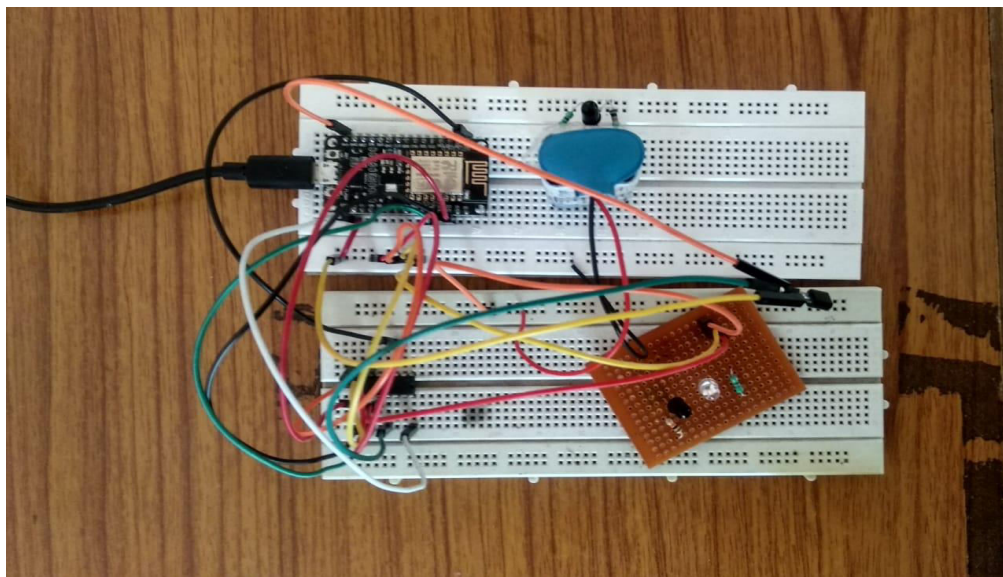


Fig. Breadboard Implementation of the proposed model.

1. LM35

Im35 works upon diode principle. Here temperature is directly proportional to the voltage. as temperature is increases the voltage also increases at known rate. This voltage is precisely amplified and calibrated into the temperature value.

2. Arduino:

Arduino consists of hardware and software and it is an open-source electronics platform. Arduino Ide is used to program Node MCU. Here we are using software part of Arduino platform (Arduino IDE) to program ESP8266 which is a third-party microcontroller.



3. Node MCU (ESP8266)

Node MCU is a low-cost open source IoT platform. It initially included firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems. NodeMCU is an open-source LUA based firmware developed for the ESP8266 Wi-Fi chip. Node MCU supports serial communication protocols which are UART, SPI, I2C, etc. Using these serial protocols we can connect it with serial devices like I2C enabled LCD display, Magnetometer HMC5883, MPU-6050 Gyro meter + Accelerometer, RTC chips, GPS modules, touch screen displays, SD cards, cloud, etc...

4. IR Transmitter LED:

The IR Module consists of IR transmitter and Photo diode. The light emitting diode (LED) which emits infrared radiations called as IR LED's which are included as IR transmitters. The specification which we used in our project is of 940 nm wavelength. Even though an IR LED looks like a normal LED, the radiation emitted by it is invisible to the human eye.

A Photo diode can detect bursts of infrared light sent by a IR transmitter and then produce an Analog output.

5. Resistors:

Resistor implements electrical resistance as a circuit element.

6. ThingSpeak Cloud:

ThingSpeak is IoT Cloud platform where you can send sensor data to the cloud. You can also analyse and visualize your data with MATLAB or other software, including making your own applications. The ThingSpeak service is operated by MathWorks.

7. 4051 MUX:

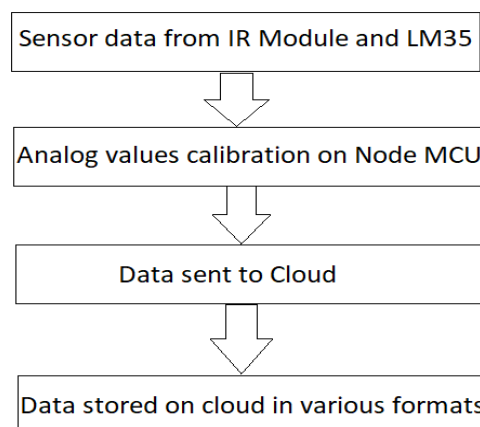
It is used to multiplex the Analog logic of Node MCU by using select pins. An ideal Analog multiplexer routes a single common pin on one side through multiple switches to multiple pins on the other.

8. Wires

There are mainly two types of jumper wires Male and Female. Male ends have a pin protruding and can plug into things, while female ends do not and are used to plug things into.

III. Working

Flowchart:





1. Glucose Detection Working:

The supply is given to IR sensor it emits the Infrared Rays and when we place our finger on IR Module some of the rays get absorbed and the remaining gets reflected these reflected rays received by photo diode generates a dropdown voltage which we calibrate and convert into digital values of Glucose levels.

Here we use beer lamberts law which consists two relations that you can that intensity of sample varied according with concentration and depth of path an exponential decrease of transmitted light occurs with increase in concentration and distance covered increased.

Transmittance depends upon absorbance and optical distance to be covered.

$$A = \epsilon \cdot c \cdot l$$

A- Absorbance

c- Concentration

l- Length of sample

ϵ - Expectation coefficient

$$T = 10^{(-A)}$$

$$A = \log_{10}(I_0/I) = \epsilon \cdot c \cdot l$$

I_0 -Received intensity

I-Transmitted intensity

We designed below formula in our project to calibrate the voltage into glucose.

$$(10 * (vtg * vtg)) - (300.73 * vtg) + 332.55$$

vtg = Voltage.

2. LM 35 working:

lm35 works upon diode principle. Here temperature is directly proportional to the voltage. as temperature is increases the voltage also increases at known rate. This voltage is precisely amplified and calibrated into the temperature value.

IV. RESULT

Here we compared the readings given by our glucose detection module with the glucometer available in market.

Our Glucose detection module	Glucometer
103.14	103
150.4(After Meal)	148
101.75	101
103.7	119

The device receives data from temperature sensor and glucose detection module (IR module) for every patient and permanently stores over thingspeak cloud in various forms which avoids problems caused by misplacing of medical documents.

V. CONCLUSION

Doctors can access patient's medical history from any location which leads to early diagnosis of disease and rapid treatment. This painless technology avoids the possibilities of infection due to Pickering of blood.



VI. ACKNOWLEDGMENT

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The blood glucose concentration values are taken from human blood samples which are taken as reference. These values are calculated using GlucoCard G+ Blood Glucose Meter.

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