International Journal of Trend in Scientific Research and Development (IJTSRD)
Volume: 3 | Issue: 3 | Mar-Apr 2019 Available Online: www.ijtsrd.com e-ISSN: 2456 - 6470

Measurement of GHT (Glucose, Heart Rate, Temperature) Using Non-Invasive Method

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How to cite this paper: Kailash. S | Karthick Raja. A | Mahesh. R | Murugappan. S | V. Mangaiyarkarasi M.E **"Measurement of GHT (Glucose, Heart Rate, Temperature) Using Non-Invasive Method"** Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-3 | Issue-3 , April 2019, pp.135-137, URL: http://www.ijtsrd.com/papers/ijtsrd21670.pdf

IJTSRD21670

ABSTRACT

The medical field has been emerged in the various sectors but the current blood glucose monitoring (BGM) are invasive as they require a finger prick blood sample, a repetitively painful process that creates the risk of infection. Hundreds of millions of dollars have been invested in companies who have sought the solution to this long-standing problem. Approaches that have been tried include near infrared spectroscopy (measuring glucose through the skin using light of slightly longer wavelengths than the visible region), measuring the amount that polarized light is rotated by glucose in the front chamber of the eye (containing the "aqueous humor"),and many others. This device provide a solution by interfacing a electronic device that has the capability of monitoring the glucose level, heart rate and temperature using non-invasive method which has less risk factors. This is a continuous monitoring device. So it helps to prevent the organ losses due to the low and high level of glucose, heart rate, temperature.

KEYWORDS: *Blood Glucose Monitoring, Invasive and Non-invasive method, Diabetes mellitus*

I. INTRODUCTION

Mellitus occurs when someone has abnormal blood sugar. There are two major types of diabetes in Type 1 diabetic patients, diabetes occurs due to the autoimmune destruction of the insulin-producing beta cells in the pancreas whereas in Type 2 diabetics the diabetes mellitus occurs from insulin resistance and relative insulin deficiency .Diabetes can cause many serious secondary health issues such as blindness, stroke, kidney failure, Ulcers, Infections, obesity and blood vessels damage, among other health complications. Approximately US $ 376 billion is spent annually in the US on the treatment and management of diabetes in diabetic patients and this amount is expected to rise to a projected US$ 490 billion by the end of 2030 .According to the International Diabetes Federation (IDF) the diabetes patients in 2011 are 366 million worldwide and this number is expected to rise to 552 million by 2030. Blood glucose measurement are categorized into three techniques; invasive, minimally invasive, and non-invasive [2]. Invasive techniques in glucose measurement devices are widely used as it has high measurement accuracy. The most common and inexpensive invasive technique is finger prick which requires blood extraction from the finger by using a lancet (small, sharp needle) [2]. The blood sample will be used to measure blood glucose level using a glucometer. Some common practices allow the blood extraction to be obtained from other sites of the body such as the upper arm, forearm, base of the thumb and thigh. However the reading of blood glucose level might vary compared to the reading obtained from the fingertip [3]. The latest technology which is non-invasive has been introduced as an alternative to reduce pain during the blood extraction and insulin injection. Various methods have been introduced such as infrared, photoacoustic, ultrasound and fluorescence to detect glucose in the blood. Most of the results showed a good correlation between non-invasive and invasive techniques. The major reason for continuous research efforts in the field of non-invasive blood glucose measurement is that it is the only way to develop a pain free glucose monitoring system.

II. RELATED WORK

"Novel Approach to Non-Invasive Blood Glucose Monitoring based on Transmittance and Refraction of Visible Laser Light," H. Ali, F. Bensaali

Laser light based sensors have demonstrated a superior potential for BGM. Existing Near-infrared (NIR) based BGM techniques have shortcomings such as the absorption of light in human tissue, higher signal to noise ratio (SNR) and lower accuracy, these disadvantages have prevented NIR techniques from being employed for commercial BGM applications. A simple, compact and cost-effective non-

invasive device using visible red laser light of wavelength 650 nm for BGM (RL-BGM) is implemented in this paper. The RL-BGM monitoring device has three major technical advantages over NIR. Unlike NIR, Red laser light has ~30 times better transmittance through human tissue. Furthermore, when compared to NIR the refractive index of laser light is more sensitive to the variations in glucose level concentration resulting in faster response times ~7-10 seconds. Red laser light also demonstrates both higher linearity and accuracy for BGM. The designed RL-BGM device has been tested for both in-vitro and in-vivo cases and several experimental results have been generated to ensure the accuracy and precision of the proposed BGM sensor.

"NIR Based Non-Invasive Blood Glucose Measurement," Parag Narkhede, Suraj Dhalwar and B. Karthikeyan. The paper describes the method of measurement of glucose concentration in the human blood non-invasively using the near infrared optical technique. In recent medical practice, the concentration of glucose in blood is measured using an invasive techniques which generally involves puncturing finger. In generic few ml of blood whereas in recent practice less than a drop of blood is taken out and passed through the standard chemical tests to measure glucose concentration. These methods are expensive as well as painful. The frequent finger puncturing causes calluses on the skin and also increases the risk of spreading infectious diseases. So, the development of a non-invasive blood glucose measurement system will be boon to the diabetic patients. The paper describes the method of blood sugar measurement in the human blood non-invasively using the painless near infrared based optical technique. The designed system consists of LED emitting signals of 940 nm wavelength. These optical signals are sent through the fingertip and reflected signals are detected by phototransistor placed beside the LED. The glucose concentration in the blood is determined by analyzing the variation in the intensity of received signal obtained after reflection. The results obtained from the designed system shows the feasibility of using NIR based non-invasive method for the measurement of blood glucose..

"Design of Digital Blood Glucose Meter Based on Arduino UNO,"
Ahmed S. Abd El-Hamid, Amani E. Fetohi, R.S. Amin, R.M. Abdel Hameed. The paper present an electronic system to perform a measurement of the blood glucose based on Arduino UNO. A glucose sensor is an electrochemical diagnostic strip which used glucose oxidizes enzymes; INA219 current sensing module converts signals from glucose sensor (milliamp) to voltage interfaces with the Arduino UNO. LCD module is used to display the measured value of the blood glucose. Software is developed in C language.

III. DESIGN OF SYSTEM MODEL

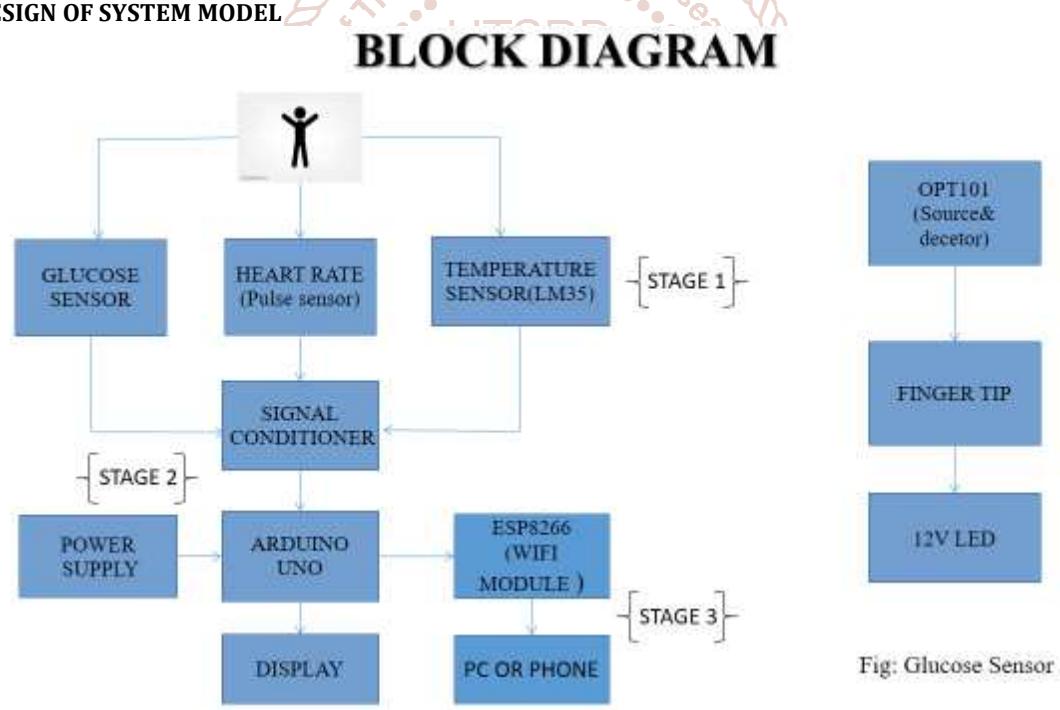


Figure1. Block diagram of GHT meter

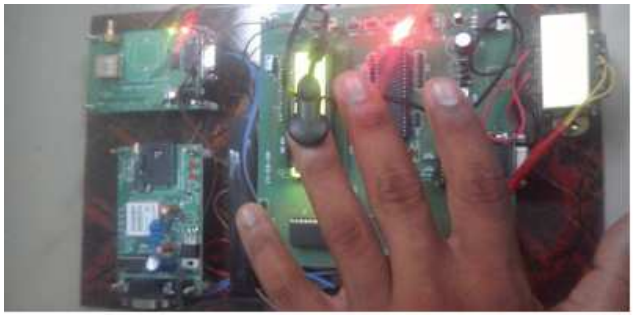
Figure 1 shows the block diagram of a GHT meter.

STAGE 1: This is initial stage were we measure the parameters from the human body using unique sensors. The sensors used here is glucose, temperature, heart rate.

STAGE 2: Each sensors output is an analog signal (current or voltage), these output signals are then transmitted to signal conditioning circuit were the external Nosie and distortion are eliminated and then converted into digital signal. The converted digital signal is given to arduino as an input. The arduino process the input signal using the source code dumped into it, The final output is displayed in the display screen with respective to their units (bpm- heart rate, ^{o}C- temperature, mill molar (mM)-glucose).

STAGE 3: The output from the arduino is given to Wi-Fi module (EPS8266). It then stores the data's in cloud for future reference. Due to cloud storage we can check reading whenever we want.

IV. RESULTS AND DISCUSSIONS



Moreover if the individual is stranded and in need of medical care due to low sugar level or heartrate or temperature effects such as shivering of body or even unconsciousness, the distress message with EPS8266 Wi-fi module is transmitted by the proposed model may be the difference between life and death. Furthermore this project can be integrated into a wearable system in the form of a wrist band model similar to the joggers monitor, thus enabling a 24/7 self-monitoring system in style and comfort.

V. CONCLUSION

Diabetes is a disease for life, it has to be monitored constantly in order to keep the condition in check .This non-invasive methodology saves the individual from excruciating pain and offers comfort to the user over the long haul, contrary to the conventional method. The database of the received test readings reveal whether the current prescribed course of treatment is working or not for the subject. Thus in real life applications this project aims in serving the populous to continually monitor and control their lifestyle, enhancing their quality of life as well as integrating their safety.

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