NON-INVASIVE BLOOD GLUCOSE MEASUREMENT AND CONTROL(2017)

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***Abstract*—Diabetes is metabolic disorder in which blood glucose fluctuates from its normal range. Insulin is a hormone produced in body to regulate blood glucose level naturally. Under some pathological failure, body is not able to produce insulin or body cells become unable to use insulin.**

Regular monitoring of blood glucose is important to avoid complication of diabetes. Commonly used glucose measurement methods are invasive which generally involves finger puncturing. These methods are painful and frequent pricking cause calluses on the skin and have risk of spreading infectious diseases. Therefore there is need to develop a non-invasive monitoring system which can measure blood glucose continuously without much problem.

In this method we use NIR SENSOR for observing the oxygen molecules in blood Where sensor rays are reflected by oxygen. When Glucose level is High the Insulin Injector will be automatically injected via Servo Motor and the result will be sent simultaneously to the Doctor's unit via SMAC

***Index Terms*—Glucose level, Insulin injector, NIR sensor, servo motor, SMAC**

I. INTRODUCTION

The existing system is an invasive method and it is quite painful. In this method the process of testing the blood glucose level is a long process as it takes too much time for getting the result. Now-a-days people are preferring testing kit for monitoring the glucose level randomly but even in this method blood sample is taken by punching at the tip of the finger and dropping the blood over the strip which was provided along with the kit. This method is expensive and it takes too much time for the wound to clear. The existing system has many disadvantages, as it leads to fast spreading of infectious diseases.

A. INVASIVE GLUCOSE MEASUREMENT

A **glucose meter** is a medical device for determining the approximate concentration of glucose in the blood. It can also be a strip of glucose paper dipped into a substance and measured to the glucose chart. It is a key element of home blood glucose monitoring (HBGM) by people with diabetes mellitus or hypoglycemia. A small drop of blood, obtained by pricking the skin with a lancet, is placed on a disposable test strip that the meter reads and uses to calculate the blood glucose level. The meter then displays the level in units of mg/dl or mmol/l.

Since approximately 1980, a primary goal of the management of type 1 diabetes and type 2 diabete mellitus has been achieving closer-to-normal levels of glucose in the blood for as much of the time as possible, guided by HBGM several times a day. The benefits include a reduction in the occurrence rate and severity of long-term complications from hyperglycemia as well as a reduction in the short-term, potentially life-threatening complications of hypoglycemia

Blood Glucose Meter and Test Strips

Figure 1.1

Though all home glucose meters measure whole blood, newer meters are designed to automatically convert the result into plasma results.The first thing you want to find out is whether your meter is calibrated for whole blood or plasma blood. If your meter is calibrated for whole blood you must do a simple conversion to compare your results with a lab result. To compare a lab result with a home test you must convert the lab result into its whole blood equivalent by dividing it by 1.12. For example, if your lab glucose result was 140 mg/dL you divide that number by 1.12 and you get 125 mg/dL. This number represents the whole blood equivalent of the lab result, which you can compare to the number on your meter.

If your glucose meter is calibrated to give a plasma result, there is no need for you to do a manual calculation. The meter does it for you. This makes it easy to do an apples-to-apples comparison of your lab test and glucose meter result.Whether your glucose meter is calibrated for whole blood or plasma you must still factor in the 20% variance. For example, if your lab result is 140 mg/dL, a clinically accurate reading would range from 112 on the low side and up to 168 on the high side

The cost of home blood glucose monitoring can be substantial due to the cost of the test strips. In 2006, the consumer cost of each glucose strip ranged from about $0.35 to $1.00. Manufacturers

often provide meters at no cost to induce use of the profitable test strips. Type 1 diabetics may test as often as 4 to 10 times a day due to the dynamics of insulin adjustment, whereas type 2 typically test less frequently, especially when insulin is not part of treatment. A recent study on the comparative cost-effectiveness of all options for the self-monitoring of blood glucose funded by the National Health Service in the UK uncovered considerable variation in the price paid, which could not be explained by the availability of advanced meter features.

II. PROPOSED SYSTEM

In our proposed system we use sensor to monitor the blood glucose level of the patient. The main advantage of our system is, we measure the blood glucose level in non-invasive method. We use LCD display to show the value of blood glucose level. High rise of glucose level may lead to heart attack or any difficulty situations. Non-invasive methods are more desirable and excellent alternatives to these devices. Non-invasive glucose monitoring could make millions of people more relaxed and comfortable about blood glucose testing. LED non-invasive blood glucose sensor is used to detect the blood glucose content, if any abnormality occurs. We use LCD display to show the value of blood glucose level. When is High Level Glucose Insulin Injector Will be Injected From Servo Motor Side. When High rise of glucose level may lead to heart attack or any difficulty situations so we use via SMAC To Server Updating to the patient Condition to Easily To Identifying in the PC Unit.

Figure 1.2 Non-Invasive Method

The NIR sensor used in this method is used for detecting the oxygen molecules in the blood flow. Since the infra-red rays passed by the sensor is passing through the tissues and then reaches the blood flow. Once it reaches the infra-red rays are reflected back whereas the water content in the blood absorbs the infra-red rays so it is easy to calculate the reflected rays from the blood.

This method provides various benefits such as it reduces cost and then it do not harm people since it is a non-invasive method. This method is acceptable because there is no need of taking blood by punching at the tip of the finger. It also helps in taking random measurement i.e more then three or four times a day. This method includes serial transmission of the patient's status to the Doctor's view via SMAC, Where smac is the serial transmitter through wireless process and it is also used to publish the result in Internet by following the particular link, so that the result is seen via Internet.

III. SYSTEM ARCHITECTURE

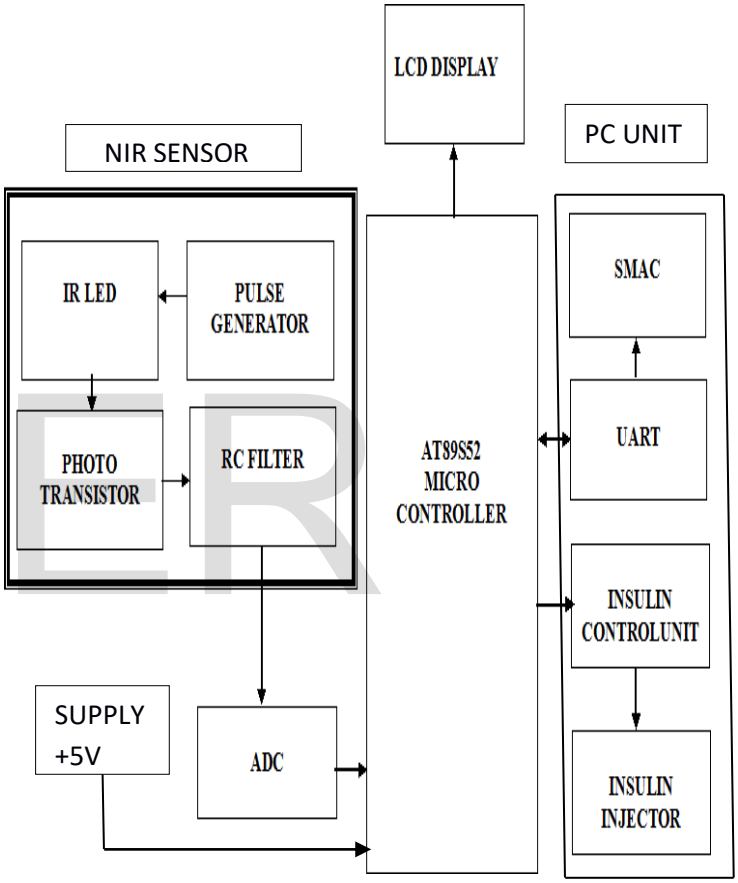

Figure 1.3 Glucose Measurement

The sensor is placed over the finger at the correct position exactly over the veins. The infra-red rays passed from the sensor reaches the blood level where oxygen reflects the IR rays whereas the water content in the blood is absorbing the passed rays. So the reflected rays are collected and then calculated for measuring the glucose level in the blood. The reflected rays are in the form of analog waveform thus it is converted into the digital form by using Analog-to-Digital Converter. Later the value is sent to the microcontroller where the operation takes place.

Once the calculation is finished the result will be displayed on the LCD screen and simultaneously the values are sent to the Doctor's view for getting the suggestion of the concerned doctor. The data is sent to the doctor table Via SMAC. Serial transmission of data is taking place in order to get some

manual assistance by the doctor. In some High glucose level measurement the Insulin injector will be automatically inject the Insulin to the patient's body. By using the link provided the result can be published in the internet.

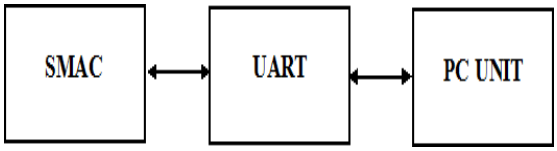

Figure1.4 CONTROL UNIT

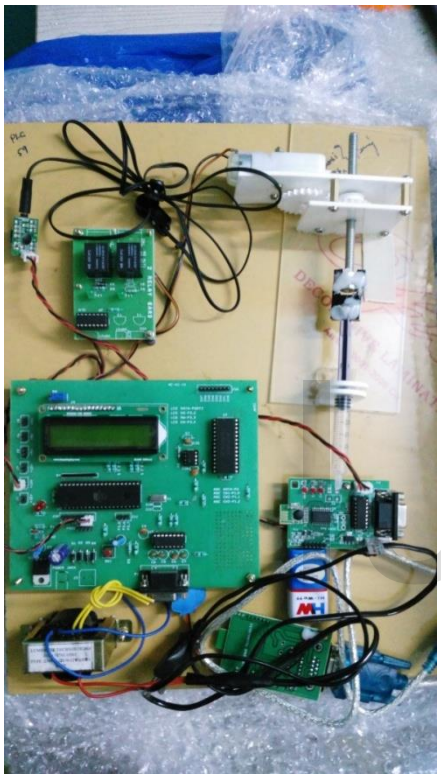

Figure 1.5 PROTOTYPE

In the figure1.5 there is the sensor clip which is connected to the photo transistor senses the blood flow of the patient. The system is initially connected to 230V power which is reduced to 5V by using step-down transformer and thus the whole kit is working in 5V.The analog signals received is converted into digital by using Analog-to-digital converter after which it is sent to the microcontroller.

Once the microcontroller caluculates the frequency result is displayed in the LCD screen attached to the kit and if the glucose level is above average then the Insulin is injected to the patient with the help of servo motor. Before the insulin is being injected the result is sent to doctor for many manual assistance. The servo motor works with the help of a relay kit.

IV. CONCLUSION

The project focuses on the need for measuring the blood Glucose level by Non-Invasive method. This method can Be useful for continuous monitoring of the glucose level Without punching for blood. It can be operated easily By knowing the value on the kit. This method is highly Efficient and the glucose level is calculated without Taking blood. The result can be viewed from any part of The world by following the link provided.

V. FUTURE DEVELOPMENT

There are currently three CGMS (continuous glucose monitoring system) available. The first is Medtronic's Minimed Paradigm RTS with a sub-cutaneous probe attached to a small transmitter (roughly the size of a quarter) that sends interstitial glucose levels to a small pager sized receiver every five minutes. The Dexcom System is another system, available in two different generations in the US, the G4 and the G5 It is a hypodermic probe with a small transmitter. The receiver is about the size of a cell phone and can operate up to twenty feet from the transmitter. The Dexcom G4 transmits via radio frequency and requires adedicated receiver. The G5 version utilizes Bluetooth low energy for data transmission, and can transmit data directly to a compatible cellular telephone. Currently, only Apple's iPhone can be used as a receiver, but Dexcom is in the process of getting an Android version approved, and anticipates availability in the second half of 2016. Aside from a two-hour calibration period, monitoring is logged at five-minute intervals for up to 1 week. The user can set the high and low glucose alarms.

Recent advances in cellular data communications technology have enabled the development of glucose meters that directly integrate cellular data transmission capability, enabling the user to both transmit glucose data to the medical caregiver and receive direct guidance from the caregiver on the screen of the glucose meter. The first such device, from Telcare, Inc., was exhibited at the 2010 CTIA International Wireless Expo,where it won an E-Tech award. This device is currently undergoing clinical testing in the US and internationally.

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