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NOVEL APPROACH TO NON INVASIVE BLOOD GLUCOSE MONITORING BASED ON TRANSMITTANCE AND REFRACTION

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ABSTRACT-Diabetes is the most common metabolic disease in the world in which Blood Glucose levels in human body remains high due to the insufficient or ineffective insulin secretion. The Prolonged existence of high Blood Glucose levels in human body for a stipulated period may lead to death in absence of proper health care. In order to manage the diabetic patients Blood Glucose levels must be monitored and treated systematically. Diabetic patient check Blood Glucose levels by performing a capillary test at least three times per day. This Blood Glucose monitoring technique is an invasive procedure, where the blood samples are collected through finger prick and manual Insulin application, this process is painful with the risk of infection. To overcome this, an Automatic Blood Glucose Regulator is developed for the critical Diabetic patients. In this automatic regulator the Blood Glucose levels are continuously monitored with non-invasive risk free procedure and in case of high Blood Glucose level the insulin will be automatically injected into the patient body by using insulin injector. In addition a SMS message about patient Blood Glucose level will also be sent to the corresponding caretaker and the same will be stored in the cloud for future reference.

***Index Terms*— Diabetes, Blood Glucose, non-invasive, cloud**

I. INTRODUCTION

Diabetes disease is the third leading cause of death and estimated that there were 400 million people affected all over the world. Diabetes is the common name for diabetes mellitus, it is a metabolic disorder that is characterized by high Blood Glucose level in human body, which may lead to blindness, renal failure, amputation, heart attacks and stroke when there is no proper health care. The currently existing method for measuring the blood glucose level for the patient is more complicated and may cause infections in the critically ill patients who are bed ridden. The blood glucose level can be measured in conventional method by finger pricking which may cause infection in the patient. For the critically ill patient who are bed ridden the metabolic activity gets slow for such patient the blood glucose level but continuously monitored .But in the conventional method the continuous monitoring of blood glucose becomes more complicated and leads to infection in the patients .this method also take some time to calibrate blood glucose value from the blood and it may require a care taker to monitor the patient continuously .So the patient requires the minimal or non-invasive method for monitoring the blood glucose level. This report specifies the requirements of continuous monitor as well as the regulation of blood glucose by non-invasive method to overcome the problem by conventional method. The concept that is being used in the non-invasive atomized blood glucose regulation

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method Here we have replaced the conventional finger pricking method by noninvasive method using laser light (laser sensor).The blood glucose level of the patient is continuously monitored by fixing the laser sensor in the patients finger the blood glucose value will be continuously displayed in the LCD and stored in the cloud for later reference.

This rapid growth in the number of diabetic patient is seen low income countries. The main reason for diabetes is overweight and obesity. As there is rapid growth in the number of diabetic patient there must rapid development in the methods for testing, monitoring and regulating the patient's blood glucose level. The blood glucose level of a patient is currently measured using either by traditional finger pricking method and using glucose meter .Though the finger pricking has the risk of infection and time consuming than the non-invasive method, it gives the accurate test result.BG can also be measured using glucose meter, though the glucose level is being displayed immediately the test value may not be accurate at all time. Value may change due to the ageing of meter, testing strip may get out of date, usage of wrong strip for the meter, and sometime sweat on your hand also leads to change in value of BG these were the problems faced by using glucose meter it is impossible to regulate the patient blood glucose level immediately in case of sudden increase in glucose level Human body arm is kept in contact with laser light which make contact with the epidermis layer of our skin then the laser penetrate through the layer of skin through the help of laser sensor. This method is very inconvenient comparing with invasive procedure then further process is carried by PIC microcontroller. Then with help of LCD we can display blood glucose level. Here we have two types of sensor one is temperature and other is glucose sensor which in kept in contact with the PIC microcontroller. After getting the correct reading of the glucose level then the value we got is further proceeded to TTL TO RS 232 convertor which converts the value into machine language. Then it is stored in cloud. to the patient this makes the patient situation still worse or sometimes leads to death. Patients also require testing method to be less invasive or non-invasive. To avoid and overcome such problems in the monitoring and regulating the blood glucose level and also to satisfy the patients need we have implemented the atomized blood glucose regulator, which measures the blood glucose by non-invasive method using laser sensor. The calibrated value can also be stored in the cloud plat form for the later reference of the doctor (as patient history).based on that medication can be given to the patient.

II. METHODOLOGY

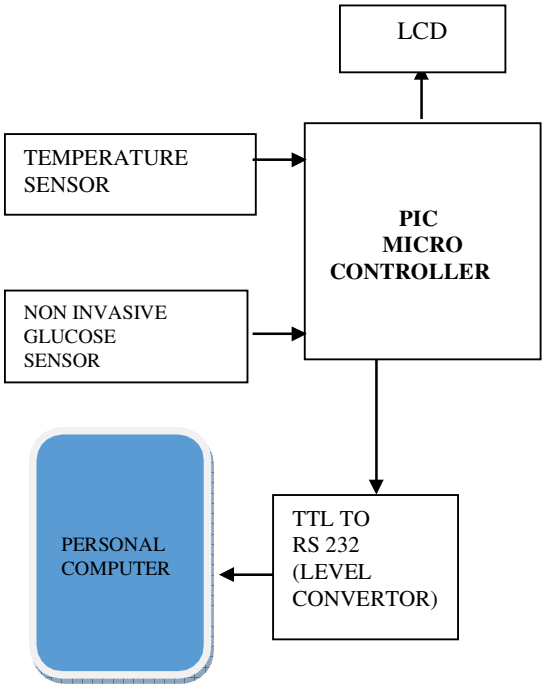

Fig1: BLOCK DIAGRAM OF NON INVASIVE GLUCOSE MONITOR

EXPLANATION OF BLOCK DIAGRAM

Human body arm is kept in contact with laser light which make contact with the epidermis layer of our skin then the laser penetrate through the layer of skin through the help of laser sensor. This method is very inconvenient comparing

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with invasive procedure then further process is carried by PIC microcontroller. Then with help of LCD we can display blood glucose level .Here we have two types of sensor one is temperature and other is glucose sensor which in kept in contact with the PIC microcontroller .After getting the correct reading of the glucose level then the value we got is further proceeded to TTL TO RS 232 convertor which converts the value into machine language .Then it is stored in cloud.

POWER SUPPLY

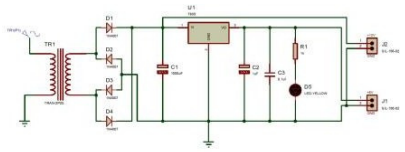

Fig2: POWER SUPPLY CIRCUIT DIAGRAM

PIC MICROCONTROLLER

PIC microcontroller was developed in the year 1993 by microchip technology. The term PIC stands for Peripheral Interface Controller. Initially this was developed for supporting PDP computers to control its peripheral devices, and therefore, named as a peripheral interface device. These microcontrollers are very fast and easy to execute a program compared with other microcontrollers. PIC Microcontroller architecture is based on Harvard architecture. PIC microcontrollers are very popular due to their ease of programming, wide availability, easy to interfacing with other peripherals, low cost, large user base and serial programming capability (reprogramming with flash memory), etc., We know that the microcontroller is an integrated chip which consists of CPU, RAM, ROM, timers, and counters, etc. In the same way, PIC microcontroller architecture consists of RAM, ROM, CPU, timers, counters and supports the protocols such as SPI, CAN, and UART for interfacing with other peripherals. At present PIC microcontrollers are extensively used for industrial purpose due to low power consumption, high performance ability and easy of availability of its supporting hardware and software tools like compilers, debuggers and simulators.

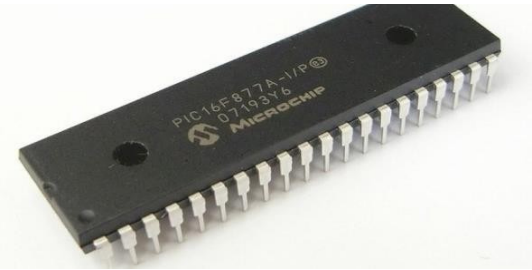

Fig3:PICMICROCONTROLLER

UART

In UART communication, two UARTs communicate directly with each other. The transmitting UART converts parallel data from a controlling device into serial form, transmits it in serial to the receiving UART, which then converts the serial data back into parallel data for the receiving device. Only two wires are needed to transmit data between two UARTs. Data flows from the Tax pin of the transmitting UART to the Rx pin of the receiving UART.UARTs transmit data *asynchronously*, which means there is no clock signal to synchronize the output of bits from the transmitting UART to the sampling of bits by the receiving UART. Instead of a clock signal, the transmitting UART ads start and stop bits to the data packet being transferred. These bits define the beginning and end of the data packet so the receiving UART knows when to start reading the bits.

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LCD DISPLAY

A liquid crystal display or LCD draws its definition from its name itself. It is combination of two states of matter, the solid and the liquid. LCD uses a liquid crystal to produce a visible image. Liquid crystal displays are super-thin technology display screen that are generally used in laptop computer screen, TVs, cell phones and portable video games. LCD's technologies allow displays to be much thinner when compared to cathode ray tube (CRT) technology. Liquid crystal display is composed of several layers which include two polarized panel filters and electrodes. LCD technology is used for displaying the image in notebook or some other electronic devices like mini computers. Light is projected from a lens on a layer of liquid crystal. This combination of coloured light with the greyscale image of the crystal (formed as electric current flows through the crystal) forms the coloured image. This image is then displayed on the screen.

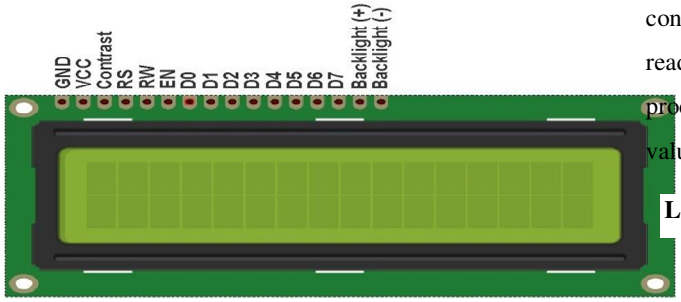

Fig4: LCD DISPLAY

III. EXPERIMENTAL SETUP

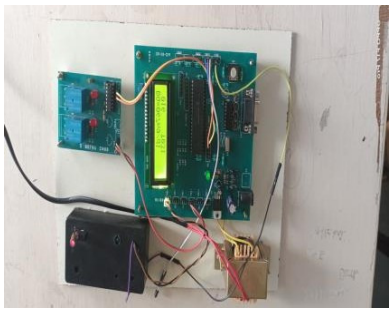

Fig4: EXPERIMENTAL SETUP

EXPERIMENTAL SETUP EXPLANATION

Human body arm is kept in contact with laser light which make contact with the epidermis layer of our skin then the laser penetrates through the layer of skin through the help of laser sensor. This method is very inconvenient comparing with invasive procedure then further process is carried by PIC microcontroller. Then with help of LCD we can display blood glucose level. Here we have two types of sensor one is temperature and other is glucose sensor which in kept in contact with the PIC microcontroller. After getting the correct reading of the glucose level then the value we got is further proceeded to TTL TO RS 232 convertor which converts the value into machine language .Then it is stored in cloud.

LCD DISPLAYING BG LEVEL

Fig5: LCD DISPLAYING BG LEVEL

From the Analog voltage value the blood glucose level is being calibrated by the PIC16F877A and displayed on the LCD display.

CLOUD

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Side by side the glucose level will be update in the cloud and the time recorded will be universal time

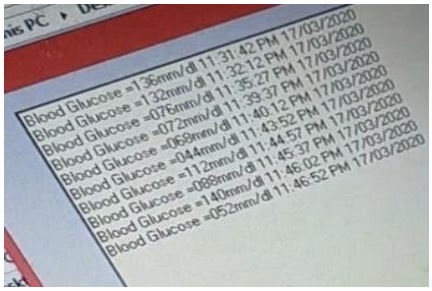

Fig6:DATA STORED IN CLOUD

IV. CONCLUSION

The normal blood glucose level of a person is 70 to 130 mg/dL. But for the critically ill diabetic patients, the blood glucose level abruptly varies and metabolic activities slow down due to the intake of medicine effects. For such patients the blood glucose levels must be continuously monitored and regulated. This Automatic Blood Glucose Regulator contributes improving the quality of life of those critical ill patients by continuous Blood Glucose monitoring and regulation throughout the day. This existing system is acute complications from the disease) without can be made more reliable by adding some other parameters measurements like blood potassium level, Hemoglobin level, respiratory rate etc., Non-invasive glucose monitoring refers to the measurement of blood glucose levels (required by people with diabetes to prevent both chronic and drawing blood, puncturing the skin, or causing pain or trauma. The search for a successful technique began about 1975 and has continued to the present without a clinically or commercially viable product. As of 1999, only one such product had been approved for sale by the FDA, based on a technique for electrically pulling glucose through intact skin, and it was withdrawn after a short time owing to poor performance and occasional damage to the skin of users.

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