Hemogluco Analyser for Clinical and Diagnostic Purposes in Diabetic Patients

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Abstract-This paper describes a technique for invasively measuring the content of glucose and haemoglobin in human blood at the same time. Invasive procedures, such as finger pricking are used to assess the concentrations of glucose and haemoglobin in blood. The creation of an invasive digital hem glucometer device will be beneficial to diabetes patients. Here our proposed model uses an intrusive electrode strip sensor-based approach for measuring haemoglobin and glucose levels in a single device and also the instrumentation amplifier is used to amplify and categorize the blood sample and identify the concentration level. More than just saving time, our gadget has the potential to make a breakthrough in the medical sphere and provide assistance and respite to diabetic patients. Using our invasive digital hem glucometer, we were able to obtain near-accurate haemoglobin and glucose levels. Our system demonstrates that only one instrument is required to monitor the levels of both haemoglobin and glucose in a human body. In this paper the variation in received signal strength obtained after blood sampling is analysed to identify the glucose concentration and subsequently the haemoglobin within the blood. The diabetic population benefits greatly from the described system. To answer the demand for a simple, inexpensive, and reliable gadget to assess haemoglobin and glucose level by health professionals outside the laboratory the digital hem glucometer was designed. This model, which can be improved and expanded upon, was created with invasive haemoglobin and blood sugar measurement utilizing electrodes.
Keywords: Haemoglobin, Glucose Level, Diabetes, Anemia, Electrode, Strips

I.INTRODUCTION

Hemoglobin is responsible for the red hue of blood, aids in the transportation of oxygen. Ahaemoglobin test is often used to check a condition called anemia, in which your body has less red blood cell's than normal. The cells in your body do not receive enough oxygen if you have anemia.Measurement of hemoglobin are made as a part of a complete blood count(CBC).The disc-like shape of red blood cells are facilitated by hemoglobin which facilitates their passage through blood vessels. Low hemoglobin indicates anemia but high hemoglobin level also lead to serious medical conditions. When our body contain insufficient red blood cells or the Red blood cell's or the red blood cell's we have do not works properly, there will be lack of oxygen which is necessary for a human body to function. This condition is termed as anemia.High hemoglobin levels could be an indication of the rare blood condition polycythaemia.With polycythaemia,the body produces an excessive amount of red blood cells, which makes the blood thicker than unusual. Clots, Heart attacks and strokes may result from this. It is a serious, lifelong ailment that, if left untreated, can be fatal. Smoking, dehydration or living at high elevations may also lead to high hemoglobin levels. It might also be an indication of other illnesses like heart or lung disease.A hemoglobin test will reveal whether a person's haemoglobin levels fall within the typical reference ranges such as. Males: 13.5 to 18.0

g/dL, Non-pregnant females: 12.0 to 15.0 g/dL ,11.0 to 16.0 g/dL in children — this range can vary with ageGreater than 10.0 g/dL during pregnancy. A blood glucose test is used to find out if your blood sugar levels are within a healthy range. It frequently aids in the diagnosis and management of diabetes. Glucose is a type of sugar which is the primary energy source for your body. Insulin is a hormone that aids in transferring glucose from your bloodstream to your cells. Blood glucose levels that are very high or low can indicate a dangerous medical problem. Hyperglycaemia or high blood sugar levels ,may be a symptom of diabetes, a condition that can lead to serious, lifelong health issues. People with type1 diabetes and persons with type 2 diabetes who take specific diabetes medications frequently have low blood sugar levels or hypoglycemia.Low blood glucose levels can occasionally be caused by illnesses like liver diseases in people without diabetes but this is uncommon. Severe hypoglycemia can cause serious health issues such as seizures and brain damage, if left untreated.A hemoglobinometer is a device used to quantify the blood's haemoglobin concentration spectrophotometrically. In locations without access to clinical laboratories, portable hemoglobinometer provide for quick and convenient measurement. Due to its simplicity, precision, and speedy results delivery, it is extremely helpful in emergency situations. [5-7]. The haem and the globin protein make up haemoglobin. Protoporphyrin and iron make up haemoglobin. It is based on a contrast of the examined blood sample's colour. Sahli's hemoglobinometer is the name of the instrument, which also includes a comparator, pipette, stirrer, and haemoglobin tube.The basic idea behind this technique is that after adding a blood sample to N/10 hydrochloric acid, the haemoglobin present in red blood cells (RBCs) is transformed to acid haematin, which results in the formation of a dark brown material. Acid haematin is diluted with water until the dark brown substance is consistent with the benchmark brown glass. With the given scale, the colour can be measured.Haemoglobin concentration is expressed as a percentage of normal or, better yet, as an absolute value in gm/dl.A blood glucose metre measures the amount of glucose (a form of sugar) in the blood and is a compact, portable device (also known as the blood glucose level). A blood glucose metre is a common tool used by people with diabetes to help them control their disease.A chemical reaction takes place inside the strip when blood or a glucose solution is added, producing a little electrical current proportionate to the glucose content. The device can track when blood is put because this current is continuously watched over while the strip is in place [8-13]Typically, the body breaks down starch and converts it to glucose for energy. The term “blood glucose concentration” or “level” refers to how much glucose (sugar) is present in a human’s blood to aid in quantitative analysis. Diabetes is characterised by either an insufficient amount of insulin produced by the body (Type 1) or an improper metabolization of the insulin hormone, which is created in the pancreas (Type-2). Cells are able to absorb glucose from food thanks to insulin.Glucometers-in helping Diabetes patients. The process of measuring the concentration of glucose in peripheral or central blood is known as glucosemetry. These Values that be either reported in mg/dL or mM/L have significant clinical significance for metabolic diseases like diabetes mellitus, malnutrition, and certain effects such as The most dangerous hypoglycemia, which is a blood glucose level below normal, and hyperosmolar coma [15-17].

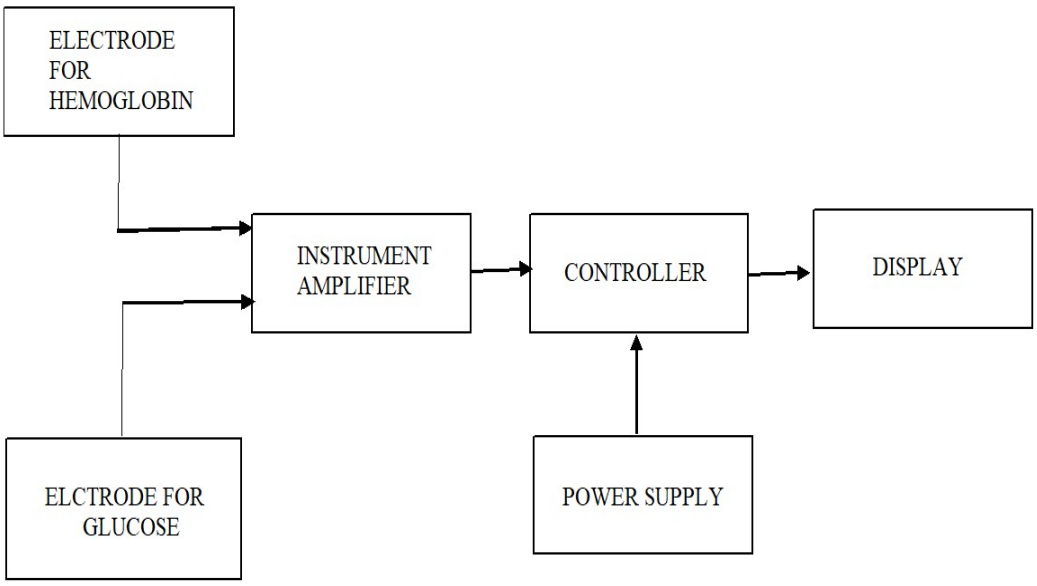

Fig 1.Block Diagram of Hemoglucometer

II.HARDWARE DESCRIPTION

2.1 Power supply: All digital circuits require a low DC voltage to operate. To provide the necessary voltage supply, a power supply unit is required. This unit is made up of a transformer, a rectifier, a filter, and a regulator. A transformer steps down an alternating current voltage of 230Vrms to the desired alternating current voltage level. A diode rectifier then generates a full-wave rectified voltage, which is first filtered by a simple capacitor filter to produce a DC voltage. Typically, the resulting DC voltage has some ripple or AC voltage variations. This DC input can be used by a regulator circuit to provide DC voltage that not only has less ripple voltage but also remains constant, even when the DC voltage varies or the load is connected.

2.2 Microcontroller: The microcontroller unit Atmega8A is introduced. The AVR ATmega8 is a low-power CMOS 8-bit microcontroller based on the AVR RISC Architecture from Atmel. It includes an internal ADC and oscillator. As a result, the cost is reduced. The ATmega8 can work with both 8 MHz and 16 MHz clock signals. As previously stated, the test strip's small current rapidly changes. As a result, using a 16 MHz clock signal yields much more accurate results. The code for the designed metre is written in C. The data type float is employed. Each result requires four bytes of memory to store. The EEPROM on the Atmega8A is 512 bytes. Though the results are displayed in both units, only the mg/dL result is saved for future reference. As a result, 128 glucose and haemoglobin testing results can be obtained and intelligent controller based on soft computing technique [5-7 and 14] are also possible to incorporate for this proposed work.

2.3 Instrument Amplifier: Biological/bioelectric signals, in general, have a low amplitude and frequency. As a result, amplifiers are designed to increase the amplitude level of bio signals. The outputs of these amplifiers are used for further investigation. Electrodes are used to generate electrical signals. The received signals are routed to the amplifier block, where they are amplified. A bio potential amplifier's primary function is to increase the amplitude of a weak electric signal of biological origin so that it can be further processed, recorded, or displayed.

2.4 LCD: A type of flat panel display known as an LCD (Liquid Crystal Display) operates primarily using liquid crystals. When compared to the technologies they replaced, such as light-emitting diode (LED) and gas-plasma displays, LCDs represented a significant advancement. Compared to cathode ray tube (CRT) technology, LCDs permitted screens to be far thinner. As opposed to LED and gas-display displays, LCDs operate on the idea of blocking light rather than emitting it, which results in a significant reduction in power consumption. The liquid crystals in an LCD use a backlight to form an image where an LED emits light. LCDs started to be superseded by new display technologies like OLEDs as they took the place of earlier display technologies.

2.5 Biosensor: The biological component of the biosensor have a precise and effective reaction. The physicochemical characteristics of the transducer surface are altered by this process. The optical/electronic characteristics of the Transducer Surface alter as a result. A measurement or conversion of the change in optical or electronic qualities into an electrical signal is used to detect it.

III.RESULTS AND DISCUSSION

To meet the demand for a "simple, affordable, and reliable gadget to measure haemoglobin and glucose level by health professionals outside the laboratory," the digital hemoglucometer was created. The digital hemoglucometer (HCG TRIESTA laboratory) is a nanobioelectronic device the size of a palm with self-calibrating sensors that estimates the levels of glucose and haemoglobin in around 60 seconds. Reflectance photometry is the foundation of the Digital Hemoglucometer System. Only 8 ml of blood sample is needed for the haemoglobin measurement when using a capillary, venous, or arterial whole-blood sample. It may be used in areas with a limited supply of electricity thanks to its 3.6 V rechargeable battery. The temperature range in which this device can be utilised is 5-45°C. The measurement range is 0 to 25 mg/dl. The Chemical reagents are contained in the tiny plastic strips known as digital hemoglucometer strips. Each time a strip is inserted into the device, a specific code from the strip's vial must be entered. 50 sterile lancets are also included in the package.

IV.CONCLUSIONS

In this effective way we have developed a digital hemoglucometer which is capable of taking both glucose and hemoglobin level at same time. It is an electrode strip based invasive equipment which uses blood samples of the desired patient to provide an near accurate output. The instruments amplifiers inside the equipment amplifies the weak signal collected by the electrode strip. The strengthened signals are displayed in the LCD Display after passing through the controller. The data can be evaluated by the medical expert to provide treatment and evaluate patient's current condition related to diabetes Mallory's. The main advantage of the project is that we are able to analyse both glucose and hemoglobin level in single device. Every human life is valuable and time is an important factor in medical field.If the proposed meter is marketed byany industry millions of people in developing and Underdeveloped country will be benefited.

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