Miniature Point -of-Care Blood Analyser

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Abstract - This study introduces a groundbreaking integrated diagnostic device designed for the simultaneous measurement of sodium salt levels and in a single drop of blood. The innovative point-of-care system is poised to revolutionize clinical diagnostics and home monitoring by combining microfluidics, electrochemical sensors, and advanced signal processing algorithms. The device demonstrates the potential to streamline and enhance the efficiency of healthcare practices. Utilizing microfluidic technology, the device allows for minimal sample requirements while ensuring rapid and accurate measurements. Electrochemical sensors play a pivotal role in simultaneously detecting glucose, hemoglobin, and sodium salt levels, offering a comprehensive diagnostic solution. The integration of advanced signal processing algorithms further refines the accuracy of measurements, making the device a reliable tool for diagnosing and managing various health conditions. Preliminary results showcase the device's efficacy in addressing health concerns ranging from diabetes to anemia and electrolyte imbalances. With its user-friendly operation and minimal sample requirements, this integrated diagnostic device holds promise for widespread adoption in both clinical and home settings. The potential impact on healthcare efficiency and patient management is considerable, marking a significant advancement in point-of-care diagnostics.

Keywords: Moisture sensor , salt sensor, hemoglobin sensor, glucose sensor

I.INTRODUCTION

Our project serves as a meant to measure the parameters like haemoglobin, glucose, sodium and cholesterol in blood sample using biosensor. Haemoglobin is responsible for the red hue of blood, aids in the transportation of oxygen. A haemoglobin test is often used to check a condition called anaemia, 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 anaemia. Measurement of haemoglobin are made as a part of a complete blood count(CBC).The disc-like shape of red blood cells are facilitated by haemoglobin which facilitates their passage through blood vessels. Low haemoglobin indicates anaemia but high haemoglobin 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. 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 hypoglycaemia. The sodium blood test measures the concentration of sodium in the blood. Sodium can also be measured using a urine test. Blood is drawn from a vein (venipuncture), usually from the inside of the elbow or the back of the hand Sodium levels are often measured with other electrolytes in another test called the anion gap. An anion gap test looks at the difference between negatively charged and positively charged electrolytes. The test checks for acid imbalances and other conditions. Sodium is a substance that the body needs to work properly. Sodium is found in most foods. The most common form of sodium is sodium chloride, which is table salt.

This test is usually done as part of an electrolyte or basic metabolic panel blood test.

II.SYSTEM DESIGN AND DEVELOPMENT

The development of a novel integrated diagnostic device for simultaneous measurement of glucose, haemoglobin, and sodium salt levels in a single drop of blood. This innovative point-of-care system aims to streamline and enhance the efficiency of clinical diagnostics and home monitoring. The device combines microfluidics, electrochemical sensors, and advanced signal processing algorithms to enable rapid and accurate measurements. Preliminary results demonstrate the device's potential for diagnosing and managing a range of health conditions, from diabetes to anaemia and electrolyte imbalances, with minimal sample requirements and user-friendly operation.

The Microfluidic Hemoanalyser utilizing biosensor technology represents a cutting-edge system in the field of medical diagnostics. This innovative platform seamlessly integrates microfluidics and biosensors to enable rapid and precise analysis of blood components. The system leverages the principles of microfluidics to manipulate small volumes of blood within microchannels, facilitating efficient and controlled sample handling. The biosensor component, embedded within the device, employs biological molecules to selectively detect and quantify specific blood analytes. This synergistic combination of microfluidic and biosensor technologies allows for real-time monitoring of various haematological parameters, including but not limited to, haemoglobin levels, cell counts, and clotting factors. The compact nature of the system enhances portability and accessibility, making it suitable for point-of-care applications. By providing swift and accurate diagnostic information, the Microfluidic Hemo Analyzer holds great promise for revolutionizing healthcare by enabling timely interventions and improving patient outcomes. The proposed system represents a groundbreaking advancement in integrated diagnostic equipment, designed for the concurrent detection of haemoglobin, glucose, and sodium salt levels from a single drop of blood. Positioned as a cutting-edge point-of-care solution, the primary objective is to enhance and streamline the efficacy of both home monitoring and clinical diagnostics. This innovative apparatus seamlessly incorporates sophisticated signal processing algorithms, electrochemical sensors, and microfluidics, facilitating rapid and accurate measurements. Initial assessments indicate its potential applicability in diagnosing and managing various conditions such as diabetes, anaemia, and electrolyte imbalances. The system's user-friendly design and minimal sample requirements contribute to its practicality and ease of use. The integration of multi-analyte detection technology holds promise for advancing patient care and improving healthcare accessibility. Furthermore, the system's ability to reflect the ratio of sodium to water intake from one's diet in the blood sodium level adds an additional layer of functionality, potentially aiding in dietary monitoring. Overall, this proposed system signifies a significant leap forward in diagnostic capabilities, with the potential to revolutionize healthcare practices and contribute to better health outcomes.

The invention presents a groundbreaking Microfluidic Hemo Analyzer equipped with an integrated biosensor, revolutionizing the field of blood analysis. This innovative device combines microfluidic technology and biosensing capabilities to provide rapid and accurate haemoglobin measurements in a compact and portable format. The microfluidic component enables precise control and manipulation of small fluid volumes within the device, optimizing the analysis process. Blood samples are efficiently processed through microchannels, reducing the required sample volume, and enhancing the speed of analysis. This technology facilitates point-of-care testing, making it an invaluable tool for healthcare professionals in various settings. The integrated biosensor plays a pivotal role in the accurate measurement of haemoglobin, glucose, and salt levels. Leveraging advanced biorecognition elements, the biosensor detects and quantifies haemoglobin concentrations with high sensitivity and specificity. This not only ensures reliable results but also eliminates the need for complex and time-consuming laboratory procedures. Key features of the Microfluidic Hemo Analyzer include its user-friendly interface, rapid analysis time, and portability, making it suitable for diverse healthcare environments. Additionally, the device is designed to be cost-effective, addressing the need for accessible and affordable diagnostic tools.

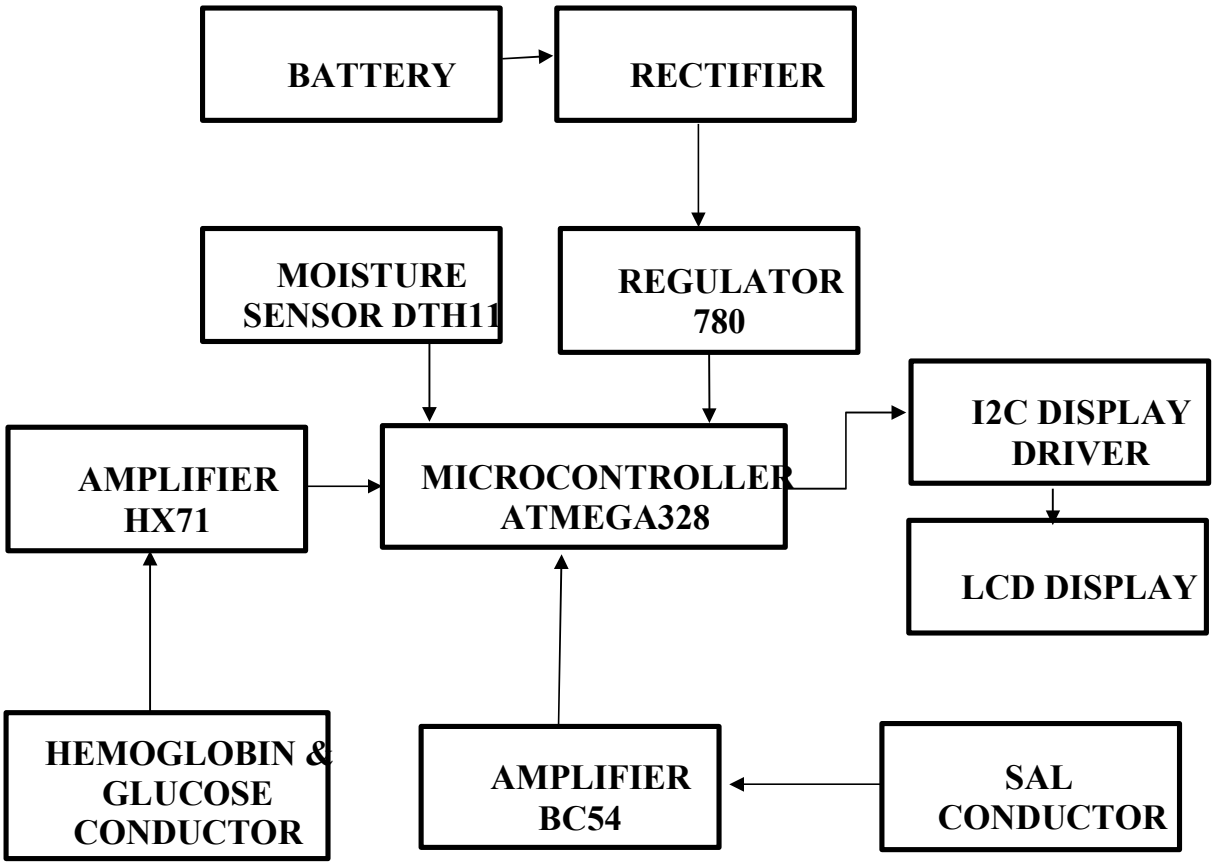

Figure 1. Block diagram of Micro Fluidic Hemoanalyzer

III RESULT AND DISCUSSION

We found that haemoglobin, glucose and salt level can be measured simultaneously using a single equipment. Our results are near accurate even in the prototype. When compared to other equipment electrode strip provides a high level of accuracy and less time consuming.

Automated analyser is a medical laboratory instrument designed to measure different chemicals and other characteristics in several biological samples quickly, with minimal human assistance. These measured properties of blood and other fluids may be useful in the diagnosis of disease. Haematologyanalysers are used to run tests on blood samples. They are used in the medical field to do white blood cell counts, complete blood counts, reticulocyte analysis, and coagulation tests. When compared to these analysers our strip sensor can provide more accurate results and are time consuming.

IV CONCLUSION

The new-type harmless blood glucose discovery strategy could give consistent (every minute of every day) continuous blood glucose observing that tackles the impediment of the customary obtrusive blood glucose meter that requires rehashed fingertip blood, which permits diabetics to screen and deal with their own blood glucose level helpfully, and has an expansive market application prospect. Right now, painless blood glucose observing strategies are by and large separated into three classifications: optical techniques, microwave strategies and electrochemical strategies. As a general rule, the upsides of optical and microwave techniques lie in their profoundly painless nature and consistent observing without invigorating uneasiness to the human body. In any case, to the extent that the exploration status goes, the deliberate worth might be not exceptionally

related with the genuine blood glucose esteem and the straight reach is thin, so resulting calculation remedy ought to be required. This undertaking has proposed a implies for harmless blood glucose, haemoglobin and salt levels testing. Inconvenience diabetic patients and work on the nature of their life through compelling diabetes the board. If the proposed meter is marketed by any industry millions of people in developing and Underdeveloped country will be benefited. The main advantage of the project is that, we are able to analyse both glucose and Haemoglobin level in single device. Every human use is valuable and time is an important factor in medical build.

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