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NON-INVASIVE GLUCOSE MONITORING SYSTEM USINGSWEAT MONITORING SENSOR

N.Rajalakshmi

Dhanalakshmi Srinivasan College of Engineering, Coimbatore, Tamil Nadu, INDIA

C.Geetha Anandhi

Dhanalakshmi Srinivasan College of Engineering, Coimbatore, Tamil Nadu, INDIA

Yamini Priya

Dhanalakshmi Srinivasan College of Engineering, Coimbatore, Tamil Nadu, INDIA

Amrita Yadav
Babu Banarasi Das University, Lucknow (U.P.) India

Abstract— Diabetes mellitus claims millions of lives every year. It affects the body in various ways by leading to many serious illnesses and premature mortality. Heart and kidney diseases, which caused by diabetes are increasing at an alarming rate. In this paper, we report a study of a non-invasive measurement technique to determine the glucose levels in the human body. Current existing methods to quantify the glucose level in the blood are predominantly invasive that involve taking the blood samples using finger pricking. In this paper, we report a spectroscopy based non-invasive glucose monitoring system to measure glucose concentration near infrared transmission spectroscopy is used and in vitro experiments are conducted, as well as in vivo. Our experimental study confirms a correlation between the sensor output voltage and glucose concentration levels. We report a low cost proto type of spectroscopy based non- invasive glucose monitoring system that demonstrates promising results in vitro and establishes a relationship between the optical signals and the changing levels of blood glucose concentration.

Keywords—Node MCU , LCD , Electrodes (Sweat sensor)

I. INTRODUCTION

Diabetes is an ongoing metabolic sickness that happens when insulin isn't as expected delivered (type 1) or utilized (type 2) to control glucose levels in the body. As indicated by the World Wellbeing Organization, it influences hundred million of individuals on Earth. Despite type, ordinary glucose level checking keeps the intricacies that come from diabetic hyperglycemia and hypoglycemia of which visual impairment, renal disappointment, heart illnesses, birth imperfections and even demise. At present, the most utilized glucose detecting strategy requires finger pricking to extricate a blood drop for examination, an aggravation process that may likewise prompt contamination. In this way, impressive endeavors are placed on tracking down harmless techniques for glucose estimation, utilizing body liquids like spit, sweat, interstitial liquid (ISF), tears and pee, notwithstanding blood . These methods can be optical, spectroscopic, ultrasound, heat, electrical, or

Electro chemical. Inventive endeavors to fabricate the end gadgets utilizing half and half printed gadgets on adaptable substrates have been as of late made. Their benefits are minimal expense per surface region, adaptability, decrease underway endeavors and fantastic similarity with human skin and cells. So harmless detecting strategies that could be incorporated with printed hardware stay a test. The need for ordinary finger pricks is a barrier for plenty sufferers with diabetes in regularly testing their glucose degrees, because the process is painful, inconvenient, and for plenty patients it must be carried out typically every day. poor manipulate of glucose stages results in a host of serious health issues inside the long time, so ensuring that sufferers can take a look at and modify their glucose tiers regularly is vital for the health of this patient population. This issue has stimulated new sorts of trying out technology which are minimally invasive and keep away from or reduce the wide variety of required finger pricks. One such promising approach involves sweat testing. As sweat is released in small quantities near continuously under normal situations and consists of glucose concentrations which can be reflective of blood glucose stages, it represents a promising testing approach. This paper surveys three best in class glucose detecting methods that might be executed utilizing mixture printed hardware. For every one, the essential rule, the execution, the presentation, the limitation(s) are framed. A unique consideration is paid to iontophoresis followed by electrochemical-enzymatic glucose detecting. We close with points of view on the obstructions that the business arrangement of the sensors.

I.1. NON-INVASIVE GLUCOSE SENSOR

There presently exist three central harmless glucose checking with printed gadgets potential: tear sweat and interstitial liquid tattoo-based.

I.2 SWEAT BASED MONITORING SENSOR

Sweat is an alluring bio-liquid for painless and persistent interstitial glucose observing applications, since it is beyond the body and effectively available. Utilizing little analytes, sweat can be examined at the outer layer of the skin, giving a relationship between the blood glucose fixations what's more, the grouping of sweat parts. The system of the sensor displayed here relies upon the iontophoretic drug conveyance framework. The electrochemical glucose detecting framework was coordinated with an iontophoretic sweat excitement framework on a solitary, wearable stage. Utilizing forward iontophoresis (see Section III), sweat- prompting drugs like acetylcholine, pilocarpine and methacholine were conveyed with the end goal that charge aversion between the emphatically charged drug atoms and the anodic iontophoretic terminals happens. Thinking about GOX and Prussian blue responses, glucose focus in the actuated perspiration could be estimated. This sensor shows short testing time notwithstanding the accessibility to do estimations very still rather than other sweat sensors.

II. MATERIALS or COMPONENTS HARDWARE : Node MCU , LCD , Electrodes SOFTWARE : Arduino IDE

A) NODE MCU (ESP8266)

Figure 1

SPECIFICATION :

- Voltage 3.3V
- Wi-Fi Direct (P2P), Soft-AP
- Current Consumption 10µA ˷170Ma
- Flash memory attachable 16MB max(512K normal)
- Integrated TCP/IP Protocol stack
- Processor Tensilica L106 32-bit
- Processor speed : 80˷160 MHz
- RAM : 32K+80 K
- Analog to Digital : 1 input with 1024 step resolution
- 802.11 Support : b/g/n.

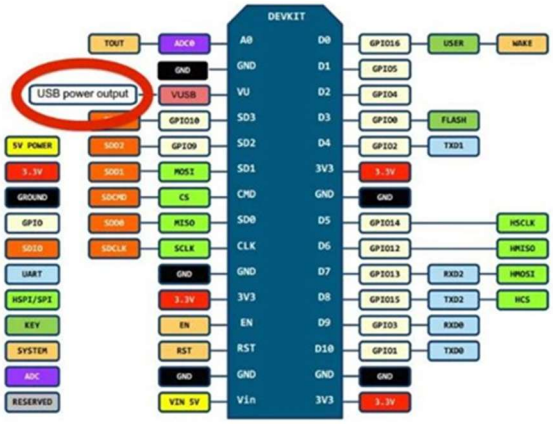


Figure 2 Node MCU pin diagram

FEATURES :

- Open source
- Arduino -like hardware
- Status LED
- MicroUSB port
- Reset/Flash buttons
- Intractive and programmable
- Low cost
- ESP8266 with inbuilt wifi
- USB to UART converter
- GPIO pins

A cable supporting micro USB port is used to connect the board. As you connect the board with a computer. LED will flash .You may need some drivers to be installed on your computer if it fails to detect the NodeMCU board.

B) LCD (GSR)

V. PROPOSED SYSTEM

C) ELECTRODES

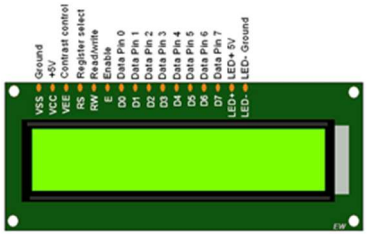


Figure 3

Near infrared transmission Electrodes is used and in vitro experiments are conducted, as well as in vivo. Our experimental study confirms a correlation between the sensor output voltage and glucose concentration levels. We report a low-cost prototype of spectroscopy-based noninvasive glucose monitoring system that demonstrates promising results in vitro and establishes a relationship. This sensor system configuration is complex and it needs further improvements of the cell and its integration to a portable miniaturized device is still necessary. Dachao et al. [30] also have reported a non-invasive sensor device that uses ultrasonic energy at the skin level to determine the glucose levels.

VI. RESULT

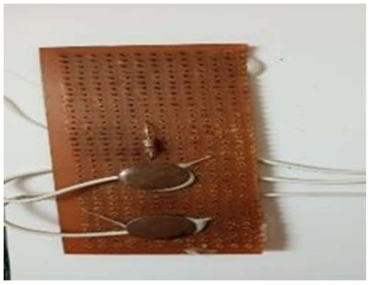
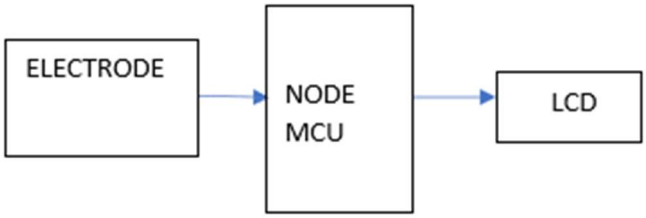


Figure 4

III. BLOCK DIAGRAM



VII FUTURE SCOPE

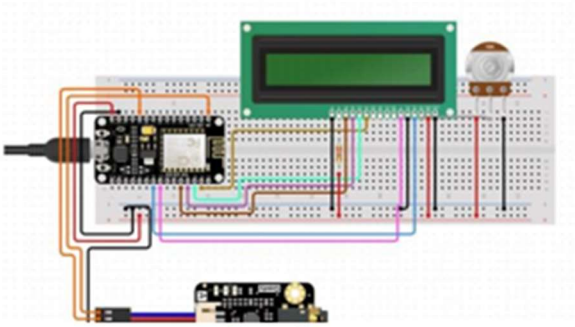


Figure 5

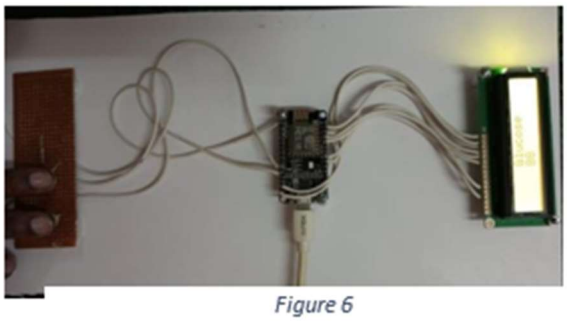


Figure 6

IV. CIRCUIT DIAGRAM

This research successfully demonstrated the relationship between the sensor output voltage and the glucose concentration, where the sensor output voltage increases as the glucose concentration increases, which have been verified and demonstrated by in-vitro experiments. The proposed noninvasive glucose monitoring system has low manufacturing and maintenance cost and showed good accuracy in vitro. The demonstrated results of the proposed non-invasive glucose sensor prototype show a very promising future for the implementation of NIR technology in biomedical field especially in optical spectroscopy for real-time and continuous non-invasive glucose monitoring. Our proposed NIR spectroscopy experiment demonstrates a great potential for non-invasive continuous monitoring of the glucose levels in the human body. There are some other possible variables which were not included in this proposed model such as skin roughness which can cause light scattering, different body fluids concentration, etc., which could have impact on the system performance, and in order to improve further the calibration and system sensitivity, in our future study, we will investigate the impact of those variables in the sensor system performance.

VIII. CONCLUSION

This will further optimize and refine the existing model and generate a stronger relationship between system inputs and outputs. Consequently this will be lead to further improvement of the proposed noninvasive system performance. Our further work will be also focused to further improving the accuracy and robustness of our device in order to perform real time measure and continues monitoring of the glucose levels and transmit the data into portable device. Multivariate regression will be deployed to make the system more robust for in-vivo testing. This would have a great impact on personal health monitoring and recording the history of patients with diabetics and non- patients.

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