An Iot Based Non-Invasive Glucose Level Monitoring System

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Abstract— **Diabetes is a condition that affects one's blood glucose levels. It is important to monitor one's blood glucose levels. In this project, we will introduce a non-invasive device that can be used with the Raspberry Pi to test and monitor glucose levels. The classification model was used to identify the characteristics of individuals with diabetes. The data collected from this project were then used to develop a one-factor analysis framework that can be used to analyze the different aspects of the disease. In addition to the development of a non-invasive device, the challenges encountered by the researchers in developing this model are also related to the various aspects of the disease**

Keywords— **LCD display, Raspberry pi module, Raspberry, pi Camera, Wi-fi module, 3d printed Case**

I. INTRODUCTION

Diabetes mellitus refers to a set of sicknesses that have an effect on how the frame makes use of blood sugar (glucose). The principal motive of diabetes varies through type. But irrespective of what sort of diabetes you have, it could result in extra sugar withinside the blood. Too tons sugar withinside the blood can result in extreme fitness problems. Non-Invasive glucose monitoring is the measurement of blood glucose levels, required by people with diabetes to prevent both the chronic and acute complications from the disease, without drawing blood, Puncturing the skin, or inflicting ache or trauma.

In these methods, a light beam is directed to human tissue, and the energy absorption, reflection or scattering is used to estimate the glucose concentration Commonly, optical methods are preferred due to their simplicity and that small laser diodes can be used to construct portable and inexpensive devices.

Technologies which gained attention in this paper are Near infrared Raman, Fourier transform infrared and spectroscopy using different sensors, microcontrollers, Raspberry pi and signal processors. Using an IOT-based monitoring framework for non-invasive blood glucose monitoring is describe. Data for the non-invasive monitoring is acquired taking a picture of the user's fingertip using the camera of the raspberry pi and then data is processed by a neural network implemented using the tenser flow libraries in a Flask microservice. The envisioned glucose values may be harvested with the aid of using a quit device

II. LITERATURE REVIEW

Blood glucose monitoring is vital for controlling the complications of diabetes. This paper deals withnon-invasive blood glucose monitor featuringmulti- detector conflation, which functions well for rapid-fire- fire yet accurate blood glucose monitoring and netting of diabetes. Although diabetes can't be cured, its complications can be reduced via blood glucose monitoring and applicable drug intervention. thus, the blood glucose monitoring plays a critical part in controlling the complications of diabetes. A fingertip blood glucose monitor is presently the good choice for blood glucose monitoring as its invasive croquette poking sample- taking system will beget pain, vitiate the cases' jitters and indeed lead to infections, this system can minimize the trouble cerebral burden on cases and encouraging them to tone- monitor blood glucose several times a day using multi sensor conflation.

This paper proposes a novel multi-sensor fusion method for monitoring blood glucose that includes temperature, humidity, blood flow, and photoelectric sensors. It aims to improve the accuracy of this method and enable quick detection of diabetes.A fine model for metabolic heat conformation- grounded blood glucose monitoring was erected, and its delicacy was vindicated by trials with a cardiopulmonary function instrument. The characteristic parameters of diabetics were uprooted by applying the one- factor analysis of friction(ANOVA) and establishing a bracket model to work out whether the subjects suffer from diabetes.Diabetics were classified

into different orders via the K- means clustering algorithm. Each order was modelled independently, and the subjects ' blood glucose values were measured by applying the weighted mean system grounded on the subjects ' status. Eventually, the delicacy of the dimension results of this system was clinically estimated in cases with type II diabetes, and the goods of multiple physiological parameters on noninvasive blood glucose dimension results were analysed

The characteristic parameters of diabetics were uprooted by applying one- factor analysis of friction, and a bracket model was established via star factors analysis and discriminant analysis to identify whether the subjects suffer from diabetes. In light of the challenges for noninvasive blood glucose monitoring modelling brought by different pathogeneses, complaint processes and complicated complications of different diabetics, the subjects were classified into different orders via unsupervised K- means clustering algorithm and modelled for each order independently for expanded content and bettered delicacy. The delicacy was clinically estimated in 254 levies with type II diabetes. The results in the Parkes error grid were as follows58.33 in Zone A,39.43 in Zone B and2.24 in Zone C, with a correlation measure of0.69 and a root mean squared error of2.67 mmol/ L.

III. PROPOSED METHODOLOGY

In Internet of Things (IoT)-based framework for non-invasive blood glucose monitoring is described. The machine is primarily based totally on Raspberry Pi Zero (RPi) energised with a energy bank, the usage of a seen laser beam and a Raspberry Pi Camera, all carried out in a glove. Data for the non-invasive tracking is obtained with the aid of using the RPi Zero taking a hard and fast of photos of the person fingertip and computing their histograms. Generated statistics is processed through an synthetic neural network (ANN) carried out on a Flask microservice the use of the Tensorflow libraries. In this paper, all measurements had been finished in vivo and the received records became confirmed towards laboratory blood exams through the imply absolute error (10.37%) and Clarke grid error (90.32% in zone A). Estimated glucose values may be harvested through an give up tool inclusive of a telephone for tracking purposes. Methodology The Beer–Lambert law is an optic measure considering the relationship between the absorbance and the amount of a material. It allows to compute the quantity of a fabric in a pattern through the

use of its absorbance rate, so the mild absorption of a fabric is proportional to the quantity of the same material.

The Beer–Lambert regulation expresses how the mild is absorbed with the aid of using matter: (a) the depth of transmitted mild decreases exponentially as attention of the substance withinside the answer increases, and (b) the intensity of transmitted light decreases exponentially as the distance travelled through the substance increases. This system became used as the primary precept for measuring the glucose attention in a blood pattern via way of means of passing a laser-beam via the fingertip. The artificial neural network (ANN) used for estimating the blood glucose concentration was constructed and trained using Tensorflow , which is an open-source platform for deep learning and machine learning developed and maintained by Google. It permits the introduction of a whole lot of neural community fashions implemented to multidimensional facts arrays, known as tensors. Some of its major functions encompass that may run on a couple of vital processing units (CPUs) however additionally on GPUs (General cause Graphical Processing Unit), and may be applied with C++, Python and Java.Data Acquisition i)The laser-beam is used as the energy source to pass throughout the medium. ii)The finger is the medium through which the light will be transmitted. iii)The camera acts as the sensor responsible to capture the transmitted light and how it is scattered along the finger.

The ANN used on these paintings consists of 256 enter neurons—the histogram values—and a couple of hidden layers, every one composed of 1024 neurons, while the output layer has simplest one neuron corresponding to the glucose concentration value. At the stop of each hidden layers, a 0.20 dropout become considered. The activation functions used in this model were ReLU in all cases.
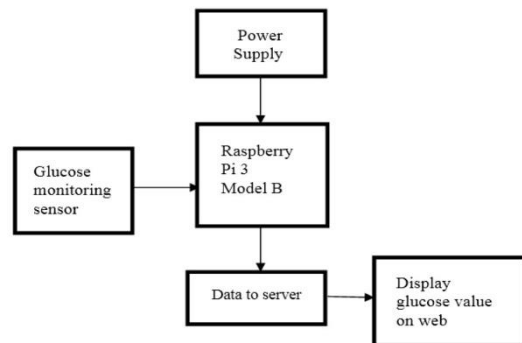

Figure 1. Block Diagram

A. Raspberry pi

The Raspberry Pi is a low cost, credit-card sized pc that plugs right into a pc display or TV, and makes use of a popular keyboard and mouse. It is a succesful little tool that allows human beings of every age to discover computing, and to discover ways to application in languages like Scratch and Python.

The Foundation of Raspberry Pi is an useful resource primarily based totally withinside the United Kingdom that objectives to get the authority of computing and virtual improvement into the palms of human beings withinside the world. The goal is to greater human beings can leverage the electricity of computing and acting generation for work, remedy and explicit themselves creatively on the way to remedy issues that truly matters. We endorse a category four or magnificence 10 microSD card of at the least eight GB. People can get a card that's pre-existed with NOOBS or Raspberry Pi OS to shop the time however it is smooth to set up self-card.

B.Raspberry pi camera

The Raspberry Pi Camera Board is a customized add-on module for Raspberry Pi hardware. It attaches to Raspberry Pi hardware thru a custom CSI interface. The sensor has 5-megapixel native resolution in still capture mode. In video mode it helps seize resolutions as much as 1080p at 30 frames consistent with second.

C.Liquid-crystal display (LCD)

A liquid-crystal show (LCD) is a flat-panel show or different electronically modulated optical tool that makes use of the light-modulating houses of liquid crystals blended with polarizers.

D.3D Printed Case

One common use for a Raspberry Pi in 3D printing is as an additional board to run software such as Octo Print. Octo Print has many benefits, along with being capable of remotely manage and reveal your printer. If you don't already have it, the download and a setup guide can be found on the Octo Print website.

One issue that improves the achievement of the Internet of Things is Cloud Computing. Cloud computing permits customers to carry out computing responsibilities the use of offerings furnished over the Internet. The use of the Internet of Things together with cloud technology has turn out to be a sort of catalyst: the Internet of Things and cloud computing are actually associated with every other. These are authentic technology of the destiny on the way to carry many benefits. Due to the speedy increase of technology, the trouble of storing, processing, and getting access to massive quantities of records has arisen. Great innovation pertains to the mutual use of the Internet of Things and cloud technologies. In combination, it will likely be feasible to apply effective processing of sensory information streams and new tracking services. As an example., sensor information may be uploaded and stored the use of cloud computing for later use as shrewd tracking and activation the use of different devices. The purpose is to convert statistics into insights and therefore power cost-powerful and efficient action.

IV. RESULT

Noninvasive glucose monitoring (NIGM) is the measurement of blood glucose levels, required by people with diabetes to prevent both chronic and acute complications from the disease, without drawing blood, puncturing the skin, or causing pain or trauma. We designed an IoT- grounded system armature from a detector device to a back- end system for presenting real-time glucose, body temperature and contextual data(i.e. environmental temperature) in graphical and mortal-readable forms to end- druggies similar as cases and croakers . In addition, nRF communication protocol is customized for suiting to the glucose monitoring system and achieving a high position of energy effectiveness. Likewise, we probe energy consumption of the detector device and design energy harvesting units for the device. Eventually, the work provides numerous advanced services at a gateway position similar as a drive announcement service for notifying case and croakers in case of abnormal situations(i.e. too low or too high glucose position). The results show that our system is suitable to achieve nonstop glucose monitoring ever in real- time

V. CONCLUSION

The system utilized the IoT technology for Non-invasive blood glucose monitoring, The system is based on Raspberry Pi Zero (RPi) energized with a power bank, using a visible laser beam and a Raspberry Pi Camera, all implemented in a glove for non invasive blood glucose measurement which plays a significant role in healthcare thereby providing better future scope and enhancement

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