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CONTINUOUS GLUCOSE PROCESSING AND ALERTING SYSTEM

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Abstract— **As a part of the proposed Continuous Glucose Monitoring, Alerting and Advising System (CGMAAS). Glucose Monitoring System is designed to monitor the glucose levels in the blood continuously. This system collects the data from the user with the help of a sensor and this data is sent to the Alerting and Advising System.we develop Glucose Sensing And Alerting System, where, the data from the sensing system is stored, processed and analyzed in the cloud. If the glucose level exceeds continuously over a period of time, the alerting system will generate an alert signal. This increase in the values of glucose can be observed in increase in current. these current values are converted into voltage form by a constant resistance and the calibrated table is mentioned in program of Alerting system. These voltage values from sensor are interfaced to the NODEMCU. Although the cost of using blood glucose meters seems high, it is believed to be a cost benefit relative to the avoided medical costs of the complications of diabetes. The benefits include a reduction in the occurrence rate and severity of long-term complications from hyperglycemia as well as a reduction in the short-term, potentially life-threatening complications of hypoglycemia.**

Keywords— Glucose, Hypoglycemia,Alerting and sensing.

I. INTRODUCTION

Diabetes emerging as one of the largest global health emergencies in the recent time [1]. In the United Kingdom, 17% of the total spending by the National Health Service is estimated to be spent on diabetes in 2035/2036 [2][3]. The most important requirement, for people with diabetes, is a tight control of the blood glucose (BG) level which can be achieved through self-monitoring of the BG levels frequently. Most common technique in self-monitoring of the glucose level is Fingerprick test, where test strips to test, and a needle to prick the blood drop are used. Though is is popular but can provide a discrete snapshot of the BG level change, though it is continuous during the day which leads in ignoring the important hypoglycemic and hyperglycemic events between the tests.

To overcome this issue, continuous glucose monitoring (CGM) methods have been developed. Among several techniques, an enzyme-based electrochemical sensing method is adopted for commercial products for its specificity and decent accuracy, and small footprint required. CGMs have made a great leap with the rapid development in circuit integration.

In the current work, we envisage a system, that can monitor the glucose levels and alert the patient, where the monitoring system collects the glucose levels and alert system process and analyse the data for providing alerts.

II. THEORETICAL BACKGROUND

Glucose concentration mostly determined using whole blood, rather than plasma, or serum samples, as the additional water lowers the readings by 15% [4]. These standard methods are invasive, requiring a certain amount of blood. Initially, glucose measurement could be performed only in laboratories by taking advantage of measuring techniques that rely on enzymatic and hexokinase methods which are presenting high degrees of accuracy, specificity and minimum cross-reaction.

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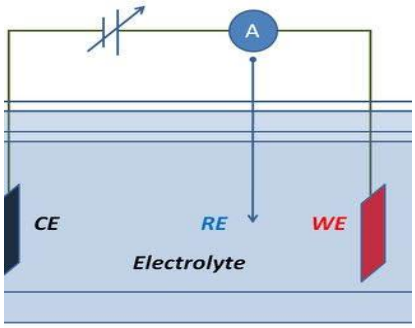

Fig 1: Electrochemical sensor

Hence, present techniques rely on enzymatic and hexokinase methods. Both present high degrees of accuracy, specificity and minimum cross-reaction, but while laboratories use both of them, point-of-care and home monitoring prefer the enzymatic method due to its simplicity and relative affordability. As these process involves high complexity it cannot be directly tested on blood. For this reason, we perform the electrolysis process by using the glucose concentration and check the glucose levels for different concentrations of glucose in water. All analysts are familiar with the principles of potentiometer and polarography and, indeed, most analytical laboratories will contain a pH meter and a polar graph. However, electrochemical methods are, in general, not very important in modern analysis. In contrast, there are specific applications such as trace metal ion analysis in water and effluents and also some other aspects of environmental analysis for which electrochemical methods are particularly attractive.

III. METHODOLOGY

Now a day we have many equipment's to measure the blood glucose. Our proposed methodology (as shown in Fig 2) collects the glucose data from the sensors and takes the decision on alerting the patient after processing and analysing the data. The change in glucose level can be detected using electrode sensor by measuring changes in the conductivity and permittivity of measuring component. Continuous Glucose Monitoring CGM) systems track glucose levels throughout the day. CMG users insert a tiny sensor wire just under their skin using an automatic applicator.

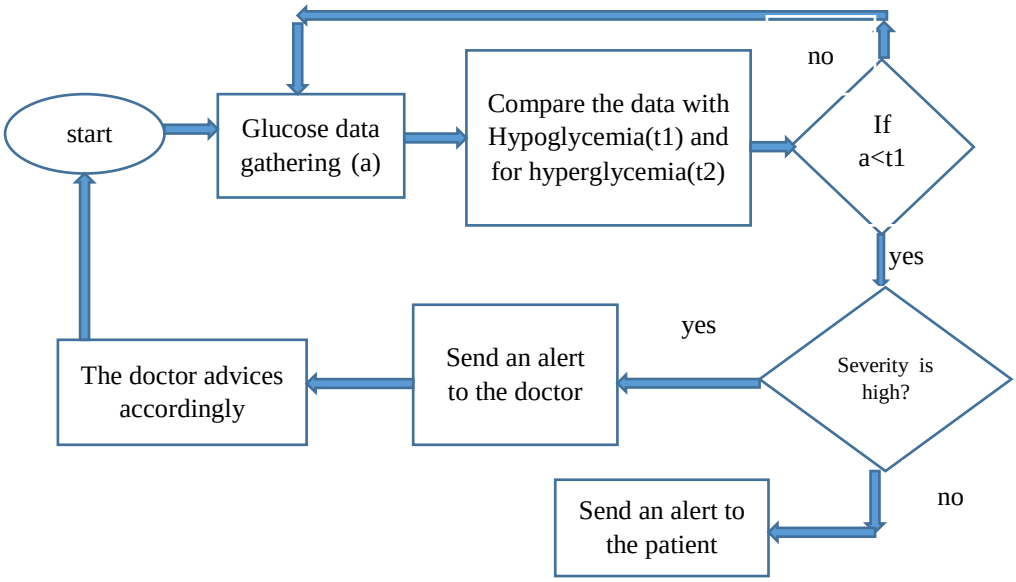

Fig 2: Flow of the CGM methodology

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While taking the readings from the electro chemical sensor for the different glucose level in the blood there is increasing in the current. Note down the current values for the different glucose levels in the blood then comparing the ranges. The values will be in the ranges as shown in Table 1 below:

Table 1: Calibration of measured glucose values to current levels

Glucose(mg)	Cal of glucose	Cal value (mg/dl)	I(u amps)
19	190/3	63	1
19	190/3	63	1
39	390/3	130	2
78	780/3	260	4
156	1560/3	520	8
312	3120/3	1040	12
625	6250/3	2083	16
1250	12500/3	4166	22
2500	25000/3	8333	30

This can be used either in the non-invasive process or invasive process. Here we will taking the values of the glucose level in the blood and these values are send to the NODEMCU after interfacing it will be giving some digital values. The values which we selected that will interface with the NODEMCU.
From the values of current for different concentrations of glucose using electro chemical sensor we can observe good sensitivity. So, it is advisable to use electro chemical sensor in interfacing the NODEMCU.
We can compare those values with the different ranges of glucose and predict the level of glucose in blood. The overall setup is shown in Fig 3.

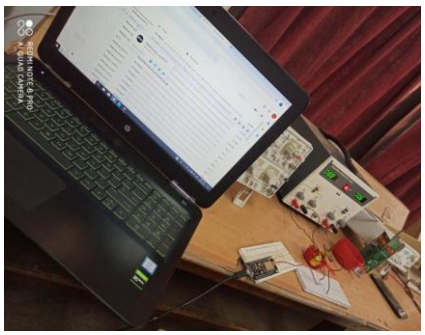

Fig 3:Actual setup of our project

IV.Results and Discussion

The glucose data from the sensor is analysed using NodeMCU. The processing can be remote are local. For local processing we use nodeMCU itsekf to take the decision and send the alert to the patient. The result of this process can be viewed as a text message as shown in Fig.4. As the current work is not limited to simple display of the glucose level, the measured data has to be stored in the cloud and analysed for the future

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predictions. Hence, we use the IFTTT plat form as shown in Fig 5, to store the data of a patient for his future health predictions (the side effects of increased sugar level in a gradual manner). The decision can be send as an email alert to the patient as shown in Fig. 6.

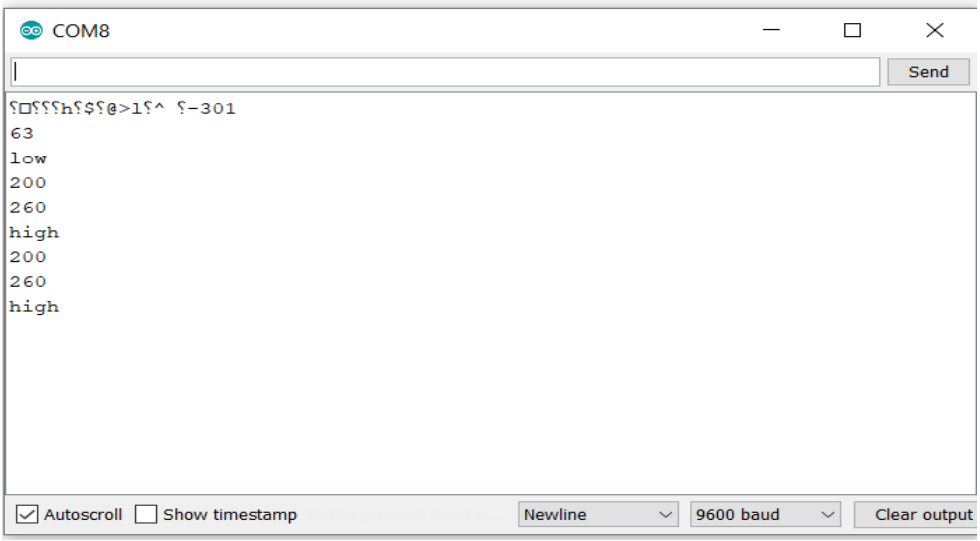

Fig 4: the output visible in serial monitor

The data is then stored in thingspeak cloud in an excel sheet and also viewed in the form of graph.

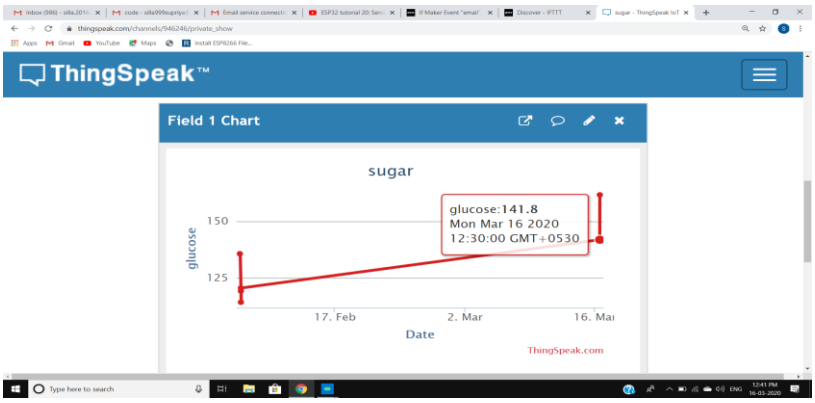

Fig 5: the data storage in Thingspeak viewed in the graph

The another output is that a message is to be sent to the user and it will be as below:

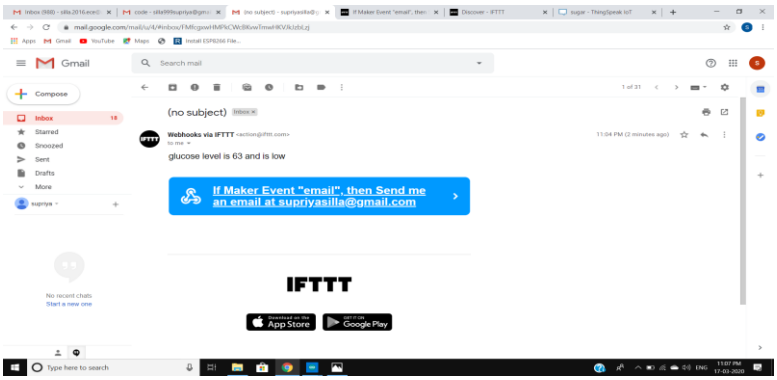

Fig 6: mail is sent

IV. CONCLUSION

In this paper, the continuous glucose monitoring device is designed and corresponding current values for different concentrations of glucose are calibrated. The current values are converted into voltages and are

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interfaced to NODEMCU. These values of glucose level are identified in digital form and the range of glucose in blood whether low, medium or high is determined.

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