Non-invasive Acetone Based Glucometer with insulin calculator and updation in cloudserver

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***Abstract*---The ultimate focus of this concept is to evaluate the blood glucose level of the patient in a non- invasive manner and to calculate the amount of insulin required and upload the same in the cloud server. Nowadays glucose level is calculated by pricking the blood from the patient's finger which is quite invasive to some patients. In our method, the patient's glucose level is calculated by the acetone sensor which is activated by the infrared sensor. The patient is asked to blow his breath towards the mouth piece/blower(focussing the sensor). From the acetone level the amount of blood glucose present is evaluated by the algorithm designed. This value in-turn is used for the calculation of the amount of insulin required. All these data that are interpreted are transmitted to the end device paired and the value is uploaded in the cloud server.**

I.INTRODUCTION

Our proposal aims at the measurement of blood glucose level through the interaction of human breath with the gas sensor. The sensor measures acetone in the breath and proportional blood glucose value is calculated. The measured value is displayed in the display provided in the end device. This value is also uploaded to the cloud server through Wi-Fi(separate domain to monitor the blood glucose level of the patients). Also, a text message is sent to one of the family members whenever the glucometer takes the readings. The glucometer is set to take readings at regular interval. The value stored in the cloud will be everlasting and remains unchanged. A memo will be sent to the concerned doctor and the respective family members incase of hyperglycemia or hypoglycemia. In addition to this , it also transmits the amount of insulin to be taken in such cases. This concept is an inspiration from the infrared based thermometer and in this the value of acetone sensor is acquired only when the infrared sensor detects the patient's mouth through the blower. This is an innovative concept that estimates the blood glucose level without hitting the patient. It's a painless glucose calculator.

A. Technical Background

The technical background for our proposal is the BREATHALYZER invented by Robert Frank Borkenstein. This instrument is to detect the alcohol content of drunken person. In this, the person is asked to blow towards the blower and the alcohol content in his body is developed by the algorithm and displayed the screen space provided. The other types listed in the references are not evaluating the appropriate value or the required value. They tend to get the exact value only when a drop of blood is given as the input to the strip but it creates pain to the patient and it is invasive. The values obtained are transmitted with a delay or not at regular intervals. This seems to be incorrect.

B. Proposed solution

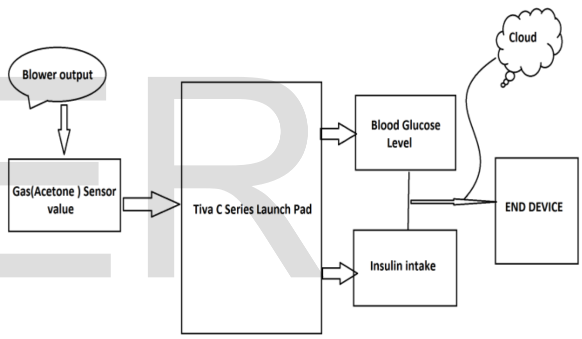


Figure 1:Basic block diagram

The above block diagram clearly explains the primary vision and mission of our concept. The blower contains the IR sensor that detects the entry of the air input when a person starts blowing. This then activates the acetone sensor to read the value of acetone. This input is processed by the launch pad and the respective output will be the blood glucose level and the corresponding insulin intake and these values are transmitted to the end devices paired via Bluetooth and the same is stored in the cloud server.

C. Organization of the Report

The organisation of the remaining part of this report paper is as follows: the next section is the proposed solution which clearly describes the components used in the project and their functionalities. The third section is the hardware implementation which clearly shows the overlapping of hardware and software that helps to implement the proposed concept. Results deals with the successful implementation area of our idea. Conclusion summarises the entire report. Appendices helps is to give the better idea about the algorithm carried out and billing done.

II. PROPOSED SOLUTION

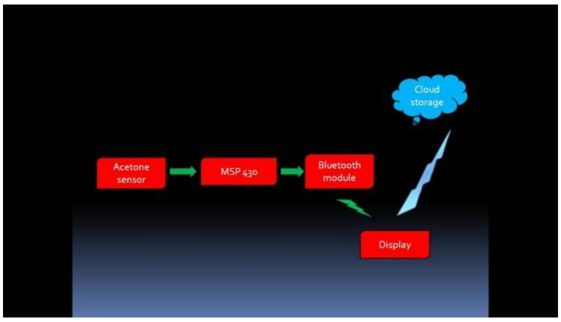


Figure 2: Conventional blocks

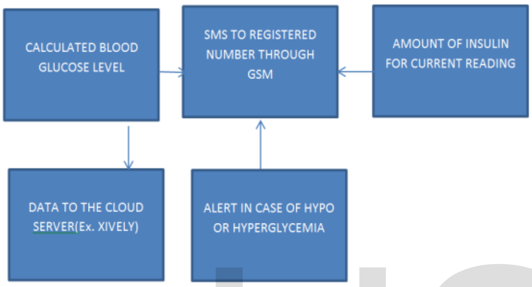


Figure 3: Transmitter blocks

The above two blocks explain the two important area of the proposal. One is interpreting the value required from the input and the other is the transmitting of the same to the persons concerned.

A. Tiva C Series Launch Pad

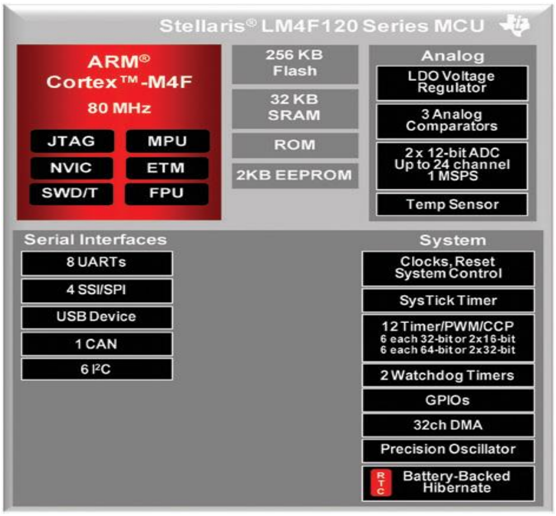


Figure 4: Functional block of Launch pad

The Tiva C series launch pad used is here serves as a primary development board. The programming to control the entire components used is done and fed in this launch pad. All the algorithm that is mentioned in the appendix B gives the clear idea on the programming done in the launch pad.

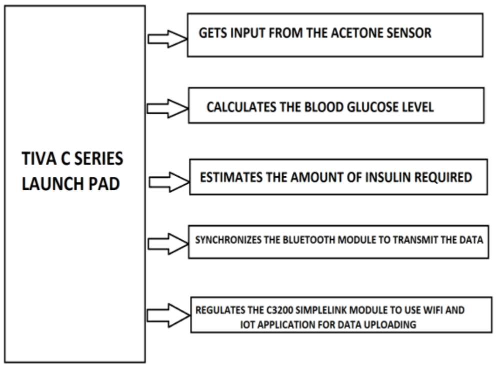


Figure 5: Functionality of the launch pad

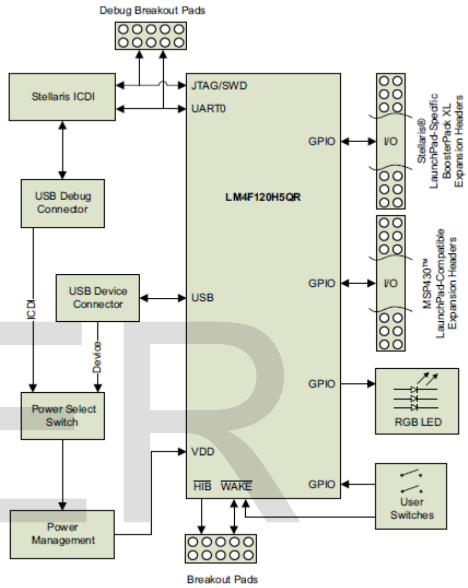


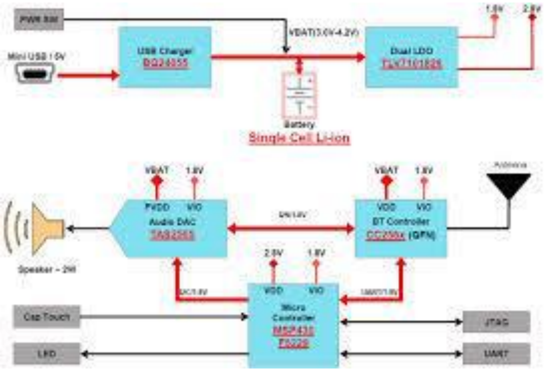
Figure 6:Launch pad evaluation board block diagram

The Stellaris LM4F120H5QR is a 32-bit ARM Cortex-M4F-based microcontroller with 256-KB Flash memory, 32-KB SRAM, 80-MHz operation, USB device, Hibernation module, and a wide range of other peripherals. Most of the microcontroller signals are routed to 0.1-in (2.54-mm) pitch headers. An internal multiplexer allows different peripheral functions to be assigned to each of these GPIO pads. When adding external circuitry, consider the additional load on the evaluation board power rails. The LM4F120H5QR microcontroller is factory-programmed with a quickstart demo program. The quickstart program resides in on-chip Flash memory and runs each time power is applied, unless the quickstart application has been replaced with a user program.

B. Bluetooth Module

The Bluetooth module used here is BT-MSPAUDSINK. This module is a low power enabled shield used for the purpose of wireless connectivity.

International Journal of Scientific & Engineering Research, Volume 6, Issue 10, October-2015
ISSN 2229-5518



It is connected to acetone sensor through the launch pad. The gas sensor senses the acetone level and transmits the data to the launch pad where the glucose level and insulin intake level is calculated. These data are transmitted to the hand device(smart phone) through the Bluetooth module.

C. Gas Sensor

The gas sensor detects the acetone level in our breath and gives the data to the launch pad which then processes it. The used gas sensor is MQ6 which has a shield, pot ,sensor, output pins along with power supply and ground. The power supplied is 3.3V.

Figure 7: Gas Sensor

When the sensor detects acetone LED changes its colour from red to blue.

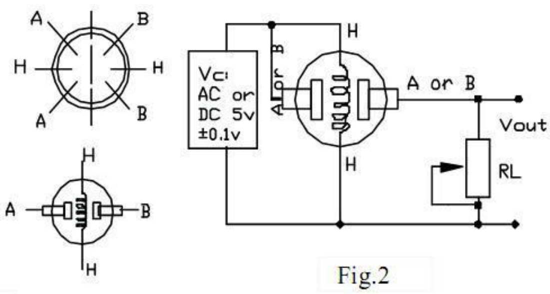


Figure 8: Schematics of Gas Sensor

We have designed and tested this gas sensor in webench designer. Webench designer tool provides the schematics of gas sensor as given in the below diagram.

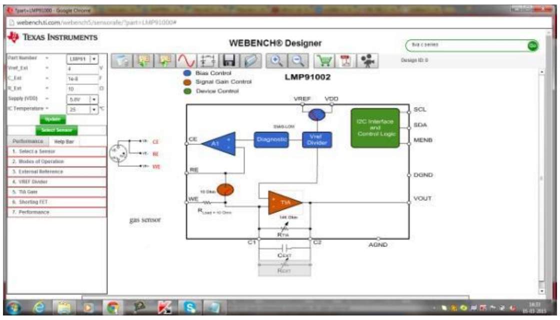


Figure 9: Gas sensor design using webench Designer

III. IMPLEMENTATION

A. Hardware implementation

The hardware used here is gas sensor, launch pad, Bluetooth module and a display(smart phone).

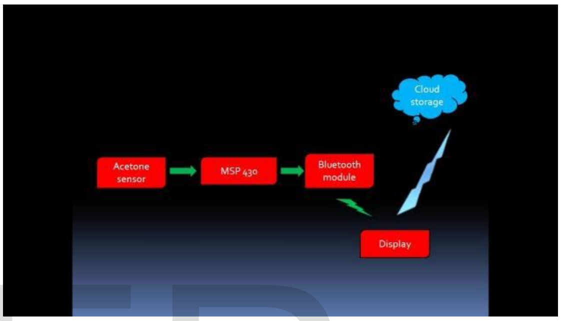


Figure 10: Conventional blocks

The gas sensor is connected to the launch pad which is then connected to the Bluetooth module. The Bluetooth module is connected with the mobile phone through the blueterm application. The application is available in Google Play store and Apple IOS store. The sensor input is fed to the launch pad through a female jack. The supply and ground also comes from the launch pad. The Bluetooth module is interfaced with the launch pad through wires. The smart phone is connected to the Bluetooth module through Bluetooth protocol. The data processed by the launch pad is transmitted to the Blueterm application through the Bluetooth module in which the required data is displayed. The data displayed in the mobile is converted to a word document along with time and date and stored in One cloud or Google Docs. The word document is synchronized with any of the cloud server. We can retrieve the data whenever needed.

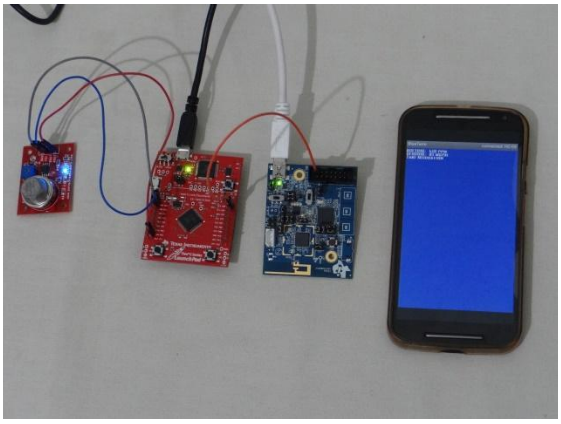


Figure 11: Implemented Prototype

B. Software Implementation

The flow chart used for writing the code is given below. We use Energia as a compiler for uploading the program in the launch pad.

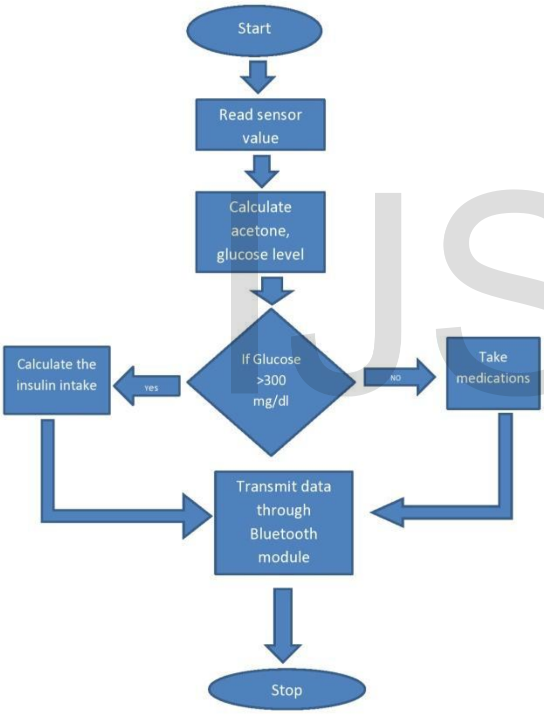


Figure 12: Flow chart of program

IV. RESULT

The final result of the prototype is shown in series of images below

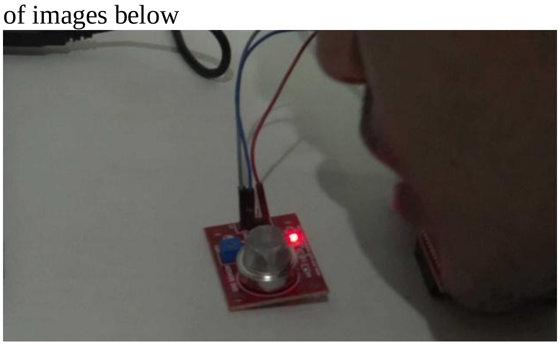


Figure 13: Blowing breath of a patient

The patient blows his breath near the gas sensor before he intakes his food.

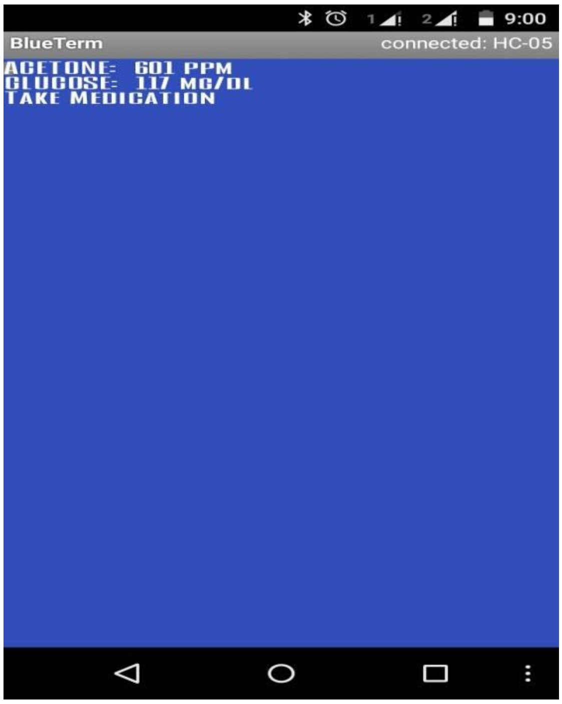


Figure 14: Results shown in smart phone

The data processed in launch pad is displayed in the smart phone through interfacing the Bluetooth module. The values shown in the figure is the result. The patient blows his breath after breaking his fastor after lunch, dinner. The result after breaking the fast is shown in the smart phone. It is noted that the acetone level has gone up likewise is the glucose level. Since the patient is not affected by hyper diabetes, there is no need for insulin intake and only medications in enough. This data is uploaded in the cloud server with time and date.

Figure 16: Cloud storage

The data from blueterm is converted to word document and is stored in cloud.

V. CONCLUSION

Thus the glucose level from acetone is found and insulin intake is calculated and the same data is updated in cloud. The original goal is to send memo to doctors and closed ones during critical situation. The work for achieving those goals is on going. This project has a major advantage over others in market due to the non- invasive method. The Bluetooth range is small and the data connection is needed in smart phone for cloud storage. We have planned to display the details in a wearable hand gear and to dedicate an android and IOS application for the same.

ACKNOWLEDGEMENT

We are very much privileged to express our gratitude to our college. Without the immense support of the Head of our Department, this paper would not have been a reality. We express our sincere thanks to all our faculty members for guiding us to finish this paper successfully. We are also thankful to our parents for their kind cooperation.

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