AUTOMATED GLUCOSE VACCINATION BY EX-VIVO METHOD

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ABSTRACT

This paper is based on how to evaluate the exact, accurate and flexible of use of a new automated device for monitoring the level of blood glucose by Ex-vivo method in normal heart beat. The proposed model is to check the glucose level of a person with glucose sensor in a normal heart if the range is above 99mg/dl, the injector model attached with this will vaccinate the person according to the level of glucose (i.e. if the person glucose level is 100mg/dl it will spray only 1ml of insulin).So that the individual does not have problem in measuring insulin and time taken for this process is less.

Key Words: ***Ex-Vivo, Insulin, Islet of Langerhans, Sensor, Vaccinate.***

I. INTRODUCTION

Glucose is a simple sugar which is an important energy source in living organisms and is a component of many carbohydrates. This built up energy molecules in each and every person body. The many sources energy building molecule that forms from glucose are insulin. The insulin are produced the beta cells present in islet of Langerhans.

The islet of langerhans is found inside the pancreas. The deficiency of blood glucose leads to less segregation of insulin in body, this leads to diabetes i.e. deficiency of insulin in body. Diabetes is a long term chronic disease. This is classified as follows based on their defects they are Type 1 Mellitus, Type 2 Mellitus and Gestational is often seen classification.

1.1. Types of Diabetes Mellitus

1.1.1. Type 1

It is based on the reduction of insulin in the body i.e. beta cell damages the insulin producing layer.

1.1.2. Type 2

It is based on the age, gene and obesity of a person. This type of person will have insulin but the liver and muscle cells lose their ability to respond to the insulin that circulated in the blood.

1.1.3. Gestational Diabetes

It is seen in pregnant ladies at their time of pregnancy. This kind of diabetes person will be having high blood glucose level.

1.2. Process of Producing Insulin

The insulin is naturally produced by beta cells in Islet of Langerhans that is produced inside pancreas. The insulin passes through the muscle cells and produces glucose which gives energy to a person.

1.3. Level of Blood Glucose

The abnormal blood glucose levels is low blood sugar (hypoglycemia), high blood sugar(hyperglycemia) and abnormality in fasting.

1.4. Measurements of Blood Glucose

The below "Table.1.1" shows the level of blood glucose in a normal and diabetes person in two states:

Condition	2 hours Glucose	Fasting glucose
Unit	mmol/l(mg/dl)	mmol/l(mg/dl)
Normal	<7.8 (<140)	<6.1 (<110)
Diabetes mellitus	≥11.1 (≥200)	≥7.0 (≥126)

Table.1.1

1.5. Advanced Technologies

In 1962 the self monitoring glucose meters i.e. Test stripes glucose meter with in-vivo methods are introduced. Now as technologies have been developed many Ex-vivo technologies and self managing glucose meters are been in use. Some of the latest insulin devices are made automated they are insulin pen, insulin pump and insulin syringe.

1.6. Drugs

The drugs used for this are based on the period of test. They are basal and bolus. The basal is used to keep the blood glucose level constant during the fasting period. The bolus is used to keep the blood glucose level normal during meals i.e. it is taken before meals but hypoglycemia patients are preferred to take after their meals. The basal-bolus makes cause some damages mostly used by Type-1 people.

II. EXISTING SYSTEM

This is a in-vivo method in which glucose test is made automated only with the help of blood sample. The other process is the silicon chip is used to sense the blood and glucose meter reads glucose level and the insulin is sprayed through the needle that is already lanced into the skin. All this is automated only small overcomes are there.

Disadvantage

- The process done with the help of blood samples
- The continuous injecting of needle leads to skin cell damage

Advantage

- Home based glucose monitoring device
- Easy to carry
- Low cost of test

III. PROPOSED SYSTEM

The continuous monitoring of glucose level in a person with normal devices with advanced methods. The device used are Glucose sensor, Heart beat Sensor, Insulin injector driver, and insulin injector. First the level of heart beat of a person is checked and if the heart beat level is normal i.e. 60 to 100 beats per min (bpm) in adults and in a child it should be 70 to 100 beats per minute(bpm). If this condition is satisfied the glucose sensor will start sensing the blood according to the equivalent voltage i.e. the signal processed by sensor measured in nA(nano ampere) in a range of 0-6nA which is low range of current which does not affect human cells.

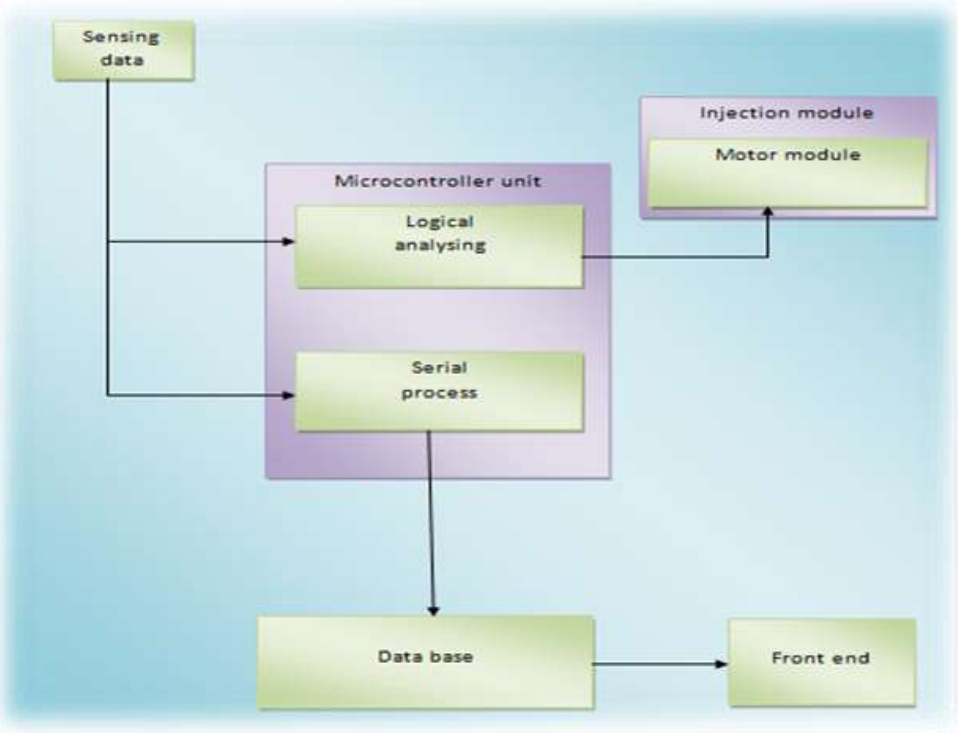

Fig.1.1: Architecture Diagram

The sensed signal are converted into digital values with the help of ADC 0804 (Analogue Digital Converter) that passes the input signal into the 8051 microcontroller port(P0).That digital signal will compare the normal glucose rate to that of the measured rate and if the range is above are below the normal level then the signal is passed to the insulin injector driver that helps to measure the level of insulin(present inside the syringe) according to the blood glucose level i.e. if the blood glucose level is above 100mg/dl the insulin sprayed in a person while injecting will be and the insulin injector will helps in injecting insulin based on basal and bolus method. Simultaneously in another side the readings of the person in getting read and updated in Pc/Mobile with the help of Zigbee module. And all the devices are in serial or parallel connection with the the help of the device called UART (universal asynchronous receiver/transmitter) i.e. the Zigbee module and the microcontroller are connected with the help of UART and the Zigbee and Pc/Mobile are also connected with the help of the UART. And the data's will be updated whenever the glucose level is measured.

The full process is outlines in "Fig.1.1" and this will makes the person to know the outline of the process. The main concept of this process is to use simple devices and makes the devices easy to use. And this not a continuous injecting device so that the person is not in a need to carry this device in them. This is mainly to overcome the damage skin cells, accurate measure of insulin and accurate reading of glucose without blood sample.

Advantages

- It is an Ex-vivo method i.e. no need of blood samples.
- Insulin will be automatically measured according to the level of glucose.
- This test can be done by individual itself.
- Easy installation , Wearable and light-weight
- Data accuracy compact

Disadvantages

- No automated injecting. The needle must be injected by us.

3.1. Devices and Its Description

3.1.1. Heart beat sensor

This medically used heart sensor is used to know the heart beat per minute i.e. to measure of bpm(beats per minute).The normal bpm of an adult is 60-100 bpm and for an child it is 70-100 bpm. Medical heart sensors are capable of monitoring vascular tissue through the edge of the finger. That sense the rate of heart beat with the help of LED light. The "Fig.1.2" shows the model of heart beat sensor.

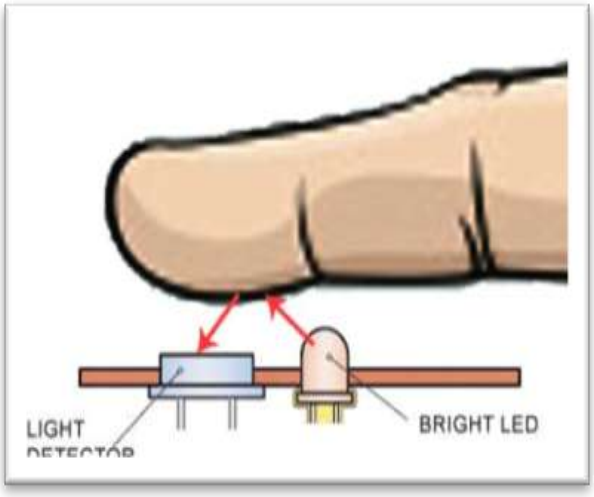

Fig.1.2

3.1.2. Glucose Sensor

The glucose sensor is used to measure the level of glucose in a person. There are three types of glucose sensor they are classical amperometric sensor, fibre-optic fluorometric glucose sensor, spectroscopic glucose sensor. In this process we use spectroscopic glucose sensor that is used for sensing of glucose by ex-vivo method.3.1.3. ADC 0804 interface with 8051 Microcontroller is defines as all the functions in a single chip. It is the main component in electronic and electrical process.

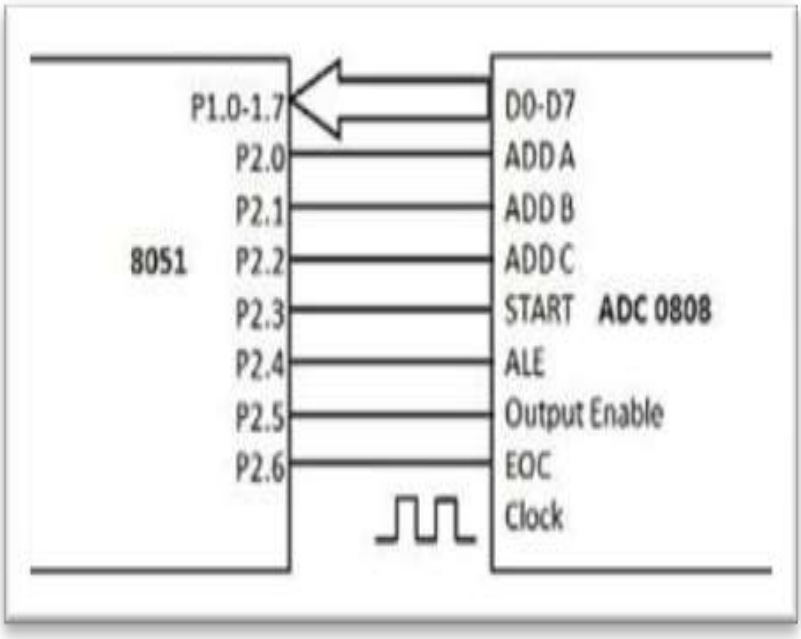

Fig.1.3

It is small chip with all sorts of functions. The microcontroller used for this is 8051.And the ADC 0804 is interfaced with this to convert the signals. The whole part is said to be interface 0804 with microcontroller 8051. The "Fig.1.3" shows the interface of ADC 0804 and microcontroller 8051.

III.1.4. Display device (Pc/Mobile)

The final output of this process are displayed as a report and stored in database for future records. The output panel may be a personnel computer or mobile. The "Fig.1.4" is a pc and mobile mode.

Fig.1.4

3.2. Input and Output Process

3.2.1 Input

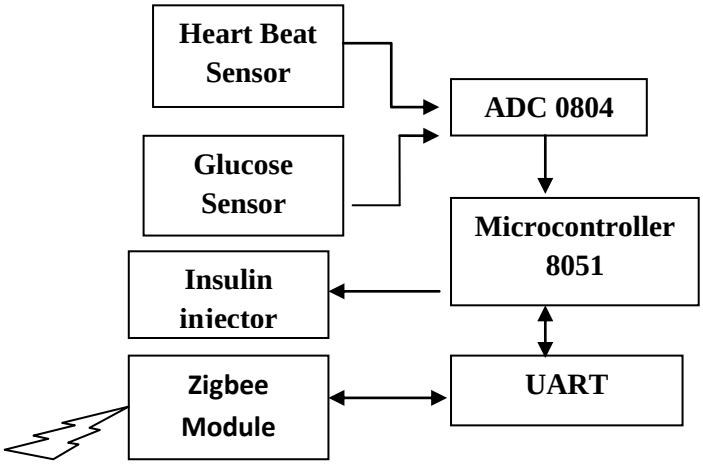

Fig.1.5:Block diagram for input

The input flow is starts with the sensing signals as input. And the signals are converted with the help of ADC 0804 in interface with 8051 and at last the injector module does the injecting work. The "Fig.1.5" shows the input block diagram.

3.2.2 Output

The output connects with the input device with the help of zigbee module. Then the readings are displayed in the display screen (Pc/Mobile).Then "Fig.1.6" displays output block diagram.

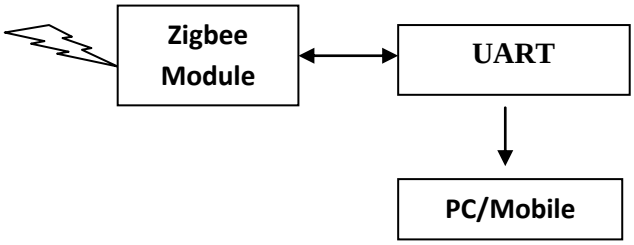

Fig.1.6:Block diagram for output

3.3. Process Flow Diagram

The Process flow tells about the flow of project in a flow model diagram, so that the whole process can be easily understood with this diagram. The "Fig.1.7" shows the flow process of the automated glucose vaccination process.

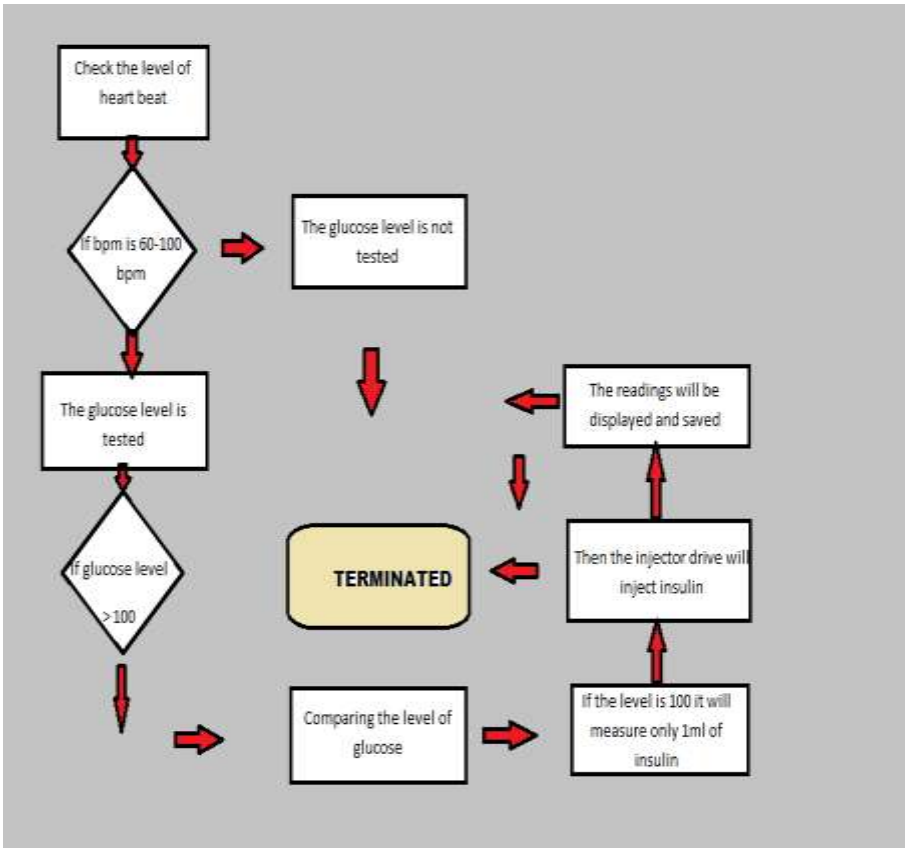

Fig.1.7: Process Flow Diagram

3.4. Hardware and Software

Hardware

- Microcontroller 8051

- ADC
- Glucose sensor
- Insulin injector
- UART
- Zigbee module
- Insulin injector Driver
- PC
- Power Supply Unit

Software

- Keil compiler - Embedded C
- Mat lab

IV. CONCLUSION

We presented a Automated glucose vaccination by Ex-vivo method considering the human skin and health condition, so that the patient does not get affected by any other side effects. This process will be safe and makes patient easy to use.

ACKNOWLEDGEMENT

We thank **Mrs K.Lalitha**, **Assistant Professor** of Panimalar Engineering College, for her guide, help and great support in our work.

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