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Design and Implementation of IoT Based Smart Health Monitoring System for Diabetic Patients Using Wireless Sensor Networks

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ABSTRCT
Internet of Things (IoT) being a advent technology in smart sensing devices, has provided practical solutions in various fields. The study combines the IoT technology with the health care monitoring system allowing the connection between the devices. The chronic metabolic disorder Diabetes is a fast growing global issue. We are adopting a monitoring system in the suggested approach that includes glucose monitoring as well as other parameters such as body temperature, heart rate, and oxygen level.
Keywords – Internet of things (IoT), Health care monitoring system, Diabetes

I. INTRODUCTION

Diabetes is a chronic disease that happens both when the pancreas does not produce enough insulin or when the bod cannot use the insulin efficiently. Insulin is the hormone that controls the sugar levels in the Hormone that controls the sugar level in the blood is insulin. The abnormality in the body the glucose accumulates itself in the blood which causes significant deterioration in human health. Type 1 diabetes is caused by the loss or disruption of insulin-producing cells in the body and can affect people of any age. It is most commonly diagnosed in children and adults. Type 2 diabetes is caused by the pancreas' inefficient insulin synthesis or the body's inefficient utilization of the insulin generated. Over the ages the traditional method used to test the glucose levels were invasive, which use blood, which is quiet a drawback. To over come the drawback we are implementing a non-invasive glucose sensing monitoring system, which is a painless and easy process. As IoT has revolutionized the health-care monitoring system, we are implementing a health-care monitoring system that allows us to keep track of a patient's glucose levels as well as test other metrics such as body temperature, heart rate, and oxygen levels (SPO2).

II. COMPONENTS USED IN IMPLEMENTATION

For the implementation of the smart health care monitoring system there is need of some components that are suitable. The components include Infrared sensor, LM35 sensor, MAX30100 sensor a Arduino UNO and a GSM module.

a. Infrared Sensor

The IR sensor is a combination of light emitting diode that emits a monochromatic red light at a wavelength of 660 nm and a Infrared light at a wavelength of 940 nm. The sensor is made up of two major components that is a transmitter and a receiver. The transmitter transmits the light through the patient's finger and the from the amount of the light received at the receiver we can calculate the glucose levels in the blood.

b. Temperature sensor- LM35

It uses the basic principal of a diode, when the temperature increase the voltage increases at a known rate. It can be operated at a range of 5V supply and the stand by current which is less than 60µA.The signal that is generated here is directly proportional to the temperature.

c. Heart rate and Oxygen level Sensor- MAX30100

The MAX30100 sensor is a combined pulse oximeter and a heart rate sensor. The sensor is intended to detect the Heart rate and the Oxygen levels(SPO_2) of the body. The sensor includes of two light emitting diode and a photodetector with a series of low noise processing devices to perform the task like detecting the heart rate and oxygen levels.

d. GSM Module

The expansion of GSM is Global System for Mobile. The GSM module is used for the communication or the interaction between the devices and the internet.

It is used for the data delivery using digital communication where SMS has a profound effect.

e. Arduino UNO

Arduino is microcontroller board which is easy to use as both hardware and software. Arduino boards are able to read inputs like a light sensor or a finger on a button and turn it into outputs like activating a motor or turning on the led.

III. PROPOSED METHOD

We used Arduino UNO to implement the smart health care monitoring system in the proposed technique. The system's main controller is the Arduino UNO. The levels of glucose in the blood, as well as the heart rate, body temperature, and oxygen levels, are all monitored. The Arduino UNO and the appropriate sensors are used to monitor these parameters, and the data is subsequently posted to the ThingSpeak server via an internet connection.

The data collected by the system is automatically updated on the server, allowing us to examine the patient's health state at any time. After the data has been monitored, we issue a command for a status update on the patient's health using the push button.

IV. BLOCK DIAGRAM

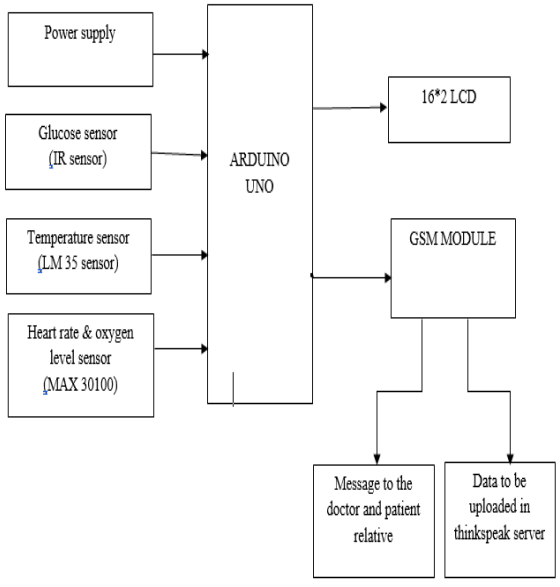

Fig 4.1: Illustration of health care monitoring system

Fig 4.1 represents the basic illustration of health care monitoring system using Internet of Things (IoT). The Arduino UNO monitors the bio medical parameters like the Glucose levels along with the body temperature, heart rate and the oxygen levels. The parameters are measured using the IR sensor, temperature sensor(LM 35), heart rate and oxygen sensor(MAX 30100) respectively. The monitored parameters are displayed on the LCD and directed to the GSM module. From the GSM module, this information is made available for the doctors as well as the patient's relatives. Also the data is uploaded in the ThingSpeak server.

V. RESULTS

Using the respective sensor, the parameters are detected and the data that is noted are directed to the Arduino UNO for monitoring. The data is then presented on the 16*2 LCD. Further the collected data is updated in the ThingSpeak server.

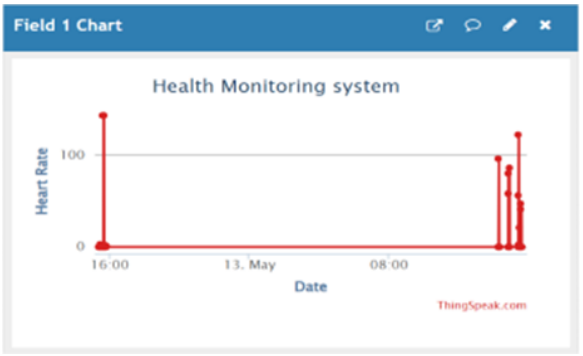

Fig5.1: Plot 1-Heart Rate

The usual heart rate of a person ranges between 60 and 100 beats per minute for healthy people. The typical restful heart for adult males is roughly 70 bpm and for adult females 75 bpm. Now the measured value is compared with this actual value ,if the heart rate is within the specified range then the message is sent to patient and doctor i.e heart rate is Normal else heart rate is Irregular.

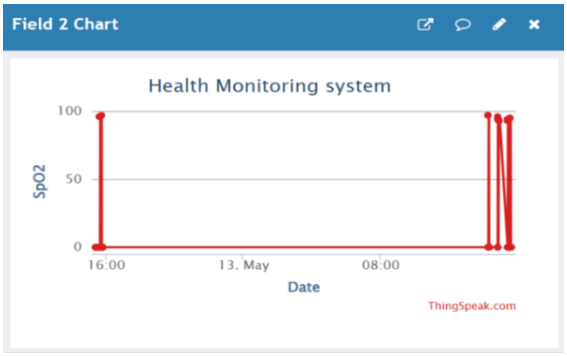

Fig 5.2: Oxygen levels (SPO_2)

A normal level of oxygen is usually 95% or higher. The recorded value of the patient is compared to the general or the actual level that is if the person's recorded level is above 95% then the patient has normal oxygen levels otherwise it is considered as abnormal

In healthy adults, the regular temperature ranges between 36.5 °C and 37.2 °C. Now the actual value and the measured value are analyzed . If the measured value is within the series of specified body temperature then the case is considered as normal else the patient is said to be in abnormal condition.

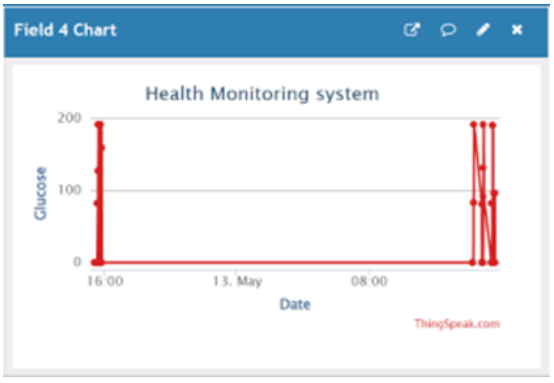

Fig 5.3: Plot 3- Body Temperature

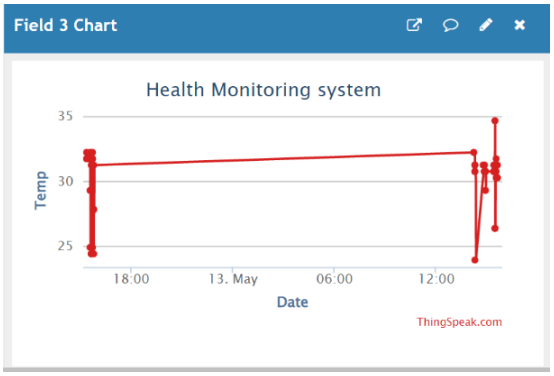

Fig 5.4 : Plot 4- Glucose Levels

A blood sugar level less than 140 mg/dL is considered as normal. A reading of more than 200 mg/dL indicates diabetes (Type-1). A reading among 140 and 199 mg/dL indicates prediabetes (Type-2).The measured glucose levels are compared with the specified levels of the diabetes, to classify whether the patient is suffering from Type-1 or Type-2 diabetes

VI. CONCLUSION

The suggested strategy aims to use IoT to provide more efficient and better health services. An effective health-care system is created, capable of examining patient health condition at any time. From afar, the doctor can keep track of the patient's health and provide therapeutic advice. The system is simple and friendly to use anywhere. It also serves as a means of communication between the doctor and the patient.

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