BLOOD LEAKAGE MONITORING SYSTEM DURING HEMODIALYSIS THERAPY BASED ON THE IMPLEMENTATION OF RTOS

M. Koteswara Rao, E. Vyshnavi, G. Durga Bhavani, N. Sai Kumar, K. Sai Deepak

ABSTRACT

The purpose of this project is to design and implementation of a monitoring device for blood leakage detection during hemodialysis treatment. The design includes a Photointerrupter, ESP8266 module, and alert components. The validation results show that it only needs a very small amount of blood and takes to detect a blood leakage. As long as the patient wear this system it gives monitoring signal to the health care unit. The absorbent material is placed at the Photointerrupter. Once the blood leakage occurs the absorbent material which is placed at the Photointerrupter absorbs the blood and the alarm will triggers. A warning light will also be activated, and a detecting signal is transmitted to the healthcare station. Immediately the health worker take action to prevent this risk. The proposed system continuously gives out an alert for continuously monitor upto hours/days. This system is more convenient to the patient and also healthcare workers. The Proposed system is developed using ARM Cortex Controller, Photo Interrupter (IR Sensor), Buzzer, LM35, LCD, RTOS and etc.

Keywords: RTOS, Blood Leakage Detection, Hemodialysis Treatment, ARM Cortex Controller, Photo Interrupter (IR Sensor) and etc.

M. Koteswara Rao, Assistant Professor, Department of ECE, Chalapathi Institutue of Engineering and Technology, Guntur, Andhra Pradesh, India

E. Vyshnavi, Department of ECE, Chalapathi Institutue of Engineering and Technology, Guntur, Andhra Pradesh, India

G. Durga Bhavani, Department of ECE, Chalapathi Institutue of Engineering and Technology, Guntur, Andhra Pradesh, India

N. Sai Kumar, Department of ECE, Chalapathi Institutue of Engineering and Technology, Guntur, Andhra Pradesh, India

K. Sai Deepak, Department of ECE, Chalapathi Institutue of Engineering and Technology, Guntur, Andhra Pradesh, India

INTRODUCTION

In the latest years, the number of patients with end stage renaldiseases (ESRD) is growing in the developed and developing countries.There are different medicines or treatment for end stage renaldiseases everywhere throughout the world, such as Hemodialysis,Peritoneal dialysis and kidney transplantation.Hemodialysis is most common and well known techniques for treating End Stage Renal Diseases (ESRD). Hemodialysis is a processthat uses an artificial membrane or dialyzer to eject waste suchas urea from blood and excess water from body. In Hemodialysis(HD), to clean blood, a special filter known as an artificialkidneyor a dialyzer are used. To take blood from patients body or into artificialkidney, doctor needs an opening or entrance into vein. Thisis done with minor surgery. In recent years, kidney renal failure is found to be a major disease in the developed and developing countries. Various therapy methods adopted for renal failure are Hemodialysis, Peritoneal dialysis, and kidney transplantation. In the above three methods Hemodialysis therapymethod is accepted to be the best treatment method by most countries for renal failure.
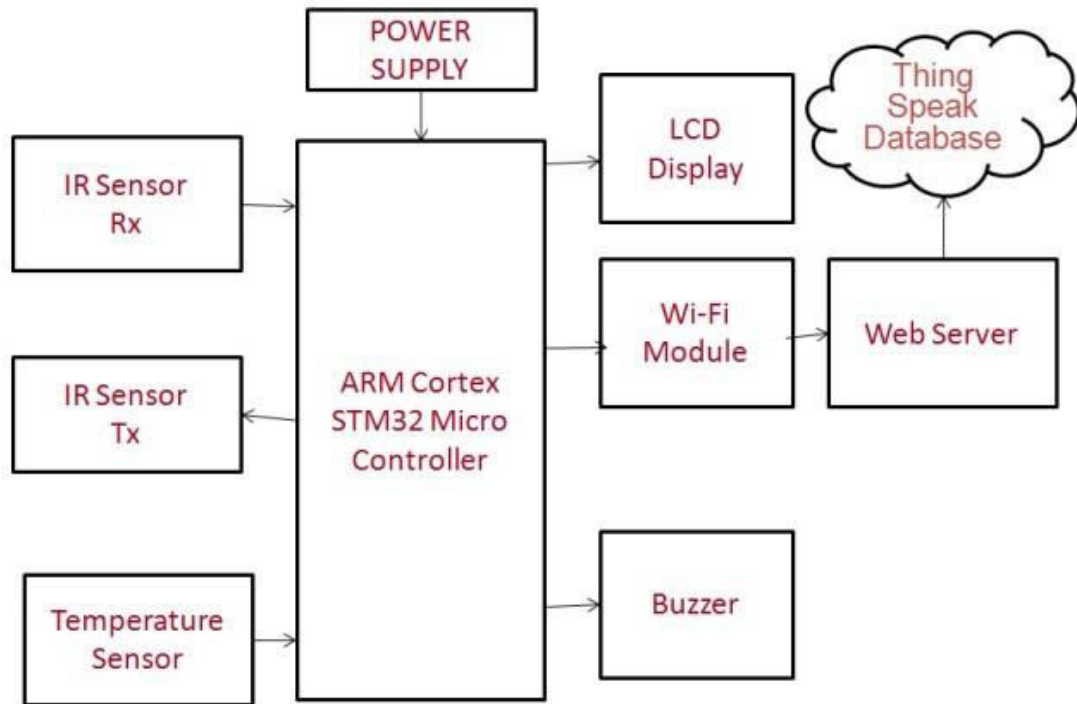
EXISTED SYSTEM

A commercial blood leakage detector, Hemodialertproducts, specific for hemodialysis therapy is currently available, which requires the sensing sensitivity of less than1 ml of blood, and the blood leaking condition can be detected in 1 ~ 2 seconds. The sensing method is basically based on the changes of the voltage signal in the sensor. This device includes a detector having two spaced apart electrodes; each electrode is connected to a signal generating source via a lead. The device also includes a signal processing unit that detects a change of state across the electrodes produced bythe introduction of a fluid and an alarm actuated by the change of state. The electrodes are encased in a flexible non conductive material and can be reused after cleaning. The other commercial product for the detection of blood leakage is available from redsense with a sensing sensitivity of approximately 1 ml of blood. The detection of a blood leakage is by a change in electrical conductance in a circuit, which comprises two metal wires separated by a slit. When the blood flows into the slit, it creates an electrical connection between the two wires, and thus, the blood leakage can be detected .This product is a disposable blood leakage device,which cannot be reused.

PROPOSED SYSTEM

The patient requires to be dependent on the technician or family members during thedialysis process. Always they seek help from others. And also, during the process the patientmust have to be in rest. The patient has to be monitored continuously by others that makesthem sometimes uncomfortable and facile awkward. Though hemodialysis can also be doneat home, in that the patient needs at least one near to them. The treatment process can be taken only when the patient is ready for treatment and the other one is available to monitor them. If blood leak occurs then it leads to further discomfort. To address all these pressing needs, a self- dialysis and blood leakage detection is developed to increase the anatomy of the patient.

BLOCK DIAGRAM

Arm Cortex: It is an unplanned steerage fix site, rumoured have the benefit of "CISC", may be prospering completed run-in to spectacular smaller direction set up simple machine, normally often known as microprocessor. The two conventionalize twosome entirely practices going from abstract thought palmy modern-day computer architecture triskelion. any assembler constituting the general reduced instruction set computing engineering science individual micro-controllers validates powerful "CISC" pattern. things of one's "RISC" . An Implementation of RTOS Based Blood Leakage Monitoring System in IoT Environment triskele are often 8085 micro-controller in addition to weapon assembly language reconfirms sensational reduced instruction set computer triskelion.

IR Sensor: An electroluminescent IR LED is a product which requires care in use. IR LED's are fabricated from narrow band hetero structures with energy gap from 0.25 to 0.4 eV. Infra red transmitter emits IR rays in planar wave front manner. Even though infra red rays spread in all directions, it propagates along straight line in forward direction. IR rays have the characteristics of producing secondary wavelets when it collides with any obstaclesin its path.

LM 35 Sensor: LM35 a temperature recorder by using the 12F675 PIC microcontroller as the controller and data store. It generates serial output so that you can view the results on a PC and it also calculates the temperature reading in Fahrenheit sending both to the serial port at half second intervals. The LM35 has an output of 10 mV/°F with a typical nonlinearity of only ±0.35°F over a −50 to +300°F temperature range, and is accurate to within ±0.4°F typically at room temperature (77°F).

Wifi Module:

The ESP8266 is a low-cost stack and microcontroller capability, Wi-Fi microchip, with a full TCP/IP stack and microcontroller capability. This small module allows microcontrollers to connect to a Wi-Fi network and make simple TCP/IP connections using Hayes-style commands. The ESP8285 is an ESP8266 with 1 MiB of built-in flash, allowing the building of single-chip devices capable of connecting to Wi-Fi.

LCD Display:

A Liquid Crystal Display (LCD) is an electronically-balanced optical gadget formed into a meager, level square made of any number of hiding or monochrome pixels piled up with fluid gems and appeared before a light source (view lighting up) or reflector. Each pixel of a LCD usually involves a layer of iot as balanced between two clear terminals, and two polarizing channels, the transmission of which are (in most of the cases) inverse to each other with no authentic liquid valuable stone between the polarizing channels.

Buzzer:

Piezoelectric Buzzer is a self drive type piezoelectric sounder with built-in oscillation circuit transistor and resistors. It generates consistent single tone sound just by applying D.C. voltage. Using a suitably designed resonant system, this type can be used where large sound volumes are needed.

RTOS (Real Time Operating System)

An RTOS is an operating system in which applications are run under specified time constraints with high reliability. Typical properties of an RTOS include multi-tasking and preemptive scheduling. In general, an RTOS problem is divided into multiple tasks and handled by several processes. A scheduler is used to manage task sequencing at run time, based on specific scheduling algorithms.

THING SPEAK

Thing Speak is an open source internet of things (IoT) application and API to store and retrieve data from things using the HTTP and MQTT protocol over the Internet or via a Local Area Network. ThingSpeak enables the creation of sensor logging applications, location tracking applications, and a social network of things with status updates. ThingSpeak has integrated support from the numerical computing software MATLAB from Math Works.

RESULT

Photo interrupter is an optical coupling (IR SENSOR) element which is electrically insulated and optically coupled to each other in the light emitting and receiving parts. Objective is to convert the input electrical signals into light, that is, the light-emitting unit emits an infrared light. The light receiving unit receives the infrared light and converts it into electrical signals so that the light emitting portion and the light receiving portion of the photo interrupter becomes conducted. The conduction between the emitter and collector can be detected by examining the signal, either high or low. The working of the kit and results screen shots are shown in below.
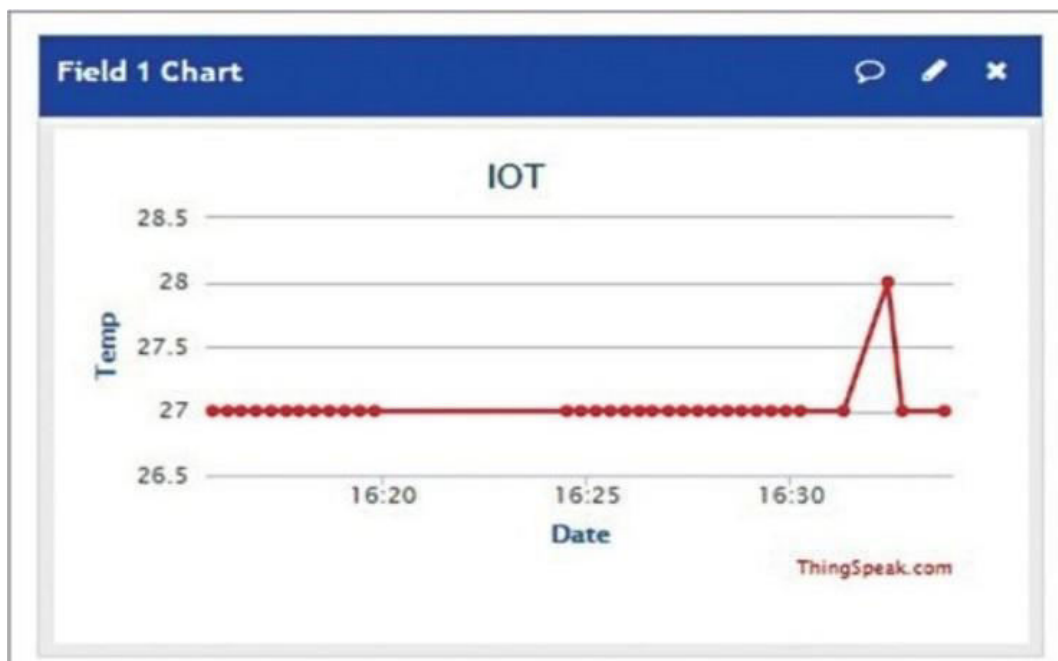
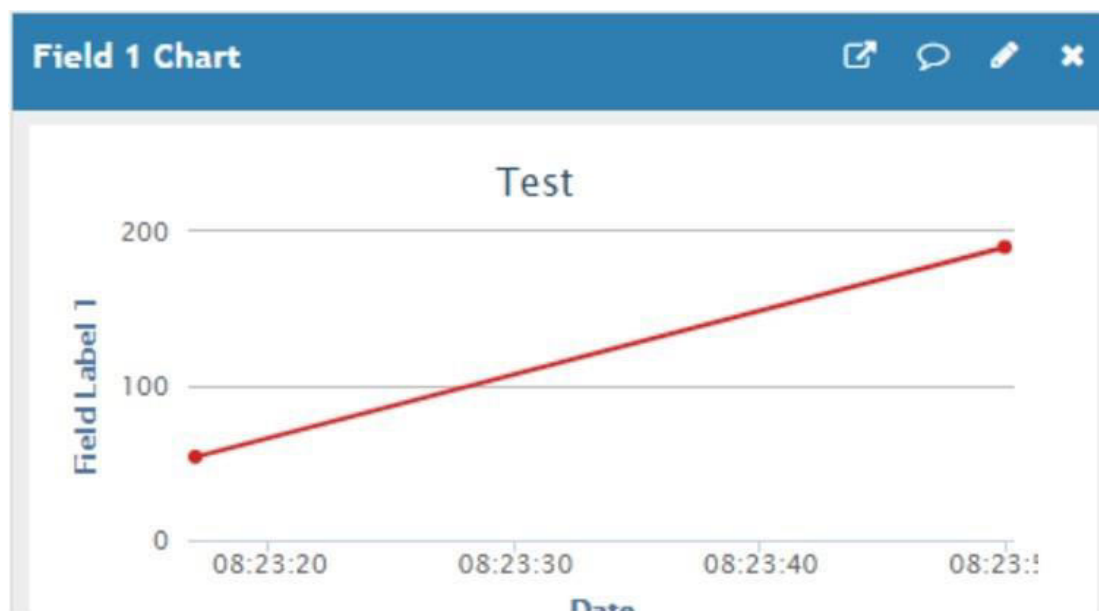**Figure 2: Patient body Temperature Values monitoring through thing speak**

Figure 3: Patient blood leakage monitoring through thing speak

CONCLUSION

Blood leakage monitoring system is also designed as a warning tool for detection of blood leakage/loss. It can indicate the risk level in both end-sensing units and remote monitor devices via a wireless network and cloud. In this study, the developed blood leakagemonitoring device duringhemodialysis is an independent system. This device is small in size, light weight, low cost and an easy installation on patientsarm. The main purpose is to design and manufacture of this device is, to detect blood leakages during hemodialysis and activate the buzzer. When alert components or buzzer activate, the healthcareor technician take immediate and appropriate action and preventpatient from any major problem. Very small amount of blood is requiredfor detection of blood leak and it detects in milliseconds. Fromthe developed device hopes the quality of healthcare is enhancingduring hemodialysis therapy.

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