



Smart Portable Kidney Dialysis Blood Leakage Detection System

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Abstract -

Hemodialysis is a procedure or therapy which is performed for patients who suffer from kidney or renal failure. This treatment helps to filter water and waste from the human body which in general is performed by the kidneys when they are healthy. Due to the kidney or renal failure a process and with the help of hemodialysis the minerals like sodium, potassium and calcium can be balanced. Even though this treatment cannot act as a replacement for kidneys, it can make the patient feel comfortable and better. The currently available hemodialert products will detect the blood leakage during the dialysis process only after sensing a leakage of a minimum of 100 ml of blood. Due to this, there are extremely high chances of a disease named 'Uremia' to possibly occur in patients. Also, the sensing method is basically based on the changes of the voltage signal in the sensor. This device includes a detector having two electrodes spaced apart from each other which is connected to a signal generating source via a lead. This device also includes a signal processing unit that detects the change of state across the electrodes produced by the introduction of the fluid and an alarm actuated by the change of state. The proposed system is designed in such a way that the blood leakage condition can be detected within 1-2 seconds, which requires a sensing sensitivity of less than 1ml of blood. IR Sensor is used as a sensor for detecting the blood leakage and it is connected to Wi-Fi for the function of wireless transmission of information.

Index Terms -Power Supply, Temperature Sensor, IR Sensor, Pressure Sensor, LCD display, DC water pump, GSM

I.INTRODUCTION

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 Haemodialysis, Peritoneal dialysis, and kidney transplantation. In the above three methods Hemodialysis therapy method is accepted to be the best treatment method by most countries for renal failure. A Hemodialysis machine has a dialyzer filter which cleans the blood. The doctor makes an access into our blood vessels. This is done with minor surgery on the arterio-venous fistula, usually to our arm. Then blood is taken into the dialyzer. The dialyzer has two parts one part for our blood and the other part for a fluid called dialysate. These two parts are separated by a thin semi-permeable membrane. Smaller waste products such as urea and extra fluid pass through the membrane and are removed. Blood cells, protein and other important things remain in our blood because they are too big to pass through it. The currently available Hemodialert products will detect the blood leakage during the dialysis process only after sensing a leakage of a minimum of 100 ml of blood. The proposed system is designed in such a way that the blood leakage condition can be detected within 1-2 seconds, which requires a sensing sensitivity of less than 1ml of blood. IR Sensor is used as a sensor for detecting the blood leakage and it is connected to Wi-Fi for the function of wireless transmission of information

II.EXISTING SYSTEM

In the existing hemodialysis machines the amount of blood needed to detect the blood leakage during the dialysis process is high which is improved way too much in the proposed system. The price of the currently available hemodialysis products is high and cannot be afforded by poor people. The existing dialysis machine occupies a lot of space. Although these products have an alarm, the loudness of the alert is limited by the distance, causing healthcare workers to give more attention to whether the alarm is warned or not, which is an inconvenience.

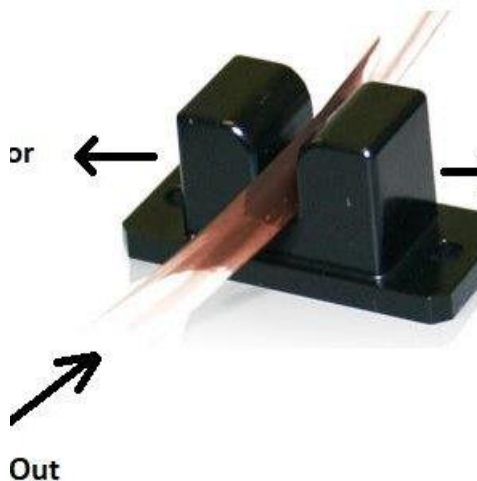


Fig2.1 Existing System

III. PROPOSED SYSTEM

The proposed system is designed in such a way that the blood leakage condition can be detected within 1-2 seconds, which requires a sensing sensitivity of less than 1ml of blood. IR Sensor is used as a sensor for detecting the blood leakage. With the help of pressure sensor we can find with how much pressure blood it taken out and GSM used to send the alert messages for communication. Temperature sensor will monitor the temperature of the body continuously. the two pumping motors are used to take the blood and pump the blood. The data will be displayed on LCD. If any sensors data increases than threshold then GSM will send message and buzzer will give alerts.

3.1 BLOCK DIAGRAM

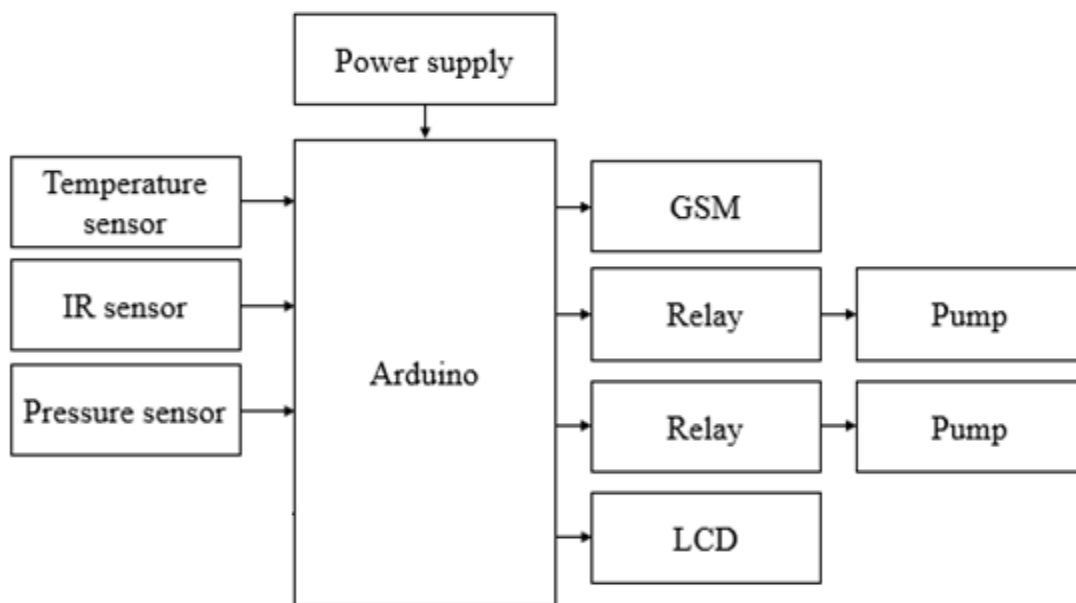


Fig3.1 Block Diagram of proposed System

3.2 ADVANTAGES:

1. Low cost
2. High efficiency
3. Early indication
4. Continuous Monitoring of the patient

3.3 APPLICATIONS:

1. Kidney dialysis centres
2. In hospitals
3. In Homes

IV.COMPONENT DESCRIPTION:**4.1: HARDWARE COMPONENTS REQUIRED:****4.1.1: ARDUINO UNO**

The Uno with Cable is a micro-controller board base on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs); 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything need to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started.

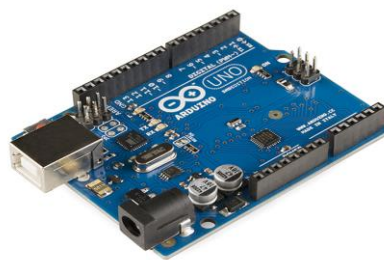


Fig 4.1.1: ARDUINO UNO BOARD

4.1.2: IR SENSOR

Infrared Sensor which is used as Obstacle detector is to transmit an infrared signal, this infrared signal bounces from the surface of an object and the signal is received at the infrared receiver.



Fig 4.1.2: IR SENSOR

4.1.3 RELAY

A relay is an electromagnetic switch that is used to turn on and turn off a circuit by a low power signal, or where several circuits must be controlled by one signal.



Fig 4.1.3 RELAY

4.1.4: DC PUMP

The working principle of a water pump mainly depends upon the positive displacement principle as well as kinetic energy to push the water. These pumps use AC power otherwise DC power for energizing the motor of the water pump whereas others can be energized other kinds of drivers like gasoline engines otherwise diesel.



Fig 4.1.4: DC PUMP

4.1.5: LCD

LCD (Liquid Crystal Display) is the innovation utilized in scratch pad shows and other littler PCs. Like innovation for light-producing diode (LED) and gas-plasma, LCDs permit presentations to be a lot more slender than innovation for cathode beam tube (CRT). LCDs expend considerably less power than LED shows and gas shows since they work as opposed to emanating it on the guideline of blocking light.

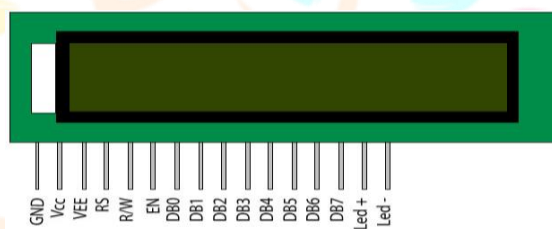


Fig 4.1.5: LCD

4.1.6: DS18B20 TEMP SENSOR

DS18B20 is one type of temperature sensor and it supplies 9-bit to 12-bit readings of temperature. These values show the temperature of a particular device. The communication of this sensor can be done through a one-wire bus protocol which uses one data line to communicate with an inner microprocessor. Additionally, this sensor gets the power supply directly from the data line so that the need for an external power supply can be eliminated.



Fig 4.1.6: DS18B20 TEMP SENSOR

4.1.7: BMP180 SENSOR

This precision sensor from Bosch is the best low-cost sensing solution for measuring barometric pressure and temperature. Because pressure changes with altitude you can also use it as an altimeter!. The sensor is soldered onto a PCB with a 3.3V regulator, I2C level shifter and pull-up resistors on the I2C pins. This board is 5V compliant.

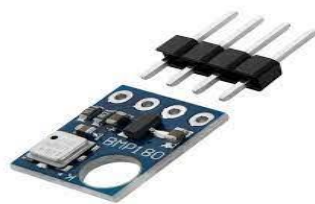


Fig 4.1.7: BMP180 SENSOR

4.1.8: GSM

A GSM modem is a device which can be either a mobile phone or a modem device which can be used to make a computer or any other processor communicate over a network. It can be connected to a computer through serial, USB or Bluetooth connection.

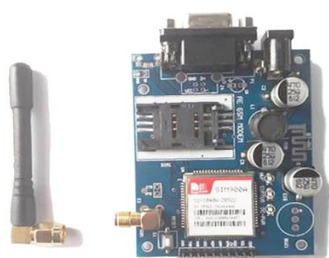


Fig 4.1.8 GSM

4.2: SOFTWARE REQUIRED:

4.2.1: EMBEDDED C

The extension of the C programming language is known as embedded C. It is generally used to develop microcontroller-based applications. Talking about the extension it is I/O fixed-point arithmetic operations, hardware addressing, accessing address spaces, and more.

4.2.2: ARDUINO IDE

The Arduino Integrated Development Environment (IDE) is a cross-platform application (for Windows, macOS, Linux) that is written in functions from C and C++. It is used to write and upload programs to Arduino compatible boards, but also, with the help of third-party cores, other vendor development boards.

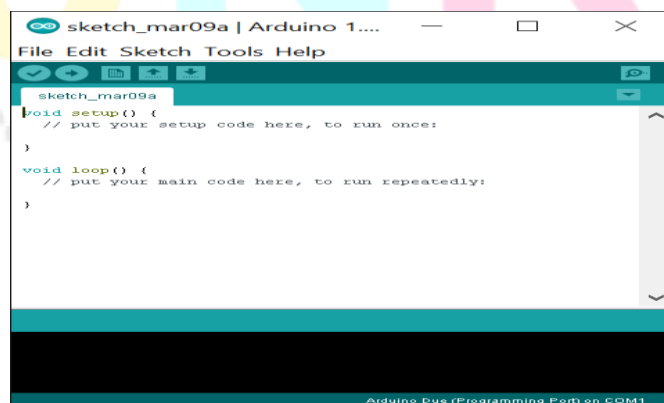


Fig 4.2.2: ARDUINO IDE

V.RESULTS AND DISCUSSION:

The proposed system developed blood leakage monitoring device during hemodialysis is an independent system. Sensors are smaller in size, light weight, low cost and an easy to install. With the help of BMP180 sensor we can monitor the pressure. The main purpose is to detect blood leakages during hemodialysis, very small amount of blood leak detected with in seconds and alert through message with GSM is an advantage. When alert messages received, the healthcare or technician take immediate and appropriate action and prevent patient from any major problem and hopes the quality of healthcare is enhancing during hemodialysis therapy.



Fig 5.1: WORKING MODEL OF PROPOSED SYSTEM

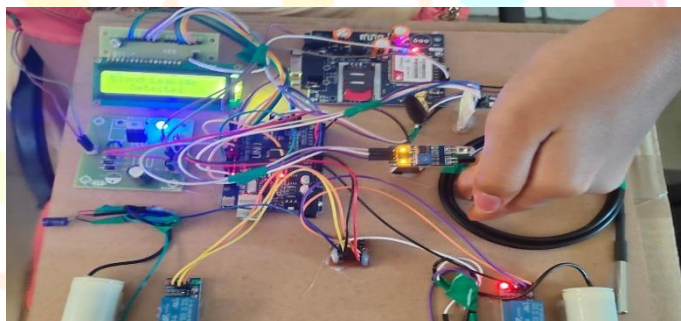


Fig 5.2: WHEN BLOOD LEAKAGE DETECTED BY IR SENSOR THEN SMS SEND TO REGISTERED NUMBER

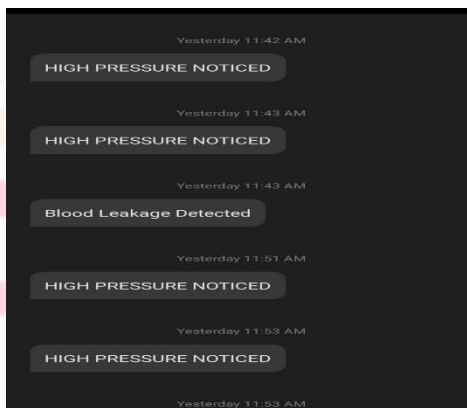


Fig 5.3: WHEN THE HIGH PRESSURE IS DETECTED THEN SMS SENT TO THE REGISTERED CONTACT

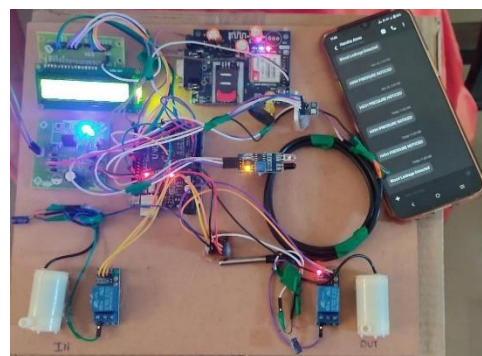


Fig 5.4: WHEN THE BLOOD LEAKAGE AND PRESSURE IS DETECTED THEN SMS SENT TO MOBILE

VI.REFERENCES:

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