



USING THE HEATING AND VIBRATION TO TREAT THE ISCHEMIA

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Abstract:

Ischemia is generally caused by problems with blood vessels, with resultant damage or dysfunction of tissue. People with diabetes can, over time, develop nerve damage throughout the body. Some people with nerve damage have no symptoms. Others may have symptoms such as pain, tingling, or numbness—loss of feeling—in the hands, arms, feet, and legs. Nerve problems can occur in every organ system, including the digestive tract, heart, and sex organ. Diabetic neuropathies also appear to be more common in people who have problems controlling their blood glucose, also called blood sugar, as well as those with high levels of blood fat and blood pressure and those who are overweight.

Compromise of the blood supply from microvascular disease, often in association with lack of sensation because of neuropathy, predisposes persons with diabetes mellitus to foot infections. These infections span the spectrum from simple, superficial cellulitis to chronic osteomyelitis.

In our project we want to provide a preliminary treatment for the problem of ischemia in patients with diabetes using heating and vibration, thus avoid infection or amputation in advanced cases.

Introduction:

Problems with blood vessels caused always ischemia, and in advance stages may cause damage or dysfunctions of tissues. People with diabetes can, over time, develop nerve damage throughout the body. Some people with nerve damage have no symptoms. Others may have symptoms such as pain, tingling, or numbness—loss of feeling—in the hands, arms, feet, and legs. Nerve problems can occur in every organ system, including the digestive tract, heart, and sex organ. Diabetic neuropathies also appear to be more common in people who have problems controlling their blood glucose, also called blood sugar, as well as those with high levels of blood fat and blood pressure and those who are overweight. The causes are probably different for different types of diabetic neuropathy. Researchers are studying how prolonged exposure to high blood glucose causes nerve damage.

Scopes:

- a) To design Sock cloth helps diabetes patients and ease the pain through the inclusion of heating and vibration circuit .
- b) To control the ratio narrows blood vessels and predict in advance based on reading the EMG sensor

Objective

- 1- To study the relationship between EMG and how affected by the ischemia.
- 2- To explain how the increase in glucose level affected in the vascular and causes ischemia.
- 4- Explain the impact of heating and vibration in helping to solve this problem as primary treatment.
- 5- Show in images how when we done simple experiment the EMG will approximately disappear and cause decrease in blood flow through the arteries.



Methods and Materials:

It is very important to choose the most appropriate components with correct specifications in order to establish well-operated circuits. The idea applies for the hardware construction and software development. Sock cloth design canvas based on the existence of vibration and heating circuit connected with electronic piece called Arduino and EMG sensor. EMG sensor read value from human body then send it to Arduino and based on these values the sock and its pieces will start the work. Micro controller processes the sensor values, and if these values outside the normal range of EMG the vibration and heating circuit that embedded inside the two pieces of cloth will start work. The basic block diagram will be as shown below in fig 1.



Fig 1: Basic block diagram

The system is divided into three sub systems as follows:

- 1- EMG sensor
- 2- Arduino
- 3- Vibration and heating circuit embedded inside sock
- 4- 3D printer heater single head
- 5- Relay

Design and Implementation:

Getting Started Using Two 9V Batteries. 1) Connect the power supply (two 9V batteries) a. Connect the positive terminal of the first 9V battery to the +Vs pin on your sensor. b. Connect the negative terminal of the first 9V battery to the positive terminal of the second 9V battery. Then connect to the GND pin on your sensor. c. Connect the negative terminal of the second 9V battery to the -Vs pin of your sensor.

2) Connect the electrodes

- a. After determining which muscle group you want to target (e.g. bicep, forearm, calf), clean the skin thoroughly.
- b. Place one electrode in the middle of the muscle body, connect this electrode to the RED Cable's snap connector.
- c. Place a second electrode at one end of the muscle body, connect this electrode to the Blue Cable's snap connector.
- d. Place a third electrode on a bony or non-muscular part of your body near the targeted muscle, connect this electrode to the Black Cable's snap connector.

3) Connect to a Microcontroller (e.g. Arduino)

- a. Connect the SIG pin of your sensor to an analog pin on the Arduino (e.g. A0)
- b. Connect the GND pin of your sensor to a GND pin on the Arduino.

Getting Started Using Two 9V Batteries

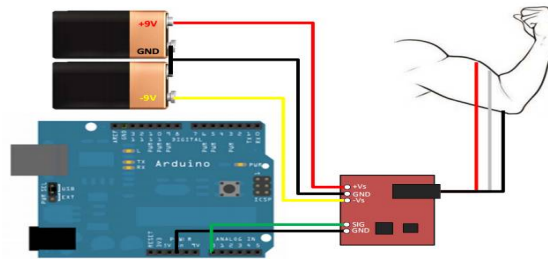


Fig 2: connecting two 9v batteries with the Arduino

EMG Sensor Circuit:

Circuit Schematic

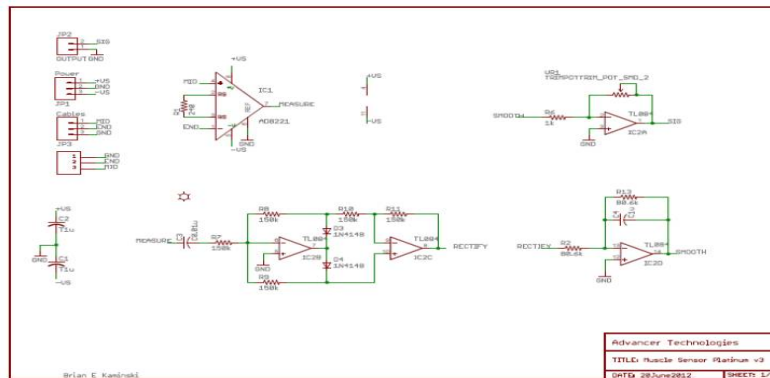


Fig 3: Circuit schematic

Vibration Motor Circuit:

The vibration motor circuit we will build is shown below:

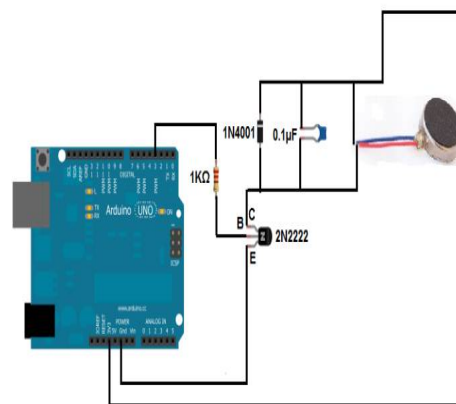


Fig 4: Vibration motor circuit

Relay:

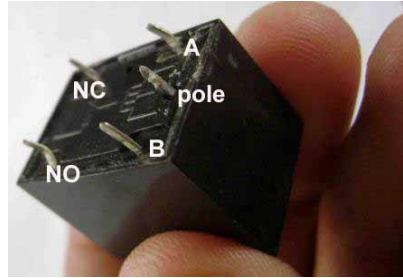


Fig 5: Relay image

Results and Conclusions:

The analogue readings from the Arduino board due to muscle movements.

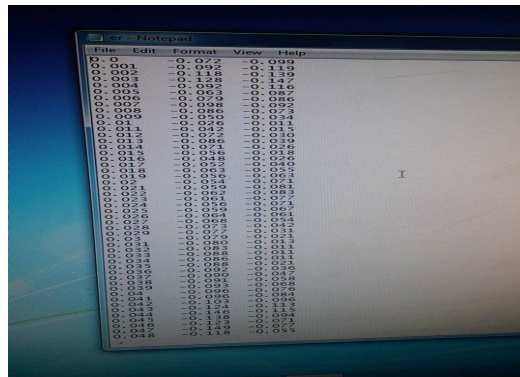
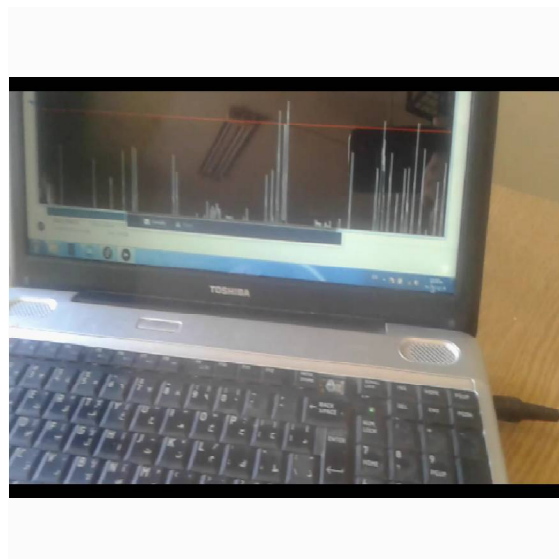


Fig 6: Analogue readings from Arduino

The spectrogram of the readings:



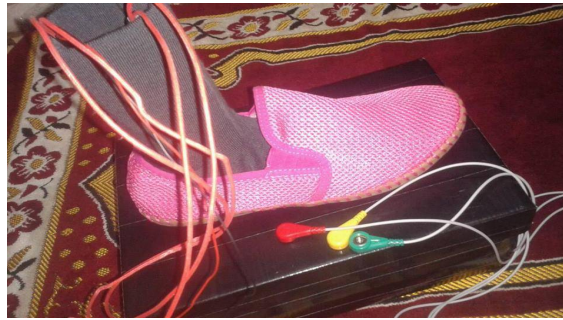


Fig 8: Final shape project

Conclusions:

1. Ischemia is a restriction in blood supply to tissues, causing a shortage of oxygen and glucose needed for cellular metabolism, caused by problems with blood vessels, with resultant damage to or dysfunction of tissue.
2. Ischemic Vascular Disease (IVD) is where a waxy substance called plaque (plak) builds up inside blood vessels, and restricts the normal flow of blood.
3. PAD (Peripheral Arterial Disease) usually affects the arteries in the legs, but it also can affect the arteries that carry blood from your heart to your arms, kidneys, and stomach.
4. Ischemic muscle type are: Cardiac ischemia, Bowel, Brain and Limb.
5. Ischemic can be caused by embolism, thrombosis of an atherosclerosis artery, or trauma, venous problems and heart conditions.
6. The term "critical limb ischemia" to describe a group of diseases, associated with pain in the legs at rest, trophic ulcers and distal necrosis of the lower extremities.

References:

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