Treatment of Paraplegia using Electric Current Based on Weight Distribution

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***Abstract*— Paralysis is a nervous disorder which damages the nervous system especially spinal cord. The main aim of this paper is to measure the weight distribution with using load cell, since it bears the large balances. Load cell is designed to automatically regulate the balancing pressure. This paper also provides therapy for patient who is suffering from paraplegia by using electrical current stimulation technique. The detection has been done by using two foot plates. Both the foot plates are designed with load cells. The detected weight may fed to the microcontroller and the output is displayed in LCD. Depending on weight obtained therapy can be used.**

Key words: **Paralysis, load cell, PIC 16F877A, LCD, Relay Switch.**

INTRODUCTION

Paralysis is the loss of ability to move the muscles in the body. The muscle movement is controlled by communication between the sensory nerves such as peripheral nervous system and the central nervous system. [1]Muscle weakness and loss of coordination may happen due to interruption of communication of nerve impulse along the pathway from the brain to the muscles and can also damages the control of muscle movement. Muscle weakness is one of the main reasons to cause paralysis. [2]Paralysis may occur in the lower half of the body is called paraplegia. If it occur in both arms and legs is called quadriplegia. This system consists of two methods such as detection and therapy. The detection has been done by load cells. Load cell is used to measure the weight distribution on foot since load cells can balance the weight. The result obtained from the load cell is fed to the amplifier LM358.On the other hand crystal oscillator is used to allow the particular frequency nearly 4Mhz.Both the outputs are fed to the PIC microcontroller 16f877a. The power supply has been directly given to the microcontroller. The output from the microcontroller is displayed on LCD. The system can also provide a treatment for patient who is suffering from paraplegia by using electrical stimulation method. According to the weight distribution therapy can be used.

EXISTING SYSTEM

The existing system consists of two ways

The first way which is used to find out the nature of foot is absolutely subjective someone has to take a look at the arch that forms at the middle part of the foot while the person has to stand perfectly normal and relaxed.

The second way is the wet test to determine the foot type. In that the person has to dip the foot in water and place on anything in order to get the printed foot. [6]It may be a paper, floor or colored cardboard piece. When the pressure applied is improper the foot print will be damaged and it needs repetition for getting accurate values.

METHODS

Our system consists of two methods namely

1. **Detection**

The detection part consists of 500kg load cell, LM358 Amplifier, Crystal oscillator, PIC Microcontroller (16f877A), LCD.

2. **Therapy**

The therapy consists of 1.6mv battery, step up transformer, rectifier, and the capacitor.

BLOCK DIAGRAM

DETECTION METHOD

The block diagram consists of load cell which can withstand the weight up to 500kg. It is used to measure the weight distribution on both the legs and it is designed with two foot plates. The load cell can act as a transducer which is used to produce an electrical signal to force being measured.

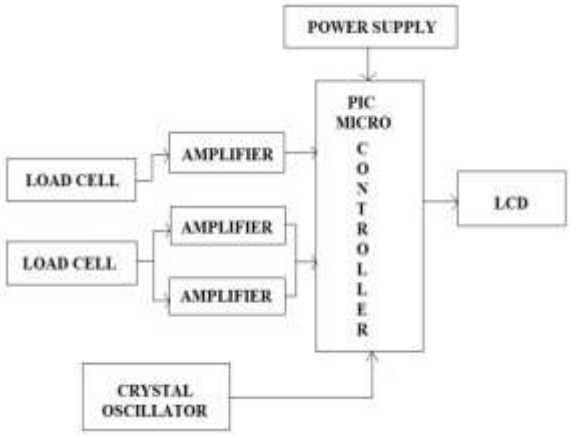

Fig. 1: Block diagram for detection method

There are different types of load cells they are hydraulic load cell, pneumatic load cell & strain gauge cells. Our system load cell type is strain gauge type. The load cell consists of 4 strain gauges arranged in Wheatstone bridge configuration. Our design uses strain gauge as sensing element. There are different pattern which is offer in strain gauge are measurement of tension, compression, & shear forces. The strain gauge load cell which is used because of the some notifications namely they particularly stiff, having good resonance, & tend to have long life in applications. The strain gauge load cell works on the principle of deformation when material of the load cell undergoes deformation. This strain gauge load cell converts the load acting on them to electrical Signal 4 strain gauge provides maximum sensitivity and temperature compensation. The output of electrical signal in the range of few millivolts and it needs some amplification. For that the output is fed to the amplifier. The LM358 amplifier which is used for amplification purpose. It is a type of operational amplifier which can operate with only a single power supply voltage and having true differential inputs on the other hand crystal oscillator circuit is fed in order to allow the particular frequency of 4MHZ. The signal which was amplified is fed to the PIC Microcontroller 16F877A having the powerful featured processor with internal RAM, EEROM, flash memory & peripherals. The program which was loaded in the Microcontroller is to check the various values of the weight distribution of patient nearly ±20 values. The samples values for both the legs are displayed on LCD.

THERAPHY METHOD

The therapy method of our system is based on electrical stimulation method. Before providing the therapy we need to set the time for providing current for the patient with the help of relay switch. The therapy may be given to the patient according to the result of 30 samples already noted in the detection method. This therapy may be given according to the values of weight changes up to ±20. Relay switch is used to setting the time for the therapy method. This switch may set the time, varies from 0 to 100 times. Once the time is set the data will be saved in the microprocessor.

BLOCK DIAGRAM

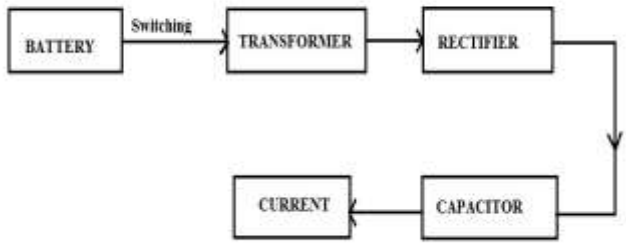

Fig 2: Block diagram for therapy method

The electrical stimulation block diagram consists of 1.6v Battery, Switching, and Rectification. The 1.6 volts battery is connected to the capacitor which automatically stores the energy and it builds up to the maximum charging. The capacitor and the diode which is in the circuit provide the voltage multiplication. The resistor which is near the battery in the circuit provides the current limiting and the other circuit provides the correct bias current to the transistor. This process is called as switching. The transformer cannot work with the direct current so, we are providing the capacitor for passing the direct current. For this purpose the transistor switches ON and OFF rapidly to create a rising and falling voltage to step up the transformer.

The goal of the therapy method is to raise the voltage in the battery to several thousand volts. The step up transformer is used in order to get the higher voltages. From the transformer the voltage undergoes rectification process. The signal from the rectification is given to the capacitor for charging.

Once we got the indication from relay the current stimulation is given to the patient according to the time which was set before.

STEPS FOR MEASUREMENTS

1. The patient is instructed to stand straight on the foot plates which are designed by load cell as shown in fig to determine the weight distribution on foot.
2. The weight distribution on foot is displayed on LCD for both foots.
3. Check 30 readings for both the legs.
4. If it varies ±20 then it shows current stimulation automatically on the LCD.
5. Set the timing for current stimulation for the patient and save the data.
6. According to the time which we have set the relay will automatically ON and OFF.
7. When it ON the capacitor stores the charge and Provide the current stimulation to the patient by placing the two electrodes across their paralysed leg.

Fig 3: load cell setup

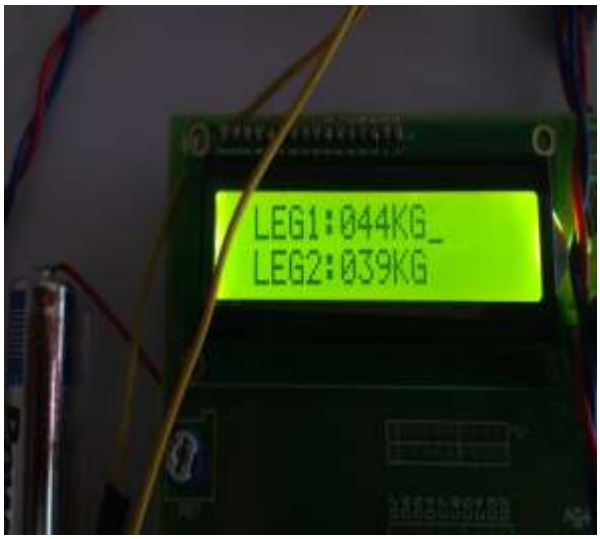

Fig 4: LCD display

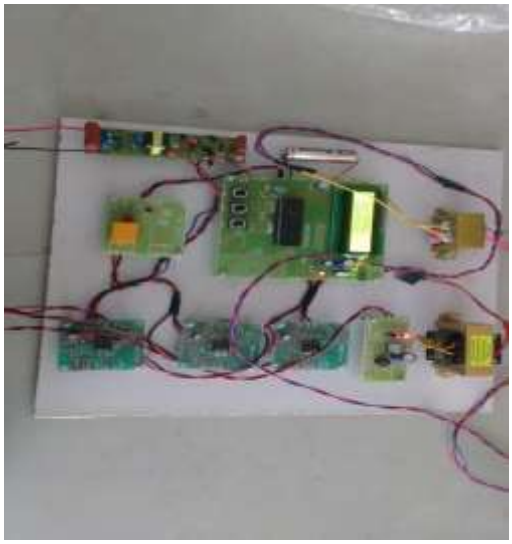

Fig 5: Experimental setup

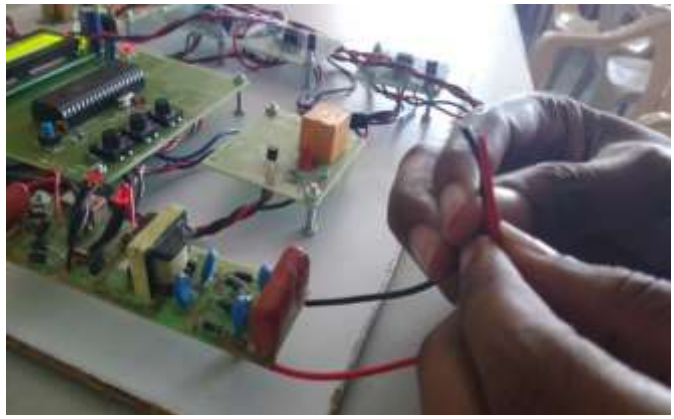

Fig 6: Experimental setup for therapy part

RESULTS

The result of the examination of weight distribution on foot is displayed in the LCD. The two foot plates comprises of two load cells. According to the weight applied on the load cells the values may be varied and shows in the LCD up to 30 readings. If the weight of the leg varies for ±20 values automatically the current stimulation starts up.

CONCLUSION

Determination of weight distribution in the foot plays an important role in the meadow of podiatry. In today's world, there are new technologies and equipments are developed frequently. The current system will become outmoded unless these new developments are included into it. At present the available methods are in manual. Our system offers completely developed and a consistent system for determining the weight distribution in the foot.

It aims in the determination of results in very short period and in very low cost. Optimistically, the idea in this work will give out a useful ground work for the progress, improvement and the support to the upcoming research. Our part is intended to tolerate a weight of 500kg only. It can also be urbanised to tolerate more weight (up to 1000kg). The values of pressure in both foots can be calculated. This module can be developed for all foot sizes. This project uses the DC electrical power supply. In future this can be made wireless by using battery system. Image processing can be implemented for the enhanced visualization of results. Therefore, the enhancement mentioned above can be implemented in the upcoming years, and making the system more compressed and easy to use.

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