Wireless Foot Osteopathic Treatment

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Abstract- *More than 66.66 citizens all over the world with confirmed, deep- rooted, persistent pain are now using compatible, matching, corresponding remedies and substitute treatments. One of them being, reflexology, which is ancient as well as useful for every case in one way or the other. The following study presents an analysis of the published relevant works, on the use of acupressure as a therapy to manage as well as heal pain. Acupressure or reflexology is widely accepted and used amongst people. Even then a methodical and meticulous fact-finding and testing is required for examining how effective this procedure can be for pain management. Till today's date, in whatever way, very few articles have concentrated on managing pain using reflexology or acupressure or physiotherapy. These methods are non-invasive, involving no pharmacological treatments. Electronic researchers are in a situation to do a meticulous experimentation on this and also decide the clinical validness of this method.*

Keywords-Calcaneus, Heel bone, Osteopathy, Physiotherapy, Reflexology, Relief.

I. INTRODUCTION

Athletes, housewives, children, students, senior citizens, working population, in short, everyone who physically exerts himself/herself experiences foot ache. Foot pain causes due to a number of reasons; due to a severe foot injury or simply over exertion. Mostly feet ache because of over exertion [1].

Senior citizens too experience foot ache. One of the reasons behind the foot ache in senior citizens is due to the swelling inside the foot heel, which causes a severe pain in the foot leading to the person to limp. According to doctors, there is no cure to the swelling of calcaneus bone. Even if it is operated, the bone will eventually swell again.

When consulted with a doctor, a physiotherapy session for about 15 days is prescribed, which include ultrasonic diathermy and electrotherapy. During physiotherapy, the pressure applied on foot may not be the same, i.e. it varies; due to which it may not have the desired effect. Thus, we are using wireless foot reflexology for healing the pain in the foot heel caused due to the expansion of the calcaneus bone as well as the frontal and hind foot along with the curve of the foot.

Reflexology is one of the non-pharmacological pain relief method [8]. There are many exploration potentials in the domain of acupressure and Osteopathy. It is a prospective giving an opportunity to aid as well as to service society. Investigated outcomes commencing massage and alternative therapy practice comprise of getting rid of pain, take down BP and eliminating anxiety.

Our aim is to build a massage board/ platform that can be easily used for reflexology and relaxation purposes; which will also be an alternative for electro therapy.

II. LITERATURE REVIEW

Bhagya shree ray, Hepsi natha and Nageswara (2017) in their paper entitled " foot reflexology: effect on pain and anxiety in post operative patient concluded that foot reflexology is used as an complementary therapy for pain management and anxiety among post operative patients. [1] In 2016, H. Chen, X.Wu, W. Feng , T. Xu and Y. He in their paper Design and Path preparation of Massage bot: one Massaging Robot hiking along the Acupressure Points" describes a 2 Degree Of Freedom massaging robot prototype massage bot which is equipped with two types of massage structures and can realize two kinds of massage by scratching and shaking on user's back [2]. L. Wang, H. Wang, D.Ma, Y. Chang, Y. feng S. in 2016 describes another technique of healing and soothing foot pain. In their research the foot path preparation on a Foot rub robot, which is on the basis of Massage treatment done in china.[3] Dalal, Maran, Pande and Manjari (2014) conducted trial randomize power to resolute reflexology as an efficiency in organization patients with diabetic neuropathy subject (N=58). These patients classified randomly in reflexology and control groups. These patients have been treated through pharmacological drugs. Homeostasis therapy gives relaxation in body organ function. Treatment was undergoing and follow up has been taken up 42 period which take 6 months to complete the process. As a result pain will reduce, glucose will get control, nerve conductivity, thermal and vibration sensitivity will reduce. This skin gestures leading to the detection of the abnormal functional states of body parts were also recorded and

analyzed. Results revealed reflexology group showed more improvements in all outcome measures than those of control subjects with statistical significance. Thus the study exhibited the efficient utility of reflexology therapy integrated with conventional medicines in managing diabetic neuropathy.[4]

In 2012, N. A. Hodgson as well as D. Lafferty conducted an experimental crossover design study comparison and examine. The study considered, patients from 18 hospitals whose age is more than 75 years. Those were diagnosed for sever tumor from last 5 years and taking treatment for cancer. The comparison is between Swedish Massage Therapy and Reflexology which took 20 minutes each. In case of result, both treatments should be give quantifiable improvement in results. [5]

Eghbali, Safari, Nazari and Abdoli (2012) conducted a double- blind clinical trial to examine the impact to the pain. In this study, 50 female and 50 male nurses have been taken into consideration. Those working in hospitals and suffering because of back ache. These participant are classified to two part. An interview has been conducted to complete A questionnaire. A forty minute session of interview were completed three times a week. The total period is of two weeks. Numerical Analogue scale is being used to calculate Pain intensity. After the intervention, it shows a significantly higher decline in pain amount scores in the Osteopathy group, as compared with the non- specific massage group. However, the non - precise massage was also considerably helpful to dropping soreness in bones. Thus, these methods are used to reduce an aching back as the pain gets milder. [6] Study on Ankle Rehabilitation Robots conducted in 2011, by a team, in their study, development and key issues of the ankle rehabilitation robot, compares the condition of injured ankles before and after replacement in their detailed study. [7]

Quasi experimental research have been conducted by Valiani, Shiran, Kianpour and Hasanpour in 2010 to assessment the consequence of result the contraction of the labor. First parity ladies have been taken into consideration. Simple random sampling method have been used. Further it has been divided into two group. Well pre-arranged, pre experienced and planned survey is done.

III. PROBLEM STATEMENT

The expansion of the calcaneus bone causes a severe pain in the foot as well as stimulate the blood circulation in the foot using reflexology.

IV. OBJECTIVE

To build a massage board/ platform that can be easily used for reflexology and relaxation purposes; which will also be an alternative for electro therapy.

V. METHODOLOGY

ADAFRUIT Vibrating mini motor discs are tiny discs, which are completely sealed. There are two wires, one black and one red coming out from the motor disc to which supply is given from either a battery or a controller, thus, controlling the vibration. This makes the motor disc buzz due to vibration. These motor discs work by converting electrical energy to mechanical energy. The discs rotate continuously, due to which vibrations are caused. Their operating voltage is from 2 volts to 5 volts. The circuit will be battery operated. We are using LI-ION battery, which can be charged using a solar powered battery charger .When a high supply voltage is given to these discs, they draw in more current, due to which, the vibration is stronger. These vibrations will be used so that the blood circulation in the body is stimulated; thus, relaxing muscles and healing the pain.

VI. SYSTEM ARCHITECTURE

VI.I Block diagram

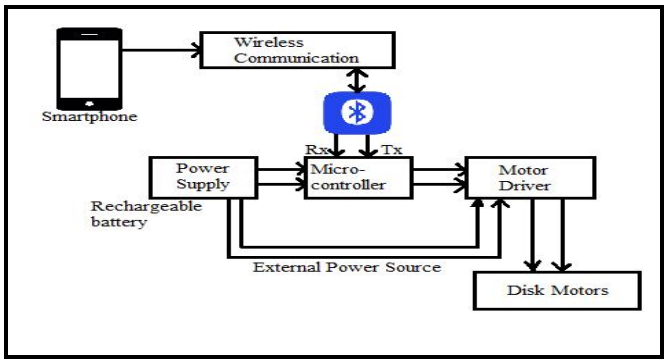

Fig.6.1.1- Block diagram of wireless foot reflexology.

VI.II.Description

INPUT

1. Arduino Pro-Mini:

The Arduino ProMini is a small but complete panel which is based on ATmega 328. It is given power through the mini-B USB connection.

It is having 6 volts to 20 volts unregulated external supply voltage; that is pin 30 and it also has a 5 volts regulated power supply; that is pin 27. The power source in arduino Pro-Mini is automatically selected which is to a highest voltage source. Arduino Pro-Mini controls the motor driver IC LM 293D. The Arduino Pro-Mini will be powered using a Lithium-Ion rechargeable battery.

2. Bluetooth Module HC-05:

HC-05 is a slave module. A slave module is such a module that cannot initiate a connection, but can only accept a connection from the master module. The transmitter pin is connected to the receiver pin of Arduino Pro-Mini and the receiver pin is connected to the transmitter pin of Arduino Pro-Mini. Due to this connection is made between HC-05 and Arduino Pro-Mini.

3. Smartphone:

A wireless connection will be formed using HC-05 and the Android based smart phone. When signal is sent from the smart phone application via the Bluetooth to the Arduino Pro-Mini, a wireless connection is set up. Thus, the smart phone, in this system, is a master module.

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The Arduino Pro-Mini will then send a control signal to the motor driver IC LM293D.

OUTPUT

4. Motor Driver- IC LM293D:

There are two motor driver IC's used. Each motor driver drives two motors. They are powered by an external battery source. These motor drivers control the direction of rotation and the speed of rotation of motors. They are controlled by the Arduino Pro-Mini.

5. External Power Supply:

The external circuitry for power supply consists of a 9 volt battery. The battery will be used as a power source to the motor driver IC's.

6. Mini Vibrating Motor Discs:

These mini vibrating motors are the main components to be used in this system. They are DC motors. They have a permanent magnet enclosed with coil windings, together packaged in a small disc like structure. They work on the principle of vibration. The motor drivers drive these motors.

VII. CIRCUIT DIAGRAM

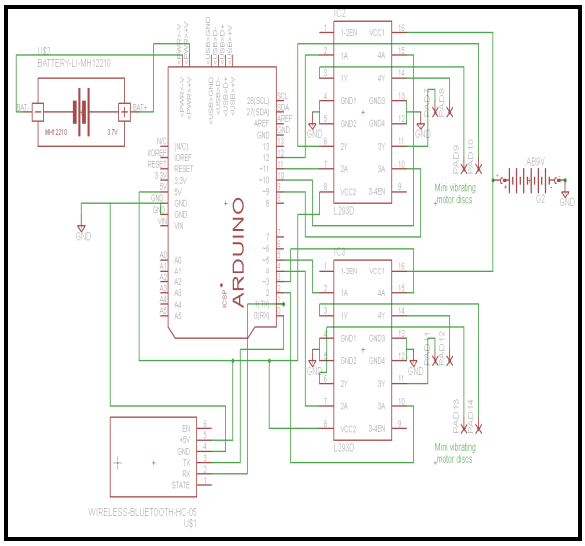

Fig.7.1- Circuit diagram of wireless foot reflexology

VII.II SPECIFICATION OF COMPONENTS:

1. MICROCONTROLLER: ARDUINO PRO-MINI

Features:

It consists of ATmega328, having thickness of 0.8 millimeters PCB. It has external USB connections. It automatically resets. Availability of an in built voltage regulator of 5V. The maximum current output is 150 m Amp. It facilitates over current protection. Provides DC voltage inputs from 5V to 12V. It weighs below 2gms. The dimensions are of 1.9cm breadth and 3.2cm length.

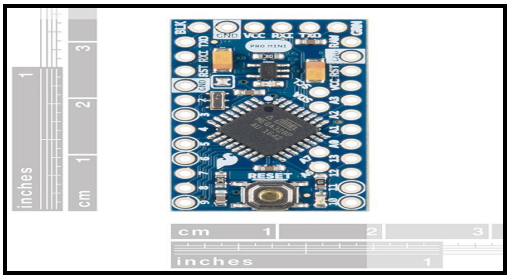

Fig.7.2.1.1- Arduino Pro-Mini front panel with dimensions.

2. ADAFRUIT VIBRATING MOTOR

It use apply power and it buzzes, remove power and it stops. Work from 2 to 5V with stronger vibrations

from the higher voltage. The drive circuit can be as simple as a battery and switch.

To drive it from a microcontroller such as an Arduino then need a series resistor to limit the current draw.

Technical Details:

Dimension is 10 mm diameter and thickness will be 2.7mm.

Voltage supply is between 2Volts and 5Volts.

I/P current for 5V is 100mA, for 4V is 80mA, for 3V is 60mA and 2V is 40mA.

At 5V revolutions per minute is about 11000 RPM

Weight of the vibrating motor 0.9 gram.

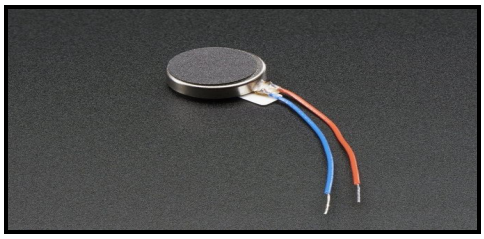

Fig.7.2.2.1- ADAFRUIT mini vibrating motor.

3. BLUETOOTH CHIP: HC-05

HC-05 is a MASTER/SLAVE module.
By default the factory settings is SLAVE. That is, it cannot initiate a connection to other Bluetooth devices, but can accept them.

Features:
3.3 to 5V I/O
PIO(Programmable I/O) Control

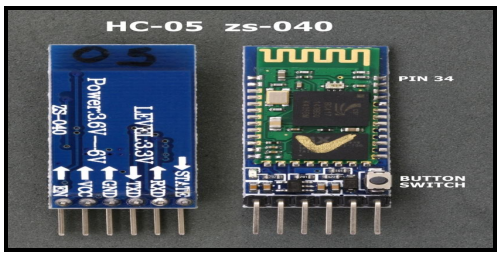

Fig.7.2.3.1- Front and back panel of Bluetooth module HC-05.

4. MOTOR DRIVER: IC LM293D

LM293D is a 16-pin IC. It is double 'H bridge' IC, in which one is able to drive two H-bridges in both directions. This motor driver IC enhances the currents because it is a current enhancer. This is because, the output from sensors cannot drive the DC motors, thus, LM293D is used. It has two enable pins. Both must be kept high to enable both the H-bridges.

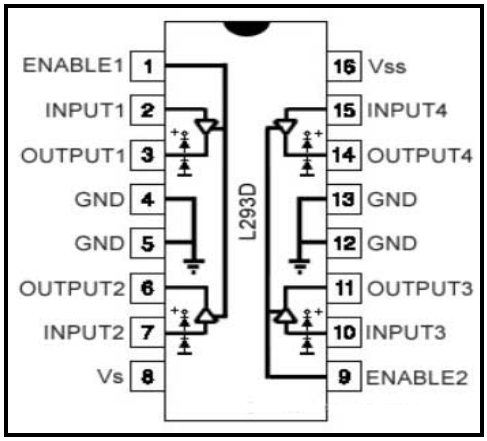

Fig.7.2.4.1- Internal circuit of LM293D.

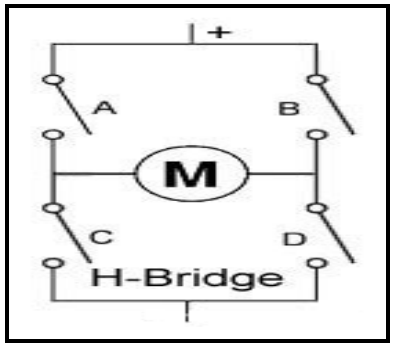

Fig.7.2.4.2-H-Bridge configuration of Motor Driver.

VII.III SOFTWARE REQUIREMENTS:

1. Arduino IDE

An Arduino program can be written in any programming language. An Arduino integrated development environment (IDE) is provided while compiling the code for an Arduino project. IDE is for the languages Processing and Wiring originated from the IDE. The Arduino integrated development environment (IDE) supports programming languages like C and C++ which uses special rules of coding or code structuring. IDE is a cross-platform application which is written in the programming language called Java. Atmel provides an IDE for their micro-controllers; they are, AVR Studio and the new Atmel Studio.

A program written for the Arduino with the IDE is called as a sketch. Sketches are saved on the computer as text files. They have a file extension as .ino.

As Arduino is an open source platform, many free public libraries exist which is useful for developers to use so that they can augment their projects.

2. Smart Phone Application- Smart Systems

Smart systems is a smart phone application which incorporates functions like sensing, actuating, and controlling to describe and analyze any situation.

Decisions are made based on the available data in an adaptive manner or in a predictive manner, thereby performing all smart operations.

This "smartness" can be accredited to autonomous operations which are generally based on closed loop controls, energy efficiency and capabilities of networking.

VIII. EXPECTED RESULTS

To build a massage board/ platform can be easily used for reflexology and relaxation purposes; which will also be an alternative for electro therapy. The power supply given to it will be solar based. Thus, using wireless foot reflexology for healing the pain in the foot heel caused due to the expansion of the Calcaneus bone.

IX. CONCLUSION

Osteopathy being a technique of healing and managing pain by applying pressure on the affected area is a very old; and an ancient, quick remedy applied for any type of first aid for pain management. The Arduino Pro-Mini controls the two motor driver IC's LM 293D, which are powered by an external battery, a 9 volt battery; is capable of driving two motors each. Bluetooth HC-05 is a slave module used to make Bluetooth connection between the phone and Arduino Pro-Mini and thus the circuit. The motor drivers drive the mini vibrating disc motors, causing the motors to run, thus they vibrate. This vibration stimulates muscles of the feet, taking away the discomfort caused due to pain, accordingly being a remedy to lessen the ache and twinge in the subjects feet. This will be controlled using a Smartphone, therefore giving an ease of access to the user.

X. ACKNOWLEDGEMENT

I express my profound feeling of appreciation to our Professor and Head Dr. D.K. Shedge to inspiring us for the support provided by him throughout the completion of our project.

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