ADVANCE PHYSIOTHERAPY MACHINE FOR LEG

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Abstract

Our Project is to Design and Fabricate a Cheaper Continuous Passive Motion (CPM) Machine than what is available commercially and with more versatile features.In the tendency,continuous passive motion(CPM) was proposed as an orthopedic treatment and a physiotherapy method that promotes recovery from the injuries after surgery of joints.The CPM is intended to accelerate the regenration of periarticular tissues,to prevent contracture,and to correct range of motion (ROM) and is more effective than conventional treatment method.

It can lead to reduction in both Hospital stay and analgesic requirement and accelerates the recovery process.in many physiotherapy centers the use of CPM is limited by the cost of the equipment .In the present work,we have design and develop the project of low cost shoulder CPM machine with the energy conservation point of view

INTRODUCTION

Leg fractures are very common and affect all age groups globally .When leg fracture occurs,patients consult othopedic physician for pre operative and operative treatment .After treatment the patients refer physiotherapist for physiotherapy exercise to reduce pain and improve range of movement and strength to regain function .Physical exercise is a common intervention after any cause of leg fracture,that exercise was prescribed to at least 90% of patients receiving rehabilitation after leg fracture

This study will be helpful for the Paralysed patients and physiotherpist who can save their valuable time and man power.The main technique used in this machine is conventional continuous passive motion (CPM).The CPM is used during the first phase of rehabilitation following leg fracture surgical procedure. CPM is carried out by a CPM device, which constantly moves the joints through a controlled range motion the exact range of which is dependent upon bone joint. CPM is used following various type of reconstructive.

Physical therapy is an essential component of a rehabilitation program for any type of leg injury. This entails a logical progression of low-intensity to high-intensity exercise desgined to restore any lost flexibility,strength and power so the victim can return to normal activities as quickly as possible.
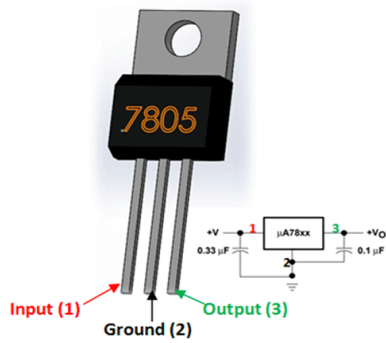
Continuous Passive Motion(CPM)

The CPM machine ,a device that requires a fair amount of effort on the part of the therapist to put it on the patient without hurting .Studies indicate that therapy using CPM following knee arthroplasty gives an ultimate benefit of more degree of motion than physical therapy alone in tearms of faster improvement in range of motion(ROM) and functional recovery measured at the end of the active treatment period.The primary focous of rehabilitation was fuctional recovery and regaining ROM in the knee.CPM changes the position of patients limb joints.it heals damage tissues and help patient recover quickly
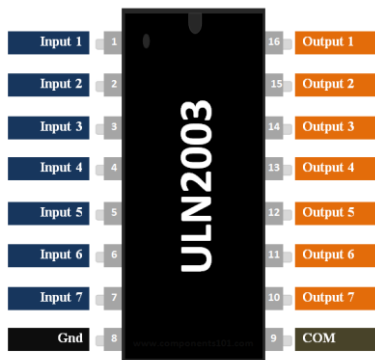
COMPONENT DETAILS

1)REGULATION IC 7805

Voltage regulators are very common in electronic circuits.They provide a constant output voltage for a varied input voltage.In our case the 7805 IC is an iconic regulator IC that finds its application in most of the project.The name 7805 signifies two meaning,"78"means thatit is positive voltage regulator and "05"means that it provide 5V as output.So our 7805 will provide a +5V output V=voltage.
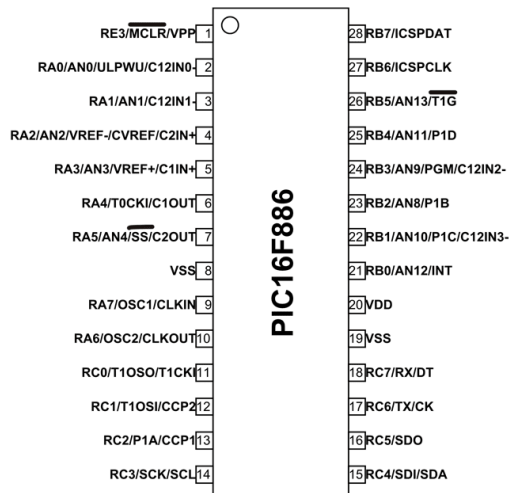
4)LIQUID CRYSTAL DISPLAY(LCD)

LCD modules are very commonly used in most embedded project,the reason being its cheap price,availability and programmer friendly.Most of us would have come across these displays in our day to day life,either at calculators

2)DRIVER IC ULN2003

ULN2003 IC is one of the most commonly used Motor driver IC.This IC comes in handy when we need to drive high current loads using digital logic circuit like Op-maps,Timers,Gates,Drivers,Pic,Arm etc.For example a RELAYS that requires 12V and 300mA to run cannot be powered by an PIC I/O hence we used this IC to source enough current and voltage for the load.
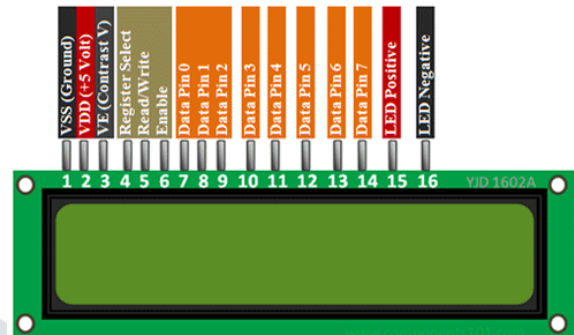
5)RELAY:

Relay are most commonly used switching device in electronics .There are two important parameters of relay,first is the Trigger Voltage,this is the voltage required to turn on the relays that is to change the contact from Common- NC to Common-NO.The other parameter is your Load Voltage& Current ,this is the amount of voltage or current that the NC,NO or Common terminal of the relay could withstand,in our case for DC it is maximum of 30V and 10A. Make sure the load you are using falls into this range

3)PIC16F886-8 BIT MICROCONTROLLER

PIC16F886 is microcontroller from 'PIC16F' family and is made by MICROCHIP TECHNOLOGY. It is an 8-Bit CMOS Microcontroller with nano-Watt Technology.This microcontroller is popular among hobbyist and engineers due its features and cost
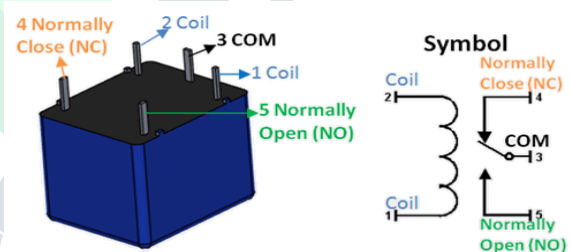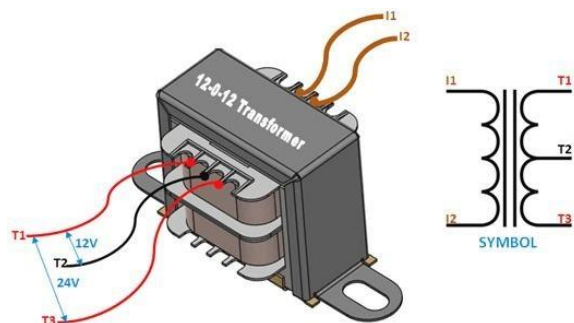
6)TRANSFORMER (CENTER TAPPED):

A center-tapped transformer also know as two phase three wire transformer is normally used for rectifier circuit.When a digital project has to work with AC mains a transformer is used to step down the voltage

7)ACCELEROMETER ADXL 335:

The ADXL335 is a small,low power,complete 3-axis accelerometer with signal conditioned voltage outputs.It can measure the static acceleration of gravity in tilt-sensing applications,as well as dynamic acceleration resulting from motion,shock,or vibration.
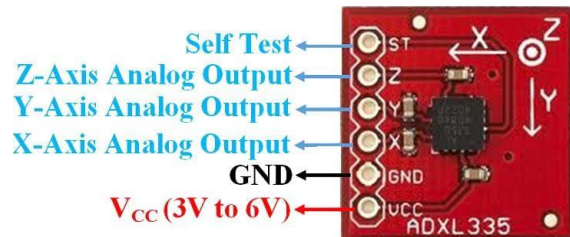
8)BLUETOOTH MODULE:

The BT module is a very cool module which can add two-way wireless functionality to your project.you can use this module to communicate between two microcontrollers like PIC or communicate with any device with Bluetooth functionality like a Phone or Laptop.
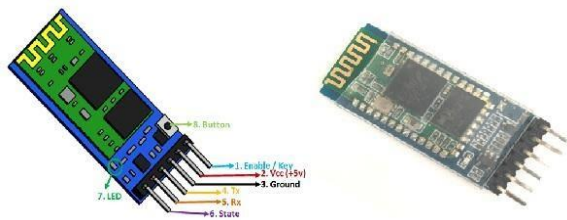

DESIGN AND METHODOLOGY

Actual Innovation Design Consists of PIC, ANGLE sensor, Screw Drive Mounted on Pipe, Limit Switches, Geared Motor. The passive motion, performed by the equipment, is for the extension/flexion of the Knee from 0º to 90º.

The equipment consists of Geared motors controlled by software, which receives the data generated by other software, interprets them and sends the information through drivers to the motors that drive the axles through synchronized.

The computerized CPM can be applied to both upper limbs, enabling computerized control of time and for the ROM to calculate automatically the speed from the data provided by the physical therapist.
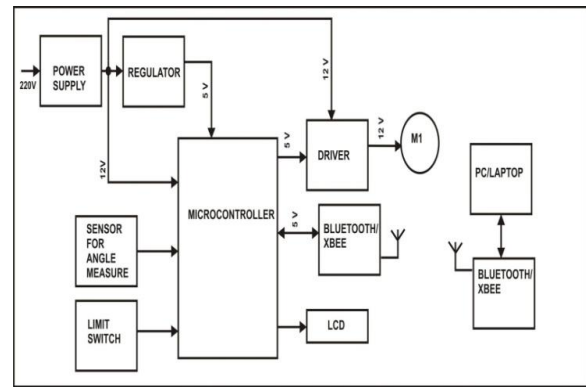
Block Diagram of automatic PM

The equipment structure includes an adjustable vertical rod , fixed at the lower end to a support base in a cross shape.

At the upper part of this rod there is an assembly attached, which is responsible for the knee flexion/extension movements.

This consists of a metal plate where they are fixed by: Screw Drive arrangement, axles, angle sensor, Geared Motor.

The motor is connected to the screw driver and platform to Movement Supporter [Ankle]. The thigh supporting base is connected to the support rod and has adjustable angular positioning that allows for an inclination of up to 90º in the sagittal plane of the patient's body. This base contains the this support and also an extension adjustment mechanism .The lateral rods from the ankle supporting base fit the lateral rods of the thigh supporting base.

PROJECT WORK

OPERATION MODES AND CONTROLLER DESIGN

Lower limit	0	5^0	45^0/min	0s
Upper limit	115^0	120^0	155^0/min	900s
Speed	1-9(150^0-440^0)/min			
Extension pause	15 min			

Graph of Physiotherapy Machine

Graph:-1 Angle=35, For 1 Oscillation

ANGLE IN DEGREE	TIME IN SECS
25	0
30	10
35	18
30	28
25	32

Graph:-2 Angle=40, For 1 Oscillation

ANGLE IN DEGREE	TIME IN SECS
25	0
30	10
35	18
40	28
35	40
30	58
25	68
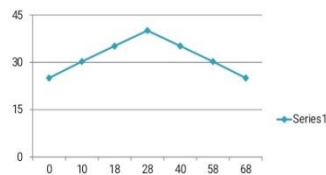
Graph:-3 Angle=55, For 1 Oscillation

ANGLE IN DEGREE	TIME IN SECS
25	0
30	10
35	19
40	29
45	39
50	49
45	61
40	71
35	80
30	90
25	100
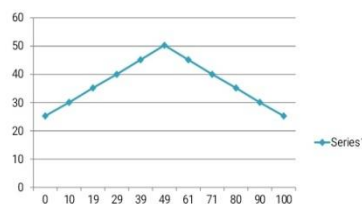
Results

The Oscillations of leg can be adjust.

The CPM machine will bend joint for according to angle settings. The Physiotherapist may program the CPM machine

to increase the amount that the joint is flexed over time. Oscillations may prevent scar tissue from forming. This may also prevent pain and stiffness in the knee.

Muscles may get stronger more quickly.

The CPM machine will gently exercise leg muscles to prevent them from getting weak. Tendons and ligaments, the tissue that connects to the muscles and bones, may also get stronger by using a CPM.

Patients may have less pain. A CPM machine will elevate leg and decrease swelling. Patient may have less pain if your swelling is decreased.

You may have increased blood flow in your arm or leg. Increased blood flow to your tissues will help you heal faster.

Conclusion

This project is very useful for strengthening the Knee muscles. It produces same effect as produced by manual work (By physiotherapist).
It saves the valuable time of physiotherapist.

Future Scope

Its motion angle can be increase up to 120°.

Manually motion angle setting (0° to 120°) and working time of machine can be provided.

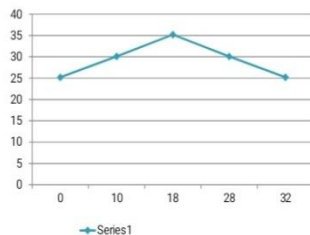Machines operation can be extended up to fingers as well as shoulders.

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3. O'Driscoll SW, Giori NJ: Continuous passive motion (CPM): Theory and principles of clinical application. J Rehab Res Dev, 37, 2000, pp. 179-188. (Pubitemid 30641246)