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ELECTRONICS AIDED WALKER FOR PARALYSIS PATIENT

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Abstract: The mechanic basis of this simulator has been obtained from the modified simple card drill machine. The system includes two alternative current motors which provide two dimensional movements for gait simulation. A rotary encoder and a pulse counter for each motor control unit, a regulator used for decreasing the speed of the electrical motor to appropriate levels, and drivers for controlling the motors. The system is completed by software for real-time control. Thus, computer controlled above knee activity can be produced for assembled foot or knee prostheses.

INTRODUCTION

In the 21stcentury, life has become more complex and more complicated with so little time left to watch and take care of old people or those who have certain physical disabilities. The key is to merge various technological branches and advancements in order to obtain an effective system to maximize its efficiency and render our system useful not only for the present but for the near and long future. Nowadays, the advancements in biology and technology are improving the quality of life of the elderly and the blind by creating and optimizing different solutions that not only will help with their daily life activities but also will make the targeted population useful members in the society instead of a burden by constructing a new life design, thus, probably saving their lives or at least improving it. The time spent with families is in gradual decrease; elder care institutions have been always criticized due to their money consumption and unpleasant treatment with elders and was noticeable on a psychological level were elders feel abandoned or imagine the idea that they have no reason to live anymore and for what purpose. Walkers assume an important role due to its simplicity and rehabilitation potential. These devices are interesting once they work as a supporting device during bipedestation and, in addition, use the person's own remaining locomotion capability in order to move avoiding the early and deteriorative use of wheelchairs. Walkers are prescribed to improve patients' mobility and help them maintain balance. These devices can increase confidence and sense of safety, which can raise a patient's level of activity and independence. There may be physiological benefits of limiting osteoporosis, reducing cardiopulmonary reconditioning and improving peripheral circulation. Static equilibrium is maintained when the body's center of mass is positioned over the base of support. Loss of balance can result when the center of mass is displaced in relation to the base of support because of voluntary movements or external perturbations, such as slips, trips or pushes. Use of a walker increases the base of support, thereby allowing a greater tolerated range for center of mass positions. They can also prevent instability by allowing stabilizing reaction forces such as holding on or pushing against the ground.

PROPOSED SYSTEM

Stage1. Polycentric mechanisms

During human gait and given the nature of elastic collisions, at foot contact stage, mechanical waves occur at the joints. In prosthesis with a single axis, the flexibility is limited and the mechanic stability is reduced compared with a four-link mechanism, in which the energy that causes the mechanical waves that propagate throughout the extremity is reduced. In central polycentric mechanisms, small differences in the lengths of the links and the position of the joints that join them can result in large changes in the kinematic behavior of four bar mechanisms.

Anatomy and Hip Biomechanics

The hip is the proximal lower limb joint: located at its root, its function is to direct it in all directions of space, for which it has three, axes (three freedom degrees). The concerning axe is the sagittal one, as the prosthesis is to move only in that plane to produce the flexion-extension movements. The hip movements are performed by a single joint, the coxofemeral, considered within the group of the ball-and-socket joints. The main elements involved in the hip stability and movement are the ligaments (on which the polycentric mechanism of the prosthesis is based): two beams of iliofemoral ligament, the pubofemoral ligament and the Ischiofemoral ligament. At heel strike, the hip is approximately 30 degrees of flexion. Immediately after the contact of the heel, the hip joint begins to move in extension. When in double support, the hip is at a neutral position of 0°. After heel off, the hip reaches a maximum extension of 20° and then begins to move in a flexion direction.

Stage2. Calculations and Mechanisms

In accordance to the Powel's equations for hip, the articulation, supports a load that is approximately 4 times its own weight, same weight that the prosthesis is thought to bare. Thus for an 80kg subject, the load is about 320kg in one foot supporting at rest. After a material research, the aluminum 6063 T6 was concluded to be the best functional low-cost material to build the body of the prosthesis, due to its elasticity module of 68,300Mpa, its resistance to environmental corrosion and the machining ease. For the articulated joint axes, bronze B144 bushings and stainless steel 304 bolts were considered, which keeps constant movement at the axes without significant wear.
From these specifications, calculations and research, a mechanical design was proposed.

COMPONENTS INVOLVED

WIPER MOTOR:

Wiper motors are devices in the wiper system that functions on a power supply in order to move the wiper blades in a smooth motion. Like other motors, the wiper motor rotates continuously in one direction which is converted into a back and forth motion. Its composition entails a lot of mechanical linkages each playing a role in initiating the movement. The gear head motor is the type of wiper motor known for its abundance in torque

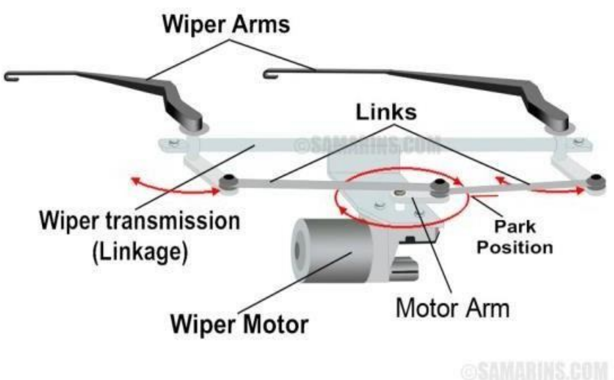

Fig: Wiper Motor

FORCE SENSOR:

Force sensors weigh freight on manufacturing and transportation equipment. They also monitor loads on machines subject to stringent safety standards such as mine lifts, construction cranes, industrial tanks, grain silos, and locomotives to ensure equipment isn't overloaded. This scale uses a double-ended shear beam to measure static and running cable tension. The cable feeds through the roller set to transmit force to the shear beam. Then a digital readout converts output into weight readings.

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Fig: Force Sensor

At the core of force sensors are load cells, transducers that convert force into measurable electrical outputs. There are hydraulic, pneumatic, piezoelectric, and capacitive load cells. However, strain-gage-based load cells are most common. These have fine wires (to 0.02 mm in diameter) made of steel, aluminum, or beryllium-copper alloy. The wire adheres to a thin paper or plastic base in one continuous zigzag that magnifies the effect of material changes in the wire in response to external loads. Leads at the beginning and end of the zigzagging wave connect to circuits. Often, four strain-gage sensing elements are bonded to a machined housing in a Wheatstone-bridge arrangement. When subject to force, this array develops strain that changes the wires' resistance and that triggers a change in electrical output.

PIC CONTROLLER

The PIC microcontroller PIC16f877a is one of the most renowned microcontrollers in the industry. This microcontroller is very convenient to use, the coding or programming of this controller is also easier. One of the main advantages is that it can be write-erase as many times as possible because it uses FLASH memory technology. It has a total number of 40 pins and there are 33 pins for input and output.

PIC16f877a finds its applications in a huge number of devices. It is used in remote sensors, security and safety devices, home automation and many industrial instruments.

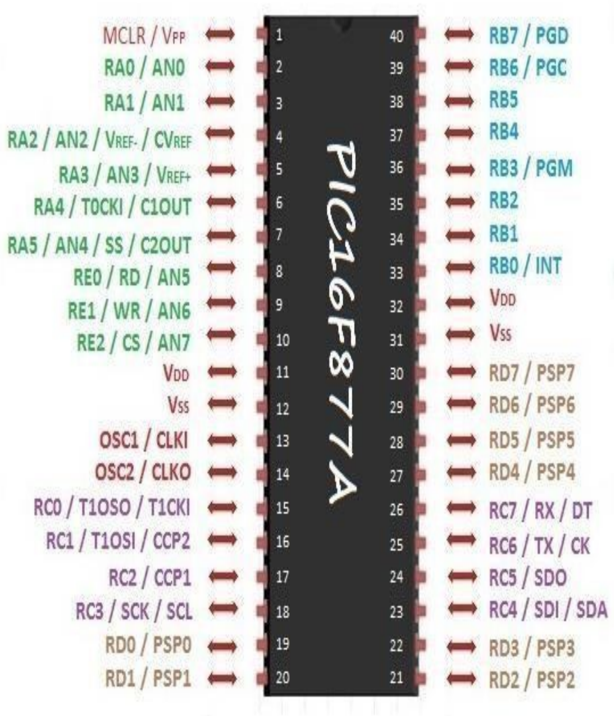

Fig: PIC controller 16F877A

An EEPROM is also featured in it which makes it possible to store some of the information permanently like transmitter codes and receiver frequencies and some other related data. The cost of this controller is low and its handling is also easy. It is flexible and can be used in areas where microcontrollers have never been used before as in microprocessor applications and timer functions etc.

- It has a smaller 35 instructions set.
- It can operate up to 20MHz frequency.
- The operating voltage is between 4.2 volts to 5.5 volts. If you provide it voltage more than 5.5 volts, it may get damaged permanently.
- It does not have an internal oscillator like other PIC18F46K22, PIC18F4550.

The maximum current each PORT can sink or source is around 100mA. Therefore, the current limit for each GPIO pin of PIC16F877A is 10 milli ampere. It is available in four IC packaging such as 40-pin PDIP 44-pin PLCC, 44-pin TQFP, 44-pinQFN.

OPERATION

This system consists of Force sensor which is used to produce the input supply to the control unit. Force sensor is used to detect the applied load , the input can also be given in the form through the keypad which consists of motion buttons by using these the patient itself can use these buttons to produce the required motions. The signal is obtained from the force sensor. Its then relays this information to a controller located inside the device, and processes feedback from the limb and actuator, the controller involved here is the PIC controller 16F8778.

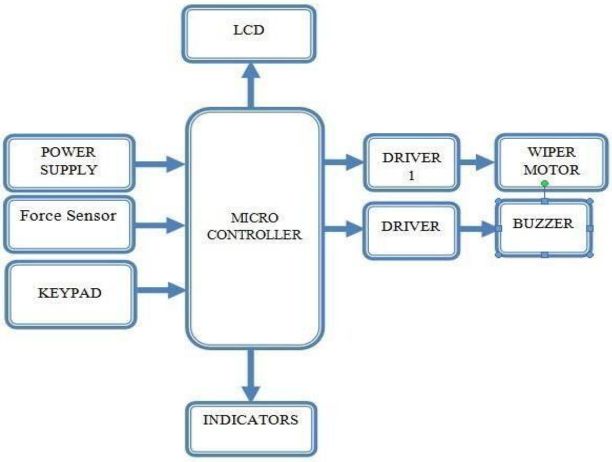

Fig: Electronic Aided Prosthesis

After processing of these signals these signals will be used to drive the driving unit, which is used to drive both Buzzer & Wiper motor. Wiper motors are devices in the wiper system that functions on a power supply in order to move the wiper blades in a smooth motion. These smooth motions are used cause the required motion which is used to produce actual movement of the knee, which in turns moves the leg. Those smooth motions are controlled using regulator to cause the apt motion.

CONCLUSION

The design of the Electronic aided prosthesis in which linear displacement from actuation was converted to angular displacement of the joint effectively. A 5/3-way proportional control valve proved to be very effective in controlling the highly nonlinear arm compared to normal 5/3- way directional control valve. It was also found that the force changes with the position of the articulated arm dynamically.

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