

In-Walk Care

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Abstract: Advancements in robotics, sensor technology and artificial intelligence promises enormous scope for developing an advanced wheelchair. Hence, we bring the proposal of In-Walk Care automatic wheelchair that move according to the brain signals. Brain controlled wheelchair is being developed to provide mobility to the individuals who find it impossible to use a powered wheelchair due to motor, sensory, perceptual, or cognitive impairments. We use neuro-mind wave sensor for collecting the brain signals which is placed in forehead and these signals are connected to the motor. Also we use a hydraulic mechanism for the upward and downward movement. A standing wheelchair is one that supports the user in a nearly standing position. They can be used as both a wheelchair and a standing frame, allowing the user to sit or stand in the wheelchair as they wish. And additional wheels are provided in order to provide balance in standing position and further movement. A belt strap is used to keep the legs from bending while standing to help maintain a proper upright posture, which should help not just with interacting with others, but to promote better blood circulation, prevent bed sores, and improve a number of other issues related to sitting in a traditional wheelchair for long periods of time.

Keywords: Cognitive, perceptual, Hydraulic mechanism, Neuro mind wave sensor, Upright posture.

1. Introduction

Normal wheelchairs works on mechanical rotation of wheels and thus the paralyzed person finds it difficult for movement in normal wheel chairs. Hence, we bring the proposal of In-Walk Care automatic wheelchair that move according to the brain signals. We use neuro mind wave sensor for collecting the brain signals which is placed in forehead and these signals are connected to the motor. We use a hydraulic mechanism for the upward and downward movement and additional wheels are provided in order to provide balance in standing position and further movement.

A belt strap is used to keep the legs from bending while standing to help maintain a proper upright posture, which should help not just with interacting with others, but to promote better blood circulation, prevent bed sores, and improve a number of other issues related to sitting in a traditional wheelchair for long periods of time.

2. Need of Such a Product

Wheelchair users having mobility impairments experience a

high level of movement and functional limitation. Many patients are unable to control the powered wheelchair using conventional interface and also they are deemed incapable of driving safely. Brain controlled wheelchair is being developed to provide mobility to the individuals who find it impossible to use a powered wheelchair due to motor, sensory, perceptual, or cognitive impairments

3. Hardware

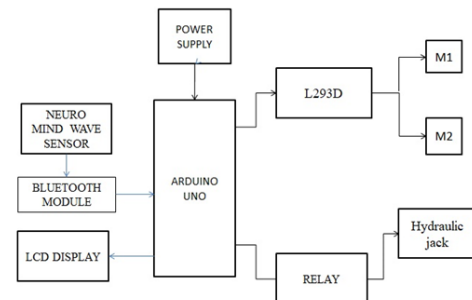


Fig. 1. Block diagram of in-walk care

A. Arduino Uno

An open-source electronics platform based on easy-to-use hardware and software. Arduino boards are available commercially in preassembled form or as do-it-yourself (DIY)

kits. Arduino board uses a variety of microprocessors and controllers. The boards are equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards ('shields') or breadboards (For prototyping) and other circuits. The boards feature serial communications interfaces, including Universal Serial Bus (USB) on some models, which are also used for loading programs from personal computers.



Fig. 2. Arduino Uno

The microcontrollers can be programmed using C and C++ programming languages. In addition to using traditional compiler tool chains, the arduino project provides an integrated development environment (IDE) based on the Processing language project.

ATMEGA 328p is the arduino used here. It is the brain of the project. ATMEGA 328 is the arduino used here. The ATmega328 is a single-chip microcontroller created by Atmel in the mega AVR family (later Microchip Technology acquired Atmel in 2016). It has a modified Harvard architecture 8-bit RISC processor core. The Atmel 8-bit AVR RISC-based microcontroller combines 32 KB ISP flash memory with read-while-write capabilities, 1 KB EEPROM, 2 KB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte oriented 2-wire serial interface, programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The device operates between 1.8-5.5 volts. The device achieves throughput approaching 1 MIPS per MHz.

B. Neurosky Mindwave Sensor

Developed by the company NeuroSky, Inc. is a manufacturer of Brain-Computer Interface (BCI) technologies for consumer product. The company adapts electroencephalography (EEG) technology. It is a headset model Flexible rubber sensor arms and rounded forehead sensor tip, T-shaped headband, and wider ear clip contacts make the sensor most comfortable EEG headset. The EEG electrode is on the sensor arm and placed on the forehead above the eye. The Mind Set detects changes in brain-wave patterns via metal sensors at the front and back of the head and at the earlobes. The device uses a mono-polar montage with one active site, and employs a pea-sized (~0.8 mm diameter) electrode clipped to the left earlobe as reference. The device samples data at 512 Hz. The Mind Wave electrodes are made of stainless steel and all connections use shielded cables. Energy is supplied by a single 1.5 V AAA battery.

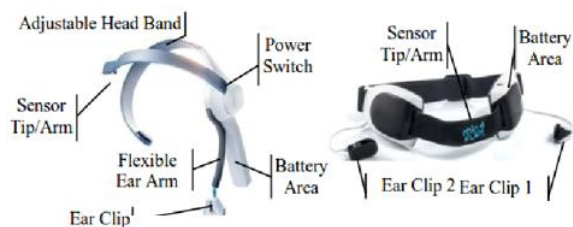


Fig. 3. MindWave (Left Side) and MindFlex (Right Side) EEG headset

The manufacturer has rated the device for continuous 8-hour operation on a single battery. Nevertheless, we took the precaution of changing the batteries after every 2 hours of use. A chip digitizes and transmits that information wirelessly via Bluetooth or RFID to a computer, which in turn translates it into commands that go back to the device. Concentrating on an object or thought produces different patterns of brain waves; after the headset calibrates itself to the individual, its algorithms

detect those characteristic patterns.

C. Bluetooth Module

It is a Bluetooth device used for wireless communication with Bluetooth enabled devices (like smartphone). It communicates with microcontrollers using serial communication (USART). The Bluetooth module at other end receives the data and send to arduino through the TX pin of Bluetooth module (RX pin of Arduino). HC-05 is the model used here.

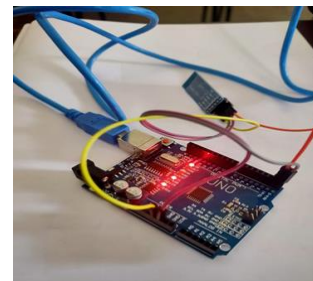


Fig. 4. Bluetooth Module Interfacing

Default settings of HC-05 Bluetooth module can be changed using certain AT commands. As HC-05 Bluetooth module has 3.3 V level for RX/TX and microcontroller can detect 3.3 V level, so, there is no need to shift TX voltage level of HC-05 module. But we need to shift the transmit voltage level from microcontroller to RX of HC-05 module. It is used to communicate with the hardware.

D. Relay

Relays are switches that open and close circuits electromechanically or electronically. Relays control one electrical circuit by opening and closing contacts in another circuit.



Fig. 5. Relay

It works on the principle of an electromagnetic attraction. When the circuit of the relay senses the fault current, it energizes the electromagnetic field which produces the temporary magnetic field. This magnetic field moves the relay armature for opening or closing the connections. The small power relay has only one contacts, and the high power relay has two contacts for opening the switch. The inner section of the relay is shown in the figure above. It has an iron core which is wound by a control coil. The relay operates both electrically and

mechanically. It consists electromagnetic and sets of contacts which perform the operation of the switching. The construction of relay is mainly classified into four groups. They are the contacts, bearings, electromechanical design, terminations and housing.

E. L293D

The L293D is a 16-pin Motor Driver IC which can control a set of two DC motors simultaneously in any direction. The L293D is designed to provide bidirectional drive currents of up to 600-mA at voltages from 4.5 V to 36 V. Both devices are designed to drive inductive loads such as relays, solenoids, dc and bipolar stepping motors, as well as other high-current/high-voltage loads in positive-supply applications. All inputs are TTL compatible. Each output is a complete totem-pole drive circuit, with a Darlington transistor sink and a pseudo Darlington source. Drivers are enabled in pairs, with drivers 1 and 2 enabled by 1,2EN and drivers 3 and 4 enabled by 3,4EN. When an enable input is high, the associated drivers are enabled, and their outputs are active and in phase with their inputs. When the enable input is low, those drivers are disabled, and their outputs are off and in the high-impedance state. With the proper data inputs, each pair of drivers forms a full-H (or bridge) reversible drive suitable for solenoid or motor applications motors. As well, this IC can drive small and quiet big motors.

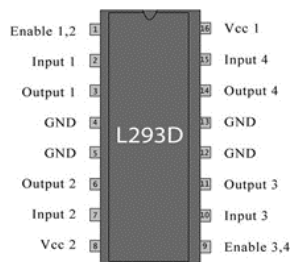


Fig. 6. Pins of L293D

F. Hydraulic Jack

A jack is a device which is used to lift heavy loads. A jack could be Mechanical, Electrical or Hydraulic, based on the method of force generation. The primary mechanism by which force is applied varies, depending on the specific type of jack, but is typically a screw thread or a hydraulic cylinder. Jacks may be categorized based on the type of mechanism used to generate the lifting force, typically mechanical power, hydraulic power, or pneumatic power. Mechanical jacks, such as the commonly used car jacks, lift heavy equipment and are rated based on the lifting capacity, which is typically expressed in terms of the number of tons that the jack can handle. Hydraulic jacks tend to have higher lifting capacities than mechanical jacks owing to the amount of force that can be generated by the hydraulic cylinders which product the lifting action. Common forms of hydraulic jacks include bottle jacks and floor jacks.

A hydraulic jack works on the basis of Pascal's law. A small

force is applied on a smaller area of hydraulic fluid and that force generates some pressure in the fluid. That pressure is then applied to a wider area at output so that adequate force is generated to lift the load.



Fig. 7. Hydraulic Jack

G. LCD display

The Liquid Crystal library allows you to control LCD displays that are compatible with the Hitachi HD44780 driver. There are many of them out there, and you can usually tell them by the 16-pin interface. The LCDs have a parallel interface, meaning that the microcontroller has to manipulate several interface pins at once to control the display. The process of controlling the display involves putting the data that form the image of what you want to display into the data registers, then putting instructions in the instruction register. Here, it is an add-on feature to display the decoded brain signals.

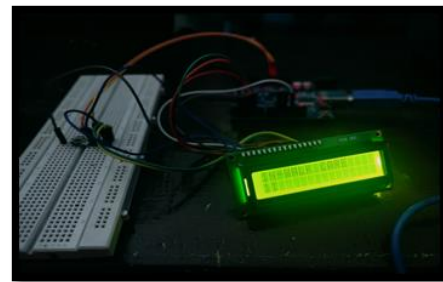


Fig. 8. LCD interfacing

H. Power Supply

It is provided by an external source. Power supply modules are used to convert AC power into usable DC power so that the system to be powered may operate properly. Also power supplies condition the DC output so that the DC voltage(s) is/are free of noise, spikes, etc. They provide electrical protection in the form of fuses or breakers, may display alarms in the case of abnormal operation and provide a mean to connect the DC output via properly chosen connectors. It is also there for safety reasons so that power grid high voltages are not (usually) present inside an electronic system. The purpose of a power supply is to provide the energy to accomplish whatever the objective of the machine is.

4. Working

Hydraulic jacks function based on a concept in fluid mechanics known as Pascal's Principal. Essentially, if two cylinders (a large and a small one) are connected by an incompressible fluid, and a given amount of pressure is applied to one cylinder, that same pressure is imparted to the second

cylinder through the fluid connecting them. However, because pressure is equal to force per unit area, the cylinder that has a larger area will experience a force multiplication effect. Even though the pressure on both cylinders is the same, the force which is produced by the larger cylinder will be higher, proportionally higher based on the area of the cylinder.

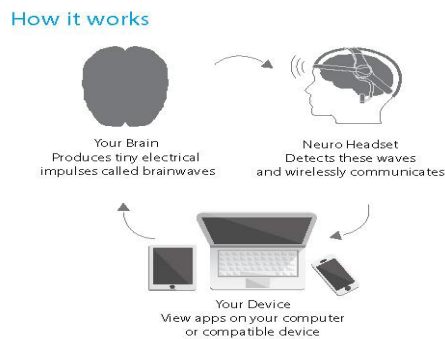


Fig. 9. Mechanism of Neuro-sky mind wave sensor

Hydraulic jacks depend on this basic principle to lift heavy loads: they use pump plungers to move oil through two cylinders. The plunger is first drawn back, which opens the suction valve ball within and draws oil into the pump chamber. As the plunger is pushed forward, the oil moves through an external discharge check valve into the cylinder chamber, and the suction valve closes, which results in pressure building within the cylinder.

5. Future Scope

Even though it is cheap compared with the other available equipments, we can develop more cheap wheelchair with the

same quality. Overcome the limitations.

6. Conclusion

The benefits of such a device include aiding independence and productivity, raising self-esteem and psychological well-being, heightening social status, extending access, relief of pressure, reduction of pressure sores, improved functional reach, improved respiration, improved flexibility, help in maintaining bone mineral density, improved passive range motion, reduction in abnormal muscle tone and spasticity, and skeletal deformities. Other wheelchairs provide some of the same benefits by raising the entire seat to lift the user to standing height. This wheelchair typically apply collision-avoidance techniques to ensure that users do not accidentally select a drive command that results in a collision.

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