VOICE OPERATED WHEELCHAIR FOR PHYSICALLY CHALLENGED

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ABSTRACT

This project opens a new hope to the physically challenged people. Freedom of mobility is the dream for every patient especially in the case of people suffering from cases such as quadriplegics and multiple sclerosis. Although many types of mobility equipments are available for these type of patient there is no independent means of mobility device for these patients since they cannot drive a joystick or manual wheelchair. In order to aid these types of patients we are developing voice operated wheelchair. The movement of the wheelchair is controlled by the voice of the user. This wheelchair can be driven to the preferred direction with minimum effort. The user requires only less training to use this wheelchair. Technically this wheelchair is integrated with a voice recognition module to identify the voice, a microcontroller which can be programmed other supporting hardware components and a motor driver L293D. The proposed microcontroller based voice operated wheelchair would bring more convenience for the disabled people. Two DC motors can be driven simultaneously, both in forward and reverse direction with the help of L293D motor driver. Here we can control the motors to move right, left, forward, reverse, free runs and stop or break. To provide tilt operation for this wheelchair we use selective movement of a single motor based on the diameter and speed of the wheel. Also can calculate how much movement is required to tilt the wheelchair at a desired angle.

KEYWORDS: Quadriplegics, Multiple Sclerosis, Voice-operated, Motor Driver, Microcontroller
1. INTRODUCTION

Currently around 10% of the total world’s population, or roughly 650 million people live with a disability. In India, approximately 15 lakhs people live with spinal cord injury. Every year, ten thousand cases added to this group. The number of people, who need to move around with the help of some artificial means, whether through an illness or an accident, is continually increasing. These means, the number of disabled people is increasing by tragic accidents also, some victims of the accidents are suffering from abnormal life with serious spinal injuries. Freedom of mobility is a dream for every person with physical disabilities [1].

With the aid of technological evolution, in order to increase the quality of life for these people and facilitate their integration into the working world. In this way a contribution may be made to facilitating Wheelchair is widely used device by disabilities. While the needs of many individuals with disabilities can be satisfied with traditional manual or powered wheelchairs, a segment of the disabled community finds it difficult or impossible to use wheelchairs independently physically challenged people have either less mobility or no mobility. The various paralyses such as quadriplegia and Multiple sclerosis. Multiple sclerosis. Multiple sclerosis (MS), also known as disseminated sclerosis or encephalomyelitis disseminate, is an inflammatory disease in which the insulating covers of nerve cells in the brain and spinal cord are damaged. This damage disrupts the ability of parts of the nervous system to communicate, resulting in a wide range of signs and symptoms, including physical, mental and sometimes psychiatric problems [3].

The name multiple sclerosis refers to scars (sclera—better known as plaques or lesions) particularly in the white matter of the brain and spinal cord. MS takes several forms, with new symptoms either occurring in isolated attacks (relapsing forms) or building up over time (progressive forms). Between attacks, symptoms may go away completely; however, permanent neurological problems often occur, especially as the disease advances. There is no known cure for multiple sclerosis. In severe cases the patient becomes paralyzed, while in milder cases there may be numbness in the limbs. Quadriplegia is paralysis caused by illness or injury to a human that results in the partial or total loss of use of their entire limb.
Quadriplegia is caused by damage to the brain or the spinal cord at a high level C1–C7—in particular, spinal cord injuries secondary to an injury to the cervical spine. The injury, which is known as a lesion, causes victims to lose partial or total function of all four limbs, meaning the arms and the legs. Quadriplegia is defined in many ways; C1–C4 usually affects arm movement more so than a C5–C7 injury; however, all quadriplegics have or have had some kind of finger dysfunction. So, it is not uncommon to have a quadriplegic with fully functional arms but no nervous control of their fingers and thumbs [4].

Typical causes of this damage are trauma (such as a traffic collision, diving into shallow water, a fall, a sports injury), disease (such as transverse mellitus, multiple sclerosis, or polio), or congenital disorders (such as muscular dystrophy). Some quadriplegic individuals can walk and use their hands, as though they did not have a spinal cord injury, while others may use wheelchairs and they can still have function of their arms and mild finger movement, again, that varies on the spinal cord damage. These results indicate a need for entirely new technology for the independent mobility of such patients. The normal electric powered wheelchair needs to be operated through joystick by hand. Since these patients are incapable for using a manual or electrically powered wheelchair the ideal solution is to use source such as voice. The project aims at designing and developing a microcontroller based voice controlled electric wheelchair with a voice recognition module to drive the wheelchair using voice commands. Here we are going to control the wheelchair by using the voice commands of the user. The user can easily learn and adapt the working of this wheelchair with minimum effort and time [5].

2. RELATED WORKS

Wheelchairs have evolved very little over the past 1000 years. Most of the design changes have occurred within recent decades. In 6th Century A.D Earliest recording of a wheelchair was found that a Chinese engraving picturing a man in a chair with three wheels. Later in 16th Century A.D, Wheelchairs were well-developed in Europe and commonly found in drawings and literature. In 1869 the first wheelchair patent was issued in the United States. Late 1903 an electrically-driven wheelchair operating on a 12-volt battery and a 3/8 horsepower motor was used to give people rides. At the time it was not used for
handicapped mobility but it did pave the way for future developments. During World War I, The first electric wheelchairs were used for the handicapped [2].

A battery and motor were applied to existing wheelchairs with a simple one-speed on/off switch. At last 1940 the first patent was issued for an electric wheelchair. In 1950 Sam duke received a patent for a releasable add-on power drive applied to manual wheelchair (the unit was actually permanently fitted to the chair with Unbolts). At late 1990’s, the popular electric wheelchairs on the market are foldable though they require removal of at least the leg rests and batteries. Folding, Light-Weight wheelchairs, manual and powered models: These wheelchairs are usually compact for indoor use and have small, self-pivoting wheels (casters) in front. Most of these powered wheelchair models are controlled by the user’s hand with a small control stick. Quadriplegics unable to use a hand for steering and control. These foldable power wheelchair models are usually purchased because they can be folded for storage, for transport in a car or car-trunk, or for transport on a train or airplane [11].

Light-Weight “Power-Assisted” wheelchair models: These are usually similar to folding manual wheelchairs and are manually propelled in similar ways. These models do have a battery plus one or two motors for propulsion assistance. Typically, the user is a paraplegic or quadriplegic person who desires to manually propel himself as much as possible for the exercise and resulting health benefits. These wheelchair models are often lighter-weight than the folding power models discussed above because the intermittent power use allows for smaller battery and motor sizes.3 “Non-Folding, Stand-Up power wheelchair models”:

These are usually sometimes used by people, unable to stand unaided, so that they can be stood up by the wheelchair for household chores or to converse face-to-face with non-handicapped people who are also standing. When in the elevated position, this type wheelchair has a very high center-of-gravity and can easily topple over. Stand-up wheelchairs are safe only on perfectly flat and smooth flooring and only if the user is properly strapped to the seat and seat back. 4. Combination “Indoor-Outdoor” power wheelchair: These models are often purchased by people able to have only a single power
wheelchair. Lack of storage space or limited finances can prevent the safer option: a person owns two power models – one for optimal indoor use – and another for optimal outdoor use. Outdoor safety requirements usually require that large, powered wheels be in front. These “combo” wheelchairs are probably most useful and safe when used (1) outdoors, on pavements and sidewalks in urban and suburban areas – not on grass or soil in rural areas; and (2) indoors, in nursing homes, assisted living facilities or apartments with wider halls and doorways that facilitate the wheelchair with larger turning radius and maneuvering space requirements.5 ‘Outdoor power wheelchair models’.

These are Very efficient outdoors, most have large diameter wheels in front with which to climb and steering may be accomplished, depending on design, by (1) rotating a rear-wheel dolly or (2) powering one of the large front wheels while breaking the other. Many such power wheelchairs are able to safely climb grades of as much as 40%; climb curbs and, sometimes, climb outdoor stairs as seen in front of a courthouse or public building. Often, these power wheelchairs are not safe or practical for use in a particular apartment.

The type of artificial aid needed by a disabled person in order to move depends to a large extend on the level of incapacity. If the user is capable of controlling head or hands, the ideal solution is the use of a joystick where there is a high level of incapacity; solution is basically centered on use of another mean, such as the voice. In the case of multiple sclerosis (MS) and quadriplegics the mobility is completely absent or restricted. People with spinal cord injuries, quadriplegic patients, multiple sclerosis are living a very painful life. Their families and their friends are also suffering from taking continuous care of the patients. A basic instinctive of life, moving around is an evidence of what they are still alive. These patients also have the right to move and want to move at all costs.

3. PROPOSED WORK

In this work, voice recognition module is used as user interface. This wheelchair is driven and fully controlled by using voice commands. In which the voice commands of the user is recognized by the voice identification module. The 8-bit digital output obtained from the voice recognition module is used to drive a microcontroller based control circuit. The microcontroller is programmed in
such a way to produce the required output for the corresponding voice commands. The output of the microcontroller is given to L293d motor driver, which can control a set of 2 dc motors simultaneously in any direction. The system consist of Voice –recognition module, Microcontroller –AT mega 32, L293D-Motor Driver, Motor (DC), Battery

In this voice identification module consist of receiver section, processing section and transmitted section. These three section controls the signals to the microcontroller. Receiver section consists of MIC and ADC. MIC is an acoustic-to-electric transducer that converts this input voice into an electrical signal. These electrical signals transmitted through ADC which converts analog signal to digital signal. Processing section controls the data base and command details. 99 commands can be stored in the data base. If the similar voice is produced in the database, corresponding output will be matching with 99 commands order and selective output will obtained. Transmitted section controls the given electrical impulses which transmitted to microcontroller

L293D is a dual H-bridge motor driver integrated circuit. Motor driver act as a current
amplifiers, since they take low-current control signal and provide a higher-current signal. Higher current signal is used to drive the motor. L293d contains two inbuilt h-bridge driver circuits. H-bridge consists of 4 switches s1, s2, s3, s4. When the switches s1 and s4 are closed a positive voltage will be applied across the motor. By opening s1 and s4 switches and closing s2 and s3 switches, this voltage is reversed, allowing reverse operation of the motor.

Two DC motors can be driven simultaneously, both in forward and reverse direction with the help of L293Dmotor driver. Here we can control the motors to move right, left, forward, reverse, free runs and stop or break. To provide tilt operation for this wheelchair we use selective movement of a single motor based on the diameter and speed of the wheel. Also can calculate how much movement is required to tilt the wheelchair at a desired angle. Here 15 degree angle movement is required to tilt either direction. To tilt 30 degree angle, user should produce the voice two times at same direction. In this way 15 degree angle is controlling the motor at a desired angle [7].

4. SOFTWARE DESCRIPTION

Hardware of the device requires appropriate software to move the wheel chair using voice commands. Considering the easiness and for reducing the complexity in programming the modules, the programming and stimulation of our system was done using multiple software [8]. Atmel studio 4 was used for programming the micro-controller unit. In this project there are mainly two software were used, AVR Studio and Proteus 8 Professional.

AVR Studio is an integrated development environment for writing and debugging AVR microcontroller application in Windows 98/ME/2000 and Windows NT environments. Atmel gives us an easy to use platform to write, built and debug applications written in C/C++ or in assembly language. AVR Studio provides a project management tool, source file editor and chip stimulator. It also interfaces with development boards available for the AVR 8-bit RISC family of microcontroller. It will support all AVR devices [9]. Proteus is software for microcontroller simulation, schematic capture, and Printed Circuit Board (PCB) design. Similar to commonly used programming
language VB. Proteus also contains a lot of inbuilt functions in it [10].

5. RESULT AND FUTURE WORKS

Hence the programme for voice operated wheelchair is done by using the software AVR Studio and Proteus 8 Professional and run successfully. In future we are developing Autonomous wheelchair for physically disabled people such as blind, quadriplegics and multiple sclerosis. In which the wheel chair can be operated in two modes automatic as well as by using voice of the user.

6. CONCLUSION

To achieve independence in mobility for people with physical disability, right mobility equipments have to be designed based on the severity and type of disability. This is not a trivial job just because the nature and type of disability varies from person to person. Voice recognition module and the motor driver control the overall operation. The proposed AVR microcontroller based voice operated
wheelchair would bring more convenience for the disabled people. By its very special features voice operated wheelchair become an advanced means of mobility aid for patients suffering from Multiple Sclerosis and quadriplegics. This Wheel chair is thus a ray of hope to freedom of mobility for many disabled.

7. REFERENCES


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