Mind Controlled Wheelchair

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Abstract: A wheelchair, we can imagine that a chair it can be move with the help of wheels, it can be used for the person who have difficulty of walking or impossible due to disability, injury, or illness. We can see that there is wide variety of wheelchairs used for the specific needs. Now a day commonly using powered wheelchairs, where propulsion is provided by the electric motors connected by the batteries. For a manually propelled wheelchair, where the movement of wheelchair is provided by the occupant pushing the wheelchair by handle, or by an attendant pushing from the rear, or by the wheelchair user.

I. Introduction

Leg is an important functional part in our body. Without leg we could not move anywhere. The main function of human leg is for walking, running and holds the total body weight. When we got an injury in our legs we can’t move anywhere. Here we are telling about the different types of wheelchair from manual wheelchair to the new advanced method of wheelchairs. And also tell about the best wheelchair for patient. Wheelchairs are mainly used for paralysis patient, it will help that patient to move without others help. Mainly they are categorized according to the patient need. According to this mainly we explained here about the mind wave wheelchair.

An unknown inventor in the Philip II of Spain, the first known wheelchair (known in 1595, also known as an inventive chair). In 1655, Stephane Farfler began a papaligic watchmaker and three-wheel chassis self-propelling chair. In 1783, Bottom John Dosson of England invented a wheelchair behind Bath town. A chair having two large wheels designed by a person named Dawson. During the first half of the nineteenth century, the bathing wheelchair crossed all other wheelchairs. However, the bathing wheelchair is not as comfortable as there were several improvements in wheelchairs in the last half of the nineteenth century. 1869 patent backplate with a single wheelchair showed the first model of cycle roads. In 1881, the push rims were invented for added self-propulsion. The first horizontal valves were used in the horizon in 1900. In London the first automated wheelchair was constructed in 1916.

In 1932 a tubular steel wheelchair was constructed by Engineer Hari Jennings. It was the first wheelchair that was similar to today’s modern day. Wheelchair, built by a friend of Jennings, who is known as Herbert Everest. The first wheelchairs were self-sufficient. This was done by a patient who voluntarily reproduces the wheels of their wheels. If a patient cannot do this, one can break the wheelchair and the suede. In powered wheelchair wheel are connected with some small motors. Efforts were made to invent a motorcycle wheelchair in 1916, but there was no successful commercial production. The Canadian inventor George Claine and some of the engineers are discovered the first ‘Electric wheelchair’ when the ‘Canadian National Research Council of Canada’ (CNRCC) was working for the redeemed after their second medical camp.

Everest, Jennings is the first company to build a large scale of electric wheelchair that began in 1956. At the same time, John Dnanowue and Brian Gate invented new wheelchair technologies for a low-loaded patient. With a wheelchair, problems will arise. The brain gate device will be immune to the brain’s brain and mobilized on the computer. They can send machine commands as they want on any machine including wheelchairs. Now a day we are using a new technology called Brain-Computer Interface (BCI).

We can see wide variety of types wheelchair differing by mechanisms of control, propulsion method, and new technology used. Some of the wheelchairs are designed general use for every day, others for single
activities in hospital, for the patients move from one place to another place with the help of any other person. Innovation in wheelchair industry is relatively common in our world. However, many innovative practices, on the way, particularly over-experts, or the unexpected price-point in the market-point. A self-propelled manual wheelchair has the following parts: a frame, seat, one or two footplates and four wheels (two for front and two for back). Two castors and two large wheels for front and back. Especially in a special seat cushion. Large rear wheels usually have push-reams with tiny diameter tires; They do not recognize tires and move on to the chair. Although ordinary horizontal wheels are usually the interval between wheel wheels, they are parking braking and in-motion breaking. Usually, the wheelchairs user will decide to wear wheelchair gloves as they create friction and heat, especially if they drift downwards. In manual wheelchairs, push handles are often located on both sides of the pedestal. This will allow you to run in the hands of a second person. This will remove the unwanted vase from people who believe that active wheelchair users can be helpful for unnecessary people.

Fig 1: Manual Wheelchair

Rigid or folding are the two major varieties of manual wheelchairs. Rigid wheelchair is doctor suggested full-time for an active users and joints are welded permanently have fewer moving parts on it. The chair would flex and absorb energy for its moves by reduce its energy required for pushing the wheelchair by eliminating some of the joints in it. Also folding joints are reduce overall weight of the wheelchair. The folding wheelchairs are generally have low end designs and the main advantage is the ability to folded by both sides are come close together. Commonly the folding wheelchairs are used by part time user and after the use it will fold, and also it have less space to store. Some of the wheelchairs are combined by both folding and rigid mechanism. At the time of using wheelchair the joints are automatically locked and after the use it can be unlock very easily.

All major items on wheelchairs are ideal for users' needs. Seating measurements, height, seat angle, football, leg rest, front castor outreaches, and adjustable backrest control are also customized. Anti-bone cycles, wheels, safety belts, adjustable backstreets, tilt and / reason features, limb, head and neck support, crutches, oxygen tanks, drink owners, soil and wheel guards will be protected. An attendant-wheeled wheelchair having wheels of similar diameter for front and back. A person behind the chair can move and move in symbols included in the rules. Braking will be provided directly by the attendant. The brake will provide by foot or hand operated parking brake. Usually steel is made by lightweight, there is a lack of concern that the user does not need to be self-prop. In developed countries, the chairs now specially designed at airports are now required. To avoid the control of aisle for narrow ventilation, passengers with wheelchairs can pass from their airplanes. [6]. An electric-powered wheelchair is usually a wheelchair called a "powerchair". The batteries and electric motors are placed on the frames of the wheelchair. It can be controlled by the wheelchair user trough a small hand movable joystick fixed on the armrest of the wheelchair. Free wheelchairs can allow free operation to users who cannot control a manual joystick, head switches, chin operated joists, or other specialist controls. Normally the ranges of 10 miles / 15 km from the normal battery are available.

Fig 2: Electric Powered Wheelchair
An indoor-chair have an advantage of cross the flat surface completely and limiting it to home use. The indoor-outdoor wheelchair is less limited, but the ceiling may be fixed to handle tiles or asymmetrical surfaces. The outdoor chair has more capacity, but it will have a very limited capacity to handle rough terrain. Normally four wheels are present on small power chair, and the outdoor chair designs having six wheels. Small wheels on the front and rear, and the large powered wheels are located on the centre.

One of the recent developed wheelchair is the power assisted wheelchair. The seating and frame are similar to rigid manual wheelchair. Here the standard rear wheels are replaced by small similar size wheels. The wheelchair containing batteries and battery powered motors on it. Hera a specially designed floating rim is present. It is one type of sensor which used to sense the pushing force of the user. This force converted to electrical energy from the circuit and it gives to the motor for its activation.[1]. A folding frame types of wheelchairs have a folding X style frame; hence it can be taken anywhere. These types of wheelchair can be fold by releasing of locking mechanism from there. These types of wheelchairs also have foot rests which can be fold or remove easily.

The frames of the wheelchair are made with titanium or aluminium. These are heavier comparing with the rigid frame. The durability of folding wheelchair is less compare with rigid frame wheelchair. So, the folding frame wheelchair need good maintenance for the proper working of all parts of it.

Mobility scooters also have some similar features with powerchairs, a mobility scooter eliminates the most human weaknesses of a vigorous wheelchair, its production steering system still requires beautiful cushion, shoulder and hand force, some upper body movements and strength. The controller, managing the design, is usually suitable for many users. Scooters have some options like body support, head or leg rest. They are very rarely designed to facilitate the patient's transfer from seat to bed.

Small mobility scooters usually have three wheels. There is a base laid down in a basic seat on the rear. There are four wheel drives on a regular seat with big scooters. There is another one type of wheelchair called standing wheelchair, it will help the patient/user for standing position. It having double use, one is for normal wheelchair and another is for standing frame.

The control of up and down movement is done by a joystick placed on the armrest. The entire seats will be raised to give full advantage to lift the user to standing height.
Some of the wheelchair can be used as stretcher are called as stretcher wheelchair. The main use of stretcher is to move patient lying on flat surface. Also, the stretcher can be adjusted for the patient to sitting a better position.

Smart wheelchair is one type of electric powered wheelchair. Here the wheelchair can be controlled by manual or automatic for user choice. The main use of the smart wheelchair is to reduce the responsibility of the user for the run of powerchair. The smart chair can be controlled by the computer attached in it, and the mobile robotics techniques used for the working of the chair. The user can manually control the smart chair by either joystick (zip and puff device) or by a touch sensitive display. This is one of the difference from the normal power wheelchair. The speed control and the direction do not interconnect with the control system of the wheelchair.

The sensor presents in the sides of wheelchair help to prevent collision with any object on the floor and prevent accidents from the object. The wheelchair sensor senses the patient muscular activity for give high level commands to the control unit. Here one of the technique used called as path-planning artificial intelligence technique. [1] [3] [9] [10]

II. PROPOSED METHOD

• Mind-controlled wheelchair

One of the latest model of wheelchair is the mind-controlled wheelchair. A mind-control wheelchair is one type of mind-machine interfacing device. It has the ability to convert neural impulses/thought to command for the running of the motor placed on the wheelchair for the motion. Some of the patients are suffering from locked-in syndrome (LIS), here the patient knows what are the happens done his/her scrounging. But the patient could not have the ability to move or communicate vocally with others. It will happen due to the complete paralysis of all patient voluntary muscles.
in the body of the patient (except the voluntary muscles in the eyes). Muscular dystrophy is one type of disease that weaken skeletal muscular system, and also hampers locomotion like walking or moving. In this situation these type of wheelchairs are helpful for the patients. The brain-computer interface system is used for the functioning of wheelchair. The neural impulses are collected by EEG using an electrode placed on the patient forehead. The micro controller senses the patient thought and convert it to controlling the wheelchair movement. Many different types of sensors like sound sensor, temperature sensor and an array of distance sensor are placed on the wheelchair. The sensors sense the stairs and steep inclines are automatically avoids. It also includes a safety switch in case if any danger also the user can close his eyes quickly for an emergency stop.

Brain-Computer Interface (BCI)

It is one type of interface/intermediate device between computer and brain with an external device of computer, robots etc. The computer has the ability to executes thoughts of the user into actions.

![Man-Computer communication through BCI](image)

Here some of the steps present in the mechanism in the BCI are; first the user visualizes performing simple specific task. Here the task is to moving their right hand. At the time the brain will produce associated signals for the movement of right hand. An EEG used for measuring the electrical activity of the brain and remove the noise present in the signal and then the signal gets amplified. A computer used for analysis the signal. It will learn the brain pattern associated with the specific task of moving the right hand. At the last the programmed computer software recognizes the brain specific pattern and certain action will execute when the person visualizes the movement of the person right hand.

EEG is one of the technology used to measure the electrical activity of the brain. The numbers of electrodes can be place on the specific skull surface. Because, each portion of the brain will be carrying different activities and produce different electric signal for different actions.

Fig 11: Block Diagram of BCI

Mind-controlled wheelchairs are developed early year in INDIA. These types of wheelchairs are the excellent technology than voice-controlled wheelchairs. The main advantages of mind-controlled wheelchairs are the faster respond to commands of the user. It will more helpful for the patients who have lost the ability to speaking with others. The users wear an EEG cap or leads, and the cap containing numbers of electrodes which receive the brain signals and monitors their brain activity. The signals produced the brain by the users visualize movement of hand or leg in a certain direction. The patient brain releases specific electrical signals when the users visualize moving their hand in a certain direction (left, right, up, down). The sensors present in the wheelchair, which sense the motion of the wheelchair.

The Brain Science Institute named ‘Toyota Collaboration Centre’ comes with a new technology of though-controlled wheelchair in 2009. Their system processes the signals from the brain at a rate of 125 milliseconds of each time. It will allow the wheelchair to move continuously without any delay. The users signal analysed by fast processing speed of the system. In addition, there is a sensor placed on the user’s cheek. The wheelchair motion can be stop and override the system by the sensor sense when the user puff his cheek.
The user can puff his cheek on the sensor when he wants to override the system and stop the wheelchair’s motion. Toyota can claim 95% accurate of their thought-controlled wheelchair successfully.

Another one type of thought-controlled wheelchair that is also being developed by the ‘Federal Institute of Technology’ in Switzerland. The wheelchair comes with two small webcams. The webcams process visual information to the computer. The feature that distinguishes with this type of wheelchair from Toyota’s wheelchair is that dual control, it means that, the wheelchair can take commands from the user thought as well as the webcam software placed on the wheelchair.

Basically, the function of computer software done perfectly with the user’s commands. So, the user does not need to maintain the control of wheelchair continuously in the same direction the patient wants to move. For example, the user can command a wheelchair to move towards a particular direction, for example forward movement. The software will take over the route to evaluate and navigate the region which helps to avoid any obstacles. Using this technology, we can avoid accident with any object present on the particular direction. The wheelchair has not yet tested on patients with stroke. [2][4][5]. The seating arrangement of a wheelchair specially designed for the user, it will help to support the user in the sitting positions and it will maintain the pressure from the patient upper body and make comfort in sitting on it.

III. Conclusion

The above described wheelchairs, better one is the mind wave-controlled wheelchair. Because a paralysed patient could not move his/her arms. So, they cannot hold joystick on their hands. In this time the mind-controlled wheelchair is helpful for paralysed patients. For the controlling of wheelchair, it need some meditation. For a paralysed patient can practice meditation easily, and there are some of software used for self-controlling our mind for the controlling of wheelchair. So, I conclude that the better one for patient is mind controlled wheelchair.

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