DESIGN & DEVELOPMENT OF SMART TERRAIN WHEELCHAIR FOR THE HANDICAPPED

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Abstract - Limited mobility is something that affects approximately 7.6 million Indians. Approximately 1.2 million are using wheelchairs or scooters of some kind to enhance mobility. Everyday obstacles present a challenge to those in a wheelchair. Also, outdoor environments such as farms, picnic spots, off-roading or even grass fields provide additional challenges for those with limited mobility. This project helps us to provide a solution the limitations faced by those using wheelchairs.

The wheels and tires of the wheelchair allow navigation through most terrains such as grass, gravel, and sand, but in some cases the wheels get stuck in muddy as well as rocky terrain, so we have come up with a new concept of adding tracks to the wheelchair in-spite of just wheels. Because of adding tracks the wheelchair cannot just drive through any terrain, but can also climb stairs. The chair has the ability to level at up to 45 degrees and can provide a manual lift of 6 inches

INTRODUCTION :

Each and every individual has the right to live Independently but there are many challenges faced by physically challenged people daily and hence they have to be dependent on someone or the other for their work. Many a times in spite of the challenges they face, they try to overcome these challenges. In our case we are trying to make a physically challenged person highly mobile by adding up strength to his mobility.

A question arises in our mind how? well the answer is simple we build a wheelchair which is highly capable to mobilize that person wherever he wants to. Another question that may arise in our mind is that there are already so many wheelchairs in the market then why do we need another wheelchair? Most of the wheelchair that are available in market are not able to climb steps or even if it is able to climb the steps its very expensive for a disabled person belonging to a poor family to afford it.

Many a times if a disabled person wants to visit a building which doesn't have any elevator, then he may not be able to reach his destination. To overcome this problem, we came up with solution to build a step climbing wheelchair which can not only climb stairs but can also operate through bumpy roads and can operate as a normal wheelchair, which will provide a complete solution to a disabled person.

The wheelchair that is being built should be built in such a way that it is capable to self-balance itself and prevent the person from hurting himself/herself. Our main aim is to build a wheelchair which is not very expensive and can be afforded by anyone for either physically challenged people or any old aged people or people suffering from paralysis ,etc.

Furthermore, as the wheelchair climbs or descends a hill or a staircase it becomes unstable and the user risks tipping the wheelchair causing injury or even death. Thus, the terrain electronic wheelchair uses a gyroscope to determine its angle of inclination and depending on user interface choices will display the angle or raise the seat with linear actuators to keep the seat level, but the cost of gyroscope is too high which becomes uneconomic to use as our aim is to build an inexpensive terrain electronic wheelchair so, we do the adjustment by hand controlled joystick.

This will keep the centre of gravity towards the front of the chair when going up a hill and towards the back of the chair when going down a hill. This enhanced stability will give the user the confidence and ability to go places where most traditional wheelchairs cannot.

Construction &Working :

There are various components being used to build up this wheelchair keeping in mind to reduce the expenditure of the wheelchair.

The components are:

1. Joystick or switches.
2. Worm or spur geared Motors.
3. Foot rest.
4. Electronic jack.
5. Track chains.
6. Chassis.
7. Power controllers.
8. Batteries.
9. Comfortable seat with a seat belt.
10. Nylon castor wheels.

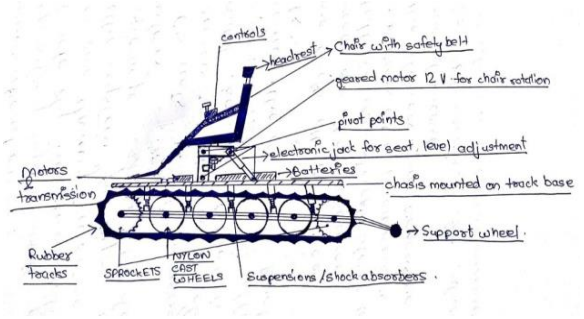

Fig no : 1

A) Switches and joystick:

Here depending on how much the person can afford, is the design we build. The basic class of wheel chair which is in the lowest range has toggle switches to start the system, push buttons to go in front, right, left, back directions which will be directly connected to the relays. the chassis of this system will not have shock absorbers, it will not have automatic seat height adjustments which need to adjusted automatically while climbing stairs or high inclination points which will again be operated by push buttons.

The fully automatic wheel chair will have a joystick to mobilize and just a small power button to start the whole system because of the microcontroller which be used hence making the circuitry more complex. Arduino also can be used. The level of seat while climbing stairs or slopes will be adjusted automatically with the help of gyro sensors. Thus, making the person free from extra operations and relieving him from stress.

B) Tracks:

The chassis of both the type of wheel chairs will be same, same type of track chains are used. The Track chains have been padded with rubber pads to avoid breaking of tiles, making noise while travelling and the most important to achieve higher traction while climbing the stairs. Higher the systems used higher is the power required resulting in more no of batteries to be installed make the system costlier.

Different types of batteries can be used like nickel cadmium batteries, polymer batteries, lithium polymer batteries, lithium batteries. The cheapest battery is the nickel-cadmium battery having the lowest cost but higher charging time, more weight, less efficiency as compared to the others in the list and having the shortest lifespan of 1-1.5 years. The lithium battery is the costliest battery which has moderate charging time, less weight, higher efficiency compared to others and also has a minimum life span of 10 years.

C) Motors:

The motors which used here are 12/48 volts dc motors. To achieve higher torque, we are using worm geared/spur geared motors. Using geared motors also increases the life of motors by reducing direct load on the motors. Two motors are used. We can also take a 360-degree turn, because of the combination of two motors.

Differentials can also be used, which will require only one motor but the system becomes complex as well as weight added is also more compared to the combination of using two motors. Using differential would also block the possibility of taking a 360 degree turn which is more important in compact spaces.

The motors to be used are 24/48 volts dc motor having current of 5/10 amps, and total torque of 200nm with a power rating of 200/250/350 watts. Safe over volting of the motors is done giving a total power o/p of 900/1100 watts.

D) Chassis:

The chassis is designed by using metallic steel square pipes of size 30x30mm and bracing them to give additional strength. Thus, resulting in lower weight of the chassis and higher load taking capacity.

The gears on the shafts connected to the tracks will be chain driven on both sides thus helping in increasing the torque. The power transmission forms the chain driven gear to the track will be through a shaft. Low to high gear ratios are used from motor side. Motors max rpms will be around 60-80.

E) Electronic jack :

Electronic jack is used to adjust or level the seat according to the inclination of the terrain or the steps. The jack is driven by a 12volts motor. High power controllers are used to drive the motors. ratings of the power controllers are 30 amps- 50volts thus giving us independence to use motors around 1500 watts.

F) Nylon Castor:

Nylon castor wheels are used to support the chassis on the chain tracks because these wheels each weigh around 150-200gm and can take a load of 1ton. The dimensions of the wheels are 200mm diameter and has a very long life. The wheel chair can travel around 90kms on a single charge if fitted with high quality lithium batteries with the rating of 150ah.

G) Rotating seat :

The seat in the wheel chair can rotate around its axis which will help while changing the position of the person operating the wheel chair while climbing up & down the stairs. The rotation of the chair will be controlled by a small 12 volts geared motor with automatic locking of the wheel chair once the hand is taken off the controller after rotating operation of the chair. The chair is also equipped with a seat belt to avoid the person to fall from the chair in case of urgent braking or inclined slopes.

H) Sprockets :

The track chains are basically designed from bike chains and spur sprocket gears from bikes. Each side needs around 4nos sprockets. So total sprockets required are 8nos. The chains are welded with metal plates of 200mm length. The metal plates in chain are padded with rubber pads to achieve higher traction and to avoid damages to the flooring in buildings etc.

I. Future Scope

We can further extend the wheelchair by making it more enhanced according to our requirement. We can modify it as per the requirement of any physically challenged person. Day by day the wheel chair will become smarter and smarter making the disabled person realize that he is not disabled anymore allowing him to conquer more and more type of terrains easily

The wheelchair can move in all type of terrains.

1. It's not common among the other wheelchair because of its different architecture.
2. The wheelchair's cost is inexpensive compared to others.
3. It can be built as per the requirement and budget of the user.
4. It's easy to do the maintenance and service works due to simplicity in the wheelchairs design.
5. Thus due to its low cost poor disabled people can afford it.
6. It takes more labor compared to other wheel chairs to mobilize it in case of battery power failure.
7. The more advanced is the chair the higher is the cost.

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