



Cost-Efficient Remote-Controlled Wheelchair

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ABSTRACT

A Smart Wheelchair is a Power Wheelchair with numerous sensors, assistive technology, and computers built in that allow a disabled person to travel around freely and safely. These wheelchair designs are gradually replacing regular wheelchairs, although a sizable number of disabled persons are unable to afford one due to their high pricing. As a result, we must deliver a smart wheelchair that is both affordable and packed with capabilities that take advantage of the most recent hardware and software. There have been many admirable attempts made in recent years to achieve this goal. They have embraced several technologies, including artificial intelligence, where they created an autonomous wheelchair that used machine learning principles to travel. Some of them have also used the Internet of Things to manage wheelchairs using a voice recognition system. This report will present a cost-effective Smart Wheelchair-based on PWM and DIR from micro-controller and IoT technology that have several features to gain disabled people, especially poor people who cannot afford expensive Smart Wheelchair, the required help to finish daily life tasks without external help. To conclude this project, we will make the Smart Wheelchair affordable to a wide range of disabled people and will be using PMDC motor, CYTRON smart drive MIDDS30 dual 30A, 12V 12AH battery and a 6-channel controller to control the wheelchair.

Keywords: Smart Wheelchair, Cost-efficient, Disabilities, Mobility

1. Introduction

With the advent of digital transformation and introduction of Artificial Intelligence/Machine Learning (AI/ML), Industrial Revolution has once again taken a new shape, popularly known as the Industry 4.0 (I-4). It brings an era where more and more tasks are automated and remote accessibility is a thing, thanks to advanced automation and control techniques along with Internet of Things (IoT). Wheelchairs enable people with mobility challenges to experience higher quality lives, they allow users to rely less on caregivers for mobility. In 2018 it was estimated that 70-100 million people needed a wheelchair, yet only 10% of these needs were met. A relatively recent improvement upon the manual wheelchair is the Powered Wheelchair (PW). These are often used by individuals who are unable to use a manual wheelchair. However, current PWs are not adequate for many individuals because they are not affordable and are difficult to use, often lacking the motor skills necessary to use them. An average PW in Asia and in the US costs about \$1,600 and

\$7,000 respectively yet many individuals in Asia who need wheelchairs are below the poverty line with incomes as low as 12 USD per month, making PW inaccessible to a large portion of the global population. There is a lot of importance of comfort and ease while travelling. The comfort of a chair refers to the level of safety offered in different kinds of situations and factors, especially like road safety. The most comfortable and luxurious wheelchairs have a high standard of riding quality. The driver, due to his disabilities, should be at max comfort and should experience low turbulence as possible.

2. Description

Handicapped people having limited mobility are still living miserable lives. Smart wheelchair consists of a special controller unit, which allows user to provide input via the 6-channel controller. The controller unit synthesizes the command and takes necessary action as provided by the user i.e., moving the wheelchair in accordance with the given input. The goal of our project is to allow more customization for individual users with special needs and abilities which will be made available at a cheaper price compared to other electric wheelchairs present on the market. The electric wheelchairs in the market currently are expensive which is not affordable to everyone. Our objective is to make it cost efficient, user friendly, provide various features like a global positioning system, and have specifications almost as near as the expensive smart wheelchairs. The intent of this paper is to design the above descriptive wheelchair. The design will cut back the price up to drastic 80%!

3. Hardware Requirements

3.1 PMDC Motor

A Permanent Magnet DC motor (or PMDC motor) is a type of DC motor that uses a permanent magnet to create the magnetic field required for the operation of a DC motor. The motor model is MY1016ZL, and its working voltage is 24V. Its operation speed ranges from 75rpm to 120rpm. The dimensions are 15cm in length and 20cm in width. It weighs 2500grams. Due to its small size, the output torque is high, noise is low, reliability is more compared to big and heavy motors and maintenance is easy.

3.2 Motor Driver

It has bi-directional control which is used for dual brushed DC motor. The driver has a support motor voltage from 7V to 35VDC. Maximum current can go up to 80A peak (1 second), 30A continuous, each channel. On board MOSFETs are switched at 18 KHz for quiet operation. Regenerative Braking. Contains thermal protection, Current limit protection. Moreover, it also has multiple input modes. The dimensions are: 81.28mm(W) x 101.60mm (L) x 42mm (H)

3.3 Battery

When it comes to batteries, we have two main options: lithium batteries and lead acid batteries. Sure, there are a few other types of batteries out there, but the main two types all over the place remain lithium and lead acid. Of course, lithium batteries and lead acid batteries each come with their own distinct advantages and disadvantages and knowing the difference will help to decide which is best for us. We used 2 lead acid batteries each of ratings 12V, 24AH.

3.4 6-Channel Controller

CT6B FLYSKY 2.4GHZ 6CH TRANSMITTER is an entry level 2.4 GHz radio system offering the reliability of 2.4 GHz signal technology and a receiver with 6 channels. This radio controller has a very lightweight and handy design with two retract switches and proportional flap dials in easy reach for channel 5 and 6. It can be powered by 8 * AA Size Batteries or a 12 V Power supply. It comes with a trainer port. This remote comes with an FS-RSB receiver which is one of the best receivers and is at a very reasonable cost. It covers the entire band width of the antenna bandwidth antenna. The specifications are Channels: 6 RF range: 2.4055-2.475GHz Bandwidth: 500KHz Band: 140 RF power less than 20dBm 2.4G system: AFHDS Code type: GFSK Sensitivity:1024 Low voltage warning: less than 9V DSC port: PS2output: PPM ANT length: 26mm Weight: 511g Power: 12V DC

4. Working

Smart wheelchair consists of a major smart controller unit which allows the user to provide the input in the form of remote control. The user gives the control according to its need and hence the wheelchair moves according to the signal given by the user. The controller unit then synthesizes the command and takes the required action to move the wheelchair to the specific position. Controller unit is pre-programmed to operate motor according to the direction given by the remote control. Initially the DC supply of 24V is given by the lithium battery. The power source has its direct connection to the motor driver which in turn has its connection with the left and right motor.



Completion of Project

5. Advantages and Features

Minimal effort is needed to control the wheelchair by use of a simple transmitter. With the smart wheelchair, you don't have to depend on someone else to push the chair, allowing you the independence of moving about. The adaptability of the smart wheelchair is astounding. People who have only control of their fingers have been set up to move their wheelchair using the remote control. The power of the smart wheelchair makes it easier for you to go up or down hills or slopes. It can be used for indoor as well as outdoor activities. When using a manual chair to go far, you need to consider how much energy and ability you must come back. With the smart wheelchair, you are only limited by the amount of power left in your battery pack. It has very smooth Controlled Operation. Has the feature of regenerative braking. It is easily foldable to fit into any car space. The driving Range is 10km. It can carry weights up to 110kg. It is suitable for Indoor as well as Outdoor applications.

6. Conclusion

As an individual, I conclude more customization for individual users with special needs and abilities which are provided at a cheaper price compared to other electric wheelchairs in the current market. As claimed earlier, the cost to make this wheelchair was reduced by a drastic 70% compared to the ones present in the market currently. Moreover, the user will not be dependent on other people and is provided with smooth control and easy mobility by user friendly control.

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