

# Smart Wheelchair as Assistive Technology Solution for Wheelchair Users from India



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## Abstract

The disabled populace of India has increased by 22.4% from 2001 to 2011. Over 2.13% of the whole populace of India is confronting with various levels of difficulties in everyday life. Assistive Technology (AT) can empower such populace to bring social equity. Assistive devices like smart wheelchair are the rehabilitation advances which are basic requirement of such disabled populace. Disabled populace can have better quality of life if they are assisted with smart wheelchair. Smart wheelchair not just helps the disabled populace to lead a normal life but defeats their inability. In India, statistics shows that disabled populous are more in rural areas. The fundamental reason behind this larger percentage in rural area is absence of best practices in assistive devices in rural area. The reasons are lack of information of smart wheelchair due to lack of education and poor financial conditions. Advances in smart wheelchair have opened a number of opportunities to help such disabled populace. This paper basically concentrates on the possibilities of the smart wheelchair with minimal cost with advanced sensor technology as effective rehabilitation technology for the Indian disabled population.

**Keywords:** Quality of life; Rehabilitation; Wheelchair

## Introduction

The disabled populace of India has increased by 22.4% from 2001 to 2011. Over 2.13% of the whole populace of India is confronting with various levels of difficulties in everyday life [1]. Assistive Technology (AT) can empower such populace to bring social equity. Assistive devices like smart wheelchair are the rehabilitation advances which are basic requirement of such disabled populace [1]. Assistive technology includes any piece of equipment or device that improves independence of a disabled person. Assistive technology covers term like assistive, adaptive and rehabilitative services for disabled. Assistive technology promotes greater independence by enabling people to perform tasks that they were formerly unable to accomplish [2]. The Manual wheelchair is one of the most commonly used assistive devices for improving of people with disabilities. A wheelchair is a manually operated or power-driven device designed primarily for use by an individual with a disability. A basic manual wheelchair incorporates a seat, foot rests, two caster wheels at the front and two large wheels at the back. The hand rims attached to the wheels have a diameter slightly smaller than the wheels. Most wheelchairs have two push handles at the top of the back to allow for manual propulsion by helping person. Persons with lower limb disabilities are mainly dependent on manually propelled wheelchairs for the mobility. Manual wheelchairs are largely used in hospitals, which are

generally driven and controlled by helping person. In case of Self-propelled manual wheelchair, the controlling and driving of wheelchair is done by hands only. But as compared to legs, the hand work is less efficient and more straining. This leads to lower physical capacity of user. Therefore long term of use of manual wheelchairs is not advisable [3].

## Power wheelchair

Power wheelchair is propelled by means of an electric motor rather than manual power. Motorized wheelchairs are useful for those unable to propel a manual wheelchair or who may need to use a wheelchair for distances or over terrain which would be fatiguing in a manual wheelchair. Power mobility allows people to move within their home and community and it can help maximize independence for those with limited mobility [4]. A power wheelchair allows people to be mobile within their home or community without expending a lot of muscle work and energy. This is especially important for people with disabilities, such as multiple sclerosis. Power wheelchairs also offer the benefit of traveling over a variety of terrain through the options of tire types and wheel positions. The most popular position for wheels in power wheelchairs are rear wheel drive, where the large wheel is in the back and the minor casters are in front which provides stability in driving both indoor and outdoor.

## Discussion

The individuals with lack of motor skills, strength or visual acuity from disabled community find it difficult or impossible to use power wheelchairs independently. These individuals often lack independent mobility and depend on a helping person to push them in a manual wheelchair. To accommodate this population, several researchers have used technologies originally developed for mobile robots to create smart wheelchairs [5,6]. A smart wheelchair typically consists of either a standard power wheelchair to which a computer and a set of sensors are added or a mobile robot base to which a seat is attached. Smart wheelchairs are designed that provide navigation assistance to the user in a number of different ways, such as assuring collision-free travel, aiding the performance of specific tasks (e.g., passing through doorways), and autonomously transporting the user between locations. The purpose smart wheelchair is to reduce or eliminate the user's responsibility on moving the wheelchair.

## Smart wheelchair

The recent development in research areas such as computer science, robotics, Artificial Intelligence and sensor technology broaden the range of possible applications that support disabled people. Smart wheelchairs extend the capabilities of traditional powered devices by introducing control and navigational intelligence.

A smart wheelchair typically consists of a standard powered wheelchair base upgraded with a computer and sensors or a mobile robot base to which a seat is attached. The Smart wheelchair minimizes the physical and cognitive load required in steering it. Smart Wheelchair is controlled by a computer, has a set of sensors and applies techniques derived from mobile robotics research in order to process the sensor information and generate the motors commands in an automatic way or with a shared control. The control module may consist of a conventional wheelchair joystick, voice based control, facial expressions or even gaze control. The localization

module estimates the wheelchair position with respect to a starting reference configuration. The sensors provide direct measurement of the obstacles. The navigation module generates the control variables, and the control module translates these control variables into commands for the motor.

Smart wheelchairs are designed for a variety of user types. Some prototypes are designed for users with cognitive impairments such as dementia, where collision-avoidance techniques used to ensure that users do not accidentally select a drive command that results in a collision. Some prototypes designed for users living with severe motor disabilities such as cerebral palsy, quadriplegia. In such cases, The role of the smart wheelchair is to interpret small muscular activations as high-level commands and execute them. Such prototypes typically employ techniques from artificial intelligence, such as path-planning.

## Conclusion

In this paper, the fundamental assistive technologies which are extremely important for the disabled people have been illustrated. The Sensors and technologies utilized for the help of disabled people discussed.

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