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SMART WHEELCHAIR

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ABSTRACT

In this paper we propose an smart wheelchair which can assist physically handicapped, visually impaired as well as elderly people. The objective of a smart wheelchair is to reduce user effort in controlling the wheelchair and to ensure safety during movement. The user can control the wheelchair using accelerometer ,voice recognition and manual switch. In this context smart Wheelchairs are instruments that are a natural development of the scientific work. Our wheelchair is developed with a view to serve the purpose. It consists of a navigation system which makes use of accelerometer and manual switch, the system contains a navigation pad which can be held in hand or tied to the head for navigating the chair.In any emergency situations the emergency switch is provided to inform to the care taker. Smart wheelchair has gained a lot of interests in the recent times. These devices are useful especially in transportation from one place to another. The Battery indicator is given to check the availability of the battery charge. Thus, it is a smart wheelchair which is cost-effective and can assist people in their daily work.

I. INTRODUCTION

Wheelchair is one of the most commonly used assistive devices for enhancing the personal mobility of people with disabilities. According to the World Health Organization an estimated 1% of the world's population or just over 65 million people need a wheelchair. Over 6.1 million people in India have movement related disability.

The overall objective of this project is to restore autonomy to disabled people by helping them use a powered wheelchair independently. Independent mobility is recognized as an important factor necessary for socio-cognitive development of an individual The wheelchairs are usually controlled through a joystick. However, using a joystick might not be possible for many patients who might have sensori-motor or cognitive impairments .

According to an estimate by United Nations], around 10% of the world’s population, or 650 million people, live with disability. Eighty percent of this population live in developing countries. According to US Census Bureau, there are approximately 56.7 million people living in United States had some kind of disability in 2010 and this accounts for 18.7% of the US population. About 12.3 million people aged 6 years and older needed assistance with one or more activities of daily living (ADL). In India, disability constitutes

approximately 5% (2% in 2001) of the population out of which at least 8% have locomotion related disabilities. A significant proportion of this population would be benefited from a smart wheelchair to help them with their activities of daily living (ADL).

A smart wheelchair consists of a standard powered wheelchair with an on-board computer and a collection of sensors. A smart wheelchair usually implements a shared control architecturewhere the control of the wheelchair is shared with the user while minimizing the human effort in carrying out various tasks like target acquisition, navigation, path planning, localization and obstacle avoidance etc.

The first smart wheelchairs were basically typical mobile robots to which seats, capable of accommodating user, were added. Nowadays, science allows having smart wheelchairs, very similar in shape to traditional wheelchairs, with high manoeuvrability and navigational intelligence, with units that can be attached and/or removed and with high power independence

In this paper, we describe the design and development of a smart wheelchair with a focus on minimizing the sensor and computational requirement thereby making it affordable to larger section of the population residing in developing countries. We avoid the use of expensive sensors like Laser, motor encoders, gyros etc. Our aim is to use better algorithms and software to compensate for the absence of sophisticated sensors. We believe that a smart wheelchair with a set of features currently available with many of the existing platforms could be provided at a cost of USD 2000. While lower cost will make this platform affordable to larger section of population in developing countries, the proposed design could bring down the overall healthcare cost also for the patients in developed countries who use smart wheelchair for their daily activities.

II. SYSTEM DESCRIPTION

2.1Navigation subsystem

This subsystem deals with the navigation of the wheelchair. It is used by the user to move the wheelchair in any desired direction. The subsystem mainly comprises of accelerometer and manual switch .

The subsystem consists of a small navigation pad . On tilting the pad in the desired direction of motion, the chair moves accordingly. The readings of x and y-axis are taken from the accelerometer and are compared against upper and lower limit, if they lie within the threshold, action is performed. This process also prevents motion of the chair due to abrupt high readings obtained from the accelerometer due to its accidental jerking. The manual switch is used for direction indication purposes. It is of great help for the visually impaired persons.

2.2 Voice guidance subsystem

Speech recognition refers to comparing a said command to a predefined library of words and identifying the said word. We have explored quite a few software packages related to speech recognition during the development of our project. Though it was quite efficient, it had a large library which was redundant for our use.

For this project, we also developed our own speech recognition algorithm using some of the basic concepts of speech recognition . We also create our own library of words to be used. We recorded samples of one of the authors, saying 4 commands namely “left” ,“right” ,“front” and “back”.

2.3Obstacle detection subsystem

This subsystem is responsible for the detection of obstacles. It consists of IR transmitter and receiver. these emit sound waves whose frequency is well above the perceivable frequency range of the human ears. These sounds waves when strike an object, gets reflected and are received by the sensor **.**

Infrared (IR) transmitters and receivers are present in many different devices, though they are most commonly found in consumer electronics. The way this technology works is that one component flashes an infrared light in a particular pattern, which another component can pick up and translate into an instruction. These transmitters and receivers are found in remote controls and all different types of devices, such as televisions and DVD players. Peripheral devices that include this technology can also allow a computer to control various other consumer electronics. Since infrared remotes are limited to line of sight operation.

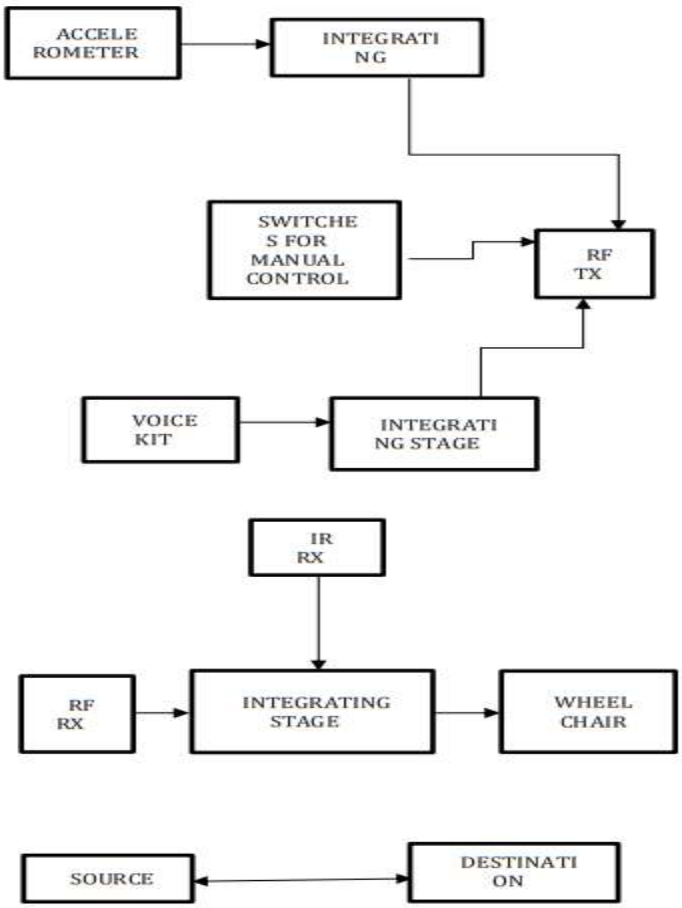

Fig1.Block diagram of the system

2.4 LCD display subsystem

LCDs can add a lot to any application in terms of providing an useful interface for the user, debugging an application or just giving it a "professional" look. The most common type of LCD controller is the Hitachi 44780 which provides a relatively simple interface between a processor and an LCD. Using this interface is often not attempted by inexperienced designers and programmers because it is difficult to find good documentation on the interface, initializing the interface can be a problem and the displays themselves are expensive.

The most common connector used for 44780

Based LCDs is 14 pins in a row with pin centres 0.100 apart.

III. FUTURE SCOPE AND DEVELOPMENT

Our future work will include incorporating iris tracking capabilities which will help the user in navigation and will further enhance the accessibility of the chair. We are also considering incorporating line following system in the wheel chair which will add to its autonomous capabilities and will help the user reach the destination without many efforts.

We also aim to use this wheelchair as a tele-medicine platform where the diagnostics of the patient could be recorded through an array of sensors mounted either on the wheelchair or on the body and transmit it to a remotely located doctor. In case of emergency, the wheelchair can raise and alarm and inform a tele-operator for assistance.

IV. MERITS AND DEMERITS

MERITS:

- The elderly and disabled use of power wheelchairs has increased dramatically. Power wheelchairs are often called electric wheelchairs
- The greatest advantage of a power wheelchair is the ease and convenience it supplies.Even though power chairs do have an electric motor, the controller is still the person in the chair. Some power wheelchairs are operated by the hands, some by the mouth or any other functioning body part.
- This project will be very much helpful for the people who are physically challenged and they can lead their life independently.

DEMERITS:

- Usually a Smart wheelchair cannot collapse or disassemble. Many people who must travel might not have a van or bigger vehicle to keep the power wheelchair.
- One time investment cost

V. CONCLUSION

The main focus of this paper was on the state of the art on smart Wheelchairs and simulators as important instruments for testing and training. This survey may be quite useful for anyone researching on the areas of adapted user interfaces,smart wheelchair health applications for handicapped users or simulation of health devices. Although several smart Wheelchair prototypes are being developed in several research projects, around the world, the adaptation of their user interface to the patient is an often neglected research topic

The system has proven to be of simple implementation and cost effective. The results obtained clearly imply that the system is easy to handle by the patients. The system is equipped with accelerometer for the movement of the chair and IR sensors for obstacle detection. Voice guidance system of the chair guides the user through the way at each and every instant. Thus, proposed system is a realistic, efficient and a good way to assist the daily needs of the person in need.

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