Automated Wheelchair using Android Technology

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Abstract: The motivation behind ANDROWHEEL project is to build an automated wheelchair that helps the physically disabled peoples. Many wheelchairs are available with various running technologies, but the cost is very high and it is not much effective. Mostly, the idea of building ANDROWHEEL is to overcome some disadvantages of the existing systems. The wheelchair is controlled with the help of an android mobile application. The purpose of selecting the android platform is that nowadays android mobile phones are commonly used. The user has to first get connected with the wheelchair with the help of application. The user then has the GUI to control the wheelchair. This system allows the user to robustly interact with the wheelchair at different levels of the control (left, right, forward, backward and stop) and sensing. The other components that are required in the system are microcontroller, motor and sensors. The sensors are used for the obstacle detection. The main motive is to let the system be more simple and efficient. The proposed system will be efficient in terms of cost and in terms of response time also.

1. Introduction

1.1 Background of the project

The 2011 census reported increase in country's disabled population by 22.4% between 2001 and 2011. In 2001 count of disabled was 2.19 crore in 2001, which to 2.68 crore in 2011 of which 1.5 crore are males and 1.18 crore are females. Most of the disabled are those with physical disability, accounting for 20.3% for total disabled population.¹ The population of disability is increasing due to various reasons as road accidents, premises fall, suicide attempts, natural disasters such as earthquakes, etc. There should be some means of machine that could provide this population to make locomotion (locomotion means to move from one place to another). The locomotion may in a limited environment i.e. inside the house or external environment.

1.2 Support to the disabled peoples

This population needs a support that is provided by wheelchair. The normal pushing wheelchair is the primitive one in which the user has to push the chair with the hands. It has a stress on the user when travelling for a long distance. So with the help of technology and human intelligence the idea of automated wheelchair was evolved. An automated wheelchair is based on some input interfacing machine which provides input to the motor. The motor processes the input provided and takes the corresponding action (in terms of movement – move left, front, back, right). With the introduction of android Smartphone in the system, the working becomes less complex. The system becomes quite user-friendly to the user.

2. Literature Survey:

In the past few years, many projects related to wheelchair have been developed. Some of the existing systems are based on the input provided by joystick, eye-ball movements, gesture-based, voice-based, patterns made by hand In last few years, many projects related to wheelchair and brain signal (neural) based etc.

In joystick based wheelchair person with different disabilities may find it difficult to move joystick as it requires considerable amount of force moreover it may affect the reaction time of the wheelchair which may be dangerous.² In the eye-ball movements [4] controlled wheelchair and head/neck [5-7] movement controlled wheelchair, the user has more stress on the eyes/head/neck. In this case, user has restricted sight as the motion of the eye-ball/head/neck is taken as an input by system that can give wrong output for that instance.

Voice controlled system [8] can provide inaccurate response in noisy environment and it can become difficult for the user to locomote in such environment.
In Accelerometer-based controlled system[9], the tilting direction of the mobile phone should be precise to receive accurate result. And moreover it will be complex for people with disabilities in wrist movements.

And pattern recognition based system[10] will require training of the user as well as the system. The training of the system will vary for different users.

Also in brain signal controlled system[11] acquires and converts the brain signal to give direction signals. This signals are generated due to electrical activity that is stimulated by brain...but brain signal cannot be relied on for motion of wheelchair as in some external electric field the device may not able to capture the accurate signal.

3. Proposed System:

In this project, the movements of the wheelchair are controlled with the help of an Android application. Graphical User Interface(GUI) is provided via the application to the user to control the wheelchair movements.

4. Implementation:

4.1 Implementation Platform:

- Hardware Requirement
  - Arduino UNO
  - Bluetooth Module
  - L298D Motor driver
  - Battery 13volts
  - 2 DC Motors
  - Android phone

- Software Requirement
  - Android Studio
  - Arduino programming

4.2 Implementation Details:

Currently the prototype of the project has been developed. The figure below depicts the same.

The above figure is the block diagram of Androwheel. The proposed system uses touch-screen-based android mobile to control the wheelchair. An android application is to be developed for this purpose. The android mobile is connected to microcontroller fitted inside wheelchair via Bluetooth controller.

The provided application gives simple user-interface to the user for selection of direction for motion of wheelchair. Based on selected input, the corresponding signal is sent via Bluetooth controller to microcontroller, which takes actions as a form of output. If the user selects the front direction, than both the motors are made to move in the same direction and with same speed. Similarly is for the reverse direction. If the user wants to move in the left/right direction than polarity of both the motors are reversed correspondingly.
The above figure is the screenshot of the application to control the ANDROWHEEL. It can be seen that there is a button to select the Bluetooth device. User first connects the mobile with the ANDROWHEEL. Then, the user can control the wheelchair with the help of various buttons provided on the application interface.

5. Result & Analysis:

The proposed system will have an advantage of efficiency and robustness as the controlling is based on android application that provides a GUI to the user.

Following are the assumed values for the calculation of effectiveness.

0%-34% - Low
35%-67% - Medium
68%-100% - High

The above table and graph shows the comparison of the proposed system (ANDROWHEEL) with the existing system.

The comparison is made on three parameters viz. Response delay, cost and stress factor. It can be seen that the existing system has low response delay, cost is also reduced and there is no much stress on the user.

6. Future Scope:

The system can be adapted to make it for the external environment by adapting the GPS location and the user can make selection to go through it.

The other way is that the path will be stored as the video and the wheelchair can travel automatically by recognizing various past patterns.

7. Acknowledgement:

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8. Conclusion:

Using ANDROWHEEL differently abled people can locomote from one place to another without requiring help from other person and also without requiring physical stress. The user interface of android application is simple and easy to use. Obstacle detection provides ease of navigation without colliding with objects in its way. The response is quick and accurate.

9. References:


