Survey on Automated Wheelchair

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Abstract

Nowadays many people are suffering from permanent or temporary disabilities due to accidents or some illnesses. Such a rapid growth in the number of accidents leads to loose self-mobility of person, so automated wheelchair serves as important tool for the handicapped people when person is dealing with difficulties in movement. The wheelchairs that are usually spotted rely on somebody else for their movement from one place to another. The system is customized taking into consideration the problems faced by handicapped people. So researchers developed the smart wheelchair that aims to solve such problems. This paper is to review studies on wheelchair movement using various techniques. The wheelchair has multiple features that help people in overcoming their weakness. It includes various techniques such as head rotation, voice commands, obstacle detection, staircase climbing.

Keywords- Smart wheelchair, Quadriplegia, Sensors, Staircase climbing, Microcontroller.

I. INTRODUCTION

Due to the increased percentage of physically disabled people, wheelchairs are the best assistive device to help them enhanced their personal mobility. The traditional wheelchairs have some limitations such as flexibility, bulkiness and limited functions. Traditional wheelchair requires assistance of third party or a lot of human efforts for its movement. Along with the dependency factor, there is risk of accidents. Due to this, even after being helping hand for handicapped people it becomes a little inconvenient for them to efficiently move the wheelchair. There are existing technologies which allow the users to use human gestures such as movement of head, movement of leg and synchronize them with the movements of the wheelchair for better wheelchair controls. Hence there is an increasing need in automated or more customized wheelchair.

A smart wheelchair is developed to help an elderly or physically disabled person to move from one place to another independently. For this wheelchair consist of multiple features like obstacle detection, various movement mechanisms such as voice commands, head rotation and one additional feature includes staircase climbing. The system focuses on integration of these entire features into single wheelchair. An automated feature provides an easy access to the wheelchair that makes the movement of wheelchair reliable. A smooth movement of wheelchair can also be achieved through this automation.

The multi-featured wheelchair would provide self-mobility to the patient to operate the wheelchair by their own, without need of another person to operate it. With this ability wheelchair are designed for the self-movement purpose and providing it with some automated features that would also decrease the risk of accidents. In this way, it would prevent the dependency factor and provides various features.

II. METHODS

A. "**Implementation of smart wheelchair using voice commands**".

Sumet Umchid et al., [1] has developed wheelchair which is able to operate using the voice commands through the given input. It consists of motor system, voice recognition module that would be controlled by the microcontroller. The microphone is used to convert voice commands into electrical signals which are transferred to voice module. According to voice commands voice module gives output to microcontroller.

Zannatul Raiyan et al., [2] has implemented arduino based voice controlled automated wheelchair. It consists of arduino, speech recognition module, relay based motor controller circuits. Speech is given as input to transducer then it is forwarded to speech recognition device designed with arduino and speech recognition module. The speech recognition device processes the data and matches it with trained data and if command matches then digital signal is forwarded to microcontroller.

Shridevi soma et al., [3] has proposed voice controlled wheelchair that uses android application text-search with the help of its artificial intelligence and the wheelchair moves according to given commands. The movement of wheelchair is controlled over Wi-Fi network which is connected through various modules including interfacing between android application and raspberry pi.

Romil Chauhan et al., [4] has developed wheelchair based on concept of artificial intelligence which uses raspberry pi for controlling device, USB microphone for voice input. In this microcontroller act as interface between voice recognition unit and motor driver system.

B. **"Implementation of smart wheelchair using head rotation".**

 Prannah Dey et al., [5] proposed wheelchair associated with accelerometer gives input to microcontroller through different postures of head movements. Two DC motors has been used to move wheels in different position. Microcontroller sends command to right and left DC motor. Arduino UNO controls the direction of wheelchair using relay. The wheelchair has been powered by solar panel.

Sanket Sameer Bagewdi et al., [6] developed wheelchair in which head movement is measured by the tilt of accelerometer that send appropriate value to arm processor with the help of zigbee trans-receiver. Arm processor is connected to DC motors and DC motors attached to wheels start rotating and the required movement of wheelchair is achieved.

Razvan Solea et al., [7] it proposes a novel head pose controlled algorithm to assist disabled patients. The control procedure is divided into two parts. First one is responsible for data acquisition of head

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position and comparing with initial position of head, this domain establishes the movement direction and send movement ratio to the motors. And second part is motor control domain.

Ericka Janet Rechy- Ramirez et al., [8] developed wheelchair which has two operation modes based on head movements. Mode one uses only one head movement to give commands and mode two employs four head movements. The proposed two control modes uses gyroscope to detect head movements.

C.   "Implementation of smart wheelchair using staircase climbing".

Sumedh Kulkarni et al., [9] has developed wheelchair which will be able to climb the staircase. The system consists of two long pair of large wheels placed at backside along with pair of star shape front wheel. The choice of star shaped wheel is because it gives spider like structure to the wheelchair which helps to climb the stairs. Gears are used to restrict free movement of front and back wheels. In order to give direction to chairs various mechanisms are used such as joystick movement, steering wheels or touchpad, gesture based movements.

Murray J. Lawn et al., [10] has presented the wheelchair using high single step capability. This mechanism is based on front and rear wheel clusters which are connected to the base via powered linkages. It permits both autonomous stair ascent and descent in the forward direction.

Luis A. M. Riascos [11] has implemented the wheelchair for staircase climbing by using only two motors for locomotion. The top chair is able to climb over obstacle and to go up and down stairs. Different types of motions can be obtained by only one motor, the wheelchair passively changes its functioning mode from rolling on wheels to stepping on legs.

Sherif Abdulatif et al., [12] has introduced mirror based two dimensional Frequency Modulated Continuous Wave (FMCW) radar scanner for the detection of stairs. A radar image based stair dimensioning approach is presented and tested under laboratory and realistic conditions.

III. SUMMARY

The recent research work of automated wheelchair focuses on independent movement of wheelchair. This paper presents multiple features for automated wheelchair like head rotation, voice commands, obstacle detection and staircase climbing. Though some low cost wheelchair projects are done, no new design is proposed for low cost multiple function facilities. This research work presents a new multifunctional wheelchair with the help of different sensors, which will help the handicapped people to operate it independently.

REFERENCES

[1] Sumet Umchid, Pitchaya Limhaprasert, "VOICE CONTROLLED AUTOMATIC WHEELCHAIR", The 2018 Biomedical Engineering International Conference (BMEiCON-2018).

[2] Zannatul Raiyan , A.K.M Asif Adnan "Design of an Arduino Based Voice-Controlled Automated Wheelchair", 2017 IEEE Region 10 Humanitarian Technology Conference (R10-HTC) 21 - 23 Dec 2017.

[3]   Shridevi soma, Nandita Patil , "An Approach to develop a smart and intelligent wheelchair", IEEE-434880, 9th ICCCNT 2018 July 10-12, 2018, IISC, Bengaluru Bengaluru, India.

[4]   Romil Chauhan , Yash Jain, "Study of Implementation of Voice Controlled Wheelchair", 2016 3rd International Conference on Advanced Computing and Communication Systems (ICACCS -2016), Jan. 22 – 23, 2016, Coimbatore, INDIA.

[5]   Prannah Dey, Md. Mehedi Hasan, "Smart wheelchair integrating head gesture navigation", 2019 International Conference on Robotics,Electrical and Signal Processing Techniques (ICREST).

[6]   Sanket Sameer Bagewdi, Shikhar Dev, "Design and Development of Smart System to Assist Quadriplegics", EEE INTERNATIONAL CONFERENCE ON ADVANCES IN ENGINEERING &TECHNOLOGY RESEARCH (ICAETR - 2014), AUGUST 01-02, 2014, DR. VIRENDRA SWARUP GROUP OF INSTITUTIONS, UNNAO, INDIA.

[7]   Razvan Solea, Daniela Cernega, "Head Movement Control of Powered Wheelchair", 2019 23rd International Conference on System Theory, Control and Computing (ICSTCC).

[8]   Ericka Janet Rechy- Ramirez, Huosheng Hu, "Head movements based control of an intelligent wheelchair in an indoor environment", Proceedings of the 2012 IEEE International Conference on Robotics and Biomimetic December 11-14, 2012, Guangzhou, China.

[9]   Sumedh Kulkarni, Beena Ballal, "Staircase Climbing Smart Wheelchair", International Conference on Electronics, Communication and Aerospace Technology ICECA 2017.

[10] Murray J. Lawn, "Modelling of a Stair-Climbing Wheelchair Mechanism with High Single-Step   Capability", IEEE TRANSACTIONS ON NEURAL SYSTEMS AND REHABILITATION   ENGINEERING, VOL. 11, NO. 3, SEPTEMBER 2013.

[11] Luis A. M. Riascos, "A low cost stair climbing wheelchair" 978-1-4673-7554-2/15/$31.00 ©2015 IEEE.

[12] Sherif Abdulatif, Bernhard Kleiner, "Stairs Detection for enhancing wheelchair capabilities based
on Radar Sensor", 2017 IEEE 6th global conference on consumer electronics.