Design and Construction of a Smart Wheelchair

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ABSTRACT

The real objection people have an emergency in walking due to illness or injury. The suggested system is easy and efficient to solve the problem of the disabled person, and it is unique and fully automatic. A wheelchair provides the umbrella, Foot mat, Head mat, and obstacle detection, which does not depend on the ability to participate in society. The humidity sensor checks the weather (rainy/hot/cold), and the head mat works automatically. Also, the ultrasonic sensor is used to detect the obstacle according to the location tracking by the GPS. A prototype system implementation shows that the proposed day/season based system is efficient in interacting with a living environment.

Keywords: Sensors, Collisions, Smart wheelchair, Season.

1. Introduction

World today makes a huge difference to people with restricted mobility. According to Nayak et al. [1], 650 million people have a disability. The advancement in technology highly furnishes the people who have a disability. Hartman et al. [2] described a wheelchair is a chair with wheels that helps the people who face difficulty in walking independently. The previous models of wheelchairs provided a way of locomotion for the disabled, did not reduce their dependence on their guardians in many ways. Akash.et al. [3] described is to make these physically impaired people self-dependent. Dalsaniya and Gawali [4] took the help of the voice of handicapped as input, whereas some with the GPS location.Wanluk [5] designed wheelchairs using GPS systems for location tracking and obstacle detection. Our model is unique and more efficient as it notifies the guardian of the hurdles and collisions during the movement of the chair according to the location tracking systems through GPS on their smartphone. It also detectsthe weather conditions for usage of the umbrella and foot mat that introduced in our smart wheelchair. Some features of the wheelchair work following the person's mood, making the wheelchair fully automatic and exclusive. The suggested modern, labor-saving smart wheelchair is a far cry from the previously used inefficient wheelchairs and is a step towards content and independent lifestyle for the physically challenged. Various researchers have discussed GPS procedure that works wheelchair. However, in this research paper, we have discussed a smart wheelchair that works according to the weather conditions and different moods of the disabled person. A standard wheelchair cannot predict whether the day is sunny or rainy. We have proposed various objectives in this research paper that highly differentiates the ordinary wheelchair. An ordinary wheelchair cannot detect whether the day is rainy or not. But our wheelchair has sensors to detect the weather. Automatic foot mats appear in the rainy season when the roads covered with water that protects their feet. Moreover, if the person feels cold, he/she can also take head mats in this wheelchair.

Various organizations help these people. The organizations also take wheelchair equipment donations, and these organizations attempt to identify the receiver and match them with the donated equipment they have received.

2. Literature Review

Ghorbel et al. [6] explained the collaborative control of the smart wheelchair. They said that a wheelchair seeks to improve the lives of physically impaired people as well as their families. They use ATMega328 Microcontroller, joystick, 16X2 LCD to display the readings the multiple sensors for making the system more user-friendly. Sivakumar and Sudhagar [7] described that the intelligent wheelchair vehicle used for countless. They were solving this problem with the help of ATMega328 Microcontroller that demonstrates the arrangement and headway organize for Wheelchair. Reddy and Kumar [8] proposed the smart wheelchair, which connected to the mobile phone of the guardian as well as the social media. They explained with the help of an accelerometer, RDIF tags voice recording system, and a GSM/GPRS module attempt to find a way to incorporate an IoT service device so that the status of the patient regularly updated on a web server. Barriuso et al.[9] considered the portable electroencephalography based wheelchair, which is a voice interface or a specially designed

smartphone application. Bastos-Filho et al. [10] define the wheelchair using an independent BCI (Brain-Computer Interface), and this interface senses the brain waves. Puet al. [11] discussed the obstacle avoidance wheelchair, which consists of an RGB camera, an IR camera, a LIDAR, and ultrasonic sensors. Ghorbel et al. [12] recognition system is used to process pressure sensor signals for the detection of the user's posture in the wheelchair by mining the hidden information of the postures and using classification techniques namely Decision Tree (J48), Support Vector Machines (SVM), Multilayer Perception (MLP), Naive Bayes, and k-Nearest Neighbor (k-NN) the cushion.Malhotra et al. [13-17] discussed the construction and design of a device for obstacle detection and reliability of systems.

3. Methodology

In general, the wheelchair facilitates people with more disabilities in their daily lives by allowing them to independently move with the help of an assistive and straightforward interface. The project offers Proportional controls that allow simultaneous control of speed and direction of the chair with the aid of a microprocessor (Microchip PIC16F88 microcontroller) and the advent of interactive technology.

System Architecture

The user input options are as follows:

- Reinforced joysticks: The userprovided with a simple but effective control mechanism, and the joystickacts as the perfect fit for the particular task.

- Directional Buttons: As a convenience addition and a backup option a directional button system is also provided that takes input from the user.
- Mobile app-based control: For security reasons and for the sake of convenience, the chair has controlled by a mobile application. The family of the user (with some paralysis) helps him that they can't interact with thesystem by themselves.
- The inputs so received by the installed Wi-Fi Module sent to the control board, which then communicates the orders sent by the user through the control interfaces to the wheelchair motors.
- Manual control of the installed umbrella: Although with the help of sensors, the umbrella is automatically controlled.
- Single switch control of the height of the footrest: The user can control the height of the footrest with a single switch control provided along with the directional buttons.

In the next section, the proposed system explained. Some of the hardware and software components shown below:

Peltier Transducer*:*As an alternative to commonly used passive cooling techniques, thermoelectric cooling can offer numerous advantages. These include accurate temperature control and faster response, the opportunity for fanless operation (subject to heat sink performance), reduced noise, space savings, reduced power consumption, and the ability to cool components to sub-ambient temperatures.

Fig.1 Peltier Transducer

Temperature and Humidity Sensor: The system has been equipped with DHT11 to get precise atmospheric readings to calibrate the under mentioned umbrella.

Fig.2 Temperature Sensor

Ultrasonic Proximity sensor*:* For sake of providing maximum security to the user, the JSN-SR04T, havingboth high precision and waterproofing, has been installed in the chair.

Fig.3 Ultrasonic Proximity Sensor

Reinforced Joysticks*:* The user provided with a simple but effective control mechanism, and the joystick acts as the perfect fit for the job. The user input fed to the circuit board, which then drives the DC motors installed in the desired manner.

Fig.4 Reinforced Joystick

Working of a Wheelchair

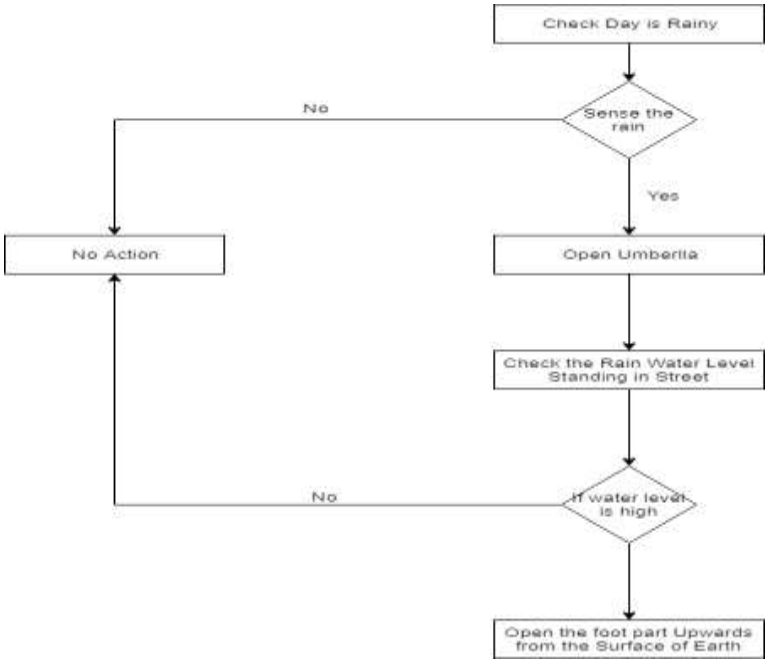

Fig.5 Flowchart of Working of Wheelchair

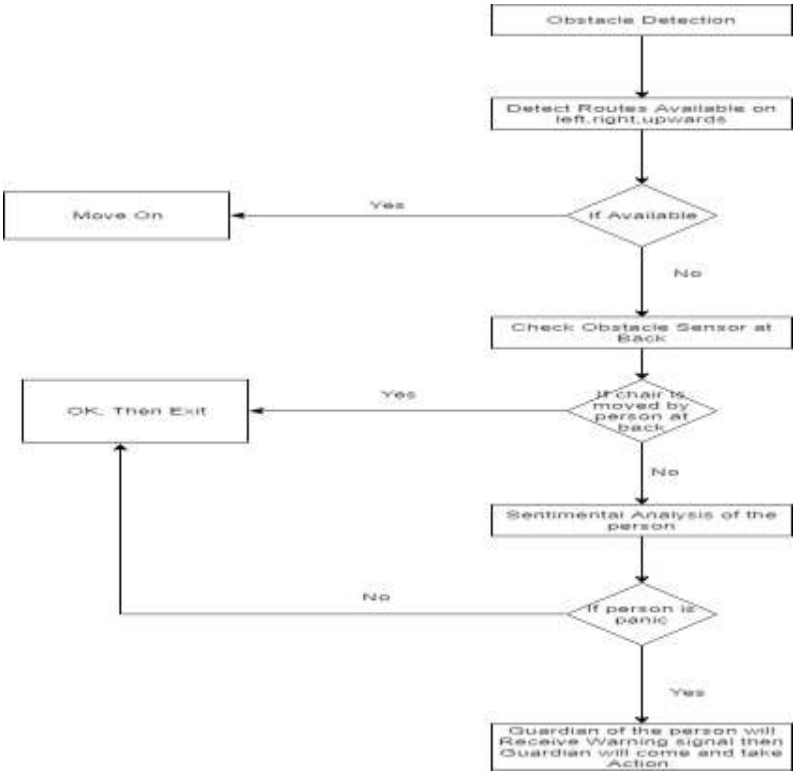

Fig.6 Algorithm of Obstacle Detection

4. Results and Discussions

This project implementation helps disabled people who are dependent on their basic needs. Sometimes their mood isnot good. Then the umbrella is so simple to operate and doesn't need any external help. The head mat operates according to feelings of personal mood. The foot mat helps during the rainy days. All the common man can reach out due to this wheelchair to become independent if the guardian holds a smartphone.

5. Conclusion

A prototype system implementation shows that the proposed day/season based system is efficient in interacting with the living environment. So there is some manual work, and in our, it is fully automatic and unique. Thus, the authorsable to make a chair that acts as a moving chair and a wheelchair (with foot mat during rainy days) depending on the need of a person using Location Track through GPS and Open Head mat using Pettier Transducer.

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