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"VOICE CONTROLLED WHEEL CHAIR"

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ABSTRACT

The elderly, as well as millions of other people, suffer from paralysis and disability, which makes them physically unable to interact normally and adhere to the demands of life. Wheelchairs are important tools to enhance the mobility of persons with disabilities. Developments in computers and communications technologies have contributed to the availability of smart wheelchairs that meet the requirements of a disabled person. In order to help the handicapped to carry out their daily work, many attempts have been made to apply modern technologies in computers and communications to build smart wheelchairs that suit their needs. These wheelchairs need to be equipped with a real-time computer control unit and a set of sensors for navigation and obstacle avoidance tasks. A disabled person can control a wheelchair by simply moving a part of the body, using sound or brain signals. The method of generating commands for guiding the wheelchair depends mainly on the patient's condition and degree of disability or paralysis. In our previous research, the brain-computer interface based on electrooculography (EOG) signals was used to control an electric wheelchair. In this paper, the voice will be used in guiding the wheelchair. Voice recognition has gained increasing importance in computer-controlled applications. Voice recognition techniques evaluate the voice biometrics of a person, such as the frequency, flow of voice, and accent.

1. INTRODUCTION

The proposed system consists of four main components, namely an electric wheelchair, voice recognition unit, real-time control unit, and position tracking unit, as illustrated. A low-cost microphone is used as voice sensor to record the person voice. The recorded voice is then sent to the voice recognition unit, which will verify the required action, based on his/her voice. A single-chip microcontroller has been used to communicate serially with the intelligent voice recognition unit. The navigation and steering of the wheelchair has been controlled using an adaptive neuro-fuzzy inference system.

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The wheelchair can be driven using voice commands (high-level control) and with the possibility of avoiding obstacles (low-level control). Both PID controller (for position and speed control) and fuzzy controller (for obstacle avoidance) were used in the proposed system.

2. TECHNOLOGY

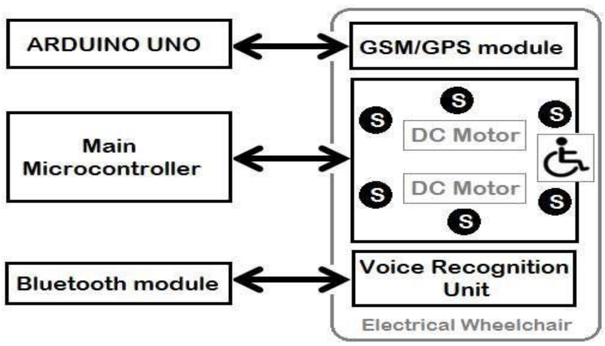


Fig 1.1: Hardware Technology

a. Overview of voice controlled wheel chair

Fig 1.1 shows the proposed model of the system. Line follower section is used to reach the specific section of hospital. This whole section also follows the same control procedure i.e. the use of BT Voice Control application which is installed in an android mobile Optical character recognition. The patient has to speak the name the particular section which are K, M and V. Line follower section consists of four pair of IR sensors and one pair ultrasonic sensor. IR sensors are the main triggers of the whole line following action mechanism. IR sensor is basically a transceiver. It consists of one IR LED as transmitter and one Photodiode as receiver. The transmitter section of IR sensor emits infrared light whch will be received by receiver diode and according to the intensity or pulse width of receiving light the decision of the movement has been taken by the wheel chair. There are two types of strips in line following path which are black strip and white strip.

A voice recognition unit (VRU) is required to provide communication channel between computer and human voice. This interface is mainly based on feature extraction of the desired sound wave signal.

There is no reflection from Black strip, low or ('0') logic will reach to microcontroller and when there is white or reflective surface there is high reflection and a high or ('1') reaches to microcontroller.

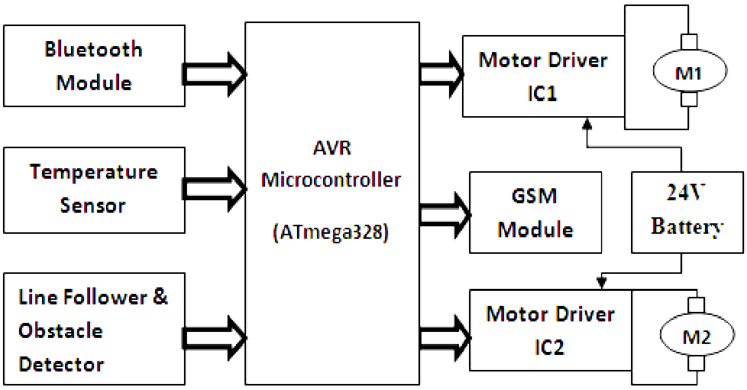
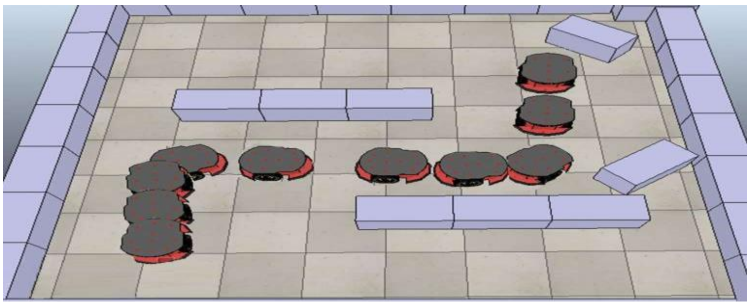


Fig 2.1: Block Diagram of the Proposed Model

Fig 2.1 shows the proposed model of the system. During the past twenty years, there has been exponential growth in voice-controlled applications, especially after the launch of smartphones, where more sophisticated voice recognition software products have been developed. Voice recognition techniques are classified into two types, namely speaker dependent and speaker independent. The speaker dependent system is based on training the person who will be using the system, while the speaker independent system is trained to respond to a word regardless of who speaks. The first type demonstrates a high accuracy for word recognition, thus it is recommended for a voice-controlled wheelchair. A voice recognition unit (VRU) is required to provide communication channel between computer and human voice. This interface is mainly based on feature extraction of the desired sound wave signal. The implementation of fuzzy logic as a decision tool and artificial neural network as a modeling methodology will help designers to investigate controllers without the need for accurate

3. WORKING PRINCIPLE

The principal part of the software implemented in this research work is the extraction of voice features. The implemented software enables the voice signals to be read and processed from a built-in microphone into command. It sends the command signal over a Bluetooth connectivity module to the microcontroller.



3.1: V-REP simulation during obstacle avoidance

Fig 3.1 shows the Image V-REP simulation during obstacle avoidance A real-time simulator was developed that integrates knowledge about the wheelchair and its working environment to illustrate wheelchair actions and how it will act according to the voice commands. The speed responses for both left and right motors to the five commands provided by the voice recognition module are demonstrated.

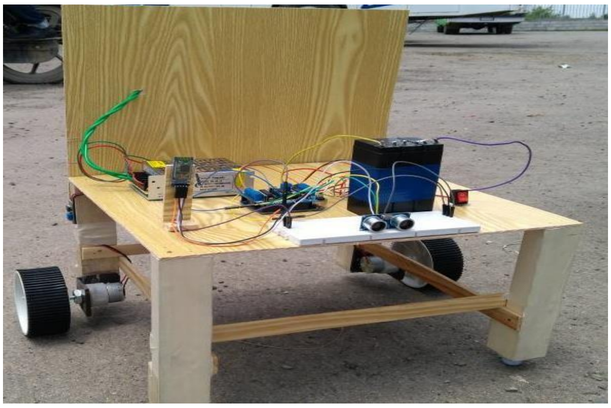


Fig 3.2: The prototype model of the wheelchair

Fig 3.2 shows the Using such a technique will update the location and the battery level situation for the owner by sending an SMS each 15 or 20 min, or any time could be indicated depending on the patient's situation, to inform him the location of the wheelchair located and what is the battery level. The owner can send SMS with the command "check" and the wheelchair system will reply immediately with SMS showing the status of the wheelchair (location & battery level). Moreover, once the stop command been activated tostop the wheelchair, a timer will start counting time, if the timer reaches three minutes and no forward action been executed, an emergency SMS will be sent to the owner telling him that the wheelchair is stopped for more than three minutes and the patient or the user might be in a trouble or might be in a sleeping situation. More safety consideration has been included using the GSM/GPS technique.

Advantages:

- This project describes the design and development of the motion control using voice recognition and graphical Android App for a wheelchair application.

4. APPLICATIONS

- Easy to drive with negligible efforts.
- Less Complexity and Hardware to mount.
- Can be mounted on the existing wheelchair.
- Wireless control helps to monitor the wheelchair.
- Reduces manpower and dependency on other human drive.
- Wheelchair is compact and economical.
- Provides easy movement for physically challenged people.
- Low power consuming and easy to operate the wheelchair.

5. CONCLUSION

An ANFIS based voice-controlled wheelchair was designed and implemented to support individuals with physical disabilities. By using voice instructions, the patient can control the electrical wheelchair. The functioning and overall performance of the implemented wheelchair prototype system was tested using various test commands and perturbations. The results obtained from the simulator and prototype model demonstrate that the use of the ANFIS based controller together with online sensor signals can maximize wheelchair performance and improve the quality of life of physically challenged people. The implemented prototype has many benefits, including simplicity, inexpensive,position tracking, and safety. It has a set of sensors to detect static and dynamic obstacles as well any slippery roads. A feed-forward multilayer neural network with (7-25-10-5) topology of input, hidden and output layers was implemented for classification to recognize the voice of individual speakers with suitable datasets for training and testing.

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