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Eye-Gaze Monitored Unmanned Motorized Wheelchair using Eye Blinking Sensor

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Abstract: *The challenging problem faced by the disabled people is their independent mobility. They need an external help to perform their day to day activities. The main objective of this project is to provide a security system for disabled people. The wheelchair will work based on the eye blinking movement of the user. The recognized blinking counts are used to generate motion control commands to the controller so that it can control the motion of the wheel chair according to the user intention. The direction command relates to the movement direction of electric wheelchair, and the timing command relates to the time condition when the wheelchair should move. The timing command with eye blinking mechanism is designed to generate ready, backward movement, and stop command for the electric wheelchair. Furthermore, to move in certain velocity, the electric wheelchair also receives the velocity command beside the direction and timing command. The disturbance observer based control system is used to control the direction and velocity.*

Keywords: *Gestures, Eye blinking measurement, Electric wheelchair control.*

I. INTRODUCTION

In modern days there is an increase in the population drastic and so many of them are affected by paralyze attack. To support the paralyzed people with several disability levels, the intelligent wheelchairs have been developed. In many cases, the eye muscles of paralyzed people function well. Therefore, by using the eye-gaze as an interface for mobilizing the paralyzed or physically disabled people. The project is useful for the patients where they can move their wheelchair in their own directions, without any third party's help or support. There are so many projects related to this wheelchair for disabled people. Such as they can move the wheelchair with the head movement, voice recognition and by using the joystick. These existing projects are costly and the poor people can't afford this project. To help the affected people financially the project will be cost efficient. In the project, there will be a wheelchair model as a Robot model, which will contain an in-built microcontroller and eye blinking system, which will perform the functions like right, left, forward and reverse operations. The wheelchair is designed in such a way that it can move freely without external support or dependency. Additional sensors are added to the project. That sensor will detect the distance in the way and find the speed of the wheelchair. Through this feature the patients can enable the movements of their wheelchair as per their desire. The gyroscopic sensor is placed on the foot plate of the wheelchair and it will sense whether the feet is placed on the foot plate or not. If the feet are not placed on the foot plate the signal is sent to the GSM SIM 900A module. The alarm message will be sent to one or more family members in case of some accidental situations to the paralyzed person such as falling down from the wheelchair. The alarm message will include the current location of the people where they fell down from the wheelchair.

II. LITERATURE REVIEW

There were many previous projects carried out on electric wheelchairs. A few of them helped us get ideas for our proposed system. In [3], a method is proposed to control the wheelchair using the head motion with the eye blinking sensor. They use accelerometer and ultrasonic sensors. In [6] they propose a new algorithm, the coherence algorithm, for eye movement tracking. The coherence algorithm monitors the movement of eye towards left or right.

The eye blinking gesture is also used by the algorithm to control the starting and stopping of wheelchair.

In [9], a method is proposed to control the motorized wheelchair using the camera to find the eye gaze directions along with the eye blinking sensor. Drawback: Eye blink is an involuntary action and if we try controlling the start and stop motion of the wheelchair through the blinking it will be difficult.

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III. PROPOSED SYSTEM

A. System Overview

The electric wheelchair system equipped with eye blinking sensors. The electronic system for control purpose is placed on the bottom of the wheelchair. The electric wheelchair adopts the differential command mechanism. The wheelchair design considers 4 important factors such as safety, easy to operate, cheap, and convenient. There are 4 commands applied to the electric Wheelchair as safety, timing, direction, and velocity. Safety command is to stop the wheelchair immediately in any situation. The timing command is used to run give the direction according to the blinking commands and used to stop the motion. The direction command is used to derive the direction of the wheelchair. The velocity command is set based on the speed of the wheelchair. The alert message is sent using the GSM SIM900A module which is connected with the gyroscopic sensor.

B. Block Diagram

Fig 1 shows the overall architecture of the assist systems that is composed of sensor design, the electronic module and the mechanical module. The sensor design comprises of gyroscopic sensor,

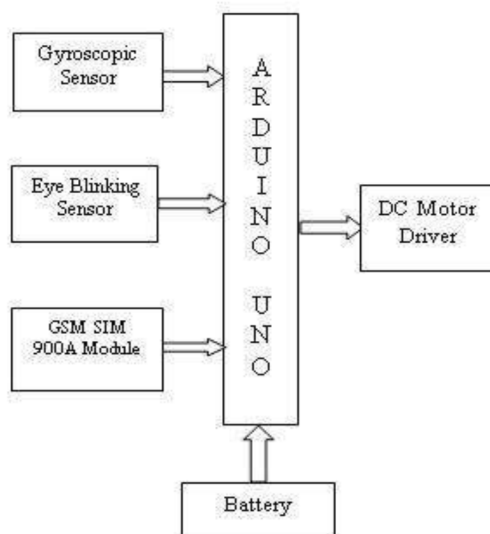


Figure 1: Overall architecture of electronic wheelchair

Eyeblinking sensor. The electronic module has an Arduino Uno microcontroller and a GSM SIM 900A module. The mechanical module consists of DC driver and motors.

C. Electric Wheelchair System

The system consists of eye blinking system and an electric wheelchair control system. All visual information processing that includes eye blinking interpretation, and safety detection, are carried out in eye blinking system. The eye blink count gives direction which generates the safety running of the wheelchair. The eye blinking and safety detection is generated command signal directly to the controller. In the wheelchair system gyroscopic sensor is placed on the foot plate and it will detect the distance of the foot whether it is placed on the foot plate or not. If the feet are not placed, it will decide that the person falls down and it will send the alert message.

D. Eye Blinking Sensor

The kind of voluntary and non-voluntary motion can be identified by the eye blink movements. The eye blink sensor senses the commands and detect whether the eye is open or closed. The eye-blink sensor works in the eyelid area with infrared light and then monitoring the changes in the reflected light using a phototransistor. When the eye is open, the LED is ON and OFF when the eye is closed.

5V (High) → LED ON

0V (Low) → LED OFF

E. Gyroscopic Sensor

Gyroscopic Sensor is used to sense whether the feet are placed on the foot plate or not. The Gyroscopic Sensor will sense the distance of the feet, which placed on the foot plate. It will send the signals to the microcontroller.

F. Arduino UNO Microcontroller

Arduino UNO is the micro-controller which is used to connect the sensors, modules and motors. In Arduino UNO, the program is coded to control the direction of the wheelchair and to send the alert message to the family members. The eye blinking sensor, GSM SIM 900A module is used to connect to the Arduino UNO. Using the eye blinking sensor commands the direction of the wheelchair is controlled using the microcontroller. The Gyroscopic sensor is connected to the microcontroller to sense whether the feet are placed on the foot plate or not.

G. Relay Driver Circuit

The circuit is designed to control the load. To drive the wheels of the wheelchair the load here is motor. The relay is used to turn 'ON' and 'OFF' of the motor. The electromagnetic switching device is called as relay. A relay consists of three pins namely common, normally close and normally open.

H. DC Motor Circuit for Forward and Reverse

The DC motor circuit consists of two relays called relay 1 and relay 2. The ON and OFF control of this relay are controlled by a pair of switching transistors. The Q2 and Q4 are the collector terminal which is connected to the relay. When relay 2 is in the ON state and relay 1 is in the off state, the motor is running in the reverse direction and vice versa for forward direction.

I. GSM Sim 900A Module

The GSM SIM 900A module is used to send and receive the messages commonly. The program is coded in the microcontroller to send the alert message to the one or more family members.

IV. ADVANTAGES

- A. User Friendly
- B. Helpful for the disabled people who don't have much stamina in the hands.
- C. Reduces the human dependability.
- D. Reduce the physical strain.
- E. Spontaneous output

V. RESULT

The electronic wheelchair that is controlled by the eye blinking sensor is designed. And the alert message is sent to one or more family members successfully.

VI. CONCLUSION

The proposed paper presents the model of a wheelchair that is controlled using an eye blinking sensor. The eye blinking sensor is controlled by the blinking counts of the eye and is used to steer the wheelchair. Along with making the eye blinking movement and control of the wheelchair easy for a disabled person we also try to give more independence to these people.

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