Research Paper

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Automatic Wheel Chair Control Using Eyeball Movement for Physically Challenged People

Physics

KEYWORDS : wheelchair, physically challenged people, eyeball sensor, user free movement

R.Venkatesh — ASSOCIATE PROFESSOR ,Department of Physics, PSNA College of Engineering and Technology, Dindigul, Tamilnadu.

R.Karthick — ASSISTANT PROFESSOR, Department of Physics, PSNA College of Engineering and Technology, Dindigul, Tamilnadu.

ABSTRACT

This paper provides a modern method to guide and control the wheelchair for physically challenged people based on their eyeball movement. In this method we use sensor based eyeball tracking system to control wheelchair. Eyeball sensor will generate distinct range of values for each position of eyeball (such as left, right, straight).This paper focuses the application to mobile and communication aid for physically challenged people. The proposed system involves two stages, first eyeball tracking and second sending of control signals to the arduino controlled wheelchair.

Introduction

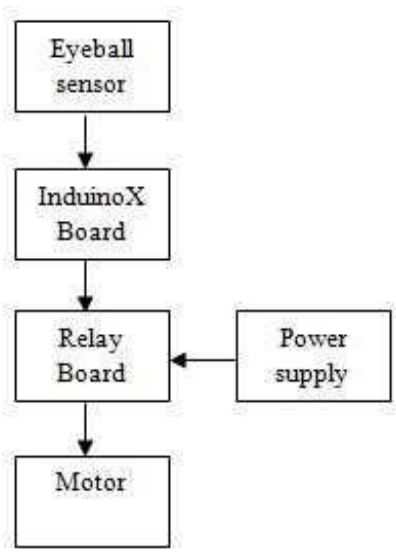
Transportation is a very important role in this advanced world. The world is moving towards automation. The aim of this project is to introduce automation in transportation for the physically challenged people. This project proposes advanced model of existing system .This existing system can operate using joysticks in hand or using head movement detection sensor. But this proposed system operates in eyeball movement detection.

Inside house physically challenged people reaching a desired destination is difficult. So, physically challenged people can't move freely inside their house they depend on others for their motion. Here with the help of eyeball movement sensor system, the new idea of providing a low cost, less hardware complex embedded system that helps the physically challenged people to move freely inside their house.

Proposed System

Our proposals importance is to serve all types of physically challenged people to move freely to smaller distances inside their residence. This system uses only eyeball detection using eyeball IR sensor. The sensor consists of two parts, one is infrared transmitter and another is receiver.

Fig 1: Flow of the proposed system.



Transmitter

Infrared transmitters and receivers are enclosed into a single unit and fixed in front of the goggles. Necessary wirings are taken through the goggles to the sensor processing. The person should wear the goggles for the sensor to work. Since the sensor is shielded it can be isolated from the external light, thus external light illumination will not affect the sensor output values.

Receiver

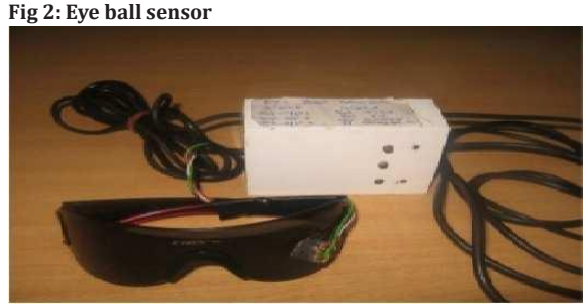
At the receiver side there will be LDR (Light Dependent Resistor) or these LDRs are used at the dark/light sensing area. Thus when the eyeball of the patient is illuminated by the light in the transmitter side, partial of the illuminated light will be absorbed by the black region of the eye and part of the light will be reflected by the white region of the eye as mentioned above. Thus by receiving the analog light pulses the LDRs (Light Dependent Resistors) at the receiver side which has ohmic resistance about 100000 will absorb the light, on absorbing the light pulses the ohmic values of the sensor will decrease or increase depending on the intensity of the light which in turn sends digital values as the output to the arduino kit.

The flow of our proposed system starts with the detection of the eyeball position. In order to detect the position of the eyeball we use the eyeball IR sensor. The values generated by the sensor depending on the position of the eyeball are routed to the arduino kit. Next the values in the arduino kit are processed and sent to the relay as the enable signals to switch on the relays and as the final step when the relays are made to switch on the motors fitted to the wheels of the wheelchair will start to rotate and thus the wheelchair will be locomoted.

Eye Ball Sensor Working

The eyeball sensor is based on the concept that "white color region of the eye will scatter the light and black color region of the eye will absorb the light". The sensor consists of IR transmitter and receiver circuitry (LDR). The IR transmitter will transmit the light. The iris of the eye which is in black color will absorb all the light and it won't reflect where as the white part will reflect the light.

Fig 2: Eye ball sensor



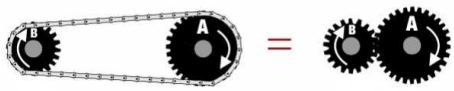
Micro- Controller

The signals from the eyeball sensor are sent to the micro-controller. Based on the signals received by the micro-controller, it sends the control signal to enable the relay circuit. The relay circuit in turn supplies power to the motors, thus the motors start to rotate and the wheelchair is locomoted.

Sprocket System

A **s**procket is a profiled wheel with teeth, cogs, or even sprockets that mesh with a chain, track, or other perforated or indented material. The name 'sprocket' applies generally to any wheel upon which are radial projections that engage a chain passing over it. It is distinguished from a gear in that sprockets are never meshed together directly, and differs from a pulley in that sprockets have teeth and pulleys are smooth.

Fig 3: Sprocket wheel arrangement.

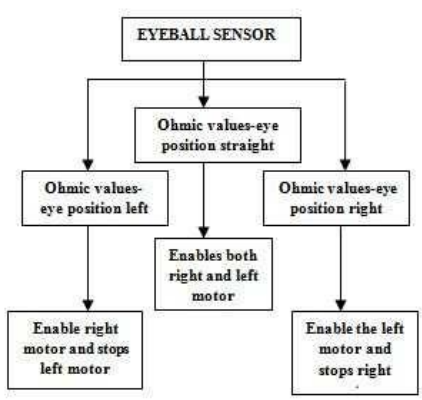


Sprockets are used in bicycles, motorcycles, cars, tracked vehicles and other machinery to transmit rotary motion between two shafts where gears are unsuitable or to impart linear motion to a track, tape etc. Perhaps the commonest form of sprocket is found in the bicycle, in which the pedal shaft carries a large sprocket-wheel (driver) which drives a chain which in turn drives a small sprocket (driven) on the axle of the rear wheel. Early automobiles were also largely driven by sprocket and chain mechanism, a practice largely copied from bicycles. In order to reduce the speed of the powered wheel chair sprocket arrangement is used but in a reverse arrangement that is the small sprocket (13 teeth) is used as a driver i.e. it is connected to the motor shaft and the larger sprocket (26 teeth) is connected to the wheel shaft and it is driven. Thus as a result we obtained speed reduction of the powered wheelchair.

Working Process

The eyeball sensor which is focused to the eyeball of the patient generates three different ranges of values depending upon the position of the eyeball.

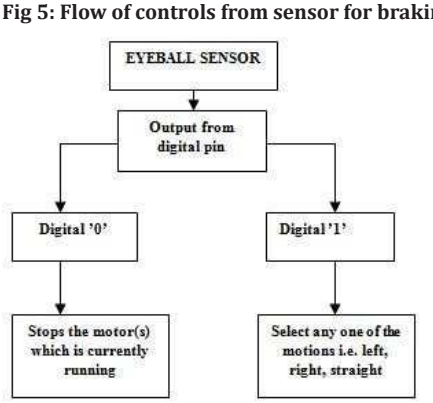
Fig 4: Flow of controls from sensor.



Braking System

As shown in the above flowchart, a value generated by the sensor is fed into the arduino kit. Now the arduino kit matches it with the value that is written in the coding.

Fig 5: Flow of controls from sensor for braking the system.



Left Motion

If the values generated by the sensor matches with the values of left in the coding, then the arduino will automate the relay connected to the right motor. Thus the right motor will start to rotate in the forward direction. As a result the wheelchair will turn left. During this time the left wheel is stopped.

Right Motion

If the values generated by the sensor matches with the values of right in the coding, then the arduino will automate the relay connected to the left motor. Thus the left motor will start to rotate in the forward direction. As a result the wheelchair will turn right. During this time the right wheel is stopped.

Straight Motion

If the values generated by the sensor matches with the values of straight in the coding, then the arduino will automate the relay connected to the right motor and also the left motor. Thus the right and left motors will start to rotate in the forward direction. As a result the wheelchair will move straight.

The system doesn't have any manual braking**.** Eyeball sensor will also produce two binary values '1' and '0'. The value '1' is produced when the patients eye is opened and one of the above three motions will be selected and the wheel chair will be moved accordingly. The value '0' is produced when the patient eye is closed and this value is passed into the arduino kit, which in turn will switch off the relay(s) which are enabled at that time.

Advantages

The existing eye tracking methods for locomotion of the wheel chair are based on image processing techniques thus it is tedious to work with images. But our system uses only eyeball sensor which tracks the position of the eye by using a simple components LDR (Light Dependent Resistor), comparator, IR LED.

Calculating the threshold values of position of the in image processing techniques is complex but using the eyeball sensor we can easily calculate the threshold values.

Fig 6: Model Wheelchair

Conclusion

This system consists of eyeball sensor, micro- controller and wheelchair. The above mentioned hardware along with the software proved to be the great tool which makes the life of the physically challenged people independent.

Future Scope

This system can also be extended to locomotion of the wheelchair in reverse also.

We can also implement obstacle sensors in this system which will be very helpful to the physically challenged people in dodging the obstacles.

The system can be extended to control the equipments such fans, lights, etc.

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