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AUTOMATIC WHEEL CHAIR MOVEMENT BASED ON EYE TRACKING

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Abstract

Automatic wheel chair movement based on eye tracking system which is designed for people with disabilities and elderly people. The concept of these research is to apply to wheel chair and communicate with the caretaker. This system comprises of three modules image processing module, wheel chair-controlled module and SMS manager module. The image processing module consist of webcam and python customized image processing. The eye movement is captured through webcam and sends to raspberry pi microcontroller for processing with Open-CV to derive the coordinate of eyeball. The coordinate of eye ball is utilized for cursor control on the raspberry pi screen to control the system. Besides the eye movement the eye blink is applied in this system for entering a command as when you press enter button keyboard. the wheel chair-controlled module is a cradle with two servos that can be moved to two dimensions and also adaptable to other wheel chair joysticks. This system communicates with caretaker via send message to smart phone.

Keywords: Raspberry pi, USB camera, Python Idle, GSM.

1 Introduction

To elderly and disabled people, it is very difficult to move on their own, hence wheel chair play a huge role in their life. However, the electrical wheel chairs are present in the market mostly controlled by using joy stick control system. In some case such as paralysis person and Parkinson disease, it may be very difficult or impossible for such patient to use such type system. There are several researches attempt to develop other techniques for controlling electric wheel chair for those patients to improve quality of their life. Such as brain-controlled wheel chair and voice-controlled wheel chair. But these systems have some disadvantages to overcome those disadvantages we are implementing automatic wheel chair movement based on eye tracking where the wheel chair movement done by eye movement. The main aim is to develop a prototype of an eye tracking system that can controlled electric wheel chair and communicate with caretaker via send message to smart phone. The main components of this project are Raspberry Pi 3 and web camera. The Raspberry Pi is programmed using python IDLE. Web camera is used to monitor the eye movement. The captured movement is sent to Raspberry Pi. With the help of motors, the wheel Chair movement starts. GSM

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module is used to send SMS to caretaker from this work, The significance of automatic wheel chair movement based on eye tracking is the wheel chair is moved based on eye movement. GSM module helps by sending SMS to caretaker in case of emergency. So, this project is to reduce the difficulty to elder and disabled people by using eye movement-based wheel chair.

2 Literature Survey

Garbage Speech signals are the most important means of communication in human beings. Almost every conversation to interact is done by means of voice signals. Sounds and various speech signals can be converted into electrical form using a microphone. Physical disability can occur due to multiple reasons like injuries from accident, age related & health problems. Wheelchair is used to provide a mode of transportation for such disabled people with impairments in hands and legs. People with such issues like paralytic people find it difficult to operate the wheelchair manually or using a remote assembly. For such people the project is designed to work on voice-based commands so that the paralytic or disabled person can give direction commands by just speaking into the microphone given. The system also includes directional buttons for wheelchair control using remote. The system consists of an Atmega328 based circuit interfaced with a voice recognition module that takes speech commands from the user converts this speech into digital data which is then debugged by the micro-controller to get directional commands. The entire system consists of 2 circuits i.e., the transmitter circuit and a receiver circuit. Transmitter circuit comprises of the voice recognition module and the receiver circuit consist of the motor and driver assembly. We use a NRF trans receiver module for the communication. A 16*2 LCD is used to display the command which is given to the wheelchair.

3 Methodology

In this system consists of three modules image processing module, wheel chair module and SMS module. The image processing module consists of webcam and python customized image processing. The eye movement is captured through webcam and sends to raspberry pi micro controller for further processing to derive the coordinate of eyeball. the coordinate of eye ball is utilized for cursor control on the raspberry pi screen to control the system. The imaging processing module is the main module of this system that start with webcam to capture the eye images and transmit to Raspberry Pi for image processing to obtain position of eye ball and define eye blink. The eye movement is also employed as the cursor control on the Raspberry Pi screen eye blink, is used for entering command. The wheel chair-controlled module is a cradle with two servos that can be moved to two dimensions and these are controlled with the help of motor drivers. The motor drivers are used to amplify the input power supply. The designed cover of wheelchair joystick that can move wheelchair joystick in two dimensions with two servos with the help of servo motors interfaced to L293D driver where driver is interfaced to Raspberry pi to provide desired direction of the wheel chair based on eye ball movement. In SMS controlled module the SMS is send to the care taker with the help of GSM module for sending the messages to the caretaker to monitor the condition of the paralyzed/disabled person. Here the GSM module and Raspberry Pi 3 to control whole system's features and interfacing all the components in this system. GSM Module

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SIM900A is used to communicate with the network for calling and messaging purpose.

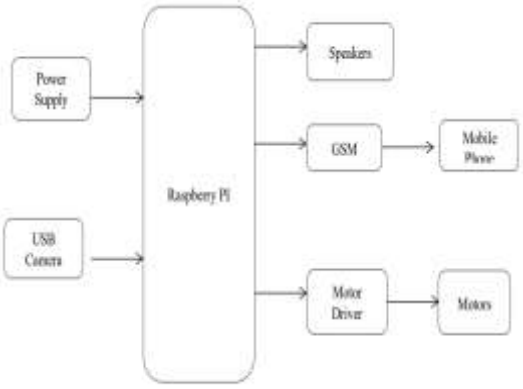

Fig.1 Block Diagram of Automatic wheel chair Movement Based on Eye Tracking

The wheel chair-controlled module is a cradle with two servos that can be moved to two dimensions and these are controlled with the help of motor drivers. The motor drivers are used to amplify the input power supply. Servo motors are connected to the wheel chair helps in movement of desired direction of the Disabled person through L293D driver. The L293D motor IC uses two pins referred to as inputs to sense the desired direction of the output. When the Power supply is given through the laptop. This System starts with webcam capture the eye images and send signal to Raspberry pi for digital image processing which is based on Open CV library to derive the 2D motion direction of eyeball. The motion direction eyeball is also used as the cursor control on the raspberry Pi screen to control some operation such as wheelchair control and sending message to smartphone. The webcam is connected to Raspberry Pi microprocessor the main micro controller of our system. Raspberry Pi microprocessor it not only performs digital image processing. The SMS is send to the care taker with the help of GSM module .In this project GSM module is used for sending the messages to the caretaker to monitor the condition of the disabled person.

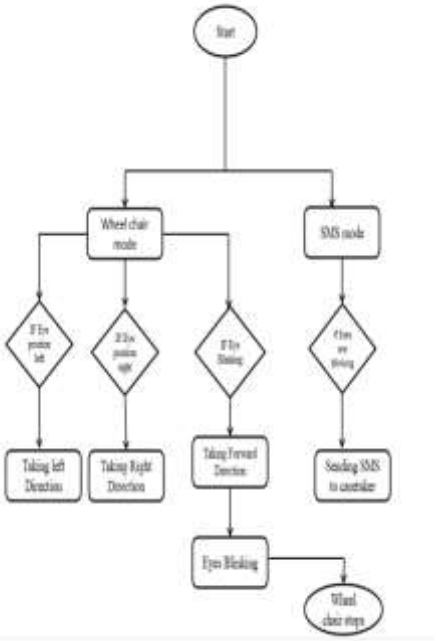

Fig.2 Flowchart of Automatic wheel chair Movement Based on Eye Tracking

Camera will start to capture the images. For the face and eye detection cascade algorithmis used. After detection of face, it tries to detect the eye inside the face and draw the rectangular box over the eye. To detect the eye pupil and define its centre points is ultimate goal of the system by several images processing technique. The system will crop the eye region of interest and it will draw the all-possible circle on that particular area to detect the eyeball. Then we applied corner detection method to detect the corner. Average of these two points indicates the centre point. To measure the distance between the centre point and eye circle centre point using coordinates system. Minimum distance indicates the eye pupil in left and maximum value indicates the eye pupil presented in right. If there is no movement of eye it will indicates eye is in middle position. When eye move in left, left side motor will run and when eye move in right, right side motor will run. If eyes are blinking, both motors

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moved and wheelchair moving in forward direction. If again eyes are blinking, system will be stop. If eyes are in left position, then wheel chair moves to left direction. If eyes are in right position, then wheel chair moves to right direction. If system is in SMS mode and if eyes are blinking then immediately SMS sends to care taker.

5 Results

Hardware circuit of Automatic wheel chair movement based on eye tracking is as shown in figure 3. In this Hardware circuit, Hardware tools used are Raspberry-Pi, USB Camera, Speaker, GSM Module, Motor Driver and Motor. All these are connected using Jumper wires.

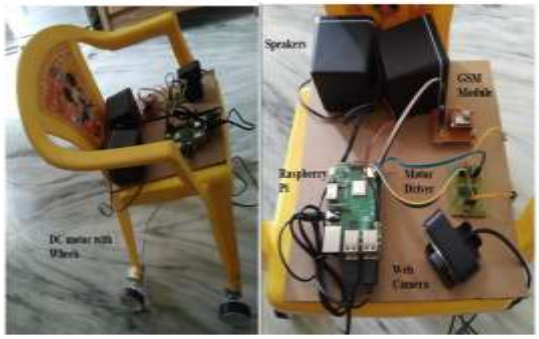

Fig 3: Hardware Circuit

(a)

(b)

(c)

(d)

Fig 4: a) Left, b) Right, c) Blinking, d) Results on python shell

The fig 4 shows position of eye and corresponding result shows on python shell. If the eye position is left then the wheel chair moves to left direction and if the eye position is right then the wheel chair moves to right direction and if eye blinks the wheel chair moves forward and again if eye blinks the wheel chair stops.

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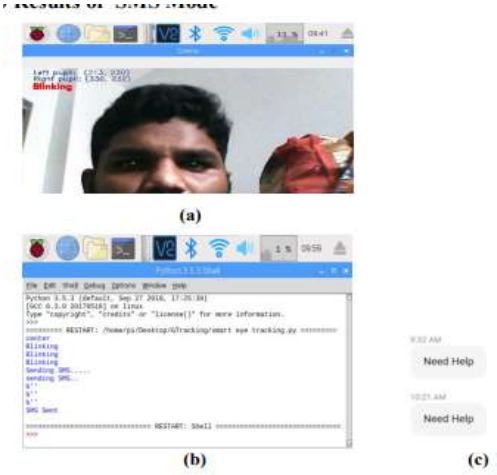

(a) (b) (c)

The fig 5 shows if the device is in SMS mode and when the eye blinks then immediately SMS sends to care taker.

Conclusion

Thus the "Automatic wheel chair based on eye tracking" has been designed and tested successfully.it has been developed by integrated features of all the hardware components used. Presence of every module has been reasoned out and placed carefully thus contributing to the best working of the unit. The system has been tested to function automatically. The idea of eye control is of great use to not only the future of natural in out but more importantly the handicapped and disabled. One of the main goals of eye tracking interpretation system is to enabled completely paralyzed patients to make their life more accessible. According our studies this project is feasible. Developed a wheelchair system which enables the disabled patient to move their wheelchair independently in their own direction. In the real time application, can use camera, emergency switch and ultrasonic sensor depends on their application. The wheelchair movement operation with some delay time. Dark light places affect the performance of wheelchair, difficult to track the eye pupil in dark light. In addition to gaze direction and eye movement patterns also other eye related measurements such as pupil size etc…even contribute to the users emotional and cognitive state. Gaze behaviour can also be combined with other measurements from user face and body enabling multi model psychological computing. In future there is a chance of maximizing the controllers efficiency in vehicles during driving

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