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AUTONOMOUS CAMERA BASED EYE CONTROLLED WHEELCHAIR SYSTEM USING RASPBERRY-PI

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Abstract - The purpose of this paper includes eye controlled wheel chair system is to eliminate the assistance required for the disable person. This system mainly depending upon the movement of eye. It provides great opportunity for the disabled to feel independent accessible life. Firstly we are using the central switch for the start up of the wheel chair. It is also used for emergency purpose to stop the movement in some attention purpose. Camera is mounted in front of the person on the wheel chair, it captures the images of the eye and tracks the position of the eye pupil by using image processing techniques. As per the movement of the pupil of the user, the DC motors of the wheel chair will move in the required direction such as forward, reverse, left, right. Here we use IR sensor, it detects Whole system is controlled by Raspberry-pi board.

Keywords: Wheelchair, IR sensors, Zig bee, Web camera, Image processing, Raspberry-pi

1.INTRODUCTION

The wheelchair is dependent system used by elder and physically disabled person. Here the design and implementation is totally depending on the eye control electric wheelchair. As per requirement of the disabilities, different kinds of automatic system are available in the market such as voice or joystick control wheelchair system. Sometimes this system are very difficult to use for paralysis person. This system provides the independence to make their life easy, more convenient, and also they save the huge amount of the human energy. Camera capture the image in the real time and analysis the image as input to move the DC motors of the Wheelchair.

The motor drivers are used to perform different operation such as forward, reverse, left, right and stop. The ultimate goal of this system is to detect the exact eye pupil location and its center point. Many computers vision library of image processing are used for automatically find out the eye pupil and tracking eye pupil, like object detection, motion detection, image color conversion, edge detection, etc. LCD display are used to display the direction such as forward, stop, left, reverse, right. Thus helps to know the direction of the wheelchair.

2.RELATED WORK

In the paper of human input with the autonomous behavior[2007], The rider must continuously specify the chair's direction and, in some cases, velocity using a joystick-like device. Unfortunately, many users who could benefit from powered wheelchairs lack these fine motor skills. For instance, those with cerebral palsy might not be able to guide a chair through a narrow opening, such as a doorway, without repeatedly colliding into the sides[1].

This paper describes the design and development of our robot wheelchair system, called Wheeler, and its vision-based navigation system. The robot wheelchair system uses stereo vision to build maps of the environment through which it travels; this map can then be annotated with information gleaned from signs. We also describe the planned integration of an Assisi robot arm to help with pushing elevator buttons and opening door handles[2].

Eye detection is required in many applications in human-computer interaction, which plays an important role in screen control, user recognition and auto-stereoscopic displays. Considering the defects of traditional methods of human-eye detection, an accurate human-eye-detection algorithm has been proposed. [2009]This paper proposes a novel technique combining the Ada boost algorithm and a hybrid matching method. First, facial part in the whole image is located with Ada boost algorithm; the human-eye area is positioned through the hybrid feature extraction method. In extraction process, edge density, dominance, HSV and skin color cues are applied separately. Some of the regions are then removed by applying rules that are based on the general geometry and shape of eyes. The remaining connected regions obtained through these four cues are then combined in a systematic way to enhance the identification of the candidate regions for the eyes. The proposed eye-detection algorithm effectively reduces the eye-detection candidate area and improves the detection accuracy.[3]

3.SYSTEM DESIGN

A. Eye controlled wheelchair system

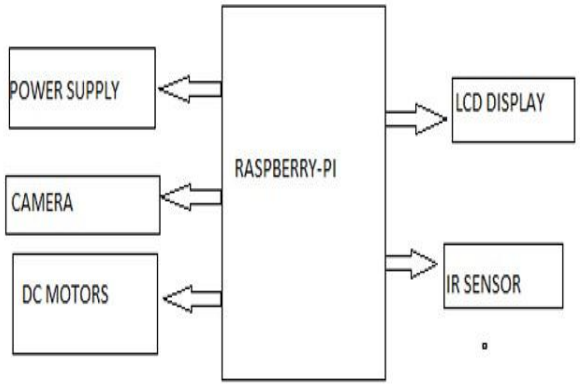

Figure 1. Eye controlled wheelchair system

Our project system implementation is working based on real time data acquisition operating system. We are using the Raspberry pi B+, the advance computer board that consumes low power. Which provides well enough in/out pins, USB ports, UART, PWM, HDMI port and Ethernet adapter port for connecting it through internet via wired or wireless connection. Also raspberry pi have up to 32 GB external memory capably. Here we are using the 512MB RAM of the Raspberry pi and it is controlled based on the ARM architecture. The figure1 represents the experimental setup of the system. The camera module is mounted on the Wheelchair in front of user/patient Eyes. The main important thing is a distance between eye and camera device is fixed, no changes can be done otherwise it won't work. It may me 10cm to 14cm.

The mounted Camera module will capturing the images of user face and eye, and find out the exact eye pupil location. After detection of pupil location, system algorithm measure the center average value from the corner of the Eye. Which gives the correct information of Eye movements. For controlling the motors driving IC, 2-channel relay board and battery for power supply of motors is used. Connects the Raspberry pi with the motor drivers which operates the entire system. And also connects the Raspberry pi with the camera module which continuously capturing the images of eye. Then system generates the command signal to enable the GPIO pins and perform the Left, Right, forward and stop operation. A system camera detects the face of user. Once it will detected, system found the eye location and marked the eye region using Haar cascade algorithm. And system accurately detect both the eyes based on the proper distance of the each other.

4.OBJECTIVE

Designing a System for tracking Face and Eye using Camera. Using Haar cascade technique detecting the movement of the eye and calculating it. Achieving Synchronization between Image Processing and the Wheelchair. Examine the existing wheelchair system in terms of human being factor of engineering. According to human factor of engineering and material selections redesign and analyse the product. Simulate the prototype of the product using solid works and ALGOR software . The aim of this project is the person who are disabled to use their energy, lead the life independent without take any help from others by only the use of their eye movements, IR sensors will helps to detects the object in front of the wheelchair and stop the motion.

5.SYSTEM ARCHITECTURE

The system will crop the eye region of interest initially and it will detects all possible circle presented on that particular area. Then it will successfully detects the eye ball. When we detects the corner of the eye, we applied method of detection for the region of the eye of interest. Where we find the average of both two point of its eye defined its Center point. Now we measure distance between the Center point and eye circle Center point using coordinates system logic. According to the eye pupil movements, distance will be vary. A minimum distance defines the eye pupil presented in left, and maximum values defines the eye moved on right. And if there is no movements of the eye, then it concludes eye is in the middle position and goes forward. Then the commands applied for all operation, when eye movement is left, a wheelchair left side motor will run. And when the eye moved is right the right side motor should be moved.

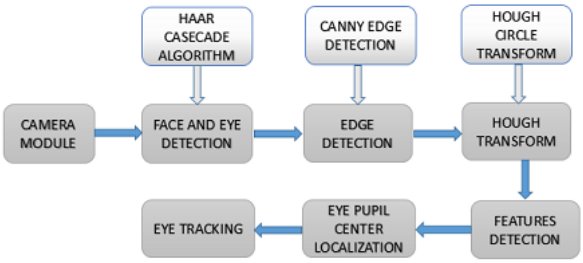

Figure 2: System architecture

If eye will be in Center both motor moved, and wheelchair moving in forward direction. For start and stop operation of wheelchair movements for eye blinking logic applied. If eye closed for 3 sec. When the user close the eye for 3sec, the complete system stop their work and once again restart/reactivate their work. To start the system, the

camera must continuously capturing the images of eye. And captured images processed in Raspberry system. To capture the image at high pixel rates we have to use USB camera. Eye will be open in the idle condition. Once the power supplied is on, the system will start working, and according to the command values system will worked. The aim of this project is the person who are disabled to use their energy, lead the life independent without take any help from others by only the use of their eye movements, IR sensors will helps to detects the object in front of the wheelchair and stop the motion.

FLOW CHART

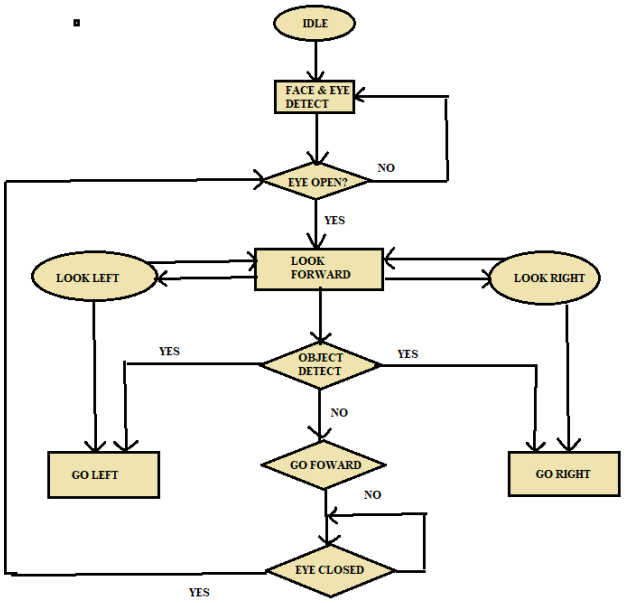

Figure 3: Flow chart

The camera will be mounted on the wheelchair. First we put the eye into the camera , then the camera will detect the face and eye. The camera first check the weather the eye will open or not , if it is not open, the working of the wheelchair is stopped. If it is open , the operation will starts. The camera will capturing the position of the eye and start the motion. If the eye looks forward, the wheel chair moves forward. If the eye looks left, the wheel chair moves towards left. If the eye looks right side , the wheel chair moves towards right .

We set the IR sensor in front of the wheelchair, it helps to detect the object comes in front of the chair. It is the main thing in our project because the disable person cant talk and use their hands and legs, so he cant stop the motion of the chair. He wants to lead the life independently so this sensor satisfies the all thing of that patient. If eye will closed the motion of the wheelchair should stop. Mainly the camera will capture the position of the eye,and gives the direction to the wheelchair.

ACTIVITY DIAGRAM

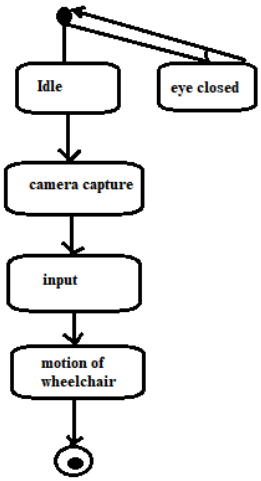

Figure 4: Activity diagram

The name of the diagram itself clarifies the purpose of the diagram and other details. It describes different states of a component in a system. The states are specific to a component/object of a system. A State chart diagram describes a state machine. State machine can be defined as a machine which defines different states of an object and these states are controlled by external or internal events.The first state of diagram is idle, it is the initial position of the working The camera will detect the face and eye of the human and capturing the position of the eyes. In the software part ,there is an zig bee transmitter, they send the serial communication to the hardware part i,e wheelchair.

6.RESULT ANALYSIS

The system acquired the resulted data of image processing, and based on the Eye pupil center value signal send to the motor driving circuit for movement of Wheel chair. The exact output of the resulted video processing is shown below figure,

Figure 5: Result analysis

7.CONCLUSION

The concept of the eye controlled wheelchair is not only represents the alternative resources but more important to help physically disabled persons to make their life independent. The aim of our project is an autonomous eye controlled wheelchair is to very highlight the features of digital Image processing. In the real time environment, there are some real time design constants measured like a system takes some time (4second) to execute the system for processing the video. Hence the whole system perform the Wheelchair movement operation with some delay time. It's very hard to track the Eye pupil in dark light places, so the system works perfect on environmental light and in a room light with fluorescent mercury vapour lights, which is low in infrared.

8.REFERENCES

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