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THE HEAD MOVEMENT BASED WHEEL CHAIR

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Abstract

A person with a disability would not be able to do any work as same as an average person if a person of such category is considered of worst happening we can consider a person who cannot move his body parts except his head so we have designed a wheel chair for this disabled category using motion sensing cameras which we use to determine the motion of the head by scanning the elevation of the nose tip depending upon the saved gesture and direction and motion of the nose as considered a person with a disabled body is assumed to be not achieving anything but our aim is to make all those assumptions to be negative to make the patient to move as he wants and to make him to move anywhere is our first step to our goal. When user moves his head up (move forward), left (move left), right (move right) appropriate angles will be given such a way to move himself as he wants. Once the image has been processed it moves onto the second part, our raspberry pi. The raspberry pi will take a USB output from the camera and convert the images into electrical signals that will be sent to the wheelchair wheels for movement. Since we will be using two gesture cameras. There will a pattern recognition system to compare both images from the patient. The final part of the project is the wheelchair itself. We will be using a electrical motor wheel chair to make it more suitable for patient. The rear wheels will provide forward. The front two wheels will be used for steering left and right. All four wheels will be connected to our raspberry pi that will send signals to control the wheels and thus the overall movement

Keywords: Nose, edge, gesture, wheelchair.

I. Introduction

Ability to move freely for a human being is very important. It is so highly valued by all people. But for a disabled patient it is the highest priority for them. For those disabled persons many electric wheel chairs have been introduced. But still they cannot enjoy their life with more freedom.

An average person can move as he wants see as many landscapes or beautiful scenes in their life. But when we are

considering a physically handicapped he cannot move as freely as an average person to make those impossibilities possible we have taken a step to make things comfortable for those patients Moreover, some disabled people cannot drive an electric wheelchair manually, even with a joystick, because they lack the physical ability to control the movement. To enable a disabled person to drive a wheelchair safely and easily so that they can enjoy a higher quality of life, researchers have proposed several electric wheelchair systems. The use of voice commands to control an electric wheelchair is one research result. A small number of command words and high-performance voice recognition are employed in this system. An electric wheelchair control with electro oculography (EOG) techniques has also been proposed. In this case, the different commands for the wheelchair are derived from the electro-occulography (EOG) potential signals of head movements. A system for electric wheelchair control using the head was proposed in 2007. A commercially available web camera is used to capture moving pictures of the user‘s face. captured image data, detecting and tracking movements of the user‘s heads, estimating the line-of-sight vector, and actuating the electric wheelchair in the desired direction indicated by the user‘s head. One of the key essentials of the proposed system is detecting and tracking the head movements. This article will be an head movement based controlled wheelchair system. A mounted camera on wheel chair hand will track head movement and control a wheelchair to go forward, stop, left or right

II. Problem Statement

A. To develop a head movement based wheelchair which can be used by disabled person to move freely

III. Overview on Components

Electric Wheelchair

The foremost electric wheelchair was invented by George Klein with the purpose to help the wounded soldiers of the World War II. With time, it has evolved into many designs and forms. The power chairs comprise a range of functions like reclining, tilting, seat elevation, chin controller, hand controlle and many more. Some of the models are portable that is they can be disassembled and carried along while travelling. The electric wheelchair is characteristically categorized into three categories

A. The front wheel powered chair: It is a power chair forindoor purposes. This is a four wheel driven chair and is most flexible among the lot.

B. The rear wheel powered chair: It is a power chairfacilitated for outdoors. Being rear wheeled, they are appropriate for rugged roads.

C. Mid wheel powered chair: This electric wheelchair is Opposite for indoors but has sturdy functions

Gesture Camera

The first product announced by Perceptual Computing is the Creative Senz3D Interactive Gesture Camera, co-created with Creative, and first unveiled at Intel's keynote speech at Computex 2013. The webcam is the first to utilize 3D sensing technology which, when paired with Intel's Perceptual Computing SDK, allows for gesture and motion control in a variety of apps and games.

Key Highlights of the Creative Senz3D Interactive Gesture Camera

- RGB video resolution: HD 720p (1280x720)
- IR depth resolution: QVGA (320x240)
- Frame rate: Up to 30 fps
- FOV (Field-of-View): 74 degrees
- Range: 0.15m ~ 1m
- Dual-array microphones
- Dimensions: 108 x 51 x 53mm
- Weight: 271g
- Cable length: 1.8 meters

Arduino

The Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter.

IV. Literature survey

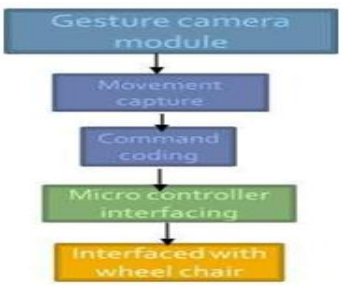
The existing computer input devices such as keyboard, mouse, and the other input devices have been used to interact

with digital instruments. These computer input devices cannot be operated by handicap persons. In this paper, a computer input device by human heads only is proposed for handicap person and also for wearable computing. The existing computer input devices can be divided into five categories: Bio-potential based method which utilizes potential from user's body actions acquired by using special instrument. Instrument such as Electrooculography (EOG), Electromyography (EMG), and Electroencephalograph (EEG), Search coil can be used for measuring bio-potential. The search coil output can be used as sources of computer input for handicap person. EOG method uses voltage differences between fore and aft surface of heads. Voice Based method, which use user's voice as source input. Voice analysis is used to analyze user's voice and convert into digital data. The weakness of this system is vulnerable against noise. Other voices which come from surrounding user may affect the Motion based method, utilizes other normal movement organs to operate computer input. Head, foot, and etc. can be used to control computer input. Image Analysis method, utilizes camera to analyze user's desire and convert into digital data. Several image processing methods are used to analyze user's desire. The user's desire itself can be done by Gaze based analyze user's desire from users gaze, Face based analyze user's desire from face expression, and the others. Search coil method uses induced voltage with coil including in contact lenses attached to user‘s heads

V. Architecture

Image Capturing Module: Image Capturing is to capture asequence of edge images from the subject using a specially designed camera. In edge recognition image capturing is a very important step. Since edge is small in size and dark in color, it is difficult to acquire good image. The image is then changed from RGB to gray level for further processing. It is to capture a sequence of edge images from the subject using a specifically arranged camera. With an average diameter of 12 mm, a camera must have enough resolution to capture the details of the edge pattern

BLOCK:



A. Heavy duty wheel chair

It is designed to be used for outdoor rationale and can be customized on the basis of individual necessities.. It can be used for travelling over coarse surfaces. These power chairs can be transferred only by the aid of lifts and ramps. Headings, or heads, are organizational devices that guide the reader through your paper. There are two types: component heads and text heads.

B. Edge Detection

First step is to calculate the Gaussian blur function. A Gaussian blur (also known as Gaussian smoothing) is the result of blurring an image by a Gaussian function. Mathematically, applying a Gaussian blur to an image is the same as convolving the image with a Gaussian function. This is also known as a two-dimensional Weierstrass transform [14-15]. The Gaussian blur is a type of image-blurring filter that uses a Gaussian function (which also expresses the normal distribution in statistics) for calculating the transformation to apply to each pixel in the image. The equation of a Gaussian function in one dimension is

$$G(x) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{\frac{-x^2}{2\sigma^2}}$$

Where x is the distance from the origin in the horizontal axis, y is the distance from the origin in the vertical axis, and σ is the standard deviation of the Gaussian distribution. When applied in two dimensions, this formula produces a surface whose contours are concentric circles with a Gaussian distribution from the centre point. Values from this distribution are used to build a convolution matrix which is applied to the original image. Each pixel's new value is set to a weighted average of that pixel's neighbourhood. The original pixel's value receives the heaviest weight (having the highest Gaussian value) and neighbouring pixels receive smaller weights as their distance to the original pixel increases. This results in a blur that preserves boundaries and edges better than other, more uniform blurring filters. Nose location is found using Daugman‘s algorithm or otherwise known as integro differential operator for finding iris location. Using this we will track the location of nose and get the coordinates of the centre of the nose. Formula used by Daugman is.

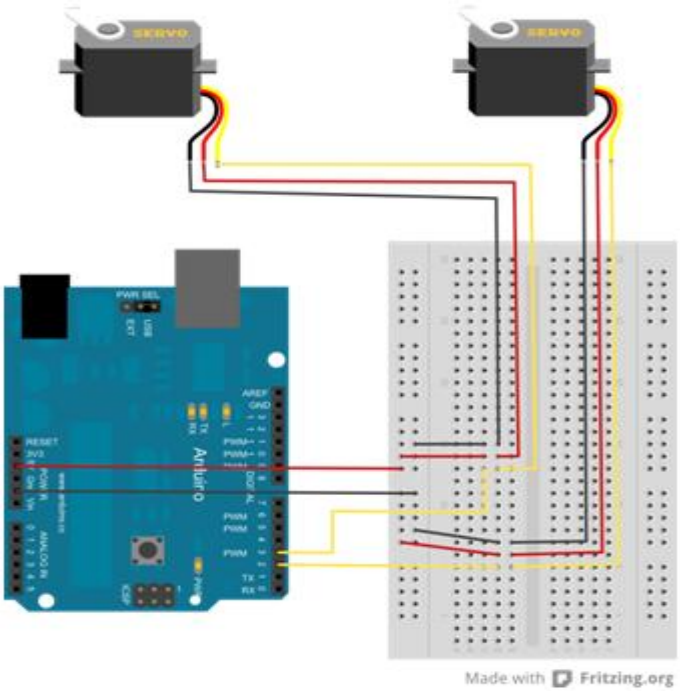
$$max_{(r,x_0,y_0)} \left| G_\sigma(r) * \frac{\partial}{\partial r} \oint_{r,x_0,y_0} \frac{I(x,y)}{2\pi r} ds \right|$$

Where G(r) function represents Gaussian Filter where the image is scaled to sigma size. It is the smoothing function blurred at a scale set by sigma, searching iteratively for the maximal contour integral derivative at successively finer scales of analysis through the three parameter space of centre coordinates and radius with x0, y0 and r values. The equation thus becomes as.

$$max_{(r,x_0,y_0)} = \left\{\frac{\partial}{\partial r}\int_0^{2\pi} I(r * cos\theta + x_0, r * sin\theta + y_0)\right\} \quad (3)$$

The specialty of this equation is even when the edge is at certain phase angle it can detect the center of the nose, this is because line integration is checking the both images from two cameras so we will be obtaining a correct response for correct edge detection.

Simulated circuit



We use servos here to control the cameras position on the wheel chair handle. We had used Fritzingto simulate the circuit and used Arduino software for servos simulation.

Software Required

- Arduino
- Processing
- OpenCV Framework (Windows, Mac, Linux)
- OpenCV Processing Library

Conclusion

This paper has presented a wheelchair system using head movements, in which nose detection that is segmentation is done using Daugman‘s algorithm and deduction of direction in which nose looks is decided by fixing range to the particular direction as user looks.

References

1. K. T. V. Grattan, A. W. Palmer, and S.R. Sorrell, _Communication by Eye Closure-A Microcomputer Based

System for the Disabled‘, IEEE Transactions on Biomedical Engineering, Vol. BME-33, No. 10, October 1986.

2. Q..X. Nguyen and S. Jo, _Electric wheelchair control using head pose free eye-gaze tracker‘, Electronics Letters, Vol. 48 No. 13, 21st June 2012.
3. Rory A. Cooper, _Intelligent Control of Power Wheelchairs‘, IEEE Engineering in medicine and Biology, 0739-51 75/95, July 1995.
4. Djoko Purwanto, Ronny Mardiyanto, Kohei Arai, _Electric wheelchair control with gaze direction and eye blinking‘, Artif Life Robotics, 14:397–400, May 18, 2009.
5. Rinard et al., _Method and Apparatus for monitoring the position of the eye‘, United States Patent, 4,145,122, Mar. 20, 1979.