Voice & Eye-ball Control Wheelchair

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Abstract: The automated wheelchair controlling is fully based on voice and eye-ball control. This system tracks the coordinates of the pupil in order to detect and make proper moves. As well as we have also included the voice control mode in which by saying some direction moving commands the wheelchair moves in that direction. We hve also included an emergency stop command that which fully stops all the process for safety purpose. This system integrates both the eye-ball or pupil detection and voice control based wheelchair control when compared to the existing system.

KEYWORDS: Gaze tracking, IFTTT, Rasberry pi, ESP32, Arduino, Raspbian OS, Ip webcam.

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INTRODUCTION

Quadraplegia, also known as tetraplegia, is paralysis caused by illness or injury that results in the partial or total loss os use of all four limbs and torso; paraplegia is similar but does not affect the arms.

Quadraplegia is caused primarily by injury to the cervical area of the spinal cord. This damage can be caused by accidental events such as falling, vechile accident, sports injury, etc.

Motorized wheelchairs are useful for those unable to propel a manual wheelchair or who may need to use a wheelchair for distances or over terrain which would be fatiguing in manual wheelchair.

STRUCTURE OF PAPER

The paper is organized as follows: In Section 1, the introduction of the paper is provided along with the structure, important terms, objectives and overall description. In Section 2 we discuss related work. In Section 3 we have the complete information about movement tracking softwares. Section 4 shares information about the hardware used in this proposed system. Section 5tells us about the methodology and the process description. Section 6 tells us about the future scope and concludes the paper with acknowledgement and references.

OBJECTIVES

Statistics suggests that there are 15,000 new cases of quadriplegia every year.

Great people like Stephen Hawking & Max Brito have been suffering from this crippling phenomenon. Our project is an attempt to make lives of people suffering from this disability easier & simpler.

The main idea is to implement a wireless smart wheelchair which allows movement of the patients on wheelchairs depending on the Voice control & Eye-ball movement of the patient.

RELATED WORK

There are numerous works that have been done related to Voice control wheelchair and eye-ball control individually.

Li, Xueen[1], Xiaojian Zhao, and Tieniu Tan, Autonomous robot architectures typically fall within two camps, top-down symbolic AI systems, and physically grounded bottom-up reactive systems. In this paper, we present a novel behavior fusion based architecture for the control of an intelligent powered wheelchair, which takes advantage of the modularity presented by the reactive bottom-up design, the inference mechanism of symbolic AI systems, and the flexibility of the layered architecture. Thus, this control architecture of wheelchair can realize the multi-level information fusion and facilitates task and information sharing and trading between man and machine. In addition, the basic behaviors and their fusion algorithm are also described.

Jiao, Liguo[2], Jae Hyoung Lee, Yuto Ogata, and Tamaki Tanaka, In Japan, the number of people who have difficulty walking has been increasing with the rise in the aging population and that of people with physical disabilities. Individuals with athetosis-type cerebral palsy may use electric wheelchairs due to abnormal walking. However, since they have problems with fine motor control, including the occurrence of involuntary movements and difficulty maintaining posture, they have difficulty intentionally controlling their hand movements. Therefore, they cannot operate a joystick, even if they desire to use electric wheelchairs, and there are risks of accidents. In this study, by considering the arch structure of hand, we developed a new joystick grip that enables the suppression of involuntary movement. We evaluated our proposed grip by comparing running stability with a conventional grip, and demonstrated the effectiveness of proposed method.

Wanluk[3], Nutthanan, SarinpornVisitsattapongse, AniwatJuhong, and C. Pintavirooj,This project is a smart wheelchair based on eye tracking which is designed for people with locomotor disabilities. The add-on controlled module can be used with any electrical wheelchair. The smart wheel chair consists of four modules including imaging processing module, wheelchair-controlled module, SMS manager module and appliance-controlled module. The image processing module comprises of a webcam installed on the eyeglass and C++ customized image processing software. The captured image which is transmitted to raspberry Pi microcontroller will be processed using OpenCV to derive the 2D direction of eye ball. The coordinate of eyeball movement is then wirelessly transmitted to wheelchair-controlled module to control the movement of wheel chair. The wheelchair-controlled module is two dimensional rotating stages that installed to the joystick of the electrical wheelchair to replace the manual control of the wheelchair. The motion of eyeball is also used as the cursor control on the raspberry Pi screen to control the operation of some equipped appliance and send message to smart phone.

MOVEMENT TRACKING

For movement tracking,we use two types of softwares for both Voice & Eye-ball.

They are:

1. Gaze Tracking.
2. IFTTT

1. Gaze Tracking:

Gaze tracking is a sensor technology that makes it possible for a computer or other device to know where a person is looking. An eye tracker can detect the presence, attention and focus of the user. It allows for unique insights into human behavior and facilitates natural user interfaces in a broad range of devices.

2. IFTTT:

IFTTT helps you connect all of your different apps and devices. When you sign up for a free account, you can enable your apps and devices to work together to do specific things they couln't do otherwise.

IFTTT derives its name from the programming conditional statements "if this, then that". What the company provides is a software that connects apps, devices and services from different developers in order to trigger one or more automations involving those apps, devices and services.

HARDWARE

The major hardware parts we used in this project are:

1. Raspberry pi.
2. L289n Motor Driver Module.
3. ESP32.

1. Raspberry pi:

Raspberry pi is a mini computer that is capable of performing many operations like a windows laptop.

The raspberry pi board runs on the Raspbian OS. This OS is user friendly. We run the eye-ball or pupil detection code in the raspberry pi board.

We program the raspberry pi board using python. It has 40 GPIO pins. We use this to detect the pupil position and based on the position it send through the GPIO pins.

2. L289n Motor Driver Module:

L289n Motor Driver is interfaced with Arduino to control the motors. It can control over DC motors, we have to control its speed and rotation direction. This can be done by combining these two technologies.

- PWM- for controlling speed.
- H-Bridge – for controlling rotation direction.

3. ESP32:

The ESP32 is dual core, this means it has 2 processors. It has Wi-Fi and Bluetooth built-in. It runs 32 bit programs. The clock frequency can go upto 240MHz and it has a 512Kb RAM.

This particular board has 30 or 36 pins, 15 in each row. We use this ESP32 to control the motor driver.

The GPIO pins from the raspberry pi are connected to the ESP32 to control the motor based on the signal or command received and makes the direction control whether left or right.

METHODOLOGY

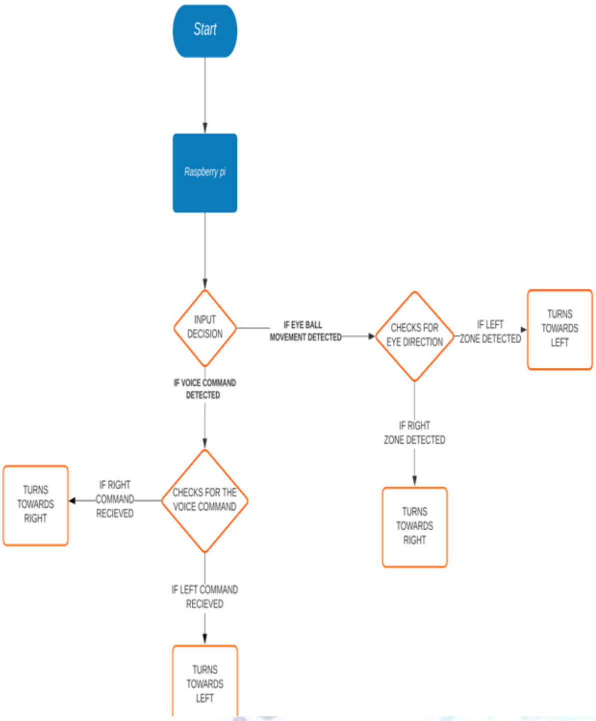
Gaze tracking is a Python (2 and 3) library that provides a webcam based eye-tracking system. It gives you the exact position of the pupils and the gaze direction in real time.

The Dlib library has four primary prerequisites: Boost, Python, CMake and XII/XQuartx. First of all, we need to detect the iris of an eye and estimate the position of the pupil. For this we need to perform image processing on the input frame from the camera. Perform operations on the eye frame to isolate the iris.

We start with image smoothing. These methods sometimes blur or smooth out everything irrespective of it being noise or edges. Because of this, there is a loss of important information about images. So to overcome this problem a bilateral filtering method is proposed.

Process Description

The following diagram makes it easier to understand how we proceed.



- The user is required to give the input either via Voice command or via Eye-ball movement.
- The input is given to Raspberry pi. It decides wheather it is Voice command or else Eye-ball movement.
- If it is Eye-ball movement it checks for the direction and moves the wheelchair in that specific direction.
- If it is Voice command it checks for the direction and moves the wheelchair in that specific direction.
- During tough situations Eye-ball control will be override by voice control

FUTURE SCOPE AND CONCLUSION

By using the gaze tracking, we track the eye coordinates of the person in the wheelchair. The input of the person sitting in the wheel chair is captured by the camera attached to the raspberry pi. The input image is been processed and the eye coordinates are found and then it detects the position of the eye ball. When the eye ball position is about left then the raspberry pi sends a high signal to the ESP32 through its GPIO pins, the signal is been received by ESP32 and this sends signal to the l298n motor driver controller to control the movements. As left turning command received the esp32 makes the wheel chair turn in that position as received by the command. And also it can receive the voice command from the ifttt using google assistant. The voice command received is then processed by the esp32 and then it turns the motors in such direction.

REFERENCES

[1] Li, Xueen, Xiaojian Zhao, and Tieniu Tan. "A behavior-based architecture for the control of an intelligent powered wheelchair." In *Proceedings 9th IEEE International Workshop on Robot and Human Interactive Communication. IEEE RO-MAN 2000 (Cat. No. 00TH8499)*, pp. 80-83. IEEE, 2000.

[2] Jiao, Liguo, Jae Hyoung Lee, Yuto Ogata, and Tamaki Tanaka. "Multi-objective optimization problems with SOS-convex polynomials over an LMI constraint." *Taiwanese Journal of Mathematics* 24, no. 4 (2020): 1021-1043.

[3] Wanluk, Nutthanan, SarinpornVisitsattapongse, AniwatJuhong, and C. Pintavirooj. "Smart wheelchair based on eye tracking." In *2016 9th Biomedical Engineering International Conference (BMEiCON)*, pp. 1-4. IEEE, 2016.

