iWalk

iWalk (to be pronounced /eye walk/), to be contemplated as "I walk".

The i also stands for intelligent, which it is used when there is artificial intelligence in a machine.

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Abstract

The project aims to design and develop a smarter wheelchair for disabled people whose muscle capabilities are limited. The wheelchair will move around by commands that are read from movements of user's eyeball. The disabled accessory designer will be able to follow the instructions of this research in order to improve the development of the project. Our approach is to employ the image processing techniques to follow the movement of eyeball around the eye itself to get a sophisticated command. The command is being translated into hardware instructions and motors are moved accordingly.

Keywords

[Image Processing, Hardware Engineering, Electrical Engineering, Eye Tracking, Wheelchair]

Introduction

The disabled people in Iraq and Kurdistan region are suffering from the lowest quality of services in our community. Despite of availably of modern technologies in the country, the lack of digital devices which could help disabled people in their daily life is clear. A vast majority of disabled people use wheelchairs, that are manufactured by local companies. The manufacture of wheelchairs and other accessories have not focused on employment of the latest computing engineering technologies.

The case of our project is to create a smart wheelchair that helps a disable person to control its movements by using only the eye ball. According to [1] Amyotrophic Lateral Sclerosis, are not able to move their body parts. While in [2], the movement of eyeballs are excluded from the rest of body parts, and it is possible to move the eye balls in few directions. The development is equipped with a single camera that reads movements of eye, process the request, then transmit the instruction to motor movements on the wheelchair.

According to our investigation in Orthopedic Medical Center in Soran City, there are 88 disabled people registered. There are 43 Males and 45 Females, that are suffering from ALS or similar disease which has disabled their muscle abilities. 10% percentage of those patients are students and would like to live their lives as ordinary individuals.

Requirements and Tools

Tool	**Model**	**Usage**
Arduino	Mega	To control the motors
Camera	USB Webcam 2mp	To Capture the images
Motors X 2	36v 19A DC MOTOR	To Move the wheels.
Battery	12v 9A	For Power.
Hardware Materials	really 5v dc wires	To Control the Speed
Raspberry	PI3	For mini Processing

Aims and Objectives

The project focuses on a number of objectives:

- To create a new system for controlling the wheelchairs
- To produce a design prototype for local business that are building disabled people accessories.
- To have solid step on the image processing, and find new results in eyeball detection and track.
- To research on feedback on the next developments that are focusing on eyeball tracking.

Methodology

The development, takes a number of steps to convert the movements of eyeball into hardware instructions:

1. The application runs of a mini computer cheap, which in our project is a Raspberry PI.
2. The software, starts with initializing ports to an Arduino and a USB Camera.
3. The images are read from the camera input, and are processed.
4. First the faces are detected, and we focus on one face only, it is a single process. The detections of the faces are done by help of this research [3].
5. Then the right is being detected by help of data collected in this conference [4].
6. Final step of image processing is to clear the surroundings of the eyeball and make the eyeball pixels the only particle with data.
7. The next step is to follow those particles, and there are 4 regions that have been defined were particles could sit.
    a. Right
    b. Left
    c. Above Middle
    d. Middle
8. The next step, detects if the eyeball has been sitting in a particular range for at least 2 seconds, insuring decreeing the error rate, while the user could be moving the eyeball with no intention.
9. The right, left and above middle ranges, will move the motors of connected hardware accordingly.
10. At the end the application goes back to its default stage, where it stopped all the motors.

Conclusion

The project has started with a prototype hardware design that enables movement of a wheelchair by installation of two motors, a battery and a piece of software to run it. The commands of the motor are not manually given, but by usage of a camera that reads the movements of eyeball. The users of the project are people who had difficulty with moving their body parts. The targets of our approach are the local companies which produce wheelchairs. The particular aim of the project is advance the digital aid for disabled people who are suffering from ALS or similar diseases.

Future works and Plans

The project could be advanced in various ways:

- Hardware Improvement, to tackle few hardware issues such as changing Motors with lower RPM (rotate per minute) and higher power.
- Using a more advanced Camera, and install it in front of the user's chair
- Use more instructions, for movements and use a sound-aided system.

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Contribution

A team of 3 students and a university lecturer as supervisor have worked on this project. The skills that are being required from students have been hardware engineering and software developments. Alongside the prototype design, the team has researched on the requirements of customers, which in this case are disabled people.

References

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