DOMOTICS BASED ON EEG WAVES AND OCUL GESTURES FOR PHYSICALLY CHALLENGED

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Abstract

Domotics based on (ElectroEncephaloGram) EEG waves and Ocul gestures for physically challenged people is a project that is designed for the people who are physically challenged. Domotics is just and Greek word given for 'smart home' and EEG waves are nothing but brain waves and Ocul is the medical name given for the human eye. So as the title tells the smart home or home automation is done or the devices are controlled using the brain waves and the eye gestures of a physically challenged person or a completely paralyzed person. The people who are physically challenged or are paralyzed could not help themselves at times, a helper or an assistant is always required for them on their side to take care of them. Then a question arises, "what if there's no one to help???", "cant that person help himself??", the answers for all these questions is this project itself which help the physically challenged person to turn ON or OFF the devices or move the wheelchair towards the direction he/she wants. This can still be updated to play a buzzer such that if the person is in any danger it must indicate the other person who is in the remote place. The project is carried out with a simple Raspberry pi 3 board, a small CPU like architecture that makes the project simpler and cheaper.

I INTRODUCTION

Eye movement controlled wheelchair is to enable completely paralyzed patient as well as elderly to make their life more accessible. Person who are unable to walk and are using wheelchair exert great amount of energy using physical strength to turn the wheels. Disabled would save energy and could use their hand and arm for other activities. Currently there are different eye based method will be used for controlling wheelchair such as EOG, ECG, EEG based, Eyeball sensing method. To decide the location of eye pupil depends on voltage variation. But for different output voltage will be generates for different user, which gives wrong location of the eye pupil.

Raspberry pi board is soul of the system, which control the complete system operation. Image processing based data signal sent to the raspberry pi, raspberry pi received the data and analyse it and send the control signal to motor driving circuit, based on the location of eye pupil. This will decide motor run either in clockwise or anticlockwise direction or stop. Two individual motors are fixed on each wheel. Ultrasonic sensor is mounted on the wheelchair for obstacle detection. If sensor gets any obstacle very close to the wheelchair, it indicates to the raspberry pi and it will sends the signal to motor driving circuit to stop the motor.

Voice activated power wheelchair system, which works properly when user speak the command clearly, according to it left, right, forward, back and stop. Other voices which come from surrounding user may affect the system [22]. The head movement based system and chin control based system, bad movement gives problem [9][10][20]. Sip and Puff wheelchair system, not good for people with weak breathing. Infrared reflection based eye pupil detection system provide accurate detection of eye pupil centre location. But the infrared radiation affects the eye and people may loss the eye visibility [23]. Eye controlled wheelchair system is introduced using camera for capture the image [19]. But someone is required to have attention on itself, so here we use central switch to stop. Camera captured the image in real time based on face, eye and eye pupil detection with minimum delay of time and analyse the image as input to set the commands to interface the motor driver IC through sending the command to GPIO pins, to perform the different operation such as left, right, forward and stop. Image processing open computer vision (openCV) library is used for face and eye detection [2]. System includes multistage that is track the eye pupil centre [11]. To detect the single or multiple face and detection of both Eyes, this is ultimate goal of this system. Several Algorithms are used to find exact pupil location direction. Haar cascade like feature detection algorithm is used [3]. Image processing are includes face detection, eye detection, color image to gray conversion, blurring, edge detection, pattern matching , filtering, noise reduction, etc. Figure 1 shows the architecture diagram of the system.

II LITERATURE SURVEY

Shawn Plesnick, DomenicoRepice, Patrick Loughnane Department of Electrical and Computer Engineering Villanova University Villanova, Pennsylvania."eye controlled wheelchair"

This document outlines a method for implementing an eye tracking device as a method of electrical wheelchair control. Through the use of measured gaze points, it is possible to translate a desired movement into a physical one. This form of interface does not only provide a form of transportation for those with severe disability but also allow the user to get a sense of control back into their lives.

Bonfring International Journal of Power Systems and Integrated Circuits, Vol. 1, Special Issue, December 2011"Implementation Of Head And Finger Movement Based Automatic Wheel Chair"

An automated system is to be developed to control the motor rotation of wheel chair based on head and finger movement of physically challenged person. In order to facilitate these people for their independent movement, an accelerometer device is fitted on persons head and a flex sensor is fixed in a glove which is to be wear by the person. Based on the head and finger movements the accelerometer and the flex sensor will drive the motor fitted to the wheel chair. The wheel chair can be driven in any of the four directions. The automated wheelchair is based on simple electronic control system and the mechanical arrangement that is controlled by a Programmable Interface Controller. This automatic wheel chair also helps people who have various other disabilities to sit on the chair and just hold the accelerometer and move it over to control the vehicle movements. In this paper the wheel chair has been mimicked using a robot.

Massimo Gneo, Giacomo Severini, Silvia Conforto, Maurizio Schmid, TommasoD'Alessio Applied Electronics Department, Roma Tre University, Rome, Italy "TowardsA Brain-Activated And Eye-Controlled Wheelchair"

All the methods to control electric-powered wheelchair (EPW) with user's gaze require a graphical user interface (GUI) to select and confirm commands. This kind of GUI may give non natural guide and partial obstructed sight. As further gaze independent inputs are needed for safety issues, we propose a high-level scheme of a system integrating an eye-gaze tracking system (EGTS) to select the desired motion command, with a brain-computer interface (BCI) using the user's electroencephalogram (EEG) as a motion activation command, obtaining a safer obstruction-free eye-and brain-guided EPW.

CHERN-SHENG LIN1, CHIEN-WA HO2, WEN-CHEN CHEN1, CHUANG-CHIEN CHIU1, MAU-SHIUN YEH31Department of Automatic Control Engineering, Feng Chia University, Taichung, Taiwan" Powered Wheelchair Controlled By Eye-Tracking System"

In this paper, we use the optical-type eye tracking system to control powered wheelchair. The userís eye movements are translated to screen position using the optical-type eye tracking system. The pupil-tracking goggles with a video CCD camera and a frame grabber analyzes a series of human pupil images when the user is gazing at the screen. A new calibration algorithm is then used to determine the direction of the eye gaze in real time. We design an interface with nine command zones to control powered wheelchair. The command at the calculated position of the gazed screen is then sent to move the powered wheelchair Powered wheelchair controlled by eye-tracking system In this paper, they use the optical-type eye tracking system to control powered wheel chair. Theuserís eye movements are translated to screen position using the optical-type eye tracking system. The pupil-tracking goggles with a video CCD camera and a frame grabber analyzes a series of human pupil images when the user is gazing at the screen. A new calibration algorithm is then used to determine the direction of the eye gaze in real time. We design an interface with nine command zones to control powered wheelchair. The command at the calculated position of the gazed screen is then sent to move the powered wheelchair.

International Journal of Science, Engineering and Technology Research (IJSETR), Volume 5, Issue 1, January 2016" Automatic Camera Based Eye Controlled Wheelchair System Using Raspberry Pi"

This paper includes the electronic wheelchair that implemented for the disabled person. The purpose of this eye controlled wheelchair is to eliminate the assistance required for the disabled person. In this system controlling of wheelchair is depend on eye movements and central switch. Camera is mounted on wheelchair in front of the person, for capture the image of eye and tracks the position of eye pupil by using some image processing techniques. According to eye pupil position of user, motor will be move in required direction such as left, right and forward. Ultrasonic sensor is mounted in front of wheelchair for safety to detect static or mobile barriers and stop the wheelchair movement automatically. A central switch is also mounted on wheelchair for emergency purpose and stop to move in require direction if any one call to stop and someone require attention on themselves. This is independent and cost effective wheelchair system. A raspberry pi board is used to control whole system.

Matt Bailey, Andrew Chanler, Bruce Maxwell, Mark Micire, Katherine Tsui, and Holly Yanco"Development of Vision-Based Navigation for a Robotic Wheelchair:"

Our environment is replete with visual cues intended to guide human navigation. For example, there are building directories at entrances and room numbers next to doors. By developing a robot wheelchair system that can interpret these cues, we will create a more robust and more usable system. This paper describes the design and development of our robot wheelchair system, called Wheeley, and its visionbased 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 assistive robot arm to help with pushing elevator buttons and opening door handles.

III BLOCK DIAGRAM

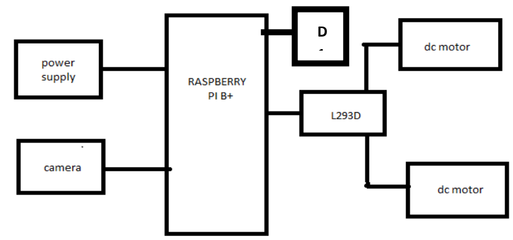

Figure 3.1: Block Diagram

The block diagram consists of the following blocks:

Raspberry Pi B+: The Raspberry Pi B+ board is the heart of the project. It is made up of the ARM-11(Advance RISC Machine version 11) processor with additional facilities like USB ports, SD card slot, HDMI port, Power Supply port. The Raspberry Pi B+ board takes the input from the connected USB camera and depending on the image captured the output devices (Wheel Chair and Devices) are controlled.

Camera: Camera is used to detect and capture the eye blink expressions of the physically challenged person or paralyzed person and gives the output to the Raspberry Pi B+ board. This capturing and detecting the eye blinks is done using the OpenCV that is installed in the Raspberry Pi B+ board.

L293D: The Raspberry Pi B+ output Pins are connected to the L293D board for energizing it to drive the DC motors that are acting as wheel chair of this project. Depending on the codes given by the Raspberry Pi B+ board the L293D board is going to control the direction of rotation of the motors.

Device 1: Device 1 may be any device like light, fan, TV etc. that is being controlled by the Raspberry Pi B+ board device on the number of eye blinks.

DC Motors: DC Motors are acting as the Wheels for the Wheel Chair on which the physically challenged is going to sit.

LED's: Light Emitting Diodes are used for the indication purpose.

Power Supply: The Power Supply is used to energies the circuit to give the required output. The voltage at which the

Raspberry Pi B+ board works is 3.3V. The voltage required by the L293D driver board for its operation is 9V.

Software: The software's that are used are **Raspbian OS** for interaction with the Raspberry Pi B+ board, **Python** for Programming to read the inputs and producing the outputs depending on the inputs provided, **OpenCV** is used for performing **Image Processing** operations that are used to detect the number of eye blinks and the position of the pupil.

IV Flow Chart to Represent the Working of the Project:

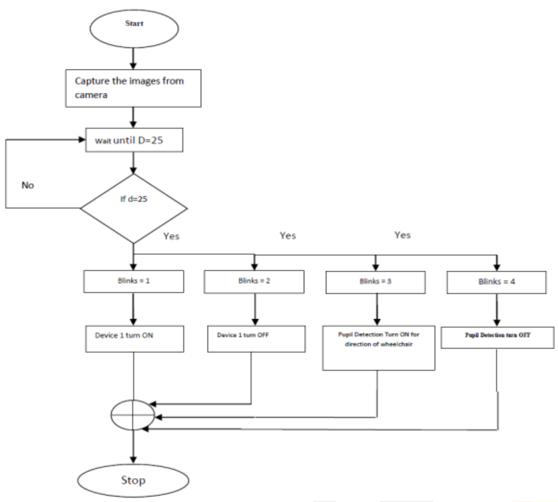

Figure 4.1: Flow Chart

V MERITS AND DEMERITS

Merits:

- ➢ As this project mainly focuses on the physically challenged person, it may give him the hope to live on his own without anyone's help or nurture.
- ➢ This project may be helpful for the physically challenged or paralyzed person to control things without any physical action and just by blinking his eyes as per the requirement and activating his neurons.
- ➢ This project may be even used in the military applications to send signals to the control room by the security guard when he is caught by the intruder.
- ➢ This project can be used in the industry where high voltage circuits are present and if the person cannot go near it.

Demerits:

- ➢ As there is headset placed on the outer part (scalp) of the brain of the human being there may be chances of getting small injuries, if used for long duration but this disadvantage can be overcome if the headset is turned ON only when it is required and rest of the time if it is kept OFF.
- ➢ The another disadvantage is that the person needs to concentrate in order to provoke the neurons so that the signals can be received by the neurosky headset if the user does not concentrate then no output can be obtained.

VI APPLICATIONS:

- ➢ It can be used in the military.
- ➢ It can be used for the physically challenged people.
- ➢ It can be used in the field of industry.

VII EXPECTED OUTCOME:

It is expected that the output will be accurate; the direction of the wheel chair will be controlled based on the pupil position of the person's eye. The devices will be turned ON based on one blink made by the person and turns OFF when the same person makes a double eye blink i.e., when the person blinks two times his eye. It is also expected that the Project would help the physically challenged person to lead his life in the simpler way like a normal person. This project will help the person not to be dependent on any other persons for his 80% of works.

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