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Review

Computer Cursor Control and Rover Control Using Artificial Vision Systems

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The purpose of the present paper is to show the use of artificial vision techniques with a infrared web cam for two applications for disable people. The first application is the move of the computer cursor through eye movement using artificial vision techniques. The tool has created great benefits for people with reduced capabilities. Offering the opportunity to interact with the outside world and thus, increasing their self-esteem. Providing the maximum functionality possible in spite of the injury they have suffered. The second application is a system that controls a rover movement using an artificial vision system. The control is done by a finger motion. The system is designed with a master-slave scheme. Both systems provide a solution for persons who cannot use their body parts to drive wheelchairs. The study affirms the usefulness of artificial vision techniques to develop tools that can improve the human being quality of life.

Keywords: Artificial vision; Computer cursor control; Rover control

INTRODUCTION

Computers are digital systems capable of processing information that proceeds from different applications. Management of a computer requires the physical movement of at least one hand of a human being, thereby limiting access to quadriplegic people. Quadriplegia is a condition caused by the damage of the spinal cord and it prevents the movement of human being limbs. People who have this condition are disabled to perform daily activities and therefore causing them psychological trauma (Health System, 2008).

In this manner, the provision of a tool that moves the computer cursor through eye movement is undoubtedly a technological help tool that allows users to interact and do certain tasks with the computer. The tool created is an inexpensive resource that helps quadriplegic people without requiring a medical intervention. Disabled people can interact with the computer and access to tasks that will ensure an improvement in their quality of life. Among the variety of opportunities offered by the tool are communications, entertainment, information access, studies or work; depending on the conditions of the user.

Nowadays exist an advanced technology for driving vehicles for disabled people. An important amount of persons cannot use these vehicles, because their physical problems affect the principal parts of the body which are used to drive the vehicle. A control system development that allows to drive vehicles (rovers) by disabled persons in a direct and easy way is useful, and

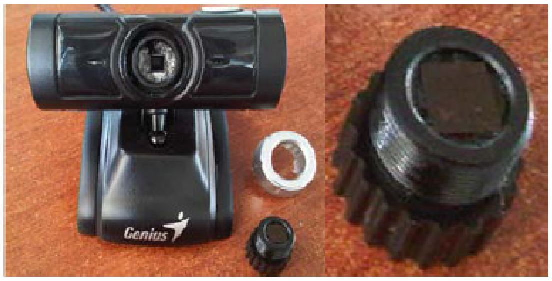


FIG. 1 a) CAMERA PARTS b) CAMARA FOCUS WITH A PHOTOGRAPHIC VEILED NEGATIVE AS A FILTER

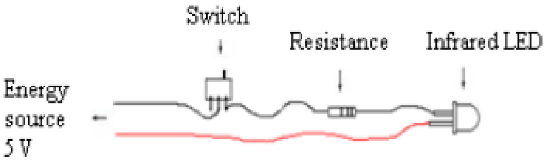


FIG. 2 INFRARED CONNECTION

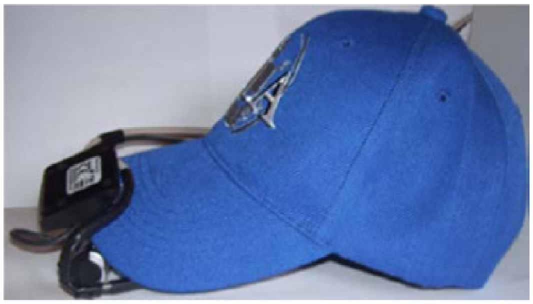


FIG. 3 ALTERNATIVE PERIPHERICAL DEVICE

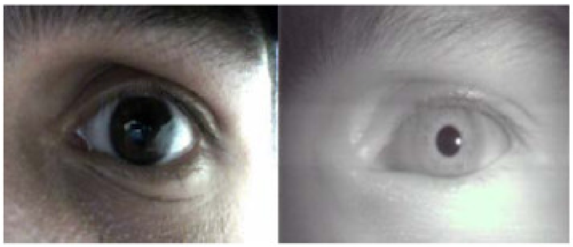


FIG. 4 a) NORMAL EYE IMAGE b) EYE IMAGE AFTER CAMERA MODIFICATIONS

improve human life for thousands of people around the world. Using finger movements we can control the vehicle.

Computer tool that allows to move computer cursor by eye movement

The computer tool designed use a video camera as a sensor that allows capturing images in real time. Regarding the lighting in the image area, the prototype uses an infrared LED (Light-Emitting Diode). This type of light is not perceived by the human eye, avoiding any discomfort as dilation of the pupil or glare. Additionally, it is necessary to apply artificial vision techniques to achieve the characteristics of the eye image. The images should be treated in order to achieve the computer cursor movement in the areas that change according to certain parameters.

The development of this prototype is based on the premise of a segmentation technique as a seed that detects the area of interest (González, 1996), (Justo,

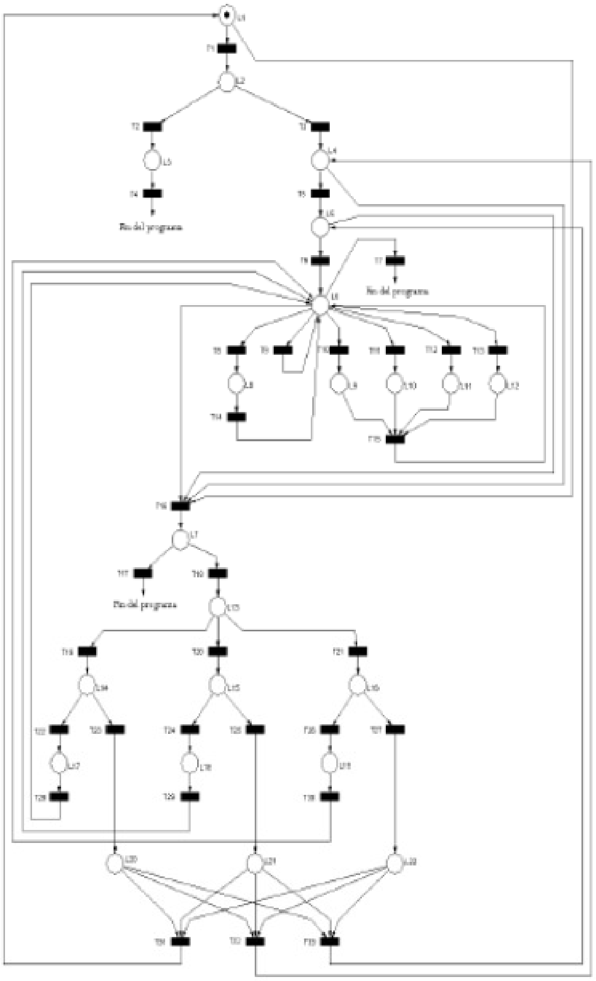


FIG. 5 PETRI NET SYSTEM MODEL

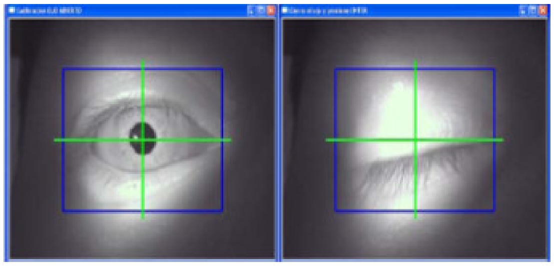


FIG. 6 IMAGE CALIBRATION a) OPEN EYE b) CLOSE EYE

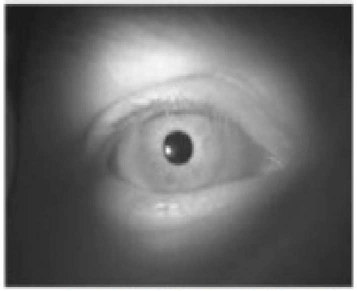


FIG. 7 INITIAL IMAGE

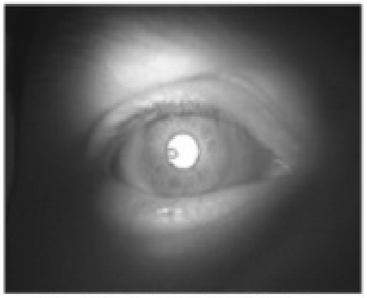


FIG. 8 SEGMENTATION

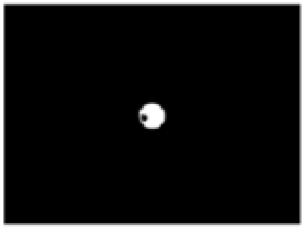


FIG. 9 UMBRALIZATION

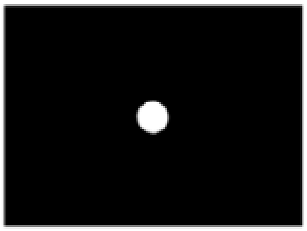


FIG. 10 FINAL IMAGE

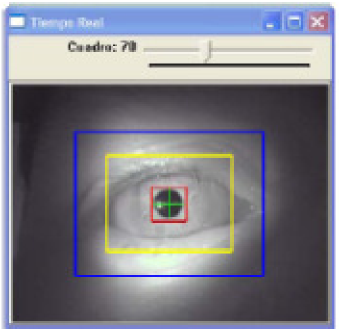


FIG. 11 IMAGE CAPTURE FROM THE SYSTEM

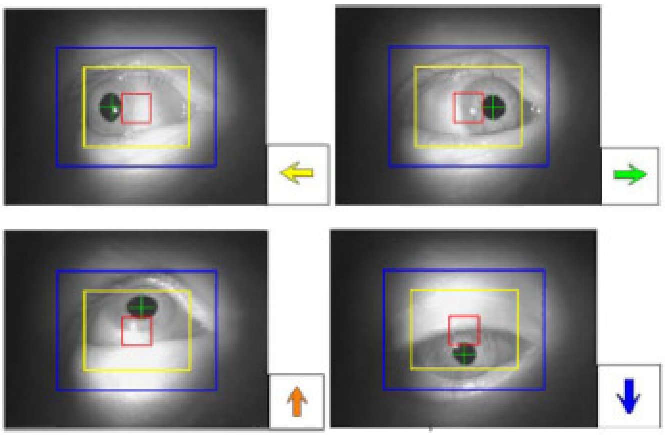


FIG. 12 EYE MOVEMENT TO: a) THE LEFT IMPLIES CURSOR MOVES LEFT b) THE RIGHT IMPLIES CURSOR MOVES RIGHT c) UP IMPLIES CURSOR MOVES UP d) DOWN IMPLIES CURSOR MOVES DOWN

2009). Manipulating the environment with vision techniques would ensure that the segmentation will have a high degree of robustness.

An Alternative Low Cost Periferical Device

It is important that the device should be located in a precise way that could capture the area of interest, in our case the user's eye region. The need of focus on the user's eye and not the further region is due to the use of an economic commercial camera of relative low resolution (1.3 mega pixel). The following subsections explain the steps followed for the creation of an alternative peripheral visual development tool.

Camera Modifications

The camera is use for video detection of the pupil and corneal reflection (measuring eye movements). The first step towards the creation of the prototype tool is to make a camera modification that captures infrared light. This is because all common digital cameras have a sensor,

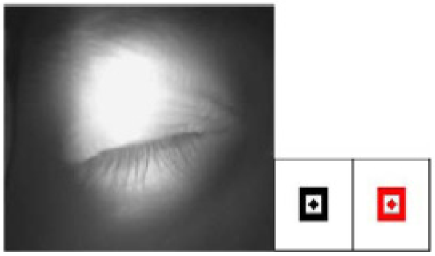


FIG. 13 CLOSE OF THE EYE IMPLIES CLICK OR DOUBLE CLICK

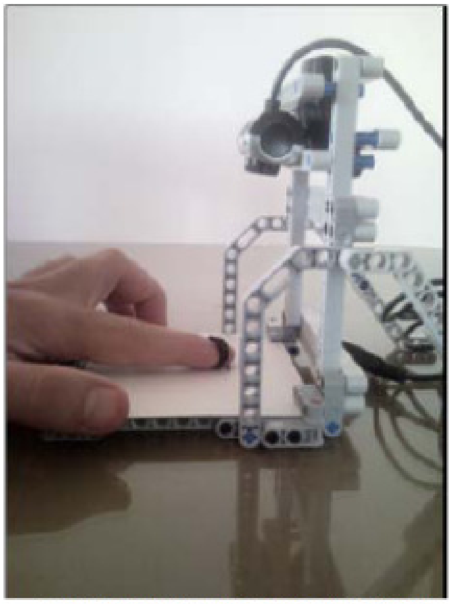


FIG. 14 WEBCAM IN PLATFORM

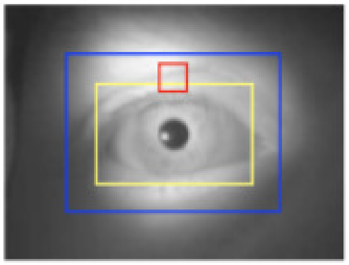


FIG. 15 INCORRECT POSITION

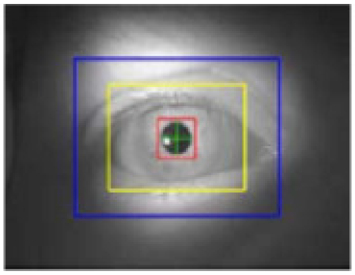


FIG. 16 CORRECT POSITION

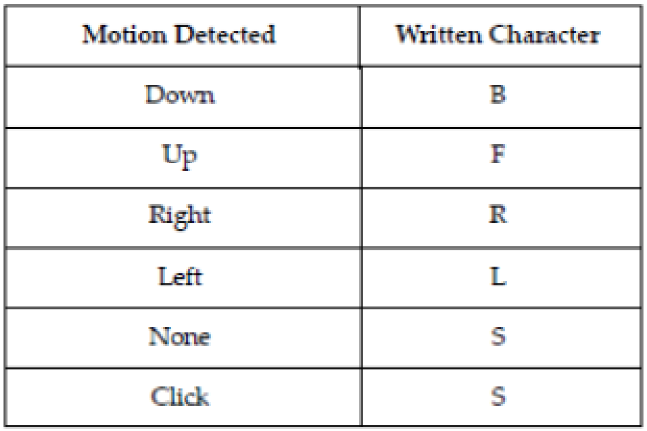
typically a CMOS (English Complementary Metal Oxide Semiconductor), which is sensitive to all visible light to the human eye and to infrared light. In order to prevent that the infrared light saturates colors and create unreal images, these sensors are fitted with a filter so that only visible light can pass. In this sense, the amendment to the camera is to remove the filter that comes with it and replace it with an infrared filter that blocks visible light and passes only infrared light. With this transformation we achieve an infrared camera.

As mentioned by Turégano in (Turégano, 2006), a number of commercial filters exist, such as Lee, Cokin, among others, which could provide better image quality. However, these filters have a significant high costs that would raise the value of the final product, distorting the original idea of creating an economic tool to achieve the desired goal. Taking this into account, the use of a photographic negative veiled as a filter, provides good picture quality and it can be easily obtained at no cost. See Figure 1.

Image Illumination

Lighting is one of the most critical elements in the treatment of image quality. In order to build an

TABLE 1: FILE INFORMATION AND INTERPRETATION



Motion Detected	Written Character
Down	B
Up	F
Right	R
Left	L
None	S
Click	S

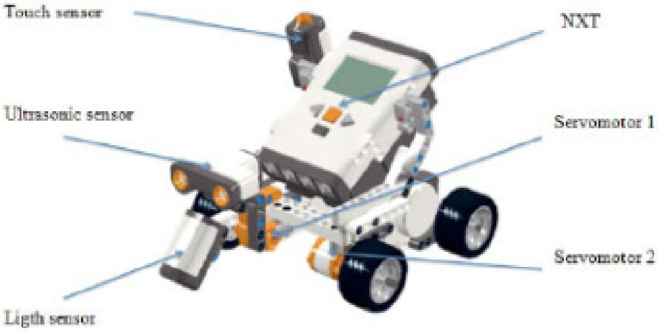


FIG. 17 LEGO PROTOTYPE

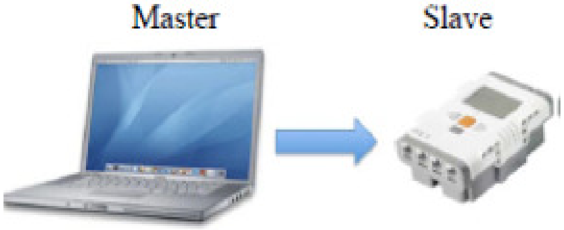


FIG 18. MASTER-SLAVE SYSTEM SCHEME

illuminate eye area, we use an infrared LED emitter. The energy provided to the LED is supplied through the computer using a USB (Universal Serial Bus). However, since the LED operates with a maximum voltage of 2 volts and the USB port provides 5 Volts, it is necessary to add a resistance, so the LED functions properly without burning (Justo, 2009). See Figure 2.

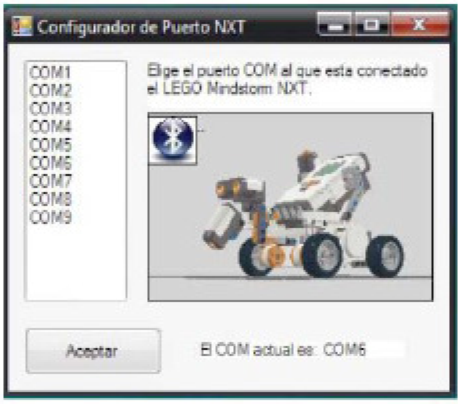
Peripherical Assemble

The next step is to assemble the image illumination device with the modified camera. Considering that the camera should be positioned in a region close to the user's eye, and should kept fixed in spite of the movement, it was decided to use a cap to hold the mentioned device. In general, it is intended to set the camera and lighting components to the cap´s peak using a screw with a nut, so that the camera focuses the area of interest. Additionally, a wire is added to the USB cord to route the LED, achieving adequately illumination of the eye region (Justo, 2009). See Figure 3.

Figure 4 shows the images taken from the camera before de camera modifications and after the modifications with the photographic negative veiled as a filter and the infrared LED emitter.

Artificial Vision Functions

Considering that real-time processing is needed by the application, so the cursor moves in coordination with the



Configurador de Puerto NXT

Elige el puerto COM al que está conectado el LEGO Mindstorm NXT.

El COM actual es: COM6

FIG 19. CONNECTION MODULE

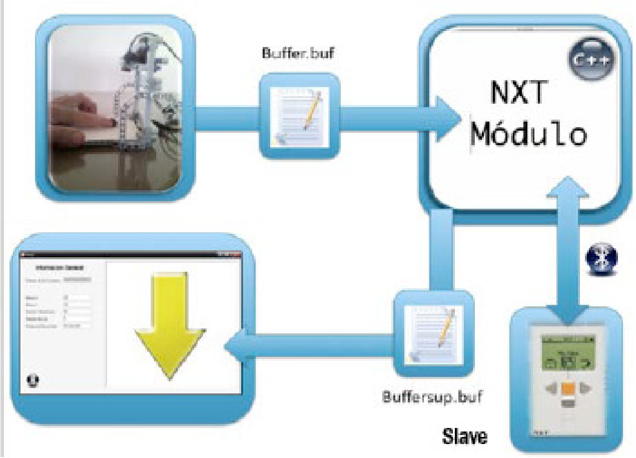


FIG. 20 COMMUNICATION MODULE

user's eye movement (with the best possible time response), it is necessary to use a programming language. We use the Open CV (Open Source Computer Vision Library), which has more than 500 functions that cover many artificial vision techniques
and is especially designed for real time images treatment (Bradsky, 2008). This will determine the use of Open CV for software development and C + + as the programming language. The library was created by Intel to open access and also is multiplatform (compatible with Mac OS, Linux and Windows). One advantage that prevailed in the decision to use the library is that the execution time of the machine vision functions used in the project were very small and they meet the design specifications, a small latency less than 130 milliseconds.

Software Steps Implementation

The following steps were performed to implement the final prototype. The first step is image acquisition, followed by image inverting. The resulting image is converted to grayscale. For the cursor movement we get the pixel or seed.

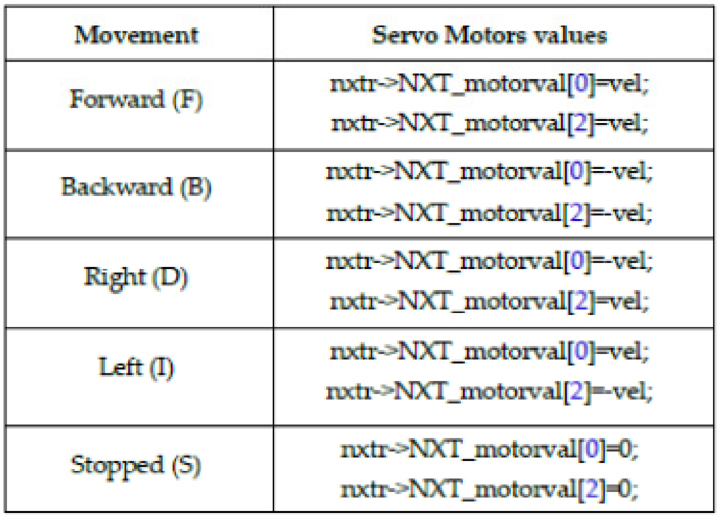
Then we apply the segmentation given a seed. After doing the segmentation we proceed to do binary morphology and find the approximate center of the circle.

To implement the click in the tool, image subtraction is done by comparison of the image captured in real time and the image captured of close eye in the calibration process. Then we apply a threshold to the resulting image subtraction. Calculate the image histogram and compare the resulting histogram with the image histogram of a completely black.

Petri Net Model

In order to obtain the system model and to implement it in a correct way, we use Petri Nets to construct the model with event discrete systesm techniques (Aguirre, 2011), (Moody, 1988). Figure 5 shows the graphical

TABLE 2: MOVEMENT AND SERVOMOTORS VALUES



Movement	Servo Motors values

Forward (F)	nxtr->NXT_motorval[0]=vel;
	nxtr->NXT_motorval[2]=vel;

Backward (B)	nxtr->NXT_motorval[0]=-vel;
	nxtr->NXT_motorval[2]=-vel;

Right (D)	nxtr->NXT_motorval[0]=-vel;
	nxtr->NXT_motorval[2]=vel;

Left (I)	nxtr->NXT_motorval[0]=vel;
	nxtr->NXT_motorval[2]=-vel;

Stopped (S)	nxtr->NXT_motorval[0]=0;
	nxtr->NXT_motorval[2]=0;

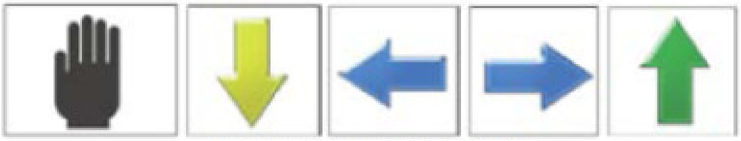


FIG. 21 MOVEMENT ICONS

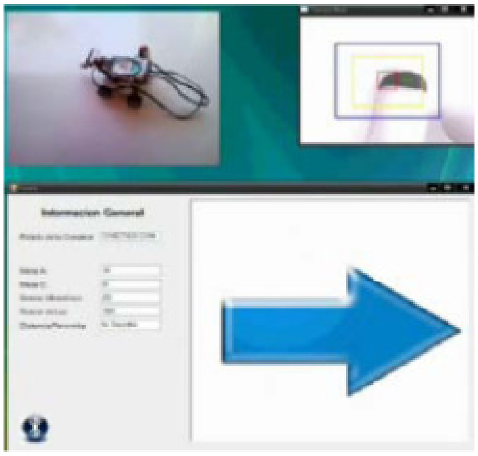


FIG. 22 VEHICLE MOVES RIGHT

representation of the Petri Net and in Appendix A are the states and transition tables. For a more detailed explanation see (Justo, 2009).

Step by Step Tool Execution

This section explains in detail the tool runtime process. First, we obtain the calibration process with two images, one for the open eye and one for the close eye, as seen in Figure 6.

A segmentation algorithm is applied to differentiate the image dark colors. Pixels with higher values than certain reference do not change, and lower values than the reference value, are modified to 255 (white color). After this process, other values different from 255, are modified to 0 (black color). The result is a binary image. The original image is converted to a black image with a white circle in the center, which represents the pupil of the eye.

Morphology algorithm is use to obtain a better differentiate pupil image. This process changes the image geometry and reaffirms the circle form. This

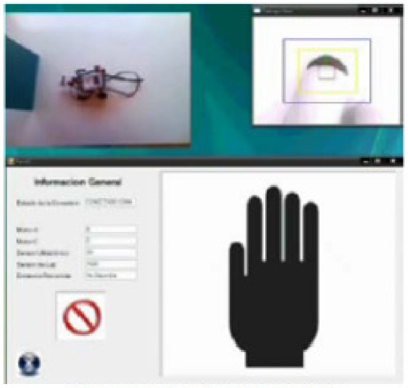


FIG. 23 VEHICLE STOPPED

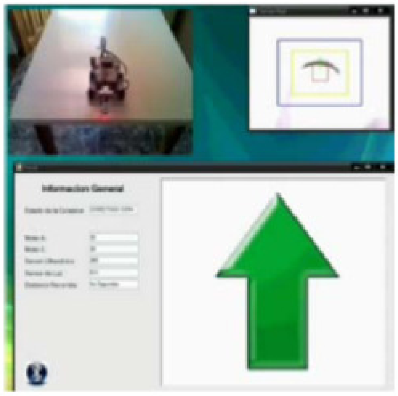


FIG. 24 VEHICLE DETECTING NO GROUND

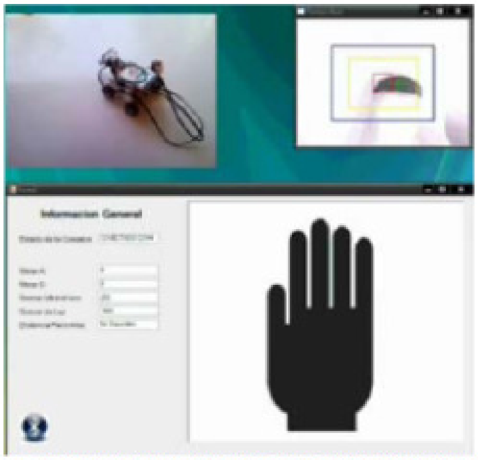


FIG. 25 VEHICLE IN EMERGENCY STATE

process is performed because the previous image does not have a good accuracy in the circle that represents the pupil eye. Finally the image is improved using the histogram algorithm. It transforms the image into gray levels (González, 1996).

The entire procedure is shown in the following images: When the image is totally processed, the image centroid is compared with the previous image coordinates. The result gives the pupil tracking. If the resultant image is totally black, it implies that the eye is closed (Justo, 2009), see Figures 7 to 10.

After taking these images the system generates a window with a new image, as the one shown in Figure 11. In the figure we can observe a green cross which represents the index tracking the pupil, and thereby the cursor movement. In addition, it reflects a red box that indicates the area in which the cursor will not move if the cross remains within that area. If the cross is outside the

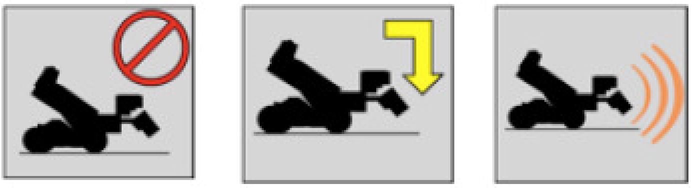


FIG. 26 ALERT ICONS

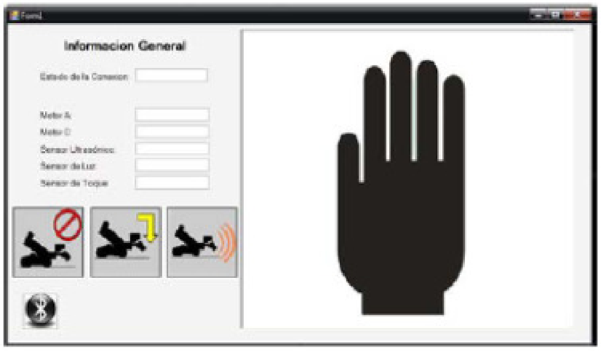


FIG. 27 GRAPHIC INTERFACE

box, the cursor moves in that direction. According to their location outside the red box, the cursor moves up, down, left or right.

In the next Figures (12 (a,b,c,d)) the eye movement is shown as the cursor moves to the desired direction leaving the red box.

Another element that is seen in figures above is a yellow rectangle, which represents the area where the study of the image is being conducted. Therefore, if the calibrated eye position is outside the yellow box, the movement is not expected. A good calibration process is needed in order to get the system to work properly. A green cross will be the indicator of movement and direction. To make the tool friendlier, a window was annexed which indicates by an arrow of a particular color when it is performing a specific movement (Justo, 2009).

Figure 13 shows how to make a click or a double click depending how much time the eye is closed. For a click 2 seconds are needed and for double click 4 seconds with the eye close. The tool provides a calibration window where the user defines the time for a click and for a double click and the cursor velocity.

Test Results

Various tests were performed in order to determine if the developed system is comfortable and allows a user friendly interface. The experiments show that the user can interact smoothly with the tool. By continuing testing the tool, we found that the cap placement should be at an appropriate angle, so no interference affects the eye area because it will affect the treaty of the image. The tool was tested on people with light eyes and dark eyes to see whether in each case, it works properly. In fact the program operates correctly in both cases. However, it was observed that this did not happen when the user wear dark (black) makeup. Because the algorithm was done to detect the darkest image area and this is the case if the dark makeup is highlighted as another area, then the system does not function properly. Given that fact it was decided to establish the condition, for using the tool, that the person should not wear dark makeup.

Because the calibration process became very tedious in the first trials, it was decided to take two images in the process (open eye and close eye) and, by default, set the values that draw the work space. However, to make the tool more sensitive to different users and their requirements, the system has the ability to graduate this region to the tastes of each user.

Additionally, it was decided to add the option that allows the user to adjust the cursor speed. This takes into account the different habilities that can vary between people with limited movement and experience. Thus, the process can be slower or faster, according to the convenience of whoever is willing to use the tool. Similarly, there was a window of sensitivity adjustment with double click, because depending on user needs, this would have to run faster or slower.

Rover control using an Artificial Vision System

Today there exists an advanced technology for driving vehicles for disabled people. An important amount of persons can not use these vehicles, because their physical problems affect the principal parts of the body which are used to drive the vehicle. A control system development that allows to drive vehicles (rovers) by disabled persons in a direct and easy way is useful, and improve human life cuality for thousands of people around the world. Using finger movements we can control the vehicle (Amaro, 2010).

Hardware Settings of the Artificial Vision System

The principal hardware adjustment on the artificial vision system is the incorporation of the teleoperation system to control the vehicle (master). The modified webcam is the sensor responsible for capturing the movements that will be processed by the vision system. The system processes the image and sends the command to the mobile device (slave) that executes the control order. The camera is placed vertically in a structure that does not interfere the system calibration.

The purpose of a black cross in the base is to adjust the camera in a central position. The teleoperator (master) is a finger that must be covered with a dark color material. The dark colored part of the finger represents the eye pupil and the white background of the structure represents the eye iris and sclera. The mobile device is the slave system.

The finger just needs to move about 1 cm in any direction to allow the vehicle to move. Minimal effort is done by the user to move the vehicle (rover). The hardware settings of the systems is shown in Figure 14.

Software Settings of the Artificial Vision System

After performing the calibration procedure, developed by Justo (Justo, 2009), the eye movement detection is made based on a red box. The box is positioned at an initial site area chosen during calibration. It is possible that the red box is not positioned exactly at the center of the window, making it necessary to close the application and return again to perform the calibration process. This problem was solved by changing the variables responsible for storing the centroiposition. The calibration process variables are equal to the values belonging to the middle of the screen showing a red square. Figure 15 shows a wrong position of the red box and Figure 16 shows the correct position of the red square.

The new development system creates a supervisor module. It shows the vehicle direction and other interest variables, obtaining a better application performance.

In order to adapt the initial artificial vision system, functions that allow moving the mouse pointer were eliminated. Instead, the detected information is exported to a text file. This file keeps a character for each command to be executed. The file information and its interpretation are shown in Table 1 (Amaro, 2010):

Prototype Design

The rover design has characteristics quite remarkable as maneuverability and safety. Created with LEGO® Mindstorms NXT product 2.0, the prototype is based on a two-axle vehicle with front wheel drive. It is driven by two actuators located at each end of the front axle. It is possible to direct the rover through their engines. When you want to move the vehicle forward or backward, both actuators are driven in the desired direction. However, to turn the vehicle it is necessary to activate a driving forward and a reverse to the direction in which it rotates.

The built mobile prototype has a base in the top of the front axle, where an ultrasonic sensor and a light sensor are positioned. The obstacle detection is made by the ultrasonic sensor that is positioned in the top of the base. The sensor emits a ultrasonic signal forward with a vertical angle to the front axle, which optimizes the detection of an obstacle in front of the rover. The ground detector, represented by the light sensor, is located in the bottom of the base; about two centimeters from de ground. The position allows the emission of light at an angle of 60º. This ensures the correct transmission and reflection of light on the ground. Figure 17 shows the prototype built and the most relevant features of it. The vehicle can connect to other devices like PDA, PC or mobile phones using a blue tooth.

Bluetooth Communication Library for LEGO Mindstorm NXT

Berger (2009) is the author of a set of C + +libraries that allow communication via bluetooth between a PC and the LEGO® Mindstorms NXT. These libraries have a set of classes, structures and methods to interact directly with LEGO® sensors and actuators. All the processing is executed on the computer and then sends the control signals to the NXT processor, which is responsible for executing the commands.

The proposed control scheme is based on master-slave configuration, where the computer acts as the master and the NXT processor as a slave. See Figure 18.

System Model

Petri Nets is a tool used to model and study discrete event systems in a formal way. The use of this modeling technique makes it possible to reveal important information about the dynamic behavior of the system, and permits the detection of failures. The system model was made using Petri Nets (Aguirre, 2011), (Moody, 1998). Three different modules are interconnected and modeled separately, each with its respective transitions and states. The modules are: the artificial vision module (VisionNXT.exe), monitoring module (NXTS.exe) and connection module (NXTM.exe), which once initiated are kept running and exchanging information. For more details on the modeling (Amaro, 2010).

System Implementation. Connection Module

The connection module is a program written in C + + that uses bluetooth communication. The module is executed as a hidden process. It interprets information taken by the artificial vision system and converts it into signals. The module is responsible to send the control signals to the mobile vehicle. It also receives signals from the state of the sensors. These signals are the basis of security algorithms. And finally exports them to the supervisor module.

Master and slave communication is made through a previously configured COM port. Then, it configures and activates the sensors and actuators. Once the sensors are configured and activated, calls are made to the routing algorithms, obstacle detection and ground absence. These algorithms are responsible for governing the behavior of the mobile vehicle. The module can identify four algorithms: the routing, the obstacle detection, the detection of absence of ground and detection of emergencies. Figure 19 shows de connection module by a COM port.

Communication Module

The artificial vision system is in charge of capturing the information from the teleoperator (master). It is responsible for initiating the other two applications. At runtime, this information is read by the connection module and after processes sends the control signals to the mobile vehicle (NXT) by the Bluetooth.

Subsequently, the vehicle processor sends signals back about the sensors status. These data represents the state of the vehicle; used by the monitoring module to be graphically displayed. The process is showed in Figure 20.

Movement Algorithm

This routing algorithm reads information from a file and depending on the value of the character taken; the servomotors are activated in order to generate the vehicle movement. This information is monitored observing the system development.

The vehicle movements are activated by both servomotors using the information in Table 2:

Figure 21 shows the corresponding icons depending on the selected movement. Figure 22 shows the system when the vehicle moves right.

Obstacle Detection Algorithm

The obstacle detection algorithm consists on a function that constantly monitors the ultrasonic sensor value. If an obstacle is detected, then the vehicle stops immediately and disables the forward movement of the vehicle. In this case, the vehicle can only move backwards or sideways, until the ultrasonic sensor value determines that there are no obstacles nearby, see Figure 23.

Ground Detection Algorithm

The ground detection algorithm uses the light sensor values to monitor the distance between the mobile and the ground. The light sensor emits a wave which bounces with the ground and returns to the sensor. This information is converted to a number between 0 and 1024, where 0 means that the reflection of the wave is maximum and 1024 means that the reflection of the wave is minimum. 0 means that there is ground and 1024 means that there is no ground.

In this case, the vehicle must stop and activate the servo motors to go backward by 2 seconds, see Figure 24.

Emergency Detection Algorithm

The emergency detection algorithm monitors the value of the touch sensor. If pressed, the vehicle is stopped immediately and the teleoperator is disabled until the button is pressed again, see Figure 25. Routing algorithms, ground detection, obstacle detection and emergency detection run continuously. Data are exported to a file, which is used to connect the information from the NXT to the supervisor module and display it on screen.

Monitoring Module

The monitoring module is programmed in Visual Basic. The module shows the servomotors and sensors information status. This application takes the vehicle data exported from the connection module and the data file and displays them graphically for easier observation.

The state of the connection between the NXT and PC is showed in the down left corner of the windows using a bluetooth icon.

Data related with the servo motors and sensors are showed in the left side of the windows. If the vehicle detects an emergency situation, the alert is indicated in the windows with the activation of an icon, see Figure 26.

The vehicle motion is detected by the value of the servomotors. It is shown using arrows and symbols in the principal part of the window. Highlighting icons indicate activation of sensors, (Figure 27 shows the image of the state "Stopped").

TEST RESULTS

Once the model, vehicle prototype and the artificial vision were implemented different tests were made. The results show an efficient behavior with respect to the routing of the vehicle. There is a small time delay between the vehicle movements and the information provided on screen by the monitoring module. The time delay is due to the time it takes to send and receive information through the bluetooth protocol. However, it is important to note that this time delay does not affect significantly the maneuverability of the vehicle. The vehicle moves in appropriated way in the directions intended by the user with minimal effort.

The obstacles detection algorithm has a good performance. A small delay is observed when stopping the vehicle in front of the obstacle. During the tests the vehicle stopped 20 cm from the obstacle.

The emergency detection algorithm, performs well. It was determined that the sensor must be pressed for at least two seconds, so that it can change its state and the vehicle may stop. Therefore we can infer that this sensor is not suitable as an emergency button.

Tests using the light sensor show that sensor values changes depending on ground characteristics. Therefore, the shadows in the ground that are dark color tones absorb more light and reflect less, and it could be recognized as a state in the absence of ground.

The light sensitivity of the receiver varies during the day or night. Logically, this trait of the sensor greatly affects the performance of ground detection algorithm. These limitations also affect the vehicle in areas where ground conditions constantly change. The performance of the monitoring module was excellent. The screen shows the information provided by the connection module with a very acceptable time response.

CONCLUSIONS

Artificial vision is a branch of science being used very successfully in several areas. It is very important in the technology area. The described prototype provides the ability, to people with reduced mobility, to interact with the computer and with this to help them in carrying out certain tasks. Motivation of the tool users is evident and it helps them to raise their self esteem and their quality of life. The tests performed to the system were of great importance since it allowed make changes and improvements for the tool without drawbacks to the end user. It also made possible to corroborate the achievement of the objectives. The prototype provides handicapped

people the chance to interact with the outside world, thereby enabling them to fend for themselves to perform different tasks. The developed system has a great economic return because is much less expensive than similar products that are in the market.

Rover control using an artificial vision system was designed and implanted with very good performance. It allows to control the vehicle trajectory efficiently, using limited processing resources and showing the information of the state of the vehicle in a functional and pleasant interface.

The developed system provides people with severe physical disabilities, the capacity to maneuver a vehicle in a convenient and secure way, using only a small finger movement. This action requires less effort than those required by current existing methods.

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Appendix A

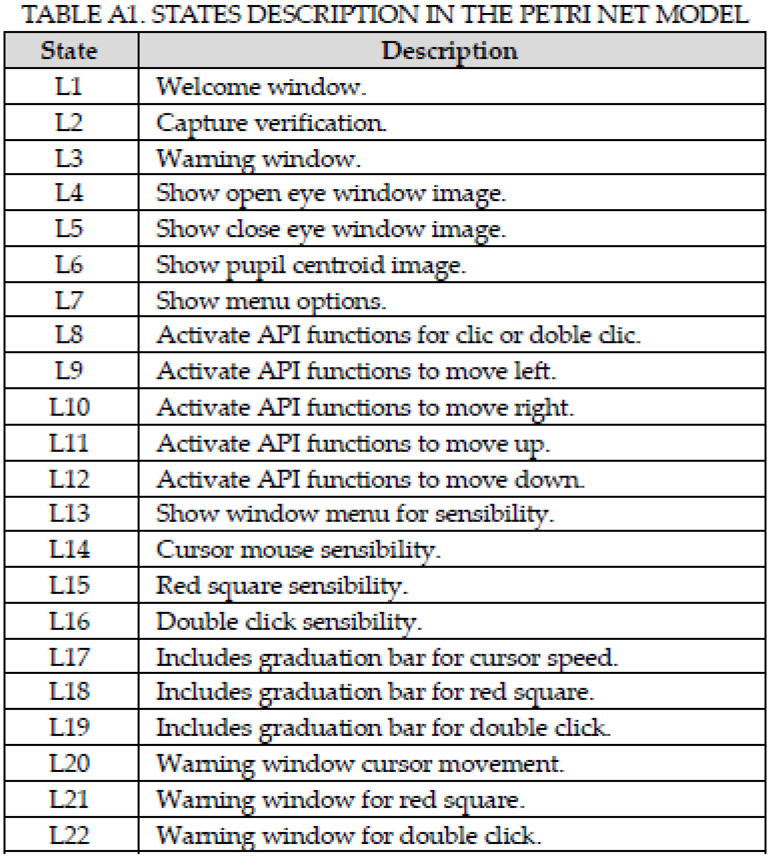

TABLE A1. STATES DESCRIPTION IN THE PETRI NET MODEL

State	Description
L1	Welcome window.
L2	Capture verification.
L3	Warning window.
L4	Show open eye window image.
L5	Show close eye window image.
L6	Show pupil centroid image.
L7	Show menu options.
L8	Activate API functions for clic or doble clic.
L9	Activate API functions to move left.
L10	Activate API functions to move right.
L11	Activate API functions to move up.
L12	Activate API functions to move down.
L13	Show window menu for sensibility.
L14	Cursor mouse sensibility.
L15	Red square sensibility.
L16	Double click sensibility.
L17	Includes graduation bar for cursor speed.
L18	Includes graduation bar for red square.
L19	Includes graduation bar for double click.
L20	Warning window cursor movement.
L21	Warning window for red square.
L22	Warning window for double click.

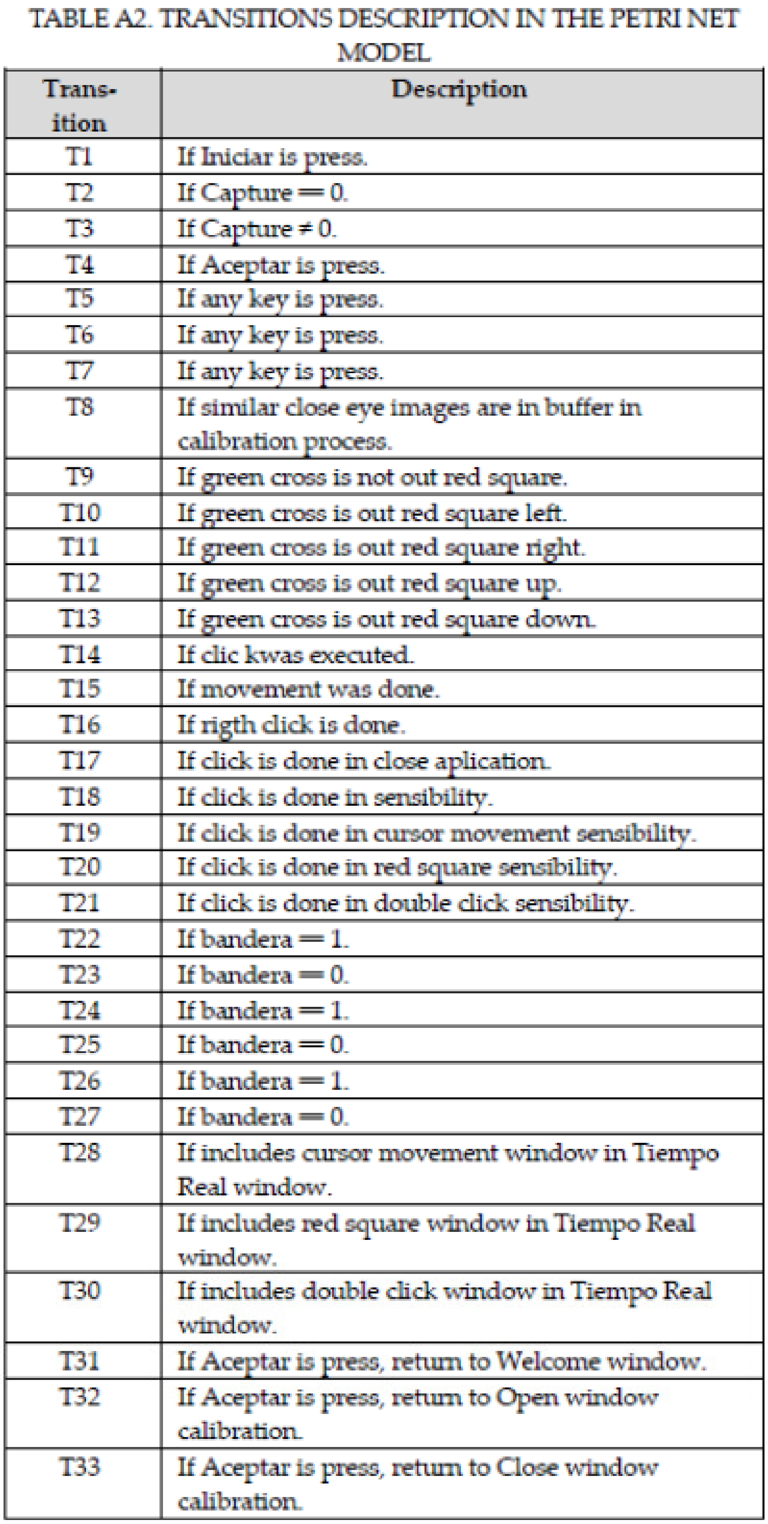

TABLE A2. TRANSITIONS DESCRIPTION IN THE PETRI NET MODEL

Trans-ition	Description
T1	If Iniciar is press.
T2	If Capture = 0.
T3	If Capture ≠ 0.
T4	If Aceptar is press.
T5	If any key is press.
T6	If any key is press.
T7	If any key is press.
T8	If similar close eye images are in buffer in calibration process.
T9	If green cross is not out red square.
T10	If green cross is out red square left.
T11	If green cross is out red square right.
T12	If green cross is out red square up.
T13	If green cross is out red square down.
T14	If clic kwas executed.
T15	If movement was done.
T16	If rigth click is done.
T17	If click is done in close aplication.
T18	If click is done in sensibility.
T19	If click is done in cursor movement sensibility.
T20	If click is done in red square sensibility.
T21	If click is done in double click sensibility.
T22	If bandera = 1.
T23	If bandera = 0.
T24	If bandera = 1.
T25	If bandera = 0.
T26	If bandera = 1.
T27	If bandera = 0.
T28	If includes cursor movement window in Tiempo Real window.
T29	If includes red square window in Tiempo Real window.
T30	If includes double click window in Tiempo Real window.
T31	If Aceptar is press, return to Welcome window.
T32	If Aceptar is press, return to Open window calibration.
T33	If Aceptar is press, return to Close window calibration.