Maestría en Ingeniería en Sistemas y Computo Inteligente

Title

Human-robot interactive routine supported by vision computer design and implementation

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Human-robot interactive routine supported by vision computer: Design and implementation

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1. Introduction

The interaction between two entities involves the designing and evaluation of the communication media that allows interchange information between each other. The response that this work is proposed for the interaction of a human and a humanoid-robot called DarwinOP (just robot in forward), a set of static body gestures that will be requested, validated and imitated by the robot through computer vision and machine learning.

The human - robot interaction require some kind of response at the visual stimulations. In the routine, through some method, the robot can recognize objects, faces and gestures and then will feedback at the person about the interpretation of the movements.

2. Objectives

2.1. General objective

To develop a routine that allows the interaction between a human and the humanoid-robot DarwinOP, supported by computer vision techniques and machine learning.

2.2. Specific objectives

- To set the face recognition at the robot in order to identify a particular person by a machine learning algorithm.
- To recognize the position of the arms and legs of a person through one identification algorithm.
- To define and program the set of finite states for the positions of robot legs and arms in order the robot play for imitating and exposing.
- To set the linear vocabulary in order to give feedback to the person about validation, recognition and asking of gestures.

3. Methodology

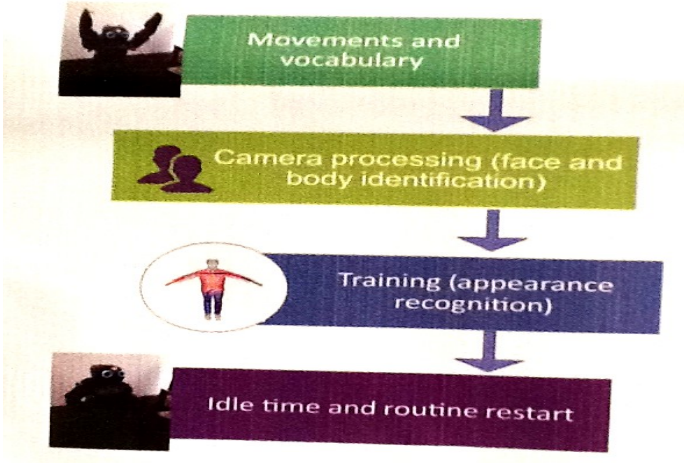


Figure 1. Methodology used in this work

3.1 Robot movements programming

In order to set the positions into the Robot architecture, it was necessary to use the RoboPlus Motion tool. Through this interface it is possible to write the positions of each servo in the robot's arms and legs to set a specific position.

The speed and range of the movements are directly dependent of the degrees of freedom that the robot allows for its own security.

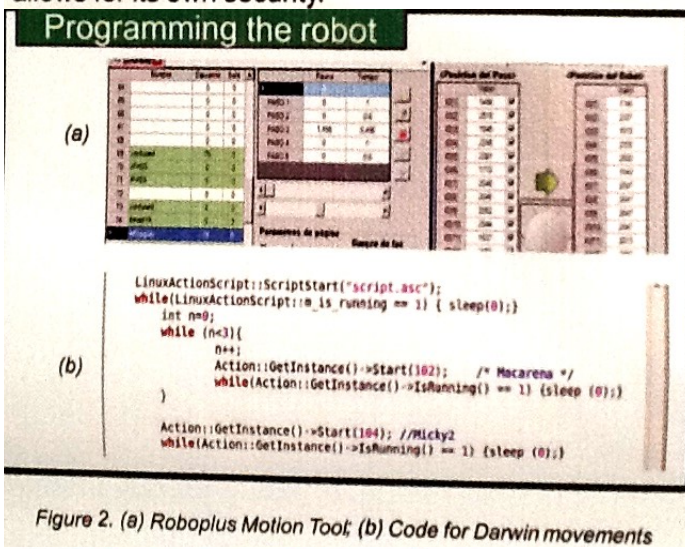


Figure 2. (a) Roboplus Motion Tool; (b) Code for Darwin movements

3.2 Camer programming

The camera programming includes OpenCV libraries and Python programming code. The method used to recognize persons and static body gestures is the Viola-Jones classifier.

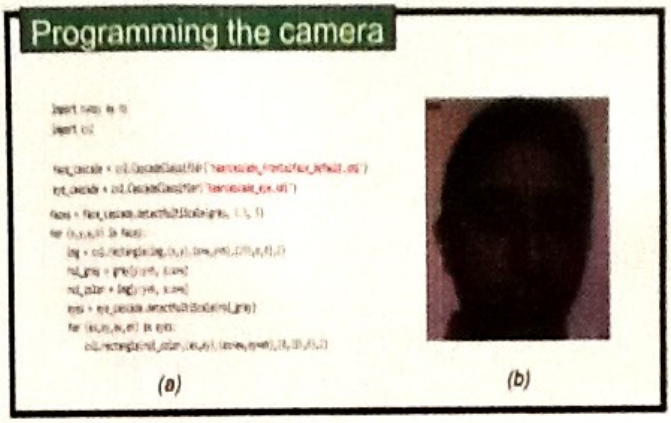
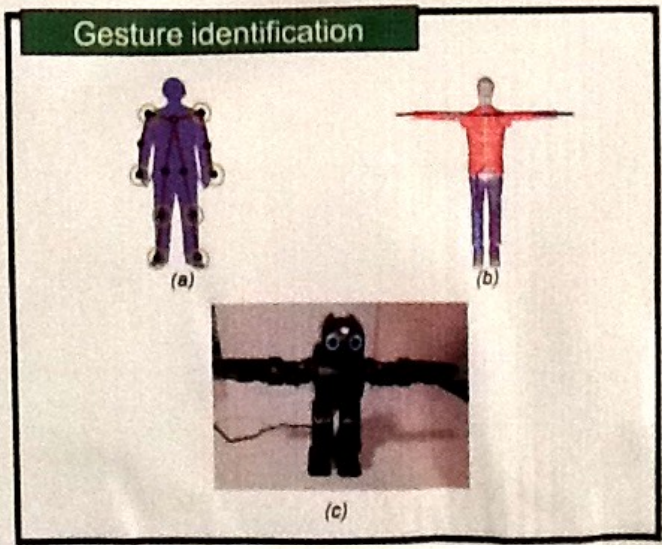


Figure 3. (a) Python2 Code; (b) Haar characteristics.

3.3Gesturesmatching

In order to identify the body gestures in this work is used the skeleton model showed in the Figure 4. In this skeleton are defined the joints that will be involved in the robot movements and positions.



4. Results

On experimental tasks the results for the image processing has been difficult in order to track the features that defines the body joints that are involved in the gestures.

Currently the face and body are fully identified, but still are not categorized as showed the Figure 4. Also the feedback sentences are listed in the figure

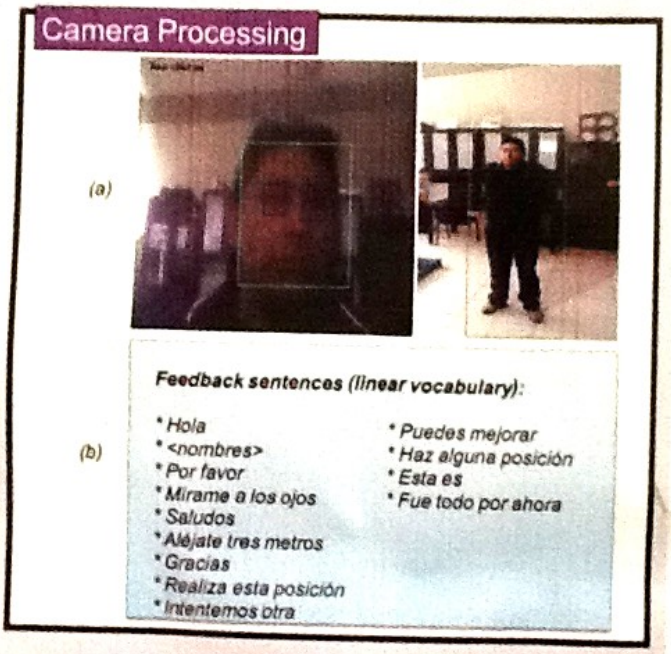


Figure 3. Face and body identification

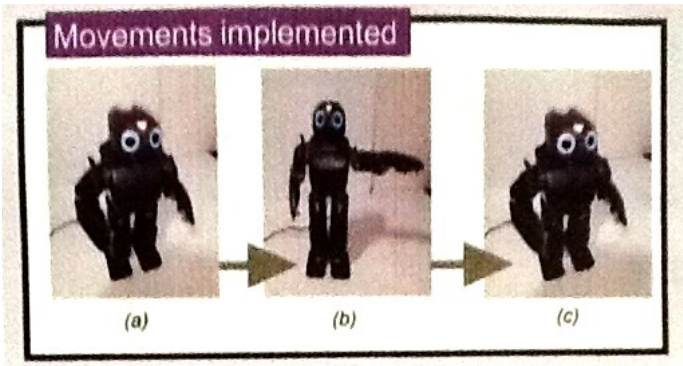


Figure 5. (a) Is the initial position, the legs are stretched out, arms folded; (b) The movements are limited by the physical structure of the robot in order to not generate collisions; (c) When the movement ends, the robot makes a transition to the initial position.

In the idle time the robot will remain in the starting position a while of time, then the routine will restart.

5. Conclusion

In order to achieve the particular objectives there are the next points:

- ✓The robot identifies that there is a face, but still is not trained to recognize any particular person.
- ✓The categorization of static body gestures will be implemented under Haar featured-based cascade classifier.
- ✓Seven new positions were selected, implemented and tested, for the matching with human gestures.
- ✓The linear vocabulary has been selected, but still not recorded with voice

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