International Journal of Latest Engineering and Management Research (IJLEMR)
ISSN: 2455-4847
www.ijlemr.com || Volume 03 - Issue 12 || December 2018 || PP. 43-52

Robot NAO H25 in Tasks of Search and Rescue of Injured to the Centro Universitario UAEM Valle de Chalco

José Alfredo Calderón Rodríguez[1], Marco Alberto Mendoza Pérez[2], René Guadalupe Cruz Flores[3]

[1]*career in computer engineering intern for the Centro Universitario UAEM Valle de Chalco*
[2]*full-time academic technician for the Centro Universitario UAEM Valle de Chalco*
[3]*full-time professor for the Centro Universitario UAEM Valle de Chalco*

Abstract: This research work shows the analysis, design and development of an application for the humanoid robot NAO H25, which allows him to perform as an assistant in the training of the external circular search pattern (with rotation) of the injured along with the description of the different types of rescue that exists in the face of a natural disaster such as an earthquake, within the Basic Civil Protection Course offered by the Directorate of Civil Protection of the Universidad Autónoma del Estado de México (UAEM), to the student community of the institutions that belong to the UAEM, such as the Centro Universitario (CU) UAEM Valle de Chalco. This application will use the operation of the different components of the robot, such as: its servomotors to give mobility to its body, its tactile sensors to perceive its surroundings and to execute different tasks, its speakers that allow you to express yourself, its microphones to hear and voice recognition. This work contemplates the realization of the documentation and experimentation, along with the development of the application, for this it was decided to use the prototype methodology for the development and implementation of the assistance application in the NAO H25 Robot; which should be innovative, creative, friendly and interactive with the users that use it, facilitating a meaningful learning to the student community that takes that course.

Keywords: Significant learning, External circular search pattern, Rescue of injured, Robot NAO H25.

Introduction

Below are some definitions on training in issues of search and rescue of injured, having as an assistant in these tasks the Robot NAO H25 SoftBank Robotics company:

The civil protection is an organization dedicated to ensuring the immediate welfare of the citizens of a country and those who have step, in case of any type of natural disaster or accident (Ucha, 2013).

The search is the methods or actions of review and location of what is lost or in danger (Training and Specialization in Security, S. L., 2016).

The rescue are those procedures, techniques and special maneuvers that are carried out for the transfer of an injured person, from the point of disaster to a safe one, for their attention (UNCA, nd).

An injury "is an abnormal change in the structure of a part of the body caused by external or internal damage" (Pérez and Merino, 2010).

The current robotics facilitates the programming of different devices that allow us to perform scheduled tasks to make work issues simpler or less dangerous.

The robots have been implemented in the search and rescue of people in different catastrophes, these tasks can be very dangerous and precise, it is worth noting what happened in the year 2001 in the United States, where robots were sent in holes of less than one meter in diameter, to locate injured people; while in 2011 after the tsunami that struck Japan, two robotic teams were assigned for the rescue and tracking of survivors (López, 2018).

The humanoid Robot NAO H25 of SoftBank Robotics company, is able to perceive the environment from its multiple sensors, among which are two cameras to detect objects and faces, four microphones for speech recognition, nine touch sensors, two sensors of ultrasound, 8 pressure sensors, an accelerometer and a gyroscope. In addition, it includes other elements of expression that give it a high degree of interactivity, such as its 53 RGB LEDs, its voice synthesizer, its two speakers and wifi connectivity that allows it to communicate with other robots of the same type. It includes graphic programming software called Choregraphe, compatible with Windows, Linux and Mac; that allows to program it without having knowledge of a programming language. And for advanced users it includes a complete set for software development, which allows to use different programming languages such as C ++, Python, JAVA, .NET and MATLAB (Alive Robots, sf).

The external circular search pattern (with rotation) is a call and listen technique, in which the person in charge has a map of the relevant points to look for, the members of the team are designated in specific places by the leader and this asks Absolute silence, while the manager mentions, "We are rescue, can you hear me?", if

none of the members of the team does not hear anything, perform the rotation to the left with the hands of the clock, taking the place of his partner; in case of hearing any noise, a member of the team points out where the noise occurred, the participants draw a line on the map of their location to the place of noise and begin the rescue work (USAID / OFDA, 2006).

Educational robotics is a learning process that is divided into the learning of robotics and learning with robotics. The first one considers that the student can learn to build a robot or to use one of the commercial kits that currently exist to assemble it and in the second case it helps us to reinforce the knowledge of other areas such as mathematics, physics, chemistry, biology , medicine, among others. The research proposal includes from the collection of requirements to the implementation of the NAO H25 Robot, an application that achieves that this robot performs as an assistant in the training of the external circular search pattern (with rotation), which is part of one of the patterns of search for injured people that currently exist and that will be addressed within the Basic Civil Protection Course taught by the Civil Protection Directorate of the UAEM. The development and implementation of this application in the robot, is based on the second classification of educational robotics that was explained above.

Methodology

The search for injured can be carried out using any of the search patterns that currently exist, which can be: in Parallel, in Multiple Rooms, External Circular (without rotation) or External Circular (with rotation). For the development of the application in the humanoid robot NAO H25 that allows him to perform as an assistant in the training of the external circular search pattern (with rotation) and in the description of each of the different types of rescue that exist in the face of a natural disaster; We are going to use software prototype development methodology, considering the following stages:

1. -Analysis:

We considered the actions that the robot can perform to assist a trainer, within a search and rescue course, specifically for the explanation of the external circular search pattern (with rotation) and the different rescue techniques, in addition to the forms of interaction that may exist between the robot, the trainer and the trainees, who may participate in exemplifying the aforementioned search pattern. From the above, the application case diagram was made (see Fig. 1).

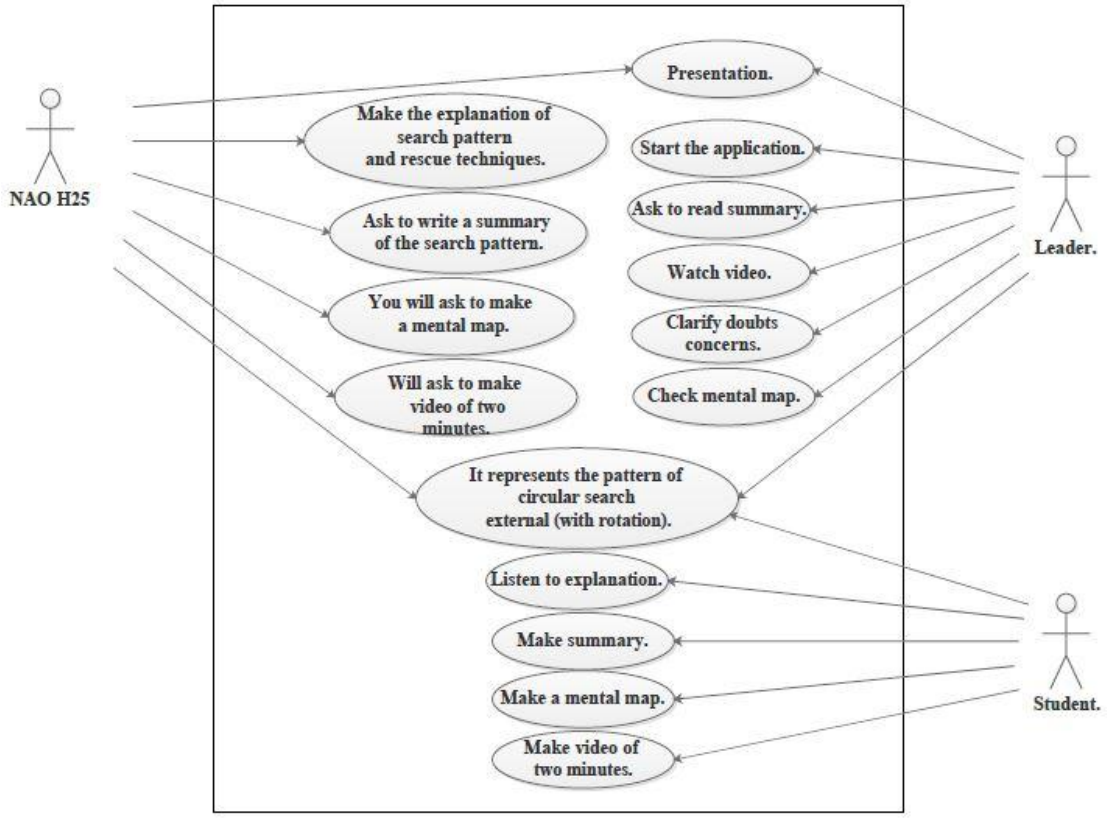

Fig. 1.Diagram of use cases of the application.

2. - Design:

The flow diagram of the application was developed, which was developed for the NAO H25 robot, which details each of the activities that the robot will perform to assist in the training of the external circular search pattern (with rotation) and the different rescue techniques (see Fig. 2).

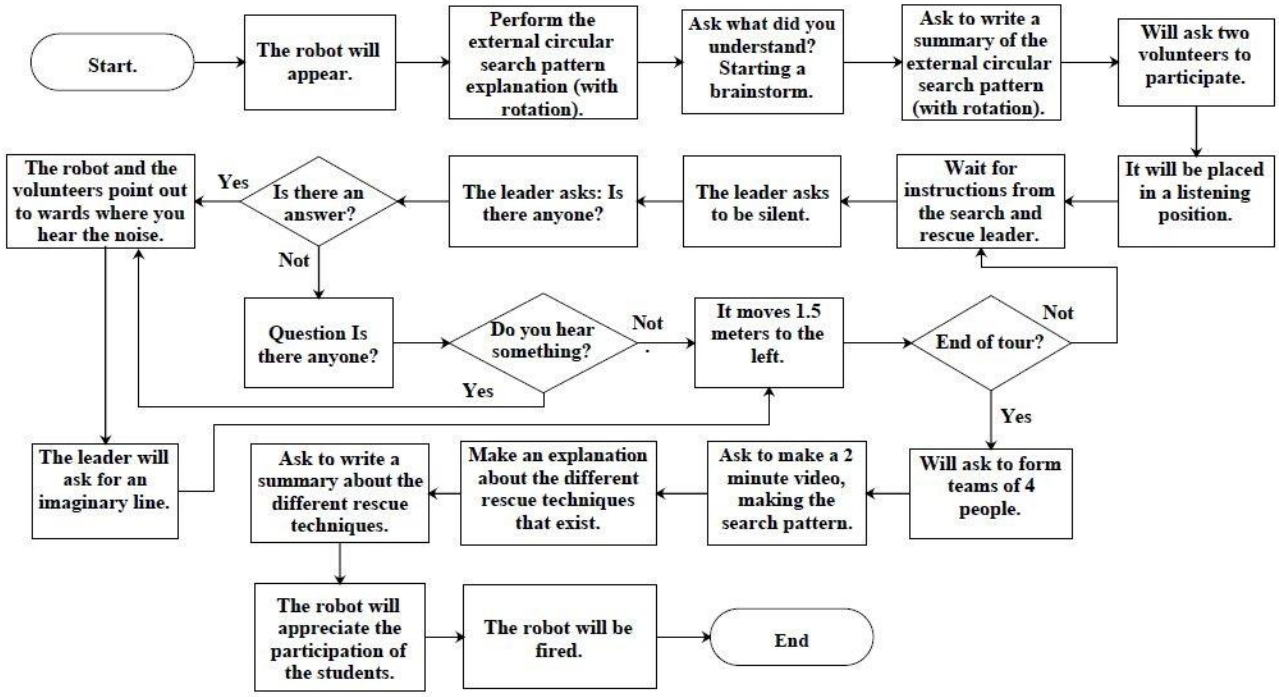

Fig. 2.Flow diagram of activities of the NAO H25 robot and trainer (leader).

The planning of the training course of the external circular search pattern (with rotation) was elaborated, as well as of the different rescue techniques that exist, this course is described below:

The course will begin, with the trainer offering a few words of welcome and initiating the application by pressing the touch sensor on the top of the head of the NAO H25 robot, greeting, presenting and starting the verbal explanation on the external circular search pattern with rotation. Once finished, ask the students: "What did you understand?",Make a brainstorm and the students elaborate a summary.

The trainees will make the summary and the trainer randomly will ask one of them to read his summary, if any question arises he will solve it together with the group.

In the second part of the course the trainer will fulfill the role of the leader of the search and rescue brigade, again press the touch sensor of the central part of the head of the robot, mention: "Friends, I need two volunteers, who are encouraged " After getting volunteers, the trainer will mention the word "NAO" which is the word that will make the robot position itself in a listening position, after that everyone will take their position according to the position of the robot. The brigade will be formed by the trainer, who will take the role of leader and the robot along with two volunteers who will take on the role of rescuers. All will be silent and the leader will ask, is there anyone, keep silence for a moment, then the robot will repeat the question, then the other 2 volunteers, when there is no answer, the word "NAO" will be mentioned again, the robot will listen to it and it will move to the left, now if the robot or one of the members of the brigade listen to something, they will point to the place where they heard it, for this it is intended that some of the students make noise to exemplify, then the leader will mention "trace your line".

After concluding with the planned route, the robot will mention: "Now it's your turn", "Cheer up, form teams of 4", "let's make a two-minute video".

The training is intended to be interactive with the trainees, so after making the video it is considered to see the recording with all the students present, through a projector.

In the third part of the course, the trainer will initiate the application and the robot will begin to make the verbal explanation of the different rescue techniques that exist and will mention: "Let's see how much they understood", "Make a mental map about the techniques of rescue".

After this the robot will appreciate the participation of the students and will say goodbye: "Well friends I was glad to see them", "Thank you very much for participating", "See you, see you next time". Table 1 shows the didactic sequence in which the most important aspects of the course are detailed.

TABLE 1.Didactic sequence of the course.

Session/ Topic.	Objective.	Teaching-learningstrategy.	Lapse.	Skills.	Attitudes / Values.	Teaching materials.	Evidence of evaluation of learning.
1.- Theoretical explanation of the external circular search pattern (with rotation).	Know the procedure to perform the external circular search pattern (with rotation).	Start: The NAO H25 robot will offer a welcome speech. Developing: The robot will give a verbal explanation about the external circular search pattern. Closing: The robot will ask what they understood by brainstorming and ask for a summary of what was seen before.	1 hour	Mental: Like the reasoning and the analysis.	Solidarity to have the intention to help a person in danger. Responsibility in the fulfillment of assigned tasks.	NAO H25 robot. Notebook. Pen.	1.- Summary.
2.- Performance.	Observe the representation of the procedure of the external circular search pattern (with rotation).	Start: The NAO H25 robot will ask for two volunteers to help exemplify the search pattern. Developing: The team consisting of the trainer, the NAO robot and the two volunteers will exemplify the search pattern. Closing: The robot will ask to form teams of 4 members, to make a video of two minutes, making the search pattern.	1 hour	Mental: Like the reasoning and the analysis. Psychomo-tor: In the execution of the motions of the external circular search pattern (with rotation).	Team participation when performing representation Solidarity to have the intention to help a person in danger. Responsibility in the fulfillment of assigned tasks. .	NAO H25 robot. Notebook. Pen. Video camera. Laptop.Projector.	1.- Video of two minutes, on the realization of the external circular search pattern (with rotation).
3.- Theoretical explanation of the different	Know the characteristics of rescue techniques.	Start: The robot will perform the verbal explanation about the different rescue techniques that	1 hour	Mental: Like the reasoning and the analysis.	Responsibility in the fulfillment of assigned tasks.	NAO H25 robot. Notebook. Pen.	1.- Mental map on the different existing rescue

rescue techniques that exist.		exist. Developing: The NAO H25 robot will ask the trainees to make a mental map about the different rescue techniques. Closing: The robot will appreciate the participation of the students and will be fired.					techniques.

3.-Programming:

Code blocks were made in phyton programming language, along with the guided programming. Said programming was made through the Chroregraphe software, in Fig. 3 you can see part of the code implemented in the NAO H25 robot, while in Fig. 4 you can see the physical connection of the robot with the training application, while in Fig. 5, you can see the guided programming of the NAO H25 robot. Said programming was carried out, considering the design of the proposed course, with the main objective of making an application for the NAO H25 robot, which would allow it to serve as an assistant in the training of the external circular search pattern (with rotation) and the different techniques of rescue; taking into consideration the modules programmed for such training (see Table 2).

TABLE 2.Programming modules of the application, implemented in different components of the robot.

Sensor.	Stage of training.	Features.	Purpose.
Touch sensor located in the upper part of the robot head.	Theoretical explanation of the external circular search pattern (with rotation).	The robot will explain verbally what the search pattern consists of.	Help the trainer to awaken the interest among the trainees.
Touch sensor located in the central part of the robot head.	Performance.	The robot will interact with the trainees and the trainer, to exemplify the search pattern.	Carry out the proposed route, exemplifying the search pattern.
Touch sensor located at the bottom, of the robot head.	Theoretical explanation of the different rescue techniques that exist.	The robot will explain the characteristics of the rescue techniques that exist.	Interact with the students, to generate curiosity about theoretical topics.

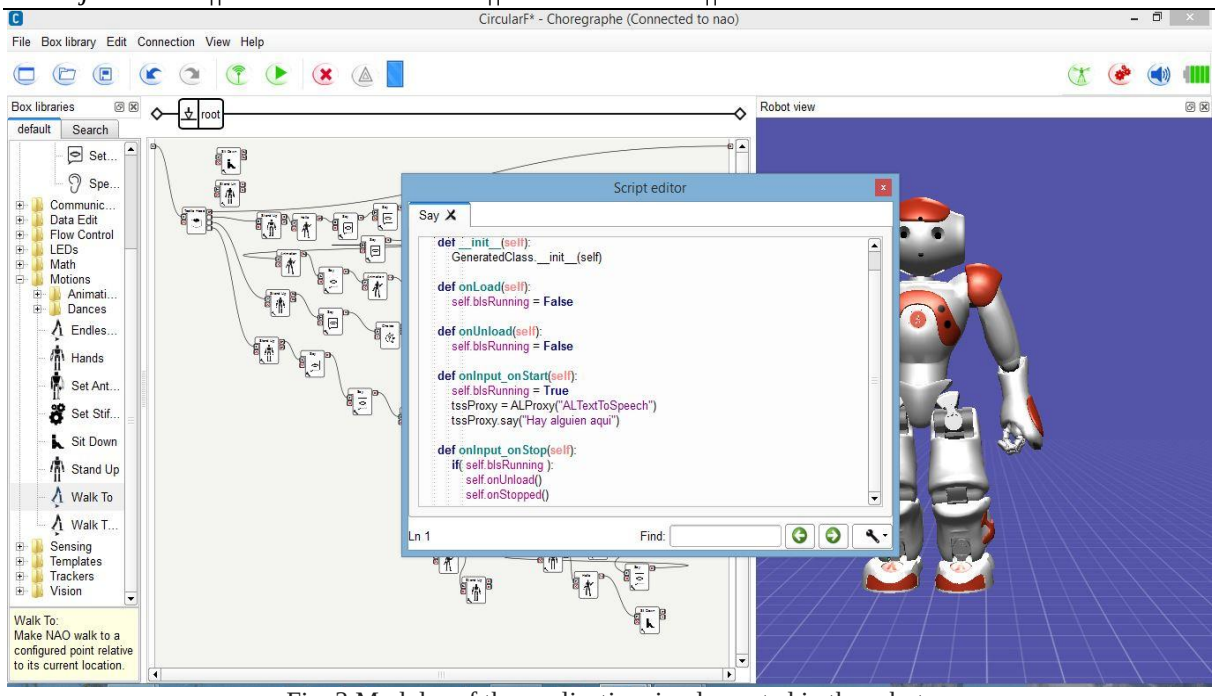

Fig. 3.Modules of the application, implemented in the robot.

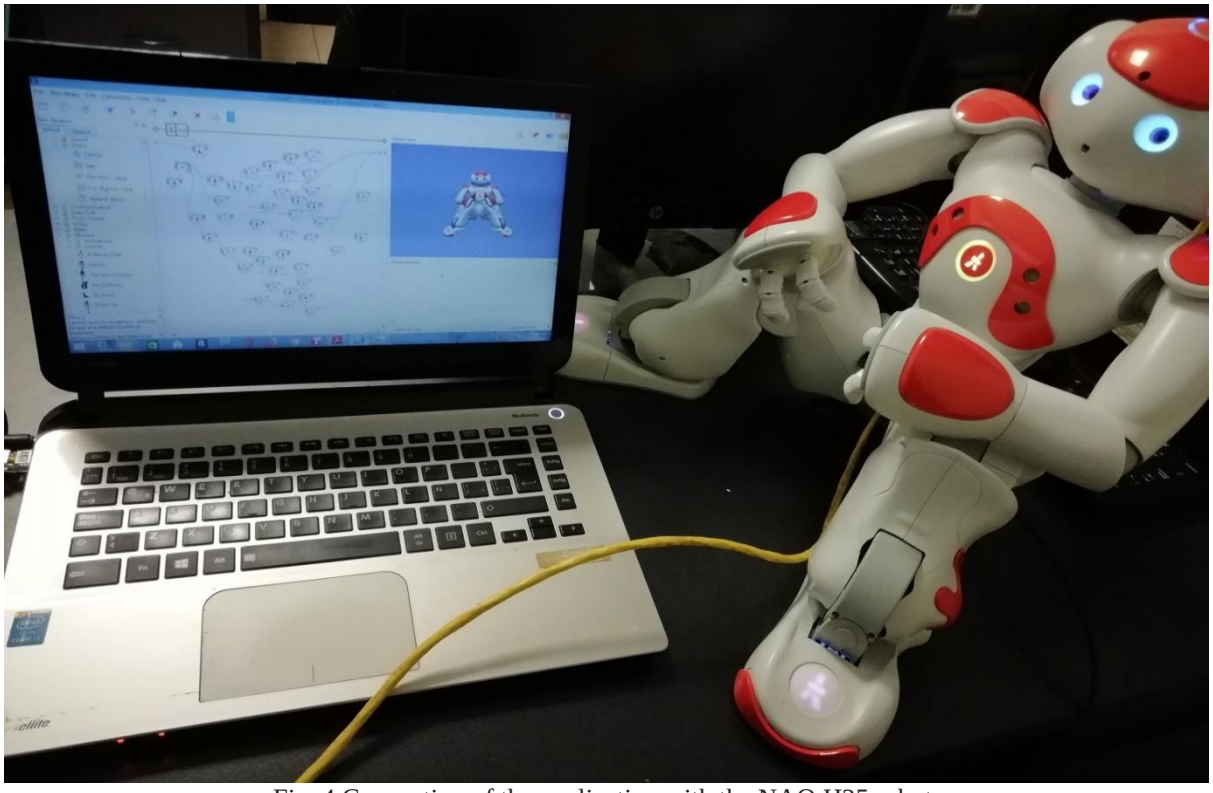
Fig. 4.Connection of the application with the NAO H25 robot.

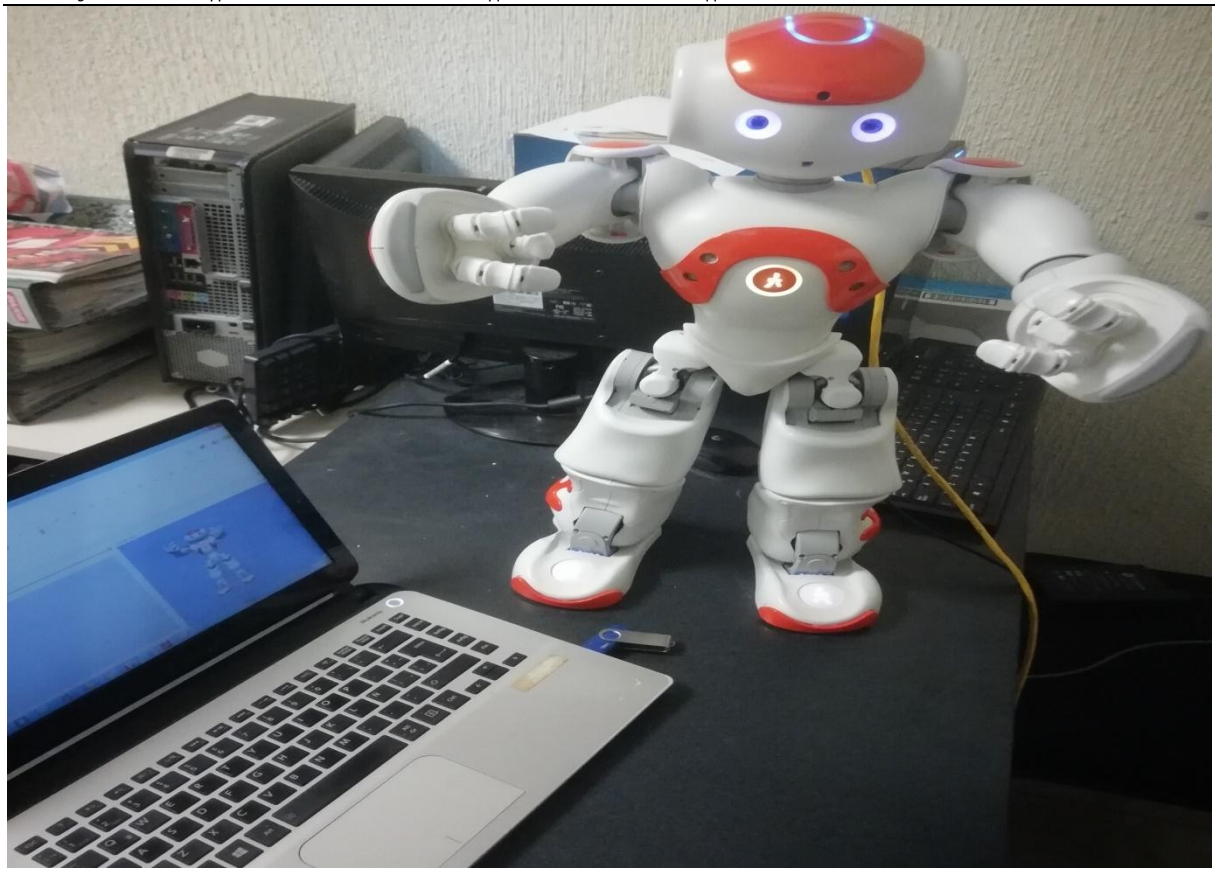

Fig. 5.Guided programming of the NAO H25 robot.

4.-Simulation:

Performance tests were performed on each of the modules that make up the application, to verify the efficiency and speed of execution of the routines in the robot, in addition to checking the complete application. First we verified the functionality of the speech, where we established that the robot spoke at an average speed, in addition to performing the planned route in the search course that exemplifies the external circular search pattern (with rotation), said brigade is made up of the leader or capacitor, the NAO H25 robot and two volunteers. In Fig. 6, we can see the route taken by the members of the brigade. These tests also contemplated body movements of the NAO robot, as shown in Fig. 7.

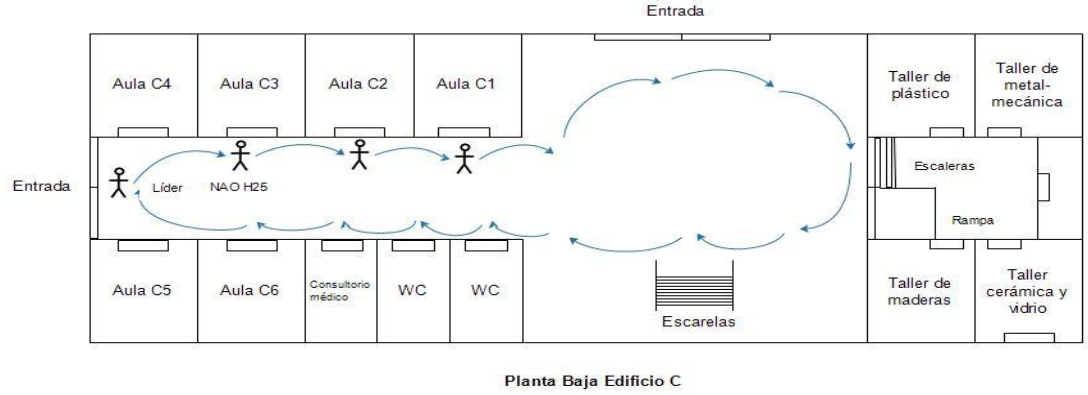

Fig. 6.Tour of the search brigade.

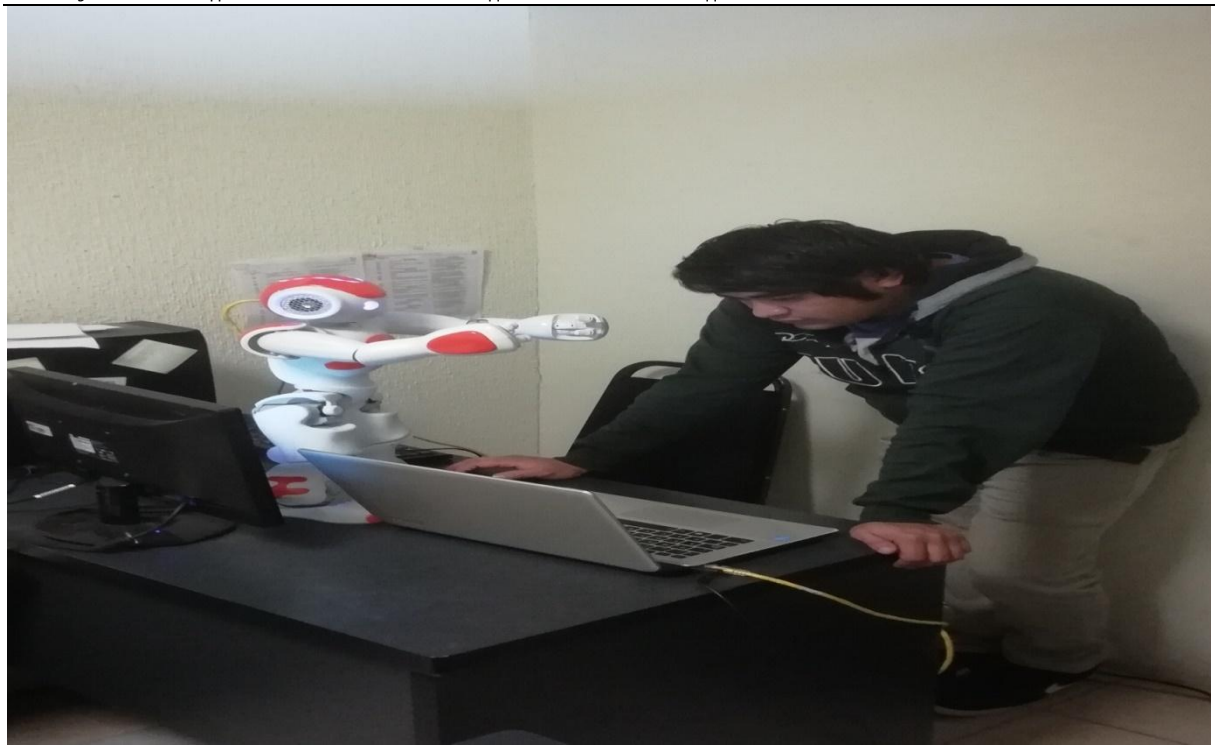

Fig. 7. Movement tests of the NAO H25 robot.

5.-Feedback:

After checking the routines implemented in the robot, it was decided to improve the application to obtain a more sophisticated version. To do this, the application was shown to a group of eight students, who showed interest in interacting with the robot. At the end of the execution of the application, they were asked three questions, which were: Did you understand the training?,Do you like the application?, What could it improve?. The results to these questions were satisfactory since 87.5% indicated that if they understood the training with the help of the application implemented in the robot and it was also to their liking, on the other hand 12.5% mentioned that the robot could speak slower for a greater understanding of his explanation.

Results and Discussion

The analysis, design and development of the application in the NAO H25 robot, which allows it to serve as an assistant in the training of the external circular search pattern (with rotation) and the different techniques of rescue of injured, has promising prospects for its use in training courses for search and rescue of injured people, within the University Center UAEM Valle de Chalco. This training is not limited to the external circular search pattern (with rotation), in this it could also be implemented to show different patterns or protocols that make up the civil protection. The application that was developed was made through the Choregraphesoftware, this gives us the necessary tools for textual or guided programming along with the execution of routines. In Fig. 8 we can see all the modules that make up the application. This was shown to a group of eight students, who interacted with the robot, listened to the explanation and carried out the activities proposed by the robot, of which 100% of them mentioned that they find the application implemented in the robot interesting and innovative, the 87.5% who understood the explanation made by the robot and 87.5% of the students said that they would recommend its use. In Fig. 9 we can visualize the interaction of the NAO H25 robot with the students.

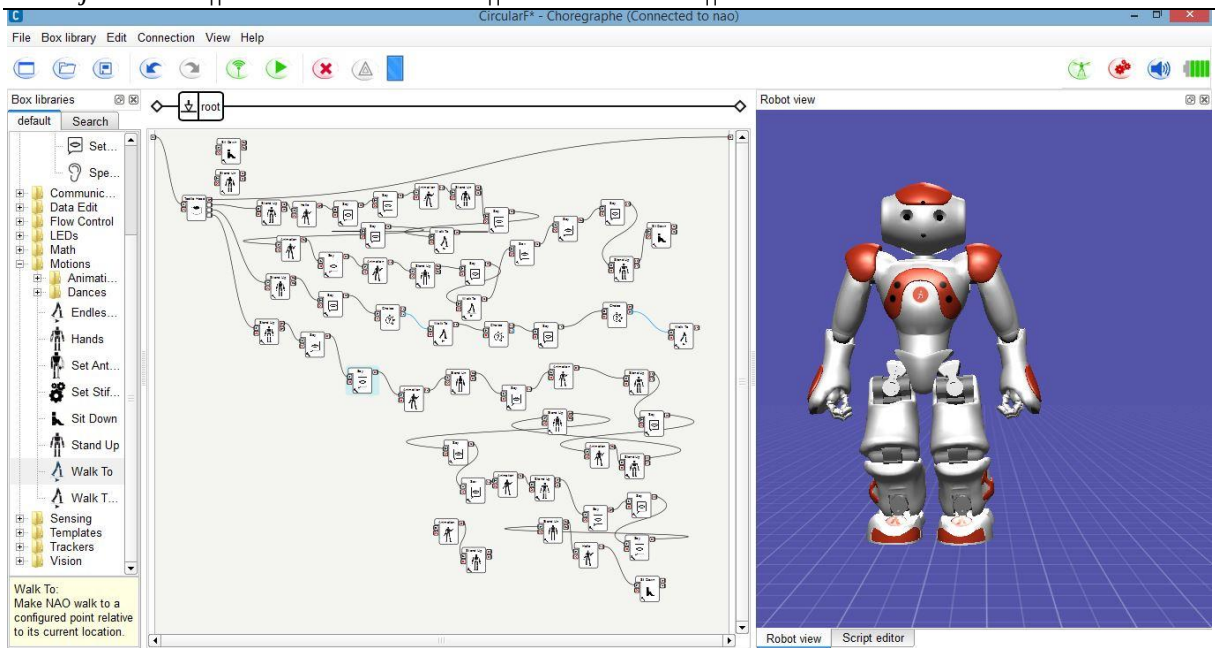

Fig. 8.Modules of the application, implemented in the NAO H25 robot.

Fig. 9.Interaction of students with the NAO H25 robot.

Conclusion

With the analysis, design, development and implementation of the training application in the external search pattern with rotation in the NAO H25 robot, significant learning was achieved in the students with the help of robotics, in addition to causing interest in the student community, being an innovative material for the obtaining of theoretical and practical knowledge. The development of applications for the NAO H25 robot that execute specific tasks such as the explanation and performance of search patterns, encourages people to learn topics of social importance. The results of this research show that in a group of 8 students all have an interest in

interacting with the robot, besides that 87.5% consider that the explanation made by the robot is understandable and recommends the use of the application.

References

[1] Alive Robots (sf). Robot NAO. Recuperado de http://aliverobots.com/nao/
[2] Caballero, A. (2016). Robot NAO Cantante. España: Universidad Carlos III de Madrid. Recuperado de https://core.ac.uk/download/pdf/79177079.pdf
[3] Craig, J. (2009). Robótica. España: Pearson Prentice Hall.
[4] Formación y Especialización en Seguridad, S. L. (2016). Vigilantes de seguridad en urbanizaciones, polígonos, transportes y espacios públicos. Madrid: Editorial CEP. Recuperado de http://cort.as/-7eUI
[5] López, A. (2018). Diseño e implementación de un robot de búsqueda y rescate. México: Universidad Anáhuac. Recuperado de https://es.scribd.com/document/306189511/Tesis-robot-busqueda-y-rescate
[6] Ortega, A. (2016). La imparable marcha de los robots. México: Alianza. Recuperado dehttps://www.alianzaeditorial.es/libro.php?id=4450262&id_col=100508
[7] Pérez, J. Merino, M. (2010). Definición de lesión. Recuperado de https://definicion.de/lesion/
[8] Ucha, F. (2013). Definición ABC, Protección civil. Recuperado de https://www.definicionabc.com/general/proteccion-civil.php
[9] UNCA (sf). Curso de Rescate Urbano e Industrial.
[10] USAID/OFDA (2006). Búsqueda y Rescate en Estructuras Colapsadas. EstadosUnidos deAmérica.