Social Robot as an Assistive Tool in the Classroom

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***Abstract*—This article presents the methos used for the development a robot, whose purpose is to assit the teacher in the classroom. This robot reach the goal to be a teacher helper and also been part of the students. This article present the interactions methods, the artificial intelligents algorithm developed and the theories used to create an assitive tool to the traditional education. This article presents how to combine differents software tools with hardware in order to create an realistic live effect for a long periods of time. This article preesents the technics to introduce a Robot in the classroom to assit the teacher in playful activities.**

***Index Terms* — Socially Assistive Robot, Socially Intelligent, Interaction, Arificial Live, Anthropomorphize.**

I. Introduction

The conventional classrooms has a teacher and the students, and some tools as videos, posters or toys. The question is, there is a possibility to include a new intenventor in the classroom? and how will help this new intenventor to improve the student learning?. This article describes the method used to introduce an interventor in the classroom. This new interventor is a Social Robot, a machine that perceive their world and make their own desitions to perform coordinate actions [1].

Cosidering a Social Robot, is possible to talk about the robot with capability to response in real time to the stimuli from the environment in autonomous way. It is necessary talk also about social behaviour, social intelligent and assitive robot.

There are several ways in which a robot is social and this is their social behaviour, and considering aspects such as their physical form [2]. Anthropomorphism in robotic system is an important part of a social robot [3]. Anthropomorphize intends to continue the illusion of reality. To achieve this illusion of live and intelligence, are involves factors such as physical realization of autonomy, esthetics, and own social behavior.

Epley defined Anthropormorphized as an agent of social coonnection, and also define three psychological facts involves in atthopomorphized and they are: Elicited agent knoledge, Effectance motivation and Socialy motivation; also this factors are compare with four parameters: dispositional, situational, developmental and cultural [4]. A social robot can interact with a person, but just for few seconds or at most minutes the reality sensation will be kept. To extend this period of time over the embodiment and artificial inteligent, is necesary to combine others factors such as external factors such as the behaviour between humans around the robot.

A socially assistive robot, Robsna2, is the second version of this social robot [5], this version has the advantage that is able to interact with more than one person at the same time. Robsna2 is able to interact with peolple beause more social qualities has been added. An extend set of abilities, reflexes and perception has been added. The control software is divide in three parts to cover the reflexes, abilities and perception in runing in parallel processes.

II. Robsna2

Robsna2 is a social assitive robot which purpose is to interact with childrens in the classroom and been an effective tool to assit the teacher in playful activities and encourage the children to give their ideas without hesitate about specific topics. The role of Robsna2 is been the childrens toy and at the same time been their friend, and never replace the teacher. The goal of this new tool is increase the children motivation in some specific learning areas. The toys are tools that has been used to stimulate the child to learn while playing, and most of child become friend to one of them toys like teddy bears or dolls. This is the idea that was taken to develop Robsna2, make a ”toy” but also a friend to help the child in his educative process.

A. Learning with toys

A human been since born has the necesity to learn about it environment. There are different kinds of toys that has been develop to help the children to nurture their cognitive develop. The table II [6], shows the toys and it cognitive effect in infants between 0 to 36 months.

TABLE I
Age and Cognitive Development

Age (months)	Cognitive Connection
0 - 6	Cause-effect, Sound and Texture,Hand-eye coordination
6 - 9	Cause-effect, Intentionality
9 - 12	Object permanence, Cause-effect, Naming
12 - 18p	Early literacy, Language,Prediction, Questions
18 - 24	Classification, Recognition Object, Permanence,Perspective taking
24 - 36	Imagination, Abstract thinking, Language,Sequencing

The table II give an idea about the way that the human been learn since it born. Also is possible to realize that the nurture the cognitive develop do not stop at 36 month, and continue through the rest of live.

Active learning is an instructional methology, it permit to a

child built it own knoledge through experimenting , tasted, constucted, or acted upon, by using their senses to interact with people [7].
Active learning allows the student to interact with the teacher and classmates. The team work of the students is doing easier than the idividual work and without any fear or shame to express their aideas to the group.

Toys, games and computer games are synonymous with play, and is not just a relaxing activity or feeling, but is an important learning experience [8].

Robsna2 is a toy, but it has social capabilities that allow the child to play with it just as another friend. The robot will encourage the child to do some activities or to say some phrases, with the goal to help the child to remember things or to include it in the social group. The robot can play games such as 'Simn say', repeat words, dance, imitation of movements, or simply answer child questions about him.

B. Embodiment

Embodiment in a social robot is important because it help to interaction process and to introduce the robot in common activities. If is a social entity that will handled in a checked phisical environment with no deliverative situations, need a body that can be adapted to different situations.
The embodiment facilitates emotional interaction and the help in negotiation process involved in grupal games. People involve in the game will put more efford if they are negotiating with an embodied robot [9].

Considering the Uncanny Valley which demonstrate that built a robot with very realistics attribute will not be helpful for interaction purpuses [10]. The robot will never been an animal or human been. A robot will be always a creature and it has to be consider as a non human or animal live.
Robsna2 has been developed considering the robot as a creature that will be a child friend. To reach this, Robsna2 has been anthropomorphize and has child appearance but preserving the artificial characteristics. Figure 1 shows the robot aspect.

Fig. 1. Robsna2

To reach the best interaction level and let also the robot be part of the phisical world, it need to be socially situaded and have capabilities to has perception of the world around it [11].

C. Social and Assistive

A social robot is a robot which is able to interact in a natural way with people. An assitive robot is a robot that is able to assist the human in their daily activities.
If both kinds of robots are combine it will be a socially assitive robot. The goal of this kind of robot is create close and effective interaction with a human user for the purpose of giving assistance and achieving measurable progress in convalescence, rehabilitation, learning, etc. [12]. In figure 2 is possible to see the relationship between the student, the teacher and the robot.

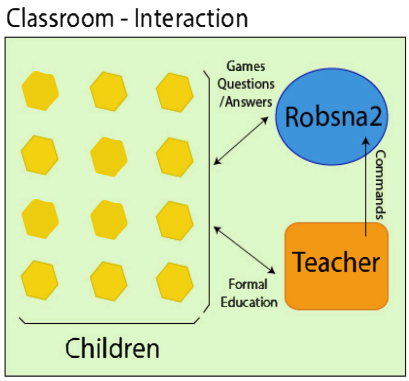

Fig. 2. Ways of interaction

The teacher with students, and students with the robot, interact in two ways, that means the teacher and the robot interact with the students and at the same time the student interact with the teacher and the robot. In another part, the teacher can give orders to the robot and the robot only 'obey' the teacher commands.
The robot is able to assist the teacher in grupal activities, encouraging children to express their ideas. Robsna2 has been designed with a child personality,this is helpful to maintain the reality sensation of live for long periods of live, because the children will obtain logical answer but with voice and words that the child know.
Introduce a robot in the classroom will take advantage of cooperative behavior of the childrens, because as part of a group the child will see the robot as one of it classmates. Also curiosity the child will be continually stimulate forthe curiosity of the others childrens, because if someone get bored abut the robot,another will have the opportunity to be nearest to the robot and will be found something to ask or learn.

D. Robot Architecture

Robsna2 has been development using many software tools to alloud it to be an intelligent agent, capable to interact in natural way, and also is able to express feelings such us happiness, ungry or sadness. The robot is able to express feelings because his face constructions.
The robot has 16 degree of freedom, of these 3 are in it face and the rest of them are in its arms and neck. To express

feelings, the robot use it eyebrows movements and the color of it nose, cheeks and the shape of it mouth.
To achieve the body gestures, and that it movements have sense, the robot use the camera Kinect. Using the camera the robot is able to see what are the childrens doing and react in a proper way with it body. Figure 3 shows the Architecture of the robot, where a virtual live in in one block apart from the embodimment. The virtual life is separate because the robot use a Bot wich is a computer program that is able to do interact with people but without the embodiment. From this Bot that was created comes the voice and the personality of the robot.

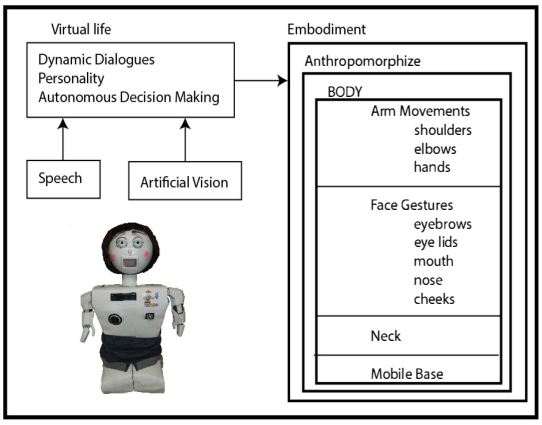

Fig. 3. Robsna2 Architecture

The robot is able to move around some specific area of the classroom to do task as dancing with the childrens.
To built the robot body many considerations was taken concerning to the security of the children and the robot. Until now there are there is no distinction of the difference between a child robot or a toy. Considering this, some points from UNESCO to built toys was taken to built Robsna2. This points basically are based on use non toxic paint, the toy can no have cutting edge, and the separations between the parts should be enough small to avoid that the child get hurt.

III. Results

An experiment with children from 3th grade of basic education was made. They are chidren around 6 and 7 years old. The robot was intruced in the classroom in session of 45 minutes for 3 weeks. The good reactions of the childrens, in sense that they want to talk with the robot and play with it, was maintained all the time. This was because the colaborative and cooperative interaction.
In table II show the relation between the robot and the childrens in differents activities in the classroom, considrering their cultural situation and their personal interest. Also show the level of cognitive developmet that the childrens has.

The robot was an effective tool to assit the teacher in group activities, responding in an intelligent way to the social requirements.The combinations of software tools to create a social intelligent robot allows the robot to simulate life and feelings.

TABLE II
Results with 15 children

Activity	Cognitive Connection	Interaction - percentage
Simon says game	Hand-eye coordination	60
Dance	Intentionality	75
Anser and questions	Questions	95
Play songs	Sequencing	85

IV. Conclusion

The goal of Robsna2 was reached, because the robot was able to interact with children in the classroom under the teacher supervision. The time of interest to interact with the robot was manteined for the social group during the sessions, about 45 minutes each.
The figure 4 shows the robotil interact with the children and with adult people in the school.

Fig. 4. Robsna2 Architecture

Also the robot was able to interact with people around the school, and with children from others classrooms.
As a tool to assit the teacher in group activities, the robot was a perfect toy to the children because they was able to talk and play with it in the way that the children was stimulated to interact in active way in the classroom.

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