PROFESOR AVATAR: TELEPRESENCE MODEL

Eduardo González Mendívil
egm@itesm.mx
Instituto Tecnologico y de Estudios Superiores de Monterrey
School of Engineering & Science

Luis Eduardo Luévano Belmonte
luevano@itesm.mx
Instituto Tecnologico y de Estudios Superiores de Monterrey
School of Engineering & Science

Eduardo López de Lara Díaz
elopez@itesm.mx
Instituto Tecnologico y de Estudios Superiores de Monterrey
School of Engineering & Science

Héctor Nahún Quintero Milián
nahun@itesm.mx
Instituto Tecnologico y de Estudios Superiores de Monterrey
School of Engineering & Science

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ABSTRACT

The evolution of technological tools has allowed for the increased quality of telepresence in the classroom. The experience using a telepresence robot and holographic projection is reported in official college level classes taught at the Tec de Monterrey in the period 2013-2016. This combination allows students to “feel” the presence of the professor in the classroom through a human scale holographic image, bi-directional audio, video, and autonomous movements of the remotely controlled robot. The individual and combined use of these telepresence devices is reported. The results founds show that we are on the correct path. This work has echoed in the Latin-American community, mainly in Uruguay, Colombia, Argentina and Chile. Our work is shown as a way of disseminating this information and as an invitation for other researchers in the world to collaborate, thereby accumulating experience, formality and scientific rigor.

Keywords

Holography, telepresence, videoconference, remote education.

INTRODUCTION

Video telephony technology had its first breakthrough in 1964; 50 years ago, AT&T presented the Tele-image service for the first time in the New York Fair. Surprisingly, this videophone invention did not have the expected success, it was concluded that, elevated costs, bad quality and consumer unwillingness to interact with cameras stopped its development. This was recognized as the first documented tele-presence event.

A quarter century needed to pass until, in the early 1980's, the digital net made long distance compressed video and audio signals possible. Since then video telephony has grown in two branches: personal and entrepreneurial, amongst which we can find the distance education field.

Long distance education has gone through three stages of development. First stage (printed) when our ancestors hired education, this came via mail to their addresses, they studied it and once they had covered all the material, they would send their written evaluation, to then receive a diploma and the access to the next level. Second stage (analogical) including: open TV, cable TV, video sending and radio programs, etc. Third stage (digital) the Internet is used (Luévano Belmonte, López de Lara, & Edward Castro, Use of Telepresence and Holographic Projection Mobile Device for College Degree Level, 2015). Newer advancements like texting and messaging apps have spurred even more efficiency within workplace communication. We have come a long way since the days of written letters and memos. Even email has become a secondary form of communication in the workplace as chat platforms are taking over. This is where the concept of "telepresence" enters, and it consists of a combination of technologies that seeks to represent a person that is in a distant location as if it was there.

What is telepresence?

Over 30 years ago, MIT professor and artificial intelligence pioneer Marvin Minsky laid out an ambitious plan calling for the development of advanced teleoperated robotic systems that would usher in a "remote-controlled economy". He wrote about it in the science and science fiction magazine Omni in 1980. In his essay, Dr. Minsky envisioned a "remote-controlled economy". He coined the term "telepresence" to describe these systems, which in his futuristic vision would transform work, manufacturing, energy production, medicine, and many other facets of modern life (Minsky, 2010).

What is holographic telepresence?

"It is a system that projects full-motion, realistic, and 3D images in real-time. A holographic telepresence system captures images of real, remote people and/or surrounding objects and compresses and transmits the images and sound over a broadband network". Once

transmitted, it decompresses the images and finally projects them. It also includes real-time audio communication that further enhances the realism experience. In some cases, it could truly rival with the physical presence of a user. In other words, “holographic telepresence it’s the combination of one or more telepresence technologies with a holographic projection as the main medium of communication between users”.

Profesor Avatar (Avatar Professor) it is a telepresence model developed at Tecnológico de Monterrey that combines the use of “Real Time Holographic Projections” and “Telepresence Robots”. It provides the opportunity of taking education where geographical circumstances, insecurity or cost could not reach. Having tele-present specialists, tutors and pairs of students interacting in real time, exchanging knowledge and experiences from diverse contexts.

The teacher or specialist can see and hear the students in real time, offering special attention, giving immediate feedback. This model offers the experience of having a professor in holographic form in the classroom, providing virtual mobility from anywhere in the world, personalized interaction with students, delivering a social presence in the classroom, even though he/she is not physically present. Seeing the professor in full body, at human scale, it generates a sum of emotions in the students while they perceive that the professor is there thus humanizing long distance education. As seen in Fig. #.

This project has been very well accepted in educational and business communities, because it creates an important expectation regarding its potential for development and scalability. Professional colleagues from around the world, who are immersed in both educational and business environments, have shown interest in replicating this proposal, since to them it represents a solution to several problems they face in their daily lives, for example, elevated transportation costs, insecurity, mobility, geographic dispersion of their venues, and personalized, real-time remote attention. It allows important cost savings and provides mobility to a limited number of tutors and students. It constitutes a transmission medium for ideas, knowledge and experience from leaders, entrepreneurs and thinker’s guides in the teaching-learning process. This model is flexible because it adapts to different methodologies and styles of learning (Luévano Belmonte, Telepresence technologies to humanize distance education, 2017).

The main benefit of this project consists of offering solutions that are innovative, low-cost, easily scalable and adaptable to different learning styles, specifically in the education field. Being able to connect via telepresence robots and/or real-time holographic projections to professors, specialists, doctors, mentors, etc., offers the opportunity to generate an advanced communication channel, where any teacher, regardless of the academic level or subject he/she teaches, can provide personalized attention to his/her students as if they were physically present. This makes the students fell that they are accompanied in the learning-teaching process, unlike traditional videoconferences where the teacher is presumably absent.

SECTION 1 PROFESOR AVATAR

Previous Experience

When the research group formed by professors from the University of Tecnologico de Monterrey, Monterrey campus began to venture into holographic projections, they began to collaborate with teachers located in the Zacatecas campus, who then acquired a holographic station. They made some tests and presentations with the holographic station.

This holographic live projection with telepresence robot included, is the result of a long history of experience, observation and learning that through 9 years, professor Eduardo Luevano acquired. As collaborator in the Tec de Monterrey Virtual University, after 15 years of experience as an Accounting and Finance teacher and after almost a decade as enabler in subjects imparted in the virtual model; professor Luevano concludes: It is difficult to retain the attention of the group, because, in a certain way, the screen is something static that can be easily ignored. The professor doesn't have visual access to the whole classroom and it becomes easy for the student to evade the professor. It's not possible to give real time feedback on the personal performance of each of the students. In the actual virtual model, classes with high quantitative content don't allow the professor to give the proper attention to the progress of the student during the session (Luévano, López de Lara, & Castro, 2015).

Telepresence, holographic projection and robot.

Professor Luevano has been doing research and working on making the long distance education process more efficient. His research is centered in the telepresence concept. Some time ago, he acquired, with his own financial resources, a telepresence robot. Based on many years of experience in long distance education in which we proposed the use of a telepresence robot denominated "Avatar Professor", with the idea of trying to reduce the present limitations of the known videoconference model. With the purpose of innovating and the interest to solve this problem, our research team, acquired, a telepresence robot, called "Avatar Professor", this experience took place in the Tec de Monterrey, Campus Zacatecas, from September 2012 to May 2013.

Searching to improve the telepresence sensation given by the professor, we propose to integrate an additional complement to long distance education, which is holographic projection. We believe that integrating the existing technologies: Videoconference, telepresence robot and holographic projection, we can assemble a technological package that will allow supplying, but never to replace, the temporary physical absence of the teacher in the classroom. Enough elements predict the use of intense telepresence technology.

Now we will describe the experience that we have had using a combination of technological resources: A 90% transparent holographic projection foil was acquired to build the screen. This foil was adhered on a 12mm glass, anchored to a metallic stable base; supported on wheels to make it easier to move. This screen allows it to visualize 3D images without distortion. This product is imported, comes in roll and is presented in different lengths, in a standard 1.52m width. The cost for this material is $3,250 mexican pesos per lineal meter.

We built two screens with a 1.80m height (Fig. 1) (Luévano Belmonte, López de Lara, & Edward Castro, Use of Telepresence and Holographic Projection Mobile Device for College Degree Level, 2015).

When doing the projection on the transparent screen, the foil retains the projection photons and then, the image of the professor appears as if he was floating, which is, telepresence, “he is there, but he’s not there”. It’s important to notice the transparency, because you can see the furniture and the white screen behind the transparent screen, giving it a very real sensation. With the intention of improving the perception of telepresence amongst students, we integrated: the holographic screen, the robot and the software to control long distance projection.

SECTION 2 RETO i

The use of Telepresence through Holographic Projection has been used in the recent years as a manner of delivering conferences in International Conferences. But towards giving official lectures in college level there is only one record of initiatives on an experimental level. The Telepresence with the Holographic Projection applied in a college course will allow the professor to, without limits as far as distance, weather, time difference, etc., to give his class on time and in a form that while he isn’t physically there in the classroom. This technology enables cost saving because it won’t be necessary to travel to other cities just to give a class, conference or meeting. The use of the Holographic Projection it isn’t only merely academic, it can be versatile and multipurpose in universities, for example a directive that is out of town can attend a meeting through Holographic Projection (Luevano & López de Lara, Uso de Dispositivo Móvil de Telepresencia en la Educación a Nivel Universitario, 2014).

An experience of the implementation of project “Avatar Professor” was "iChallenge", where, through our model, five universities from four countries (Guatemala, Peru, Chile and Mexico) connected in a sustainability challenge (Fig. 2). "iChallenge" consisted of building, in a week, a sustainable electricity generator from recycled materials, with remote tutoring through the “Avatar Professor” telepresence model. At the end of the challenge, the products manufactured by the students were donated and installed in vulnerable areas of each region (Luévano Belmonte, Telepresence technologies to humanize distance education, 2017).

QS Awards

In December 6th 2016 Professor Avatar: Telepresence Model was awarded the silver medal in the category of “Best use of ICT Tools” at the Reimagine Education 2016 edition, organized by QS Stars and Warthon University of Pennsylvania. Being recognized as one of the most innovative projects in the world that are designed to improve the pedagogy and employability of university students. The concept behind “Reimagine Education Awards” is that traditional education it’s insufficient and excessively expensive for the necessities of modern students, and therefore it must be "reimagined" (StarMedia, 2016).

After winning the silver medal in the category of “Best use of ICT Tools” *Profesor Avatar*,

developing holographic projection technology, launched like a rocket out of Mexico in 2016 by providing holographs to five universities on three continents. Green Shoots and Profesor Avatar have collaborated for the first use of holographic technology in South African education and the first application of *Profesor Avatar* at the K-12 level.

EXPERIMENTAL METHODS (if any)

The pedagogical approach used was challenge-based learning and active learning, through the innovative use of telepresence, which made it possible to engage in a truly international and collaborative effort: teacher-teacher, teacher-students, expert-students, student-student. Students strengthened key competencies for their employability and valuable knowledge to improve their communities. Through the telepresence model students from four countries collaborated in the construction of a sustainable electricity generator. Action Research methodology was also used as a method for gathering information and data that consists in a collective introspective inquiry undertaken by participants in social situations with the objective of improving the rationality and justice of their social practices or educational, as well as the comprehension of these practices and the situations that they take place in. It is a form of research that binds the experimental focus of social science with social action programs that respond to social principal problems. Because of social problems that emerge from the usual, action research starts the questioning of the phenomena from the usual, travelling systematically, as far as philosophical. Through action research, what it is intended to treat in a simultaneous way are: knowledge and social changes, in a manner that theory and practice unite.

The anthropomorphist characteristic in which the student sees the professor in real human scale retaining that he or she is present (Fig. 3). The students that participated in the “iChallenge” were given a survey so that they could review and give feedback of the whole experience showing the following results:

89% of the students perceived the teacher as real and felt confidence with him and 80% of the students consider acceptable the feedback from the professor, and 93% of the students would recommend this telepresence model (Luévano Belmonte, Telepresence technologies to humanize distance education, 2017). Now, more than ever, the commitment of making “Avatar Professor” a more human and accessible experience, is even greater. This model can help to take quality education to places that are not easily accessible, owing to geographical circumstances, costs or insecurity.

Some of the main results of the instruments analyzed to prove the project impact are:

87% perceived the holographic projection as the social presence of their professor

86% of the students were satisfied with the project

88% of the students felt comfortable with the “Professor Avatar”

93% would recommend this model to other students.

97% would participate again in tele-presence projects.

Impact results:

The one week i Challenge, required students to construct a sustainable electric generator using recycled material useful to solve a necessity of a local community in poverty. Facing a real problem in a community promotes student's social commitment awareness, allows them to relate classroom theoretical learning to practice, work collaboratively, and to develop decision-making, communication, and leadership skills offer sponsorship for the project (Luevano, 2017).

The student survey applied by the end of the project showed the following results:

100% considered that tele-presence contributed to learning improvement.
87% considered that the activity goal was met.
97% considered that new skills were developed.
98% considered that the i Challenge helped to get them involved in their social, economic and environmental reality.

CONCLUSIONS & RECOMMENDATIONS

Holographic projection technology clearly has a big future ahead. As this audiovisual display continues to get high profile credibility, we are likely to see more companies advertising their products or marketing their business in this way. The holographic projectors that are under development will be able to be much smaller and portable than image projectors that rely on conventional, incoherent light beams. Ultimately, holographic projectors may become sufficiently small to be incorporated into future generation cell phones.

Projectors will be able to render sharp projected images from relatively small projection devices (e.g. cell phones) because they do not require high intensity, high-temperature light sources. Investigators at companies and universities are working toward applied science that could make television with holographic projections that can project moving, three-dimensional pictures outside of the screen (Elmorshidy, 2010).

Technologies such as virtual and augmented reality are paving the way for holographic communication, but it is still in a development stage, it is estimated that in the next 5 years there will be significant breakthrough. One area of opportunity that exists with this technology is the ability to make it as portable and compact as possible, since it depends on several factors from having the right space, lighting and equipment.

TABLES AND FIGURES

Fig. 1 Holographic Telepresence Class Tec de Monterrey Campus Zacatecas

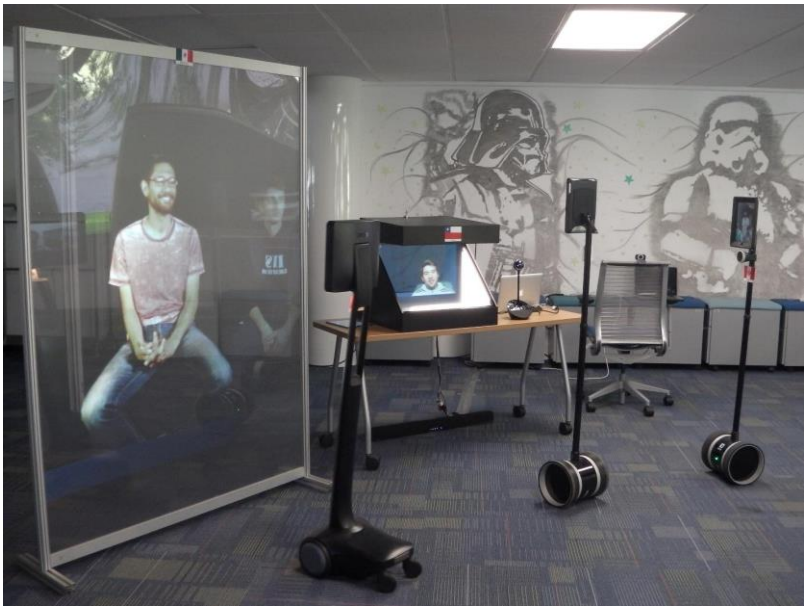

Fig. 2 Holographic projections on glass (from Zacatecas), holographic station (Chile) and remote control robots (Guatemala and Peru), establishing communication between multiple students across Latin America being transmitted in the city of Monterrey.

Fig. 3 Holographic projection of a professor from Zacatecas campus being projected in Monterrey campus.

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