Open Activities And Technologies During COVID-19 From The IEEE Student Branch at UNED

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***Abstract*— Firstly, the IEEE Student Branch at UNED belongs to the Institute of Electrical and Electronic Engineers (IEEE). The IEEE Student Branch at the UNED is an association of students of the UNED based on volunteerism, sharing knowledge and experiences, desire to improve and interest in science and technology. The crisis of the coronavirus has turned the online formation into a good of first necessity and in a challenge so much for the students as for the companies of formation. The former has had to get used to seeing their teacher through a screen. The second, to adapt all content to the online universe. For this reason, from the IEEE Student Branch at the UNED we have developed several activities during the COVID-19 to provide a series of training resources online and free. Throughout this paper we describe the activities carried out, the technological resources used, and the benefits obtained, both for the Student Branch itself and for those attending the different activities. In addition, we provide a series of lines of future work.**

Keywords*— *Collaboration, Distance Education, Educational Robotics, Learning technology

I. INTRODUCTION

The confinement measures imposed by the Executive on the Coronavirus pandemic have turned digitalization into a necessity; and the development of applications that allow us to do everything remotely, in essential. One of the sectors that already had quite a long history is training, and its need to adapt to the new situation has been urgent, but not as intense as in other sectors. The arrival of the crisis has forced the various training schools, universities and postgraduate centers to put all their tools online, and those that did not have them to make them available to students who could no longer come to their centers to receive training of excellence [1].

Thus, the optimal format for continuing training activities is to provide online access training. Currently there is a wide variety of training activities that are carried out in online format, such as those described in the papers [2]. It is also important to identify the challenges involved in making a

transition from educational content in traditional format to educational content provided online, as detailed in [6].

In a situation like the current one, online training can be a great support to solve a public health problem like the one we have experienced due to the coronavirus pandemic. Therefore, and as part of our vocation to help as far as we can, from the Student Branch of the IEEE in the UNED we have intensified the activities of scientific dissemination on issues related to technology. The educational content traditionally provided by the IEEE Student Branch at the UNED is of the type described in [7].

This paper is divided into 5 sections. Section II shows details about the IEEE Student Branch at UNED and some of the activities that have been carried out throughout the year 2019. Later, section III details the activities that have been carried out during the month of March 2020 due to the confinement caused by the COVID-19 pandemic. The following section describes the results obtained during the experiences described. Finally, section V includes conclusions and future work.

II. IEEE Student Branch at UNED

The IEEE Student Branch at UNED is a students' association that promotes technical activities and scientific dissemination. The Student Branch focuses mainly on STEAM (Science, Technology, Engineering, Arts and Mathematics) activities and on activities for Women in Engineering. In addition, the Student Branch carries out different activities with the aim of attracting more members. It also promotes the remote or delayed broadcast of the activities carried out and the affluence of people of both genders in them.

The IEEE Student Branch at UNED has two chapters: (1) Education chapter and (2) Women in Engineering chapter. This association works in 4 main areas: (1) activities, (2) projects, (3) collaborations and (4) dissemination.

Examples of projects that have been developed in the Student Branch are (1) HeCRE, (2) PILAR-VISIR, (3) LAPSIO, (4) OCULIS and (5) UNED POLAR.

HeCRE is a Collaborative Tool for Educational Robotics based on FPGA and Arduino, some descriptions about this project can be found in [15]. PILAR-VISIR is a Laboratory Integration platform based on the VisiR Architecture, some details about this project are mentioned in [18]. UNED POLAR is a line of work to develop POcket LAboratories for Robotics. LAPSIO and OCULIS are devices to measure perceptual-visual characteristics in children with ASD (Autism Spectrum Disorder).

The activities carried out by the Student Branch are usually: (1) webinars, (2) workshops, (3) talks, (4) collaborations and (5) participation in conferences. As examples of activities developed during the year 2019. More details about this type of collaborations can be found in [19].

On June 20, 2019, the Webinar "La Rama de Estudiantes del IEEE de la UNED: Technical activities and professional future". Throughout this session, the different activities carried out by the UNED, the IEEE Student Branch at the UNED, were presented. Also presented were the lines of development at the professional level to which companies with a strong engineering component are focusing.

On July 18, 2019, the session "The IEEE UNED Student Branch: Introduction to the digital Twin with Arduino". This session had as main axis the digital twin technology. In this session we used the Arduino tool and a software that allows to make solutions where the virtual solution and the real environment are synchronized. The programming language used is visual block programming language. This workshop was mixed, that is, there were attendees who attended in person and other attendees connected remotely. The group of attendees was composed of Siemens Mobility employees and UNED students. The face-to-face part took place at the UNED's Associate Center. During this workshop, the students were able to develop a simple solution based on the digital twin technology.

Two activities were held on October 22, 2019. Firstly, a talk was organized by CITIUS (Centro Singular de Investigación en Tecnoloxías Intelixentes) and CESEI (IEEE Educational Society Chapter in Spain). The topic of the talk was visual block programming languages and their use in educational robotics. This talk was structured in three main sections. The first section covered different existing visual block programming environments were presented, and the Scratch and Crumble tools were discussed in depth. In a second part, a series of educational scenarios were shown with which to develop STEM-based applications and educational robotics. Finally, A series of articles describing the use of these tools and this type of educational content were also proposed. At the end of the day a debate was opened between the attendees and the speakers. The second activity consisted of a session on the Ingenio para la Movilidad contest organized by Siemens Mobility Spain. The University of Vigo, the UNED, the CESEI, the student branch of the IEEE of the UNED and the student branch of the IEEE of the University of Vigo collaborated in this activity. During this activity, the competition was explained. Students can participate in this competition to promote the optimization of the control of a train along a route so that it adapts its speed automatically and consumption is optimal, thus reducing CO^2 emissions. At the end of this session, the attendees were able to raise the questions that were raised.

On November,5, 2019, the talk "STEM Online education and experimentation: challenges and strategies" was held. in collaboration with the eMadrid network (http://www.emadridnet.org/) at the special eMadrid session at SIMO Education 2019 Applications and other resources for innovation in the classroom. Throughout this presentation, the challenges related to STEM education and online experimentation are shown. To show the strategies involved, a variety of practical examples of use with different tools and how to face the identified challenges are illustrated.

On December 28, 2019, the student branch of the IEEE of the University of Vigo and the UNED, and the association Bicos de Papel have organized an educational robotics event, ROBOTCRAZE. It was held at the Alvaro Cunqueiro Hospital in Vigo. This event has been organized with the collaboration of the Engineering School of the University of Vigo, CuboXYZ, a digital manufacturing company in Vigo, the Spanish Chapter of the IEEE Education Society, IEEE Hispania Branches, and IEEE Young Professionals. All the activities of the event are designed for children of all levels to participate in the following activities: Learn how to program your own video games with Scratch, Explore the world of

electronics with Crumble, and Program your combat robot with Arduino.

Although this format of activities was quite well received, and the results obtained were positive. When the confinement began, the Student Branch decided to go for a purely online format to continue with the scientific dissemination activities and workshops. The following section shows details about the different activities that were carried out during the month of March 2020.

III. Activities during COVID-19 pandemic

Prior to confinement to prevent the spread of the coronavirus, online training was already an established option for those who had trouble adapting to the face-to-face system.

Now, the shutdown forced by the pandemic has meant for many the temporary or definitive loss of their jobs or the reduction of their working hours. That is why many people have seen confinement as a good opportunity to train and acquire knowledge that will improve their chances of working or finding a job when it's all over.

At a time when face-to-face training in schools, universities and other educational centers has been paralyzed as a measure to stop the spread of the virus, online courses have become important, not only to avoid interrupting academic courses that were already underway, but also to evaluate new forms of learning, both in times of quarantine and after the situation returns to normal.

The IEEE has taken the initiative to give free access to its online courses so that the university community can follow these courses from home. In line with this initiative, the IEEE Student Branch at UNED has organized a series of activities with the aim of bringing science and technology closer together.

Before starting with the activities, there were an internal meeting in the Student Branch called Student Branch Report and Plan. The objective of this meeting was to show the different activities carried out in the student branch, to analyze the results obtained and to define the following actions to be carried out. Throughout the meeting, the focus of the different activities to be carried out in the short and medium term were discussed.

After this meeting, the activity Presentation IEEE UNED 2020 Branch was carried out. The IEEE UNED Student Branch presents the association, the activities they have carried out during 2019, the activities that will be organized during 2020 and encourages the attendees to become part of the association.

The other sessions that were held are described in the following sections.

A. Digital Twin with Arduino and mBlock

This session introduces Digital Twin technology. This is one of the technologies that is changing the dynamics of the industrial sector. When Digital Twin technology is applied, they create virtual replicas of objects or processes. These replicas simulate the behavior of their real counterparts. One of the aims is to analyze the efficiency of the real system or the behavior under certain assumptions to improve its efficiency. This technology is also especially useful when it comes to detecting the origin of the failures of the real system, since both the digital copy and the real object are totally synchronized. How will we do it? Through an amazingly simple application based on Arduino and block programming. This way, people without previous knowledge in programming and electronics will be able to implement their own Digital Twin.

The agenda of this webinar is composed by the following: Digital Twin, Arduino Hardware, mBlock Software, Using the LEDs, and Challenges.

Figure 1 shows an example of the software obtained at the end of the session and the hardware assembly that is completely synchronized with the virtual part.

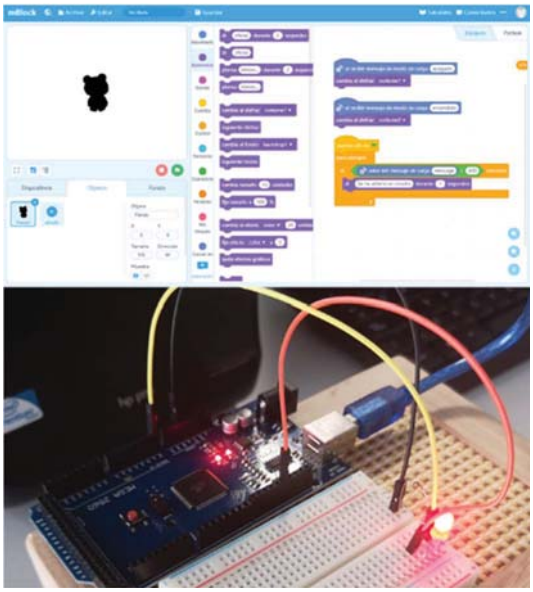

Fig. 1. Software and hardware for Digital Twin webinar.

B. Active learning methodologies with educational robotics

This session introduces the concepts related to active learning methodologies with educational robotics. Examples of educational experiences and future lines of work are presented.

The content of this webinar is as follows: Active learning methodologies, Design thinking, Project based learning, Educational robotics tools, Use cases and Challenge.

C. Introduction to Pocket Labs, UNED POLAR

This session introduces the pocket laboratories and the UNED POLAR working group. The prototypes that are being worked on, the technologies used, and the future lines of work are presented.

This webinar included the following parts: Pocket labs, UNED POLAR, Technologies, Light Laboratory, Environmental laboratories, and Challenge.

The project UNED POLAR (Pocket Laboratories for Robotics) was presented as an initiative that works to obtain: (1) Compact solutions, (2) Allow remote access, (3)They are blocks for applying IoT, (4) They can have grouped them together, (5) Integrable in MOOCs, and (6) They allow Digital Twins scenarios.

Figure 2 shows the light prototype used during the webinar, the Light POLAR laboratory. This laboratory was managing an LED matrix composed by 256 RGB LED. This laboratory can manage each LED independently and showing up to 17 million colors.

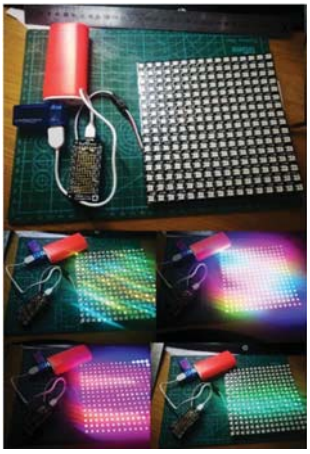

Fig. 2. Light POLAR laboratory and different aspects.

Figure 3 shows the control prototype used during the webinar, the Control POLAR laboratory. This laboratory was showing different aspects in its screen. This laboratory also allows user interface using a joystick and 2 buttons.

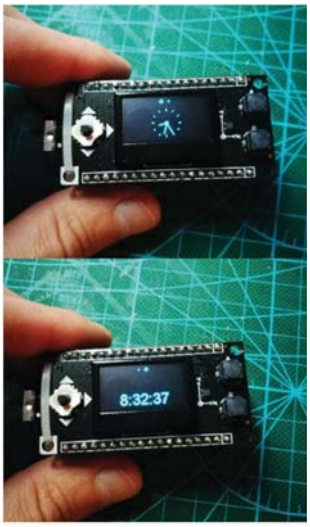

Fig. 3. Control POLAR laboratory and different aspects.

D. *Prepare your video classes*

Through this session we share a series of tools with which you can prepare your video classes. This webinar provided to attendees the use of tools such as OBS Studio (https://obsproject.com/), OpenShot Video Editor (https://www.openshot.org/) and Scratch (https://scratch.mit.edu/).

E. *Scratch as the first contact with educational robotics*

Through this session we will learn about the Scratch block programming tool and perform a series of activities to familiarize ourselves with it and see the potential it has for working with computer thinking and educational robotics. The contents provided along this webinar were extracted from the experiences detailed in [20].

This webinar was composed by the following: About Scratch, Basic use of Scratch, Notions of programming, Image editing, and Challenge.

Figure 4 shows some examples of the project developed by attendees. In this case, the attendees were working on the development of a traffic light.

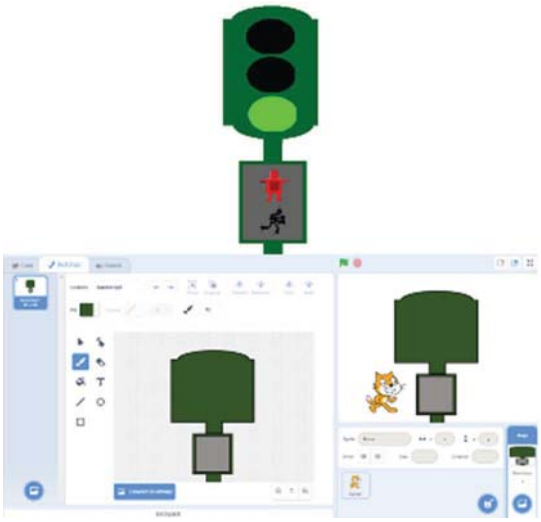

Fig. 4. Traffic light with Scratch.

F. *A walk through PILAR and the use of VISIR in the educational environment for the Secondary stage*

PILAR-VISIR is an Erasmus+ project aimed at establishing a federation based on VISIR remote laboratory. The resulting federation provides a powerful platform for measurements on electrical and electronic circuits remotely. In situations such as those we are experiencing due to COVID-19 where Students cannot travel to the lab, the PILAR-VISIR solution is a tool that brings the lab closer to the students. It is widely used by researchers, teachers, and students. More detailed information about PILAR-VISIR is described in [11], [18] and [27]. The following topics were discussed in this webinar: VISIR remote laboratory: potential benefits and intrinsic drawbacks of an isolated VISIR system, Federating remote laboratory services, PILAR: designed federation, and Integration of new tools [28][29][30].

IV. Evaluation of the PILAR project.Results

A total of 68 people participated in the sessions described in the previous section. Of these, 29 were members of the IEEE and 39 were invited guests from outside the IEEE. In addition, 18 were women and 50 men. From the geographical point of view, the people attending were connected from Madrid, Andalusia, Castile-La Mancha, Galicia and Valencia. Most of the people attending showed great interest in the initiative and in the contents of the sessions.

To evaluate the opinion of the attendees, a survey was carried out. The aim of this survey is to know the degree of satisfaction with the activities carried out and to know which types of activities may be interesting to carry out in the short and medium term. The results will be treated anonymously and will serve to promote innovation and motivation of students during the learning process in the STEM context.

This survey was completed by a total of 49 people. Figure 5 shows the profile of the people who completed it. Most of the people who responded to the survey were in the age range of 26-55 years. In fact, more than half of the people belonged to the range age group between 37 and 55 years old. From the point of view of gender, more than 75% of the people were men, only 22.4% of the answers were provided by women. In the STEM environment this is the relationship that exists.

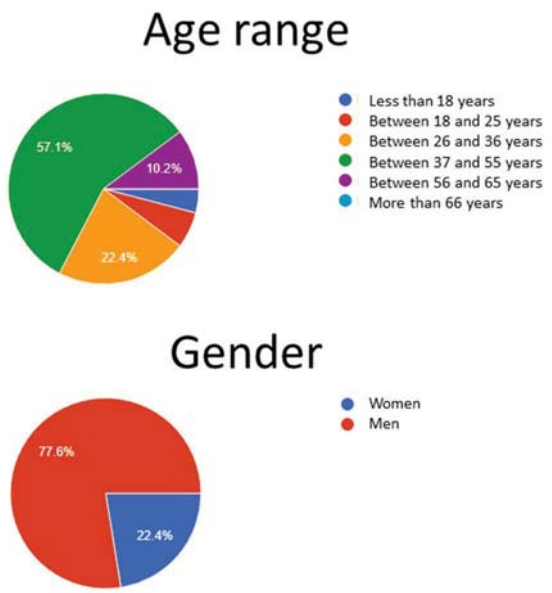

Fig. 5. Profile of the people who answered the survey.

The survey asked participants their opinions about the activities carried out during the last few weeks. The options available were (1) it was great, (2) it was good, (3) I didn't like it, (4) I couldn't participate, (5) I would have liked to participate and (6) none of mentioned. Figure 6 shows the results obtained on the degree of satisfaction of the activities carried out.

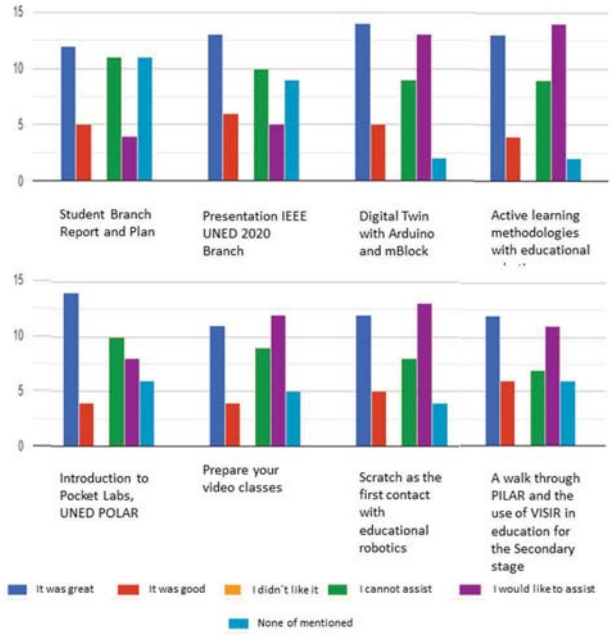

Fig. 6. Satisfaction with the activities carried out.

Most of the answers agreed that the activities carried out were either great or although some people were not able to attend the activities, the responses indicated that they would have liked to attend.

From these results we get that the quality of the activities carried out was good. In addition, it would be good if activities were repeated, since the people who responded to the survey showed interest in attending those sessions that they were unable to attend.

Finally, as part of the survey, several activities were proposed to be carried out in the short or medium term. The answers that were available were: (1) it is very interesting, (2) it is interesting, (3) it's not in my interest, and (4) no. Figure 7 contains the results obtained for this question.

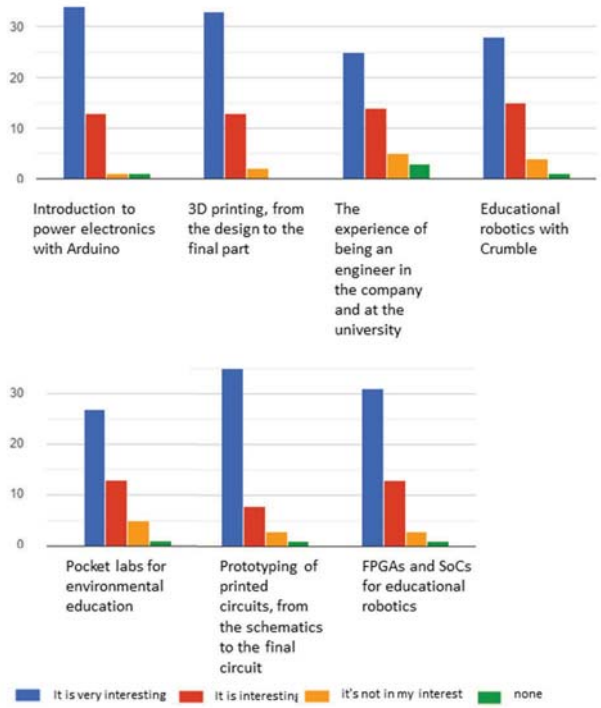

Fig. 7. Opinion with the activities to be carried out.

As can be seen from the results obtained, practically all the answers agree that it would be remarkably interesting or worthwhile to carry out the activities mentioned. A minority of answers indicate that the activities are not of interest to the respondents and some cases indicate that their opinion is not within the options provided.

V. Conclusions

Throughout this article we describe the type of activities that the IEEE Student Branch at the UNED usually carries out and the new format of activities that it has carried out on confinement due to COVID-19. Several purely online activities have been described. In addition, the results of the satisfaction of the people who have attended these types of activities are shown.

As shown in the results obtained, both the format used, and the contents offered have been widely accepted by those attending. In addition, new activities have been identified to continue with this type of activities.

Therefore, the IEEE Student Branch at the UNED will continue to propose this type of activity and the proposed contents that have had a large degree of acceptance. In spite of this, once the confinement by the COVID-19 is finished, activities will be proposed in which it will be possible to participate both in face to face mode, and in online mode joining people, both physically and remotely at the same time.

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