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Journal of Information Technologies and Communications

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Presentation of the Content

In the first chapter we present, *Influence of digital technologies on higher education students in times of the Covid-19 pandemic and the repercussions on their study habits*, by MIRELES-MEDINA, Antonia, MOLINA-WONG, Ma. del Refugio, ÁBILA-AGUILAR, Verenice and MOTA-GARCÍA, María Juana, with adscription in the Instituto Tecnológico Superior Zacatecas Norte, as next article we present, *Analysis, design, and creation of a learning program in Big Data at the higher education level: Case study Instituto Tecnológico Superior de Rioverde, SLP*, by MENDOZA-GONZÁLEZ, Omar, AMADOR-GARCÍA, Mónica, TORRES-MERAZ, Yurivia and GARCÍA-PADRÓN, Fabiola, with adscription in the Facultad de Estudios Superiores Aragón UNAM and Tecnológico Nacional de México/ITS de Rioverde, as next article we present, *Use of Augmented Reality App as a means of motivation for high secondary education in times of COVID-19*, by NAVARRERE-ARIAS, Dulce J., HERNÁNDEZ-GARCÍA, Héctor Daniel and PÉREZ-BAUTISTA, Mario, with adscription in the Instituto Tecnológico Superior del Occidente del Estado de Hidalgo, as next article we present, *Artificial vision system for object classification in real time using Raspberry Pi and a Web camera*, by SERRANO-RAMÍREZ, Tomás, LOZANO-RINCÓN, Ninfa del Carmen, MANDUJANO-NAVA, Arturo and SÁMANO-FLORES, Yosafat Jetsemaní, with adscription in the Universidad Politécnica de Guanajuato.

Content

Article **Journal of Information Technologies and Communications**
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Influence of digital technologies on higher education students in times of the Covid-19 pandemic and the repercussions on their study habits

Influencia de las tecnologías digitales en los estudiantes de educación superior en tiempos de pandemia del Covid-19 y las repercusiones en sus hábitos de estudio

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Abstract

In this article, a second analysis is carried out that consists of monitoring the study habits of a group of 17 students, during the period of their higher education. The study was carried out on students who correspond to the area of Computational Sciences and consists of making a comparative evaluation of the application of the study habits questionnaire to such a group of students in four moments of their career path. In the first, second and third moments, the students attended classes in a face-to-face modality and in the fourth moment the students attended due to COVID-19 pandemic situations in a virtual modality. Based on the second context, the analysis has been carried out. The interest in delving into study habits is to identify areas of opportunity and implement strategies that allow students to improve them and avoid vices that hinder enough to obtain better academic performance.

Information and Communication Technologies, Study habits, Virtual modality

Resumen

En este artículo se realiza un segundo análisis que consiste en el seguimiento de los hábitos de estudio a un grupo de 17 estudiantes de sexto semestre, durante el periodo de su educación a nivel superior. El estudio se realizó a estudiantes que corresponden al área de las Ciencias Computacionales y consiste en hacer una evaluación comparativa de la aplicación del cuestionario de hábitos de estudio a tal grupo de estudiantes en cuatro momentos del recorrido de su carrera. En el primero, segundo y tercer momento los estudiantes asistieron a clases en una modalidad presencial y en el cuarto momento los estudiantes asistieron por situaciones de pandemia del COVID-19 en una modalidad virtual. En base al segundo contexto es que se ha llevado a cabo el análisis. El interés por ahondar en los hábitos de estudio es para identificar áreas de oportunidad e implementar estrategias que permitan a los estudiantes mejorarlos y evitar vicios que entorpecen que estos sean los suficientes para obtener un mejor rendimiento académico.

Tecnologías de la Información y Comunicación, Hábitos de estudio, Modalidad virtual

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Introduction

COVID-19 has struck our education system like lightning and shaken it to the bottom. (Kandri, 2020). Without a doubt in our Mexican country has not been the exception of such a situation that has led him to consider new strategies to bring education to his students. The World Health Organization (OMS) defines COVID-19 as a disease caused by the novel coronavirus known as SARS-CoV-2. OMS first became aware of the existence of this new virus on 31 December 2019, when it was informed of a group of cases of "viral pneumonia" that had been declared in Wuhan (People's Republic of China) (OMS, 2020).

On 11 March 2020, the OMS declared the COVID-19 epidemic a pandemic (OMS, 2020a), which currently affects countries around the world. The global COVID-19 crisis has affected education systems around the world, including institutions of higher education (IES), as most of them have been forced to close their facilities and temporarily suspend on-campus learning. (UNESCO, 2020). Given the situation declared by the OMS, Mexico also interrupted the face-to-face interaction of the school system at the higher education level. (México. Diario Oficial de la Federación, 2020).

The Ministry of Public Education in coordination with the National Council of Educational Authorities (CONAEDU) and in collaboration with the Ministry of Health as part of the provisions of the education sector in the face of the coronavirus (COVID-19) carried out the suspension of face-to-face classes on March 20, 2020 (SEP, 2020a).

The National Education System contributed to the temporary suspension of activities of 40.7 million people who study and work in all types and levels of education, equivalent to 32.3% of the national population. On the other hand, the IES also contributed to the temporary suspension of activities of 5.3 million people, which is equivalent to 4.2% of the national population (SEP, 2020b).

According to UNESCO (2020), IES have a crucial role to play in ensuring that the right to quality education and learning opportunities for all is not compromised by the COVID-19 pandemic.

In the case of higher education in Mexico, certain entities issued documents as suggestions, such as the National Association of Universities and Institutions of Higher Education (2020). In the context of the global health contingency caused by COVID-19, public and private institutions of higher education and public research centers, associated with ANUIES, reiterate their commitment to safeguarding the health of their communities and society in general; ensure the continuity of their academic services; make available to society its scientific and technical capabilities, and if necessary, its infrastructure and equipment to address the effects of this epidemiological phenomenon (ANUIES, 2020).

COVID-19 shows us that continuity of education must be ensured and UNESCO is committed to supporting governments in distance education, open science and the exchange of knowledge and culture (UNESCO, 2021). The closure of educational centers and the replacement of face-to-face classes by on-line and distance training has no alternative, due to the situation we are facing with a health crisis. So there is no other possible way out than to close schools and replace face-to-face classes with online training (SANZ, 2020).

According to data from UNESCO (2020c), more than 90% of the world's population has had to continue their educational processes from home, learning remotely and implementing at the same time different learning platforms.

Problem

Currently, the way classes are taught in educational institutions has changed dramatically, this stemming from the COVID-19 pandemic; in a sudden way and without expecting such a situation the schools of higher education have seen the need to change their didactic planning to adapt them from a face-to-face modality to a virtual modality. Inaddition, to look for strategies that encourage students to study habits. Based on this, a series of questions have arisen such as: How do digital technologies influence higher education students in times of the COVID-19 pandemic?, what are the repercussions on their study habits of students when implementing Information and Communication Technologies (ICT)?, howhave study habits beenstrengthenedin the virtual modality?,

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Will study habits have increased by implementing a virtual modality to meet the needs of the teaching-learning process in students? How has the behavior of study habits been throughout the career of students belonging to the area of Computational Sciences?

General objective

Analyze the study habits in 17 sixth semester students of Computer Systems Engineering of the Tecnológico Nacional de México, Campus Zacatecas Norte through a comparative study taking into account four periods, where the first, second and third correspond to the study habits implemented by the students in a face-to-face modality and the fourth moment in a virtual modality derived from the pandemic situation generated by COVID-19.

Specific objectives

1. Apply the questionnaire of study habits of José Luis Díaz Vega to the students of the area of the Computational Sciences of the Tecnológico Nacional de México, Campus Zacatecas Norte.

2. Capture and interpret the results obtained from the data collection instrument applied to students in the area of Computational Sciences of the Tecnológico Nacional de México, Campus Zacatecas Norte.

3. To present a comparative analysis of the results obtained in the four periods studied in the students of the area of Computational Sciences of the Tecnológico Nacional de México, Campus Zacatecas Norte, Campus Zacatecas Norte.

Reference framework

TCI in education in a virtual modality

Information and communication technologies (ICT) have now provided adequate tools to support the teaching-learning process so that they have been used in both the presencel and virtual modality. "Both in the face-to-face and in the virtual modality the purpose is the construction of knowledge by the students" (Manzuoli & Escofet Roig, 2015).

"Virtual education is a learning modality that has grown rapidly in practice, but still, it is pending the dissemination of the way in which the educational process is managed" (Toledo, Correa Castillo, Valdés Montecinos, & Hadweh Briceño, 2020).

For García Aretio (2002), distance education "is a technological system of two-way (multidirectional) communication, which can be massive, based on the systematic and joint action of didactic resources and the support of an organization and tutoring that, physically separated from the students, promote in them an independent (cooperative)learning".

Aliste (2006) says that distance education is "the combination of education and communication technologies to reach an audience interested in learning that is separated by great distances".

Torres (2004) considers it as: "a set of pedagogical strategies and communication mechanisms that link tutor teachers with students to develop teaching and learning activities, not coinciding in time and geographical space, developing, in general, outside university campuses".

While Burns (2011) defines it as a planned learning experience characterized by the separation between the student and the teacher, whose separation is compensated by the exchange of information and communication through print and electronic media.

The terms or expressions that have been used to refer to network learning have been different: network learning, teletraining, e-learning, virtual learning, etc. By all of them we generally refer to the training that uses the network as a technology for the distribution of information, whether this network is open (Internet) or closed (intranet) (Almenara, 2006).

With the use of new information and communication technologies, information reaches anywhere in the world in seconds. Through networks, science reaches everyone. Current conditions require new means to facilitate the mass transmission of the teacher's knowledge to students and their assimilation by them. Technologies act as intermediaries in this process, without their mediation it is impossible to create a broad and effective education system (Sanchez & R, 2003).

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Use of ICts in education in times of COVID-19 pandemic

"Quarantine, in short, has accelerated by great strides the use of ICT for almost all daily activities, forcing users to use smart mobile devices connected to the network to perform any daily work" (Reinoso, 2020). Likewise, (Abitia, 2021) considers that the COVID-19 pandemic has accelerated the use of digital technologies for 10 years, given that in 2000 there was 5.1 percent penetration of ICT; a decade later it went to 31 percent; in 2015, to 57.4 percent, and at the moment we are at more than 70 percent. "Chances are we'll have near-total coverage in the next two years."

UNESCO produced a list of applications, platforms and resources for education with the aim of helping parents, teachers, schools and administrators to facilitate student learning and provide care and social interaction during school closures. Most of the selected solutions are free and many are adapted to multiple languages, classified according to distance learning needs (UNESCO, 2020b).

For its part, the TECNM (2021) also recommends some educational technologies. Based on this, the Tecnológico Nacional de México, Campus Zacatecas Norte homologized the use of technologies for virtual classes, so Zoom was chosen for video calls or videoconferences, Moodle as an LMS platform, as well as the use of email and Whatsapp as additional technologies and for other communication scenarios. It was decided to use the Moodle LMS platform because it is chosen by higher education institutions around the world, being used by more than 60% of all higher education in the world. Among the most popular uses are online exams, active learning (forums, wikis), online grading, etc. (Moodle, 2020).

Zoom is a Cloud Platform for video and audio conferencing, collaboration, chat and webinars (UNESCO, 2020b) Kandri (2020), in its article expresses that each level of education faces its unique challenges, it is the segment of higher education that can end up, by necessity, triggering a learning revolution. Universities are distinctive in the point that their students are old enough to handle the rigors of online work and technologically intelligent enough to navigate new platforms.

(Lloyd, 2020)mentions that the COVID-19 pandemic has exacerbated the already well-known educational discrepancies in Mexico and other countries. He also says that despite the need to cancel face-to-face classes due to the virus, the Mexican government and educational institutions have helped with a variety of technologies in an attempt to continue providing education to more than 36 million children and adults in the country. However, the new virtual offer faces limitations, difficulties and ethical questions, especially in terms of the fairness of the model.

Study habits(SH)

"The habit of study are constant modes of action with which the student reacts to new contents, to know them, understand them and apply them. We can list, as the most important the following: take advantage of the study time, achieve ideal conditions, discard the disturbing elements, effectively raise the work, correctly select the sources of information and documentation, properly present the results, master the techniques of observation, attention, concentration and relaxation" (Sánchez, 2002).

Habit requires three elements to put it into action: a) knowledge, b) abilities and c) desire (Covey, 2009). The habits that a student has can be lost, but they can also be increased or recovered (Díaz and García, 2008). Authors such as Bajwa, Gujjar, Shaheen and Ramzan (2011) mention that a student cannot use effective study skills until they have good habits and argue that an individual learns more quickly and deeply than others because of their successful study habits.

Escalante (2005), mentions that the success or failure of our studies depend largely on study habits, which are formed by the following variables: Hygiene strategies, Material conditions and Study strategies. As they state (Gutiérrez, Pacheco Amigo, & Rodríguez García, 2017) "Study habits are the right means to achieve the conditions for a better education".

(Gutiérrez, Pacheco Amigo, & Rodríguez García, 2017) quoting Aula Santillana consider that "Study habits are the constant modes of action with which the student reacts to new contents, to know them, understand them and apply them".

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For the purposes of this analysis, the questionnaire proposed by (Díaz Vega, 2006) has been considered as a data collection instrument, which considers seven variables or factors such as: Time Distribution (TD), Motivation towards the Study (MtS), Distractors in the Study (DS), Class Notes (CN), Reading Optimization (RO), Exam Preparation (EP), and Attitude towards Study (AtS).

Methodology

The research that is proposed has the following characteristics: it is descriptive, it has a quantitative approach, with a non-experimental design, merely longitudinal (Sampieri,Collado Fernández, & Baptista Lucio, 2014), derived from the fact that a statistical analysis of study habits is presented in four periods respectively, in a sample of 17 students of Computer Systems Engineering of the National Tecnological of Mexico, Campus Zacatecas Norte , that is, data from the first, second, fourth and sixth semester have been collected by means of a questionnaire of the author (Díaz Vega, 2006), which considers seven variables or factors such as: Time Distribution (TD), Motivation towards the Study motivation in the study (MtS), Distractors in the Study (DS) , Class Notes (CN), Reading Optimization (RO), Test Preparation (EP), and Attitude toward Study (AtS).

It is important to mention that this article takes into account the same objects of study to which the following authors refer in their research (Medina, Arredondo Salcedo, Castañeda Delgado, & Mota García, 2020), in order to monitor the behavior of the study habits that students have presented in the modalities: face-to-face and virtual. Once the data have been obtained, statistical techniques have been used and interpreted for analysis in order to understand the situation with respect to the study habits that students practice. To later, inquire about the repercussions on study habits by the use of technologies in classes in a virtual modality.

Results

It is necessary to consider in this section the weighting of the study habits that are made up of the points and percentages that are acquired once the data collection instrument proposed by the author has been answered (Díaz Vega, 2006).

As shown in Table 1 cabe highlight that a score greater than or equal to 21 (70%), is the acceptable score, however, it can be further reinforced through the implementation of appropriate didactic strategies. The weights shown are those that the author mentioned above considers to measure the study habits in students:

Weightings	
Points	**Percentage %**
30	100%
27	90%
24	80%
21	70%
18	60%
15	50%
12	40%
9	30%
6	20%
3	10%

Table 1 Weighting in points and percentages
Source: Own Elaboration, (2021)

Table 2 shows the variation in study habits based on the average that has been acquired as a group in the four semesters:

Average in percentage per semester				
SH	**First**	**Second**	**Fourth**	**Sixth**
TD	42	32	37	42
MtS	70	64	69	67
DS	50	42	48	48
CN	63	59	65	57
RO	49	39	49	49
EP	64	61	63	67
AtS	64	57	60	63

Table 2 Average as a percentage per semester of the SH
Source: Own elaboration, (2021)

The data in the table above are shown in Graphic 1, in which it can be identified that in five of the seven variables are maintained or there is an increase in the percentage of SH. In the variables DS and RO there is no change; however in TD, EP and AtS show an increase.

It should be noted that the students in the sixth semester were forced to venture and adapt to a virtual modality, due to the pandemic situation, which is the world stage in the education, with this pausing the face-to-face classes; so it is reflected in the variables MtS and CN with a downward change.

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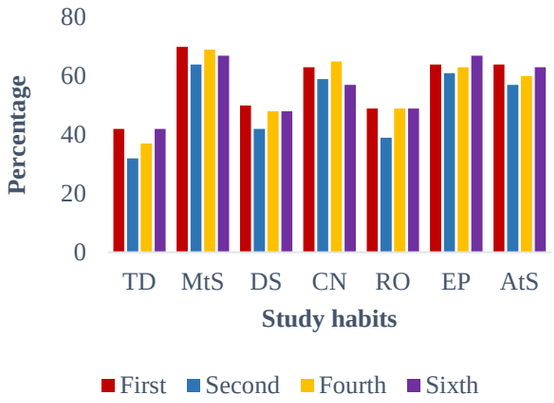


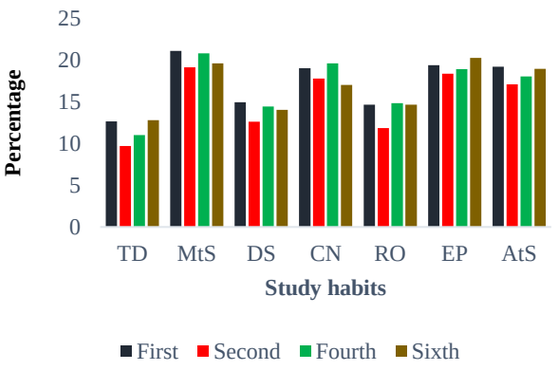
Graphic 1 Group average of SH in %
Source: Own Elaboration, (2021)

Another statistical technique that has been used for the treatment of the data in this article is the standard deviation Table 3:

Average in percentage per semester				
SH	**First**	**Second**	**Fourth**	**Sixth**
TD	12	10	12	13
MtS	10	10	11	20
DS	10	15	11	14
CN	11	14	12	17
RO	14	16	12	15
EP	8	13	13	20
AtS	9	9	9	19

Table 3 Group standard deviation of the SH
Source: Own Elaboration, (2021)

Graphic 2 shows the behavior of the standard deviation of the study habits of the 17 students of Computer Systems Engineering of the Tecnológico Nacional de México, Campus Zacatecas Norte, in order to see how dispersed the data are with respect to the mean. By which a greater variability or dispersion can be seen in some data which indicates a certain heterogeneity in some study habits:



Graphic 2 Percentage of group standard deviation of SH per semester
Source: Own Elaboration, (2021)

Acknowledgment

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Conclusions

Facing the great challenge of classes in a virtual modality involves teamwork on the part of higher education institutions, as well as constant monitoring in the promotion of study habits in students, to generate strategies that allow positively favoring the customs they implement to acquire constant learning.

As can be seen from the results, the impact of the COVID-19 pandemic on conducting classes differently from how students were used to has affected their study habits to some extent, so that there is no significant increase, rather in some of them there is a considerable decrease.

It should be noted that in the study habits where there was a decrease in the period where the virtual modality has been implemented due to the COVID-19 pandemic are: motivation to study (MtS) and class grades (CN).

For the above mentioned, it is necessary as future work to carry out a study where the causes and consequences that affect so that the study habits in students are not consolidated as techniques used in their continuous learning process are identified.

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Analysis, design, and creation of a learning program in Big Data at the higher education level: Case study Instituto Tecnológico Superior de Rioverde, SLP

Análisis, diseño y creación de un programa de aprendizaje en Big Data a nivel de educación superior: Caso de estudio Instituto Tecnológico Superior de Rioverde, SLP

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Abstract

In this paper results of a quantitative and qualitative study are shown to identify interest and acceptance level of Big Data in university students. The creation of a learning program is proposed that will allow students to obtain the necessary knowledge to form a solid foundation regarding Big Data, as well as the necessary tools to start working with this technology. A survey has been carried out of students who study the Educational Programs of Computer Engineering and Engineering in Computer Systems at ITSRV, the results show that 41% of the respondent's report having zero knowledge of Big Data, 51.28% mention that it is important to learn about the subject by development professional and the most suitable way, according to the answers, is through a workshop or a certification. Of the eight most used Big Data tools, Hadoop and Spark were the ones identified by the respondents, due to this, and the literature reviewed, it is important that spaces and Big Data learning programs are generated in higher level institutions that allow Students obtain the necessary basic knowledge and identify applications of Big Data in the professional and job context.

Big Data, learning program, Hadoop

Resumen

En el presente trabajo se realizó un estudio cuantitativo y cualitativo, para identificar el nivel de interés y aceptación en temas de Big Data en estudiantes de nivel superior. Se plantea la creación de un programa de aprendizaje que permitirá a los estudiantes obtener los conocimientos necesarios para formar una base sólida respecto al Big Data, así como las herramientas necesarias para comenzar a trabajar con esta tecnología. Se ha realizado una encuesta a estudiantes que cursan los Programas Educativos de Ingeniería Informática e Ingeniería en Sistemas Computacionales en el ITSRV, los resultados muestran que 41% de los encuestados informan tener nulo conocimiento de Big Data, 51.28% mencionan que es importante aprender sobre el tema por desarrollo profesional y la manera más idónea, según las respuestas, es a través un taller o una certificación. De las ocho herramientas de Big Data más utilizadas, Hadoop y Spark fueron las que identificaron los encuestados, debido a ello, y a la literatura revisada, es importante que se generen espacios y programas de aprendizaje de Big Data en instituciones de nivel superior que permitan a estudiantes obtener los conocimientos básicos necesarios e identificar la aplicabilidad de estos temas en el ambiente profesional y laboral.

Big Data, Programa de aprendizaje, Hadoop

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Introduction

Nowadays, the amount of information generated in everyday activities has increased considerably. From common activities, such as ordering food at home to checking the state of traffic in a city, continuously generate a large amount of data that must be collected, stored, processed and analyzed.

Different information systems are limited in the capacity to deal with this volume of data, and only storing data is not enough (Becerra, 2015); in addition, many companies do not have a unified solution to collect and analyze data (Escobar & Mercado, 2019), which can affect proper decision making.

The concept of Big Data allows the management of this type of information thanks to the ability to process large amounts of data quickly and effectively for subsequent analysis, which facilitates decision making (Aguilar, 2013), (Corea, 2019), (Salazar, 2016).

One of the reasons why companies do not benefit from this concept, is due to the lack of qualified professionals in the subject, as mentioned by Elena Gil Lizasoain, CEO of LUCA, Global Big Data Unit at Telefónica (Pontaza, 2019), from here arises the need to provide a space and learning program to train students of the Instituto Tecnológico Superior de Rioverde (ITSRV) in the area of Big Data.

It has been identified that the content of the ITSRV students' curricula does not include subjects that allow them to learn and deepen in the relevant aspects of Big Data. The creation of a learning program will allow students to obtain the necessary knowledge to form a solid base regarding Big Data, as well as the necessary tools to start working with this technology.

Within this document there are sections where you can find the methodology, which corresponds to the description of the method to be used to carry out the project; in the results section, within the analysis from the regression by demand curve, you can observe the degree of acceptance that ITSRV students present to the proposal and finally the learning program suggested as a result of the research is shown; as the last section are the conclusions including future work.

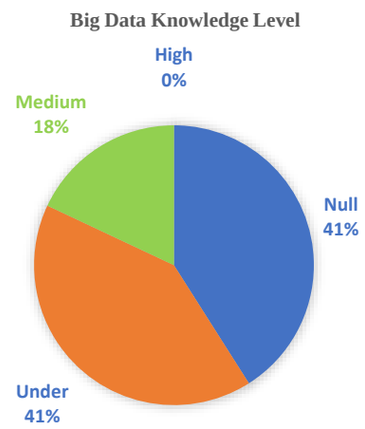
2. Methodology

A sample of 39 students was analyzed out of a total of 126, which corresponds to 31% of the ITSRV Computer Engineering and Computer Systems Engineering careers, it is worth mentioning that this percentage of participation completely covers the minimum required of 10% of the population to be representative. The study that was applied is quantitative and qualitative, helping to identify elements of current knowledge of Big Data in higher level students, as well as percentages of interest in learning about the subject; a documentary type research was applied that helped to determine the current status of learning about Big Data at the higher level, in addition, the grids of Computer Engineering and Computer Systems Engineering were analyzed, identifying only the inclusion of general topics without going deeper into the subject.

Regarding the instrument, a questionnaire containing 15 items was used, including questions of general knowledge of Databases, Programming, Operating Systems and basic topics of Big Data in addition to options of learning schemes. One of the most widely used self-administered survey methods was used, which is the online questionnaire.

3. Regression analysis by the demand curve

According to the survey entitled "Level of interest in the area of Big Data", 41% of the students report having no knowledge of Big Data, the other 41% have a low knowledge and only 18% mention having some knowledge, which is shown in the graph below. 1.



Graph 1 Level of knowledge of Big Data
Own Source

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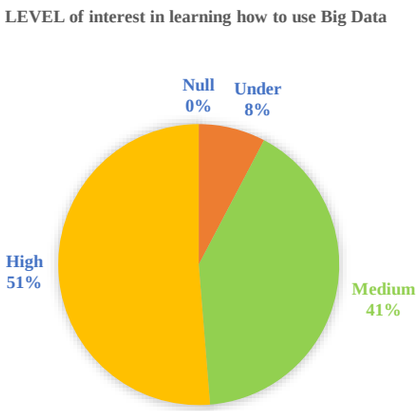
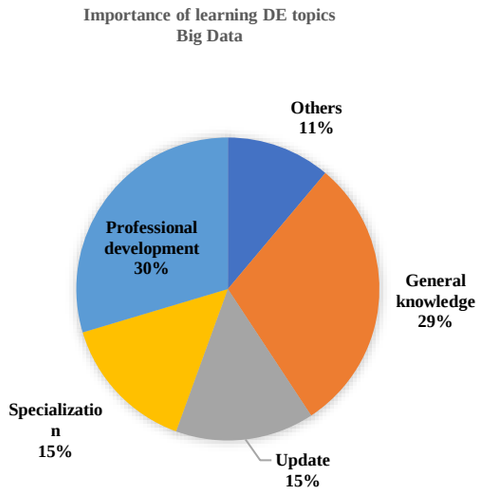
It is highlighted that 51% of the respondents show a high interest in using Big Data tools, 41% a medium interest and 8% a low interest, as shown in Graph 2.



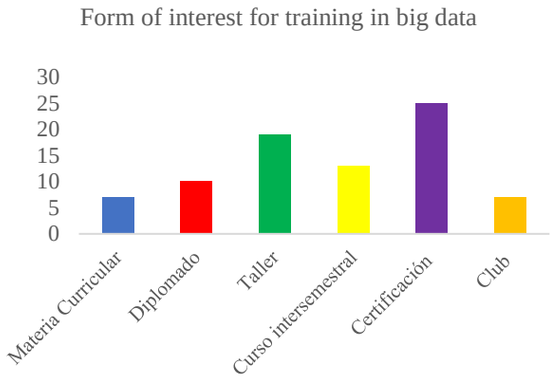
Graph 2 Level of interest in learning how to use Big Data
Own Source

51.28% of the respondents mentioned that it is important to learn about the topic for professional development, 20.5% for general knowledge, 10.26% for updating, another 10.26% for specialization and the remaining 7.7% for other reasons, as shown in Graph 3.



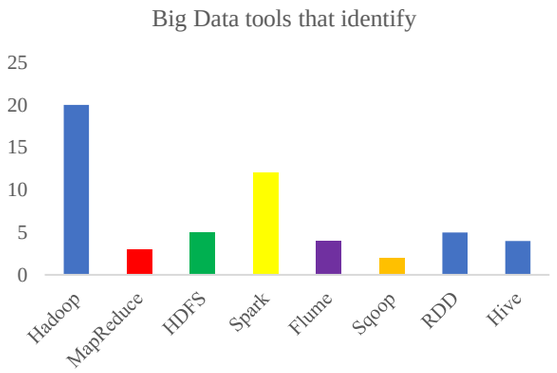
Graph 3 Importance of learning Big Data topics
Own Source

Respondents let it be known that the way in which they would be interested in being trained in Big Data topics mostly is through a certification or a workshop, according to the options with the highest choice, as shown in Graph 4.



Graph 4 Form of interest to be trained in Big Data
Own Source

To determine which tools can be added in the educational program to be proposed, the respondents were asked about the Big Data tools they identify, resulting that most of them recognize Hadoop and Spark, as shown in Graph 5, they had the option to choose several and the results are shown by number of students.



Graph 5 Big Data tools identified by respondents
Own Source

Graph 6 shows the degree of knowledge of the different topics, which are identified as important and necessary that the interested party should know before venturing into Big Data, so they are suggested to be part of the content of the program that will remain as a proposal to meet the interest of the students surveyed.

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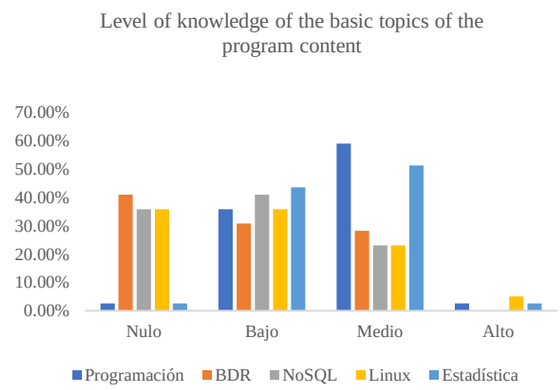

Graph 6 Level of knowledge in the basic topics
Own Source

4. Results

Big Data encompasses many concepts, tools and technologies, in addition, it is associated with other terms such as Data Science (Hernández et al., 2017), Data Analytics and Data Mining, but the fundamental objective of all of them is to extract value from data. The present proposal focuses on higher level students enrolled in a career related to computer systems and informatics can get to have general training of data processing tools, to operate with large volumes of information, either in batch or fast data streams in real time.

Derived from the survey results, it has been determined that Big Data training programs should include training in:

– Programming languages, essentially some of the most widely used are Python (Caballero et al. 2018) and Java the latter because it is the basis of the Hadoop ecosystem, also another language that is increasingly being incorporated for its versatility to Big Data course programs is Scala, because Storm and Spark allow to operate with it.

– Data warehousing, training in both relational and NoSQL databases is important, since Big Data is a concept that refers to the storage of large amounts of data and the procedures used to find repetitive patterns within this data.

– Data processing and storage, the central part in the Big Data training proposed is in data processing, therefore, the Hadoop ecosystem is fundamental (Power Data, 2014), (SAS, n, f), including its distributed processing system (MapReduce) and its distributed file system (HDFS), in addition data ingestion tools such as Sqoop and Flume and storage and analysis tools such as the e Hive.

– In addition, the Apache Spark ecosystem that has taken a great importance in Big Data (Chambers & Zaharia, 2018), (Holden & Konwinski, 2015) due to its speed, it is estimated to be one hundred times faster in memory computation and ten times more agile on disk than Hadoop; to the fact that it supports different languages: Scala, Python, R and Java; to the fact that it is very versatile and has a number of interesting tools: Spark SQL, Spark Streaming, MLlib and GraphX.

– Data analytics, descriptive and predictive statistics. The Big Data training program should include basic notions about data analysis, mathematical, statistical and methodological foundations of data analysis, and then, in advanced training, include topics such as Machine Learning, Neural Networks, Deep Learning, pattern recognition, predictive models, clustering, etc.

Conclusions

The results presented in this work show the relevance of including a Big Data learning program at a higher level, in order to contribute to the development of knowledge, competencies and skills of students in the management of huge volumes of information, allowing them as professionals to provide effective solutions to customers and companies. Therefore, the basic content was presented to help achieve this goal.
On the other hand, the information derived from the application of the instrument shows the interest of students in learning about Big Data, through various schemes, among the most chosen are: workshop and certification.

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Previous studies also indicate that it is imperative to include thematic content on Big Data in the curriculum of Educational Programs related to the area of Information Technology, Computer Science and Informatics, due to this, the suggestion is derived to incorporate a subject that covers the needs related to the topic in question, as this aspect requires a series of internal procedures, according to the type of institution, it is proposed to start with a workshop that includes the content proposed in the results section.

The implementation of the certification option is not considered adequate for the moment, since it requires the application of specific procedures to validate knowledge on the subject and to be a Certifying Body in the area in question, or to be part of one.

As future work is considered the analysis and generation of a syllabus that includes teaching and learning activities, as well as suggested practices, tools to be used and including competencies to be developed, both specific and generic, focused on Big Data.

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Use of Augmented Reality App as a means of motivation for high secondary education in times of COVID-19

Uso de App de Realidad aumentada como medio de motivación para la educación media superior en tiempos de COVID-19

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Abstract

As the COVID-19 health crisis continues, schools have been forced to close their doors, leading school systems to find innovative ways to reach and teach their students. A novel way of reaching students is Augmented Reality. High secondary level students have abandoned their studies and / or the idea of studying at a college, this derived from the methodology of teaching and monitoring their learning. The virtual environment developed in this research is intended to motivate the student of high secondary education of specialty related to the career of engineering in computer systems to continue with their studies at a college by showing them the applications that can develop themselves with the tools technologies and the knowledge to be acquired within the computer systems engineering study program. For this proposal, the Unity 3D software was used, since it presents flexibility for the creation of any type of environment. An initial and final survey was implemented after presenting the AR app to determine whether after its use the students feel motivated to continue with their studies.

COVID-19, Augmented Reality, Educational apps

Resumen

A medida que continúa la crisis sanitaria por la COVID-19, las escuelas se han visto en la obligación de cerrar sus puertas, conllevando a los sistemas escolares a encontrar formas innovadoras de llegar y enseñar a sus estudiantes. Una forma novedosa de hacerlo es la Realidad Aumentada. Los estudiantes de nivel media superior han abandonado sus estudios y/o la idea de estudiar a nivel superior, esto derivado de la metodología de impartición y seguimiento a su aprendizaje. El entorno virtual desarrollado en esta investigación, tienen la intención de motivar al alumno de educación media superior de especialidad afín a la carrera de ingeniería en sistemas computacionales a continuar con sus estudios a nivel superior al mostrarles las aplicaciones que ellos mismos pueden desarrollar con las herramientas tecnológicas y los conocimientos a adquirir dentro del programa de estudios de ingeniería en sistemas computacionales. Para esta propuesta, se utilizó el software Unity 3D, ya que presenta flexibilidad para la creación de cualquier tipo de entorno. Se implementó una encuesta inicial y final después de presentarles la app de AR para determinar si posteriormente de su uso los alumnos se sienten motivados en continuar con sus estudios.

COVID-19, Realidad Aumentada, Apps educativas

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Introducción

Currently, society is confined to its homes due to the health crisis caused by COVID-19 and there is uncertainty as to when it will be possible to return to normality. Due to this, it is essential to adapt to the new dynamics of life and to the use of technological tools that allow, while safeguarding personal integrity, to resume the activities that were carried out on a daily basis. School and work activities have been affected (Reeves, Lang, & Carlsson-Szlezak, 2020). In Mexico, since March 20, 2020, a health emergency was declared, therefore, before this resolution, the educational centers closed their facilities.

Suspending academic activities in such a sudden and unexpected way, caused a rapid transition of the educational system in which, now the "face-to-face" teaching-learning process turned to an "online" model. This new scheme has had to be launched with little preparation time, without having a suitable strategic planning for this new work modality (García-Peñalvo, Corell, Abella-García, & Grande, 2020), there is no doubt that before A normal scenario for the teaching of online classes, the ideal would be to redesign each of the subjects taught and taken in person in a distance format, making a consensus to ensure that all actors have the minimum required electronic means, necessary digital skills and a positive disposition to change.

On the other hand, due to the deficiencies in the technological skills of teachers and as mentioned above, the lack of planning for this new scheme derived from reaction time, some situations have emerged that slow down or cancel the learning process of the students , i) accessibility: not all the population has the necessary resources such as internet or electronic devices to receive classes, ii) usage time: people who do have technological equipment have to share the resource with another member of the family, iii) training: related to the limited ability and knowledge on the part of students and teachers to use videoconferencing platforms and LMS platforms based on the Cloud, as well as to impart knowledge through digital content, and iv) predisposition: concerning the will to students and teachers to get involved with technological devices and tools for the acquisition of knowledge (Enguita, 2020).

The present work is focused on students of the sixth semester of upper secondary level, this being the last semester before making a decision of which career to choose and in which institution to continue with their studies. Before the pandemic there were already problems such as failure and abandonment, with the health emergency that we are going through, school dropouts have skyrocketed and consequently upper secondary students do not continue with their professional training. According to data presented by INEGI in its press release on March 23, 2021 for reasons associated with COVID-19 or due to lack of money or resources, 5.2 million people in Mexico did not enroll in the 2020-2021 school year.

There are several variables that can be attributed to this dropout, such as lack of interest in studying, lack of motivation in the face of the new teaching scheme and / or financial deficiencies. This article shows the implementation of a mobile application with Augmented Reality that allows sixth semester students of upper secondary education in specialties related to computer systems engineering, to visualize virtual elements that are combined with the physical environment as a medium. motivation to continue with higher level studies. The proposed application allows, through Unity, to display in an attractive and innovative way textual information about the entrance process to the educational program of engineering in computer systems. The purpose of this experiment is to motivate students to continue with their higher-level studies by visualizing and understanding the application programming and its functions.

Augmented reality in education

It is feasible to think that we are in a process of consolidation of different trends of emerging technologies within the educational context, such as mobile devices, 3D modeling and augmented reality (“Augmented Reality”) (AR). Augmented reality seeks to enrich the physical world by integrating virtual elements under an interactive environment, in which it is possible to interact in real time through different technological devices, ranging from tablets, smartphones, to special glasses. This reality has the following characteristics (Prendes Espinosa, 2014):

1. Combine the real and the virtual
2. Interact in real time

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3. Register in 3D

On the other hand, Prendes (2014) mentions that augmented reality has different levels that are summarized as follows:

- Level 0 (Hyperlinked): This is characterized by not having three-dimensional elements or a record of bookmarks and, basically, it is hyperlinks to other content. This level makes use of barcodes, QR codes, and random image recognition to link.

- Level 1 (Marker-based): At this level, two-dimensional pattern recognition and 3D objects are recognized. The markers you use can be plain, asymmetrical black and white images. This is the level that has been used in the educational field in recent years, since from an image that the virtual object of study is recognized and visualized.

- Level 2 (Without markers): It uses the GPS of the mobile device and based on the location and orientation; points of interest are superimposed on real images. At this level, applications can use the accelerometer to calculate the incline and react to it.

- Level 3 (Augmented vision): This AR is immersive, since it makes use of special displays that the user must wear, such as the use of glasses, instead of the screen of the mobile device.

The appearance of augmented reality in the educational field has facilitated, through tablets and mobile phones, the promotion of innovative teaching strategies, as well as influencing interest and positive motivation based on augmented reality (Reyes, 2020). Studies show that experiences with interaction for the assimilation of knowledge within the classroom are related to an increase in academic performance (Cabrero Almenara & Barroso Osuna, 2016), also with a positive acceptance by students to use reality applications increased in learning (Lagunes, Torres, Angúlo & Martínez, 2017), as well as to assess with high levels of satisfaction participation in the training experience with strategies that involve the simulation of reality (Fonseca, Redondo & Valls, 2016).

In education, augmented reality is an emerging and transformative technology with a great impact since it allows the creation of content by the teacher to later show the students, these contents present characteristics of interactivity and three-dimensionality, allowing the enrichment of printed materials for students. students with additional virtual information. Augmented reality is versatile since it can be used in different subjects and disciplines, encouraging students to motivate them to generate their own learning objects (Blas, Vázquez, Morales & López, 2019).

In higher-level education, the use of ICT has become a fundamental issue, since from it it is sought to design digital teaching tools in order to incorporate knowledge-generating elements for the representation and analysis of concepts and reality, in addition to adding to meaningful learning for students (Fernández, Sánchez & Calatayud, 2018). 21st century education considers augmented reality an emerging technology with a high possibility of impacting the teaching-learning process, since it offers various educational guides and great potential to improve meaningful learning by students (Almenara, Vázquez-Cano, Meneses & Martínez, 2020).

Methodology

Interface development

The virtual environment developed in this research is intended to show that through a configuration within the Unity development environment and programming, virtual objects can be created to interact with the physical environment, applications that can be created for any type of environment.

The proposed application has the following interaction scheme with the student, i) start: here the student must run the application and focus the camera of their device on the target image, immediately a text is displayed that shows the requirements to process a file at the Tecnológico Superior del Occidente of the State of Hidalgo (ITSOEH), ii) later the student can click on the two virtual buttons that are presented, the first is to go to the social network Facebook of the computer systems engineering degree belonging to to ITSOEH and the second directs them to the official ITSOEH website (see Figure 1).

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Figure 1 RA Scene Screen
Reference Source: Own Elaboration

Development of the experiment

The experiment focuses on sixth semester students from upper secondary educational units in the area of influence of the Higher Technological Institute of the West of the State of Hidalgo. ITSOEH is an educational center that offers quality education, which guides its students to become ethical professionals, maintaining a curriculum according to the student's necessary learning for their incorporation into the work environment. However, derived from the health crisis in which we are living, teachers of all educational levels have seen the need to migrate their face-to-face classes to a remote-virtual way, adapting methodologies and tools in which they had little knowledge.

As a result of this situation, it has been identified that students from upper secondary education centers no longer wish to continue with their professional studies, this can be established by detecting the abandonment of studies in the sixth semester and by not processing an entry form in any higher education campus.

The objective of this research is to compare with an initial and a final survey applied to sixth semester students in upper secondary education to know the degree of motivation of students to continue with their university studies in a profile of computer systems engineers. To measure the motivation of the students for the use of the application, an online survey was implemented through a Google form, which consisted of 10 questions with multiple-choice answers on the Likert scale (totally agree, up to totally disagree). The questions focused on the aspects of motivation and satisfaction; this last aspect included elements related to the user experience.

Results

In total, the experiment was carried out in 5 upper secondary institutions where the student was given a talk about the operation of the augmented reality application and what was the development to create it, after the talk, they were provided with the installer (apk) so that they themselves installed the application on their cell phone and could interact with the app. In total, 78 students were involved in this process. Defining those 78 students was the population that participated in the total of the talks.

As can be seen in Figures 2 and 3, the students responded positively as to whether the use of the AR app motivates them to continue with their studies at a higher level and in satisfaction, we obtained a positive response by approaching this knowledge in an attractive way, easy to use and easy to understand.

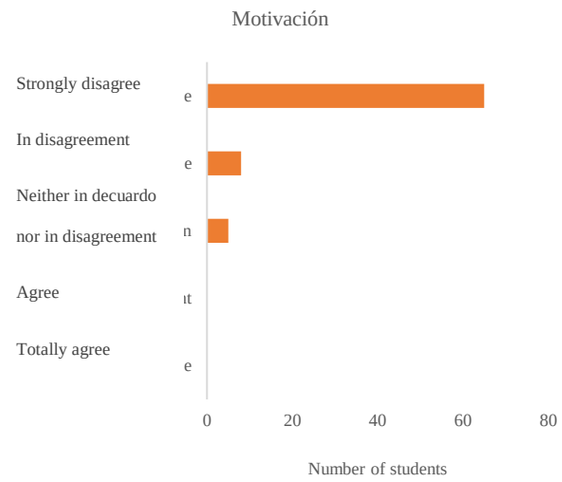

Figure 2 Student's perception of whether the AR app motivates them to continue with their higher-level studies
Reference source: Own elaboration

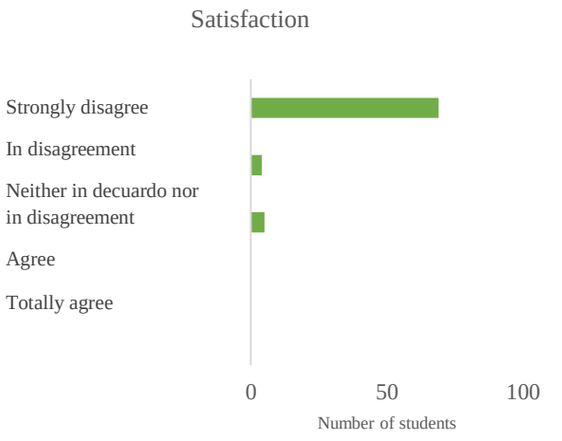

Figure 3 Student's perception of their degree of satisfaction with the operation of the AR app
Reference Source: Own Elaboration

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In addition, at the end of the questionnaire an open question was included where it was possible to collect information regarding comments on the application to later implement a word cloud that helps us find the descriptive words of the comments made by the students. In Figure 4 we can visualize this word cloud, from which we can rescue which programs, exciting, knowing, interesting and learning are the largest words, therefore they have the highest frequency in the responses of the students.

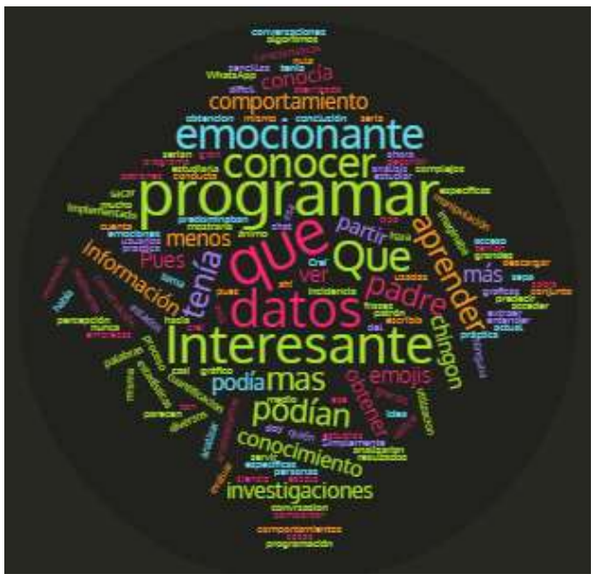

Figure 4 Word cloud in relation to the perspective of the students regarding the AR app
Reference Source: Own Elaboration

Conclusions

The objective of this study was to develop a mobile application for the Android operating system that uses augmented reality to motivate upper secondary students to continue their studies at a higher level within the area of computer systems. The results obtained reflect that the student finds it interesting to know how the application works through programming.

On the other hand, it would be very positive to implement this motivational technique with augmented reality applications in programming subjects within the ITSOEH, in order to corroborate that augmented reality has a decisive influence on taking in a positive way the knowledge that makes us tedious or complicated when time to study.

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Artificial vision system for object classification in real time using Raspberry Pi and a Web camera

Sistema de visión artificial para clasificación de objetos en tiempo real usando Raspberry Pi y una cámara web

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Abstract

Computer vision systems are an essential part in industrial automation tasks such as: identification, selection, measurement, defect detection and quality control in parts and components. There are smart cameras used to perform tasks, however, their high acquisition and maintenance cost is restrictive. In this work, a novel low-cost artificial vision system is proposed for classifying objects in real time, using the Raspberry Pi 3B + embedded system, a Web camera and the Open CV artificial vision library. The suggested technique comprises the training of a supervised classification system of the Haar Cascade type, with image banks of the object to be recognized, subsequently generating a predictive model which is put to the test with real-time detection, as well as the calculation for the prediction error. This seeks to build a powerful vision system, affordable and also developed using free software.

Computer vision, Raspberry Pi, OpenCV

Resumen

Los sistemas de visión por computadora son parte esencial en tareas de automatización industrial tales como: identificación, selección, medición, detección de defectos y el control de calidad en partes y componentes. Existen cámaras inteligentes empleadas para la realización de dichas tareas, sin embargo, su alto costo de adquisición y mantenimiento es privativo. En este trabajo, es propuesto un novedoso sistema de visión artificial de bajo costo, para la clasificación de objetos en tiempo real, mediante el sistema embebido Raspberry Pi 3B+, cámara Web y la librería de visión artificial Open CV. La técnica sugerida comprende el entrenamiento de un sistema de clasificación supervisado del tipo Haar Cascade, con bancos de imágenes propios del objeto a reconocer, generando posteriormente un modelo predictivo el cual se pone a prueba con la detección en tiempo real, así como el cálculo en el error en la predicción, Con esto se busca la construcción de un sistema de visión poderoso, de costo accesible y que además sea desarrollado mediante software libre.

Visión artificial, Raspberry Pi, OpenCV

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Introduction

One of the pillars of Industry 4.0 is computer vision, which is revolutionizing the way automation and quality control systems are carried out in manufacturing processes. Tasks such as the identification, selection, measurement and detection of parts or components are seen in a daily example of applications in this field.

In the industrial field, it is still common the use of expensive cameras, specifically designed for artificial vision tasks, these cameras have specialized hardware and software for processing part or the entire information on site, Compensating the modest performance of the computer equipment or embedded systems to which information is sent from the camera.

Today the roles have changed, with the availability of computers and embedded systems with higher performance, reduced size and competitive cost, allowing the use of ordinary cameras. It moves the video processing, from the camera to the embedded system or the computer. without compromising speed and real-time response. It represents a great advance in the field of artificial vision, allowing ordinary video cameras such as those found in smartphones or personal computers (webcams) to achieve results that were previously reached by cameras with special lenses, optic filters, depth sensors, proprietary processing hardware, among other additions.

The proposed system follows this approach, using as sensor an inexpensive web camera, with a resolution of 1.3 Mega pixels and data transmission via USB 2.0. For video processing is used the Raspberry Pi 3B + embedded system, a low-cost bank card size single board computer with a 1.4 GHz 64 bit processor, 1GB ddr2 ram memory, four USB 2.0 ports, HDMI, WiFi, Bluethooth, 40 GPIO input and output pins, among other features. Another advantage of this work is the use of the artificial intelligence algorithm known as Haar Cascade, a supervised classifier that has proven an outstanding performance, in embedded systems for face recognition. For the development of the Artificial vision system for object classification in real time, Python3 programming language, OpenCV computer vision library and Raspberry OS operating system were used, giving priority to the use of free software tools.

The field of artificial intelligence is strongly linked to the development of computer vision applications. There are learning algorithms which can be applied to video captured in real time, which can detect and classify objects for which they were trained. This has led to a number of applications in manufacturing processes, safety and even in the automotive sector with the development of autonomous vehicles.

There are two types of learning algorithms: supervised and unsupervised. Supervised learning consists of the generation of a predictive model through the analysis of examples in which the answer is known. In the case of computer vision, the examples can be large image banks, in which the object to be detected is found in different positions, types of environments and lighting. The greater number of images under different conditions, the more robust the predictive model becomes, always trying to find a balance between computational cost and prediction error.

The Haar Cascade classifier proposed by Paul Viola and Michael Jones (Viola & Jones, 2001) is from a supervised type. Unlike other classifiers whose computational cost is considerable in order to achieve acceptable performance, Haar Cascade has shown good results at a lower computational cost. This has led to its implementation in smartphones, single board computers, and embedded systems which generally sacrifice performance in their portability feature.

The specific objective of this research is to implement a classifier with the aforementioned hardware and software characteristics, which distinguishes a specific type of immersed part among other types, to later label it, regardless of its size or position. In this case, the classification of hexagonal nuts was arbitrarily chosen, which will be found immersed in screws and washers of different sizes, simulating a classic classification problem in an industrial environment.

Classification system development

The implementation methodology for the artificial vision system applied for object classification in real time is described below.

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This involves three successive steps: the first corresponds to the capture of the image database with the object to be classified, the second implies the training and generation of the predictive algorithm through the database and the Haar Cascade classifier. Finally, the real-time detection test is performed, as well as the measurement of the classification error.

Obtaining the image database

The first step to carry out this work is to generate an image database for training the Haar Cascade classifier. The database must contain a great number of images and for this reason a program in Python and Open CV to carry out the compilation in a most efficient and simple way was implemented. A rectangular frame has been delimited and the object whose image must be captured must be placed inside it. If a key is pressed, the image inside the frame is saved and resized to 50x60 pixels. The reduction is carried out in order not to extend the training process too long.

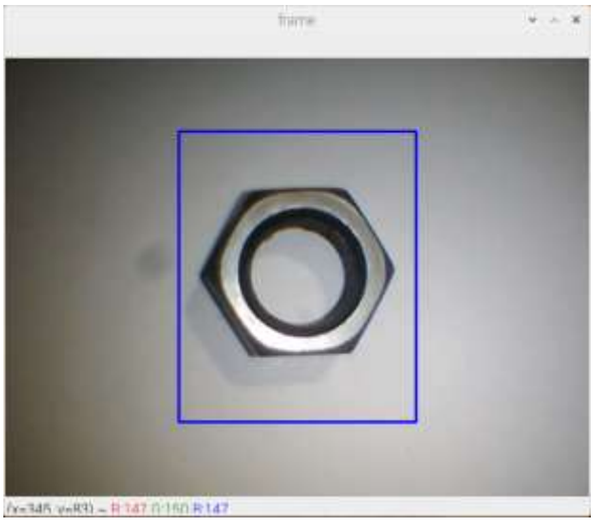

Figure 1 Capturing an image for the training database

The Haar Cascade classifier requires an image database separated into two large groups: the first corresponds to the positive images, in which the object to be recognized (class nut) is found, trying to vary the size of the object, the position and if possible, environments similar to those found in the classification scenarios.

Figure 2 Database sample with positive images.

The second group competes for negative images, which correspond to all objects and backgrounds that do not belong to the nut class and which may be found in future classification scenarios, including possible false positives such as washers and bolts with different sizes and types. A white background is considered for all images in the database, because it simulates a controlled environment for an industrial process, which in turn reduces the complexity of the classification process.

Figure 3 Database sample with negative images

Classifier training

The Haar Cascade classifier falls within a type of machine learning algorithms known as AdaBoost (adaptive enhancement). They use weak classifiers connected in succession to form a more efficient algorithm known as a strong classifier. Haar Cascade applies this principle, using as weak classifiers a type of binary windows known as Haar characteristics, which have different configurations that, when superimposed on a certain section of an image, serve to detect lines and contours of different attributes.

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There are a large number of Haar characteristics, exceeding hundreds of thousands, which makes their direct use in the extraction of characteristics computationally expensive. As a consequence, the Adaboost algorithm is applied, selecting the most relevant Haar characteristics found in the positive images from the training database, and discarding the vast majority which are irrelevant. These characteristics will be used in the generation of weak classifiers, as part of a predictive model for classification using Haar Cascade.

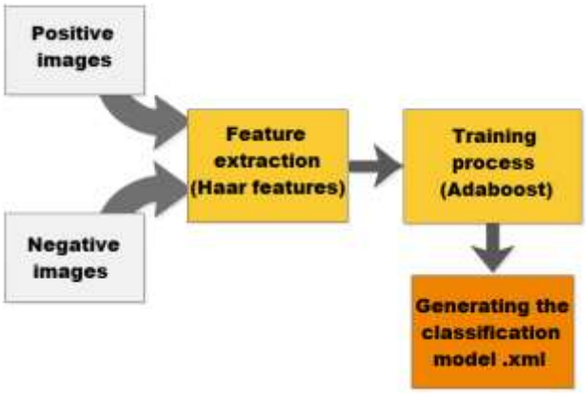

Figure 4 Block diagram for the training process

It should be mentioned that the training carried out offline and can generally last from tens of minutes or even days, depending on the complexity of the object to be detected and the number of sample images in the database.

Real-time detection test

The next stage consists of the generation of a test algorithm, which receives input images with similar environmental and lighting conditions to those of the training database, although at the same time completely new. These images must be transformed to grayscale for further processing using the classification model generated in the previous stage.

The next step is the implementation of the Adaboost algorithm, applying the weak classifiers obtained in the previous stage, for the analysis of different subregions in the test image. Analyzing at such locations can give both positive and negative results. In the case of having a positive result, the region is assigned a higher weight and in the opposite case it is assigned a lower weight.

The results in the subregions with negative label being almost immediately discarded and the analysis is focused on the regions where higher weights are obtained or with positive results, implementing in them the cascade analysis of different weak classifiers. If the sub-region stands up to the scrutiny of all classifiers showing positive results, then the final result of the classification of that sub-region is positive.

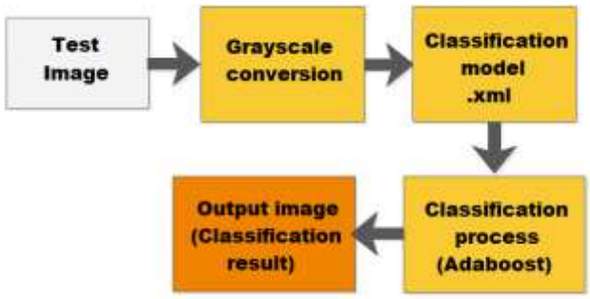

Figure 5 Block diagram for the detection process.

It should be considered that the system was designed to analyze in real time, a video signal acquired from a Web Camera. This is possible due to the computing power of current embedded systems, achieving analysis and classification in tens of images per second.

For the classification system test, a stage was created with the same lighting and background as that used in the training images, placing different distributions of nuts, bolts and washers with different dimensions. The distance between the objects to be classified and the Web camera is not completely fixed, allowing a certain degree of movement, as could happen in some industrial processes including analysis on a moving conveyor belt.

The system was trained to generalize and recognize the nut class, regardless of whether they vary in size, color, or texture. The algorithm was configured to enclose the objects detected as positive, in a blue box with the label corresponding to the nut class (tuerca). Objects that are not detected within that class are simply ignored.

Figure 6 shows a screenshot of the proposed machine vision system in operation. The image corresponds to a 1.3 Mega pixel video signal at 30fps, processed in real time. It is observed that the classification of the nuts was correct, without false positives or negatives.

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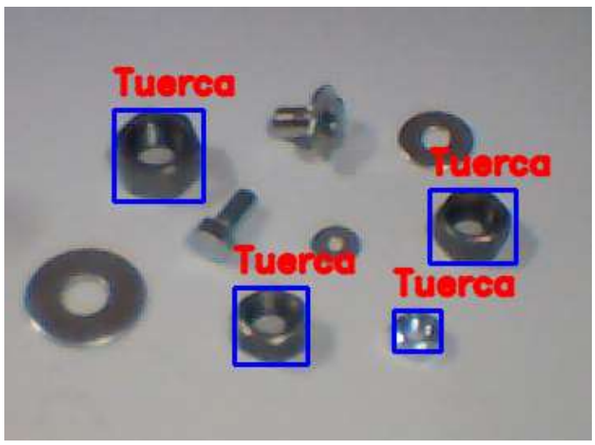

Figure 6 The proposed artificial vision system performing the classification of nuts (tuercas) in real-time using Har Cascade, Raspberry Pi and Web camera.

Changes were made in the distribution, number and type of pieces, obtaining satisfactory results in the classification. Figure 7 shows a classification case in which a change was made in the distribution of the pieces.

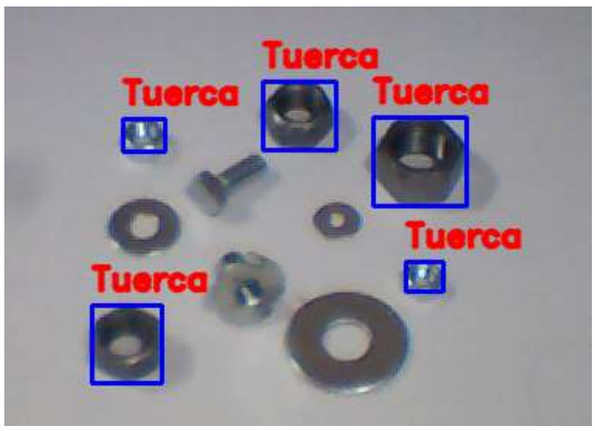

Figure 7 Change in the parts distribution with a correct classification.

Algorithm performance

A database with 100 images was implemented for testing, in which scenarios similar to those shown in figures 6 and 7 can be observed, although with the difference that each image has its ground truth. The objective is to use this database to test the performance of the vision system, implementing the confusion matrix with the classification percentages in the parameters: true positive TP, true negative TN, false positive FP and false negative FN. This is possible because the Haar Cascade is a supervised classification algorithm.

The results obtained in the calculation of the confusion matrix are shown below.

	Predicted Positive	Predicted Negative
Actually Positive	TP =0.85	FP =0.20
Actually Negative	FN =0.15	TN =0.80

Table 1 Confusion Matrix

To calculate the accuracy, the following formula is applied:

$$Accuracy = \frac{TP+TN}{TP+TN+FP+FN} \quad (1)$$

$Accuracy = 0.825$
$Error\ rate = 0.175$

Conclusions

According to the objectives stablished at the beginning of this work, an artificial vision system for classifying objects in real time using Raspberry Pi and Web camera was successfully developed.

The advantages to consider are described below:

– Low cost
– Good performance
– Implementation with free software
– Real-time operation
– Embedded system
– Conventional webcam
– Portable

The system was implemented with free software in specific Python and OpenCV, with the advantages that this entails in portability, costs and debugging capacity. In addition to this, the use of the Raspberry Pi 3B + card and a conventional webcam as hardware, provide the system with an affordable cost (no more than 100 dollars) although with good computing power, achieving fluid and real-time operation. In addition, it has the advantage of being portable and small in size, becoming a serious competitor to expensive industrial cameras for computer vision applications.

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[Title in Times New Roman and Bold No. 14 in English and Spanish]

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* Correspondence to Author (example@example.org)
† Researcher contributing as first author.

Introduction

Text in Times New Roman No.12, single space.

General explanation of the subject and explain why it is important.

What is your added value with respect to other techniques?

Clearly focus each of its features

Clearly explain the problem to be solved and the central hypothesis.

Explanation of sections Article.

Development of headings and subheadings of the article with subsequent numbers

[Title No.12 in Times New Roman, single spaced and bold]

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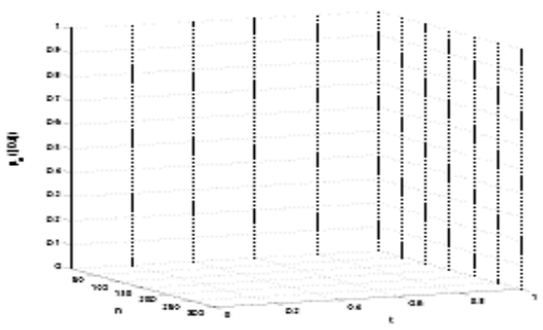

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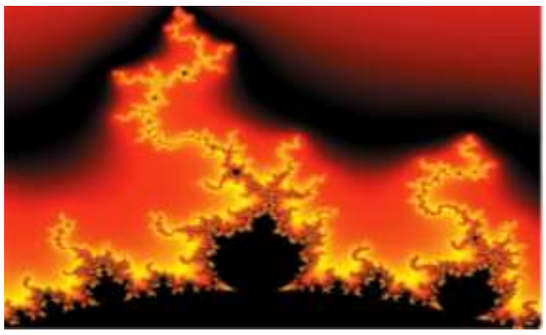

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For the use of equations, noted as follows:

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Methodology

Develop give the meaning of the variables in linear writing and important is the comparison of the used criteria.

Results

The results shall be by section of the article.

Annexes

Tables and adequate sources

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Indicate if they were financed by any institution, University or company.

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Explain clearly the results and possibilities of improvement.

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