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Journal of Technological Development

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Support the international scientific community in its written production Science, Technology and Innovation in the Field of Engineering and Technology in Subdisciplines of technological development, digital technology, technological impact, teaching with computer help, reliability of computers, heuristics, computing, machine arithmetic instructions, artificial intelligence, algorithmic languages, programming languages

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The works must be unpublished and refer to topics of technological development, digital technology, technological impact, teaching with computer help, reliability of computers, heuristics, computing, machine arithmetic instructions, artificial intelligence, algorithmic languages, programming languages and other topics related to Engineering and Technology.

Presentation of the Content

In the first chapter we present, *Programming to develop reports during online classes generating docx or pdf files including mathematical analysis and graphic expression of remote activities*, by GONZÁLEZ-GALINDO, Edgar Alfredo, DOMÍNGUEZ-ROMERO, Francisco Javier, PÉREZ-GARCÍA, Jorge and SORIANO-HERNÁNDEZ, Víctor Hugo, with ascription in the Universidad Nacional Autónoma de México, as a second article we present, *Jonassen model in the development of integrative projects*, by QUEZADA-ARGUIJO, Alondra Jacquelinne, POZAS-CÁRDENAS, Mariano Javier, CURIEL-ANAYA, Arturo and HERNÁNDEZ-SÁNCHEZ, David, with ascription in the Universidad Autónoma del Estado de Hidalgo, as the following article we present, *Development of a practical module created with 3D printing for the education and training of students in the oil area maintenance career*, by LICONA-GONZÁLEZ, Marlon, QUIROZ-RODRÍGUEZ, Adolfo, GALINDO-MENTLE, Margarita and BLAS-SÁNCHEZ, Luis Ángel, with ascription in the Universidad Tecnológica de Xicotepec de Juárez, as the following article we present, *Web system for monitoring physical variables in aeroponic crops*, by PAREDES-XOCHIHUA, María Petra, MORALES-ZAMORA, Vianney and SÁNCHEZ-JUÁREZ, Iván Rafael, with ascription in the Instituto Tecnológico Superior de San Martín Texmelucan.

Content

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Programming to develop reports during online classes generating docx or pdf files including mathematical analysis and graphic expression of remote activities

Programación para desarrollar reportes durante la modalidad de clases en línea generando archivos docx o pdf incluyendo el análisis matemático y la expresión gráfica de las actividades a distancia

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Abstract

The programming was designed to develop reports that include mathematical and graphical analysis during the online class modality. The report generator included within the MATLAB software libraries allows the generation of files in pdf, word, power point and html formats to be developed through programming. The software captures and generates dynamic reports of the results and graphical expressions to document the results in a single report, facilitating collaboration with other users to share a template based on professional standards in companies, organizations, educational institutions and universities. Importing libraries like mlreportgen.dom and mlreportgen.report into a script, specifies the structure of objects such as the header, titles and subtitles, image footer and table citation. The report for the delivery of online activities, students are required to enter their personal information, the report includes the equations and the results generated by the template makes it easy for students to deliver the activities instantly. Obtaining a script capable of generating reports with professional standards of remote activities, developed for delivery, thus allowing immediate collaboration and evaluation

Dynamic reports, Online classes, Evaluation

Resumen

Se diseñó la programación para desarrollar reportes que incluyen el análisis matemático y gráfico durante la modalidad de clases en línea. El generador de reportes incluido dentro de las librerías del software de MATLAB permite desarrollar a través de la programación la generación de archivos en formatos pdf, word, power point y html. El software captura y genera reportes dinámicos de los resultados y las expresiones gráficas para documentar los resultados en un único informe, facilitando la colaboración con otros usuarios para compartir una plantilla basados en los estándares profesionales en empresas, organizaciones, instituciones educativas y universidades. La importación de librerías como mlreportgen.dom y mlreportgen.report dentro de un script, especifica la estructura de objetos como el encabezado, títulos y subtítulos, pie de imagen y la cita de tablas. El reporte para la entrega de actividades en línea se requiere que los estudiantes ingresen su información personal, el reporte incluye las ecuaciones y los resultados que genera la plantilla facilita que los estudiantes entreguen las actividades al instante. Obteniendo un script capaz de generar reportes con estándares profesionales de las actividades a distancia, desarrolladas para su entrega permitiendo con esto la colaboración y la evaluación de manera inmediata.

Reportes dinámicos, Clases en línea, Evaluación

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Introduction

The implementation in the delivery of activities in online classes is very important since many platforms that offer learning management tools for virtual classes such as: BrainCert, OpenEduCat, Classtime, Edsby, Unik LMS, SkyPrep, Tovuti, Flumind, iTacit, Eduflow, Teleskill Live, Edtek LMS, Jforma, Absorb LMS, Thought Industries, Google Classroom and Moodle, among others, accept the sending of activities carried out online, tasks, reports, logs, etc., are requested in pdf formats , docx, ppt, html, but today more than ever the global situation of confinements due to severe acute respiratory syndrome (SARS CoV2), and the disease it causes is called COVID-19. It has made certain programs available free of charge for academics and students to make use of the tools that the National Autonomous University of Mexico has provided through agreements with The MathWorks company. This facilitates students of the electrical and electronic engineering career of the Faculty of Higher Studies Aragón. Many schools in different parts of the world, many educators and students were not prepared for online education. This transition has caused considerable problems. This challenging period forced a change in the way of learning, the use of learning aids, and taught new educational possibilities. By switching to other tools used in the educational process, teachers, as well as students, had to acquire new skills, for example, working with new software to generate reports for their distance evaluations in the Electronic Electrical Engineering Career (M. Trojanová, 2021).

One year and eight months after the start of the COVID-19 pandemic, almost half of the world's students are still affected by the partial or total closure of schools. UNESCO is tracking through a virtual map on its portal to support countries in their efforts to mitigate the impact of school closings, address the issue of learning losses and adapt their education systems, especially for communities. most vulnerable and disadvantaged. To mobilize and support the continuation of education, UNESCO established the Global Coalition for Education, which currently has more than 160 members working on three core issues: gender, connectivity and teachers (UNESCO, 2021).

Through these central themes, the operation of mechanisms and public and / or remote information is developed; take measures so that Universities can continue to operate with remote information and communication systems; as well as the use of a distance learning platform to continue facilitating the teaching-learning of students. In the event that no tool is available, it is possible to implement any of the multiple applications and educational platforms, bearing in mind that part of the students may only be able to use smart devices (Ojeda Misses, 2021). In order to understand distance education, several authors define it by mentioning the following: “Distance education is based on a didactic dialogue mediated between teachers of an institution and the students who, located in a different space than the former, can learn from independently or in a group”. Which it indicates to be valid in different contexts, encompassing almost all the denominations and forms linked to this modality, which has been enriched thanks to increasingly sophisticated technology (Reyes Campos, 2021).

Allowing Professional and Comprehensive training, this implies acquiring mastery of operations and instruments, appropriation of knowledge and adaptability that promote the use of new technologies. Training, then, is not a static process and must transcend current needs, so the instructor must be a model of coherence. Likewise, the contemporary instructor must demonstrate a solid handling of Information and Communication Technologies - ICT”. The new normal creates a need for instructors to continually update themselves in the use of digital tools. It is decontextualized, for example, teaching the apprentice theories that no longer have applicability or the use of obsolete techniques and tools. For this reason, training programs are subject to curricular redesign updates, training projects must be modified according to the new needs and problems of the productive sector, where relevant, the relevance and coherence of the instructor in front of the contents he imparts. Therefore, the training of the instructor must be permanent and contextualized with the new technical, pedagogical, didactic and methodological changes (González Alarcón, 2021). It is indisputable that teachers are doing a great job, it is not just trying to fulfill an academic program, but keeping in touch, making a presence despite the distance; with the information sent such as: notes, dynamic reports, presentations, videos, in addition to showing interest in students.

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The introduction of ICT and TAC (for its acronym Learning and Knowledge Technologies) in school processes "opens a new range of possibilities, especially if one takes into account that in life in society it becomes daily and necessary , presenting a scenario where children grow up with the internet, using computers, smarphone, tablets, game consoles, virtual voice assistants and digital televisions ". Then, it will be necessary to add to the teacher one more task to those already mentioned above, which consists of reviewing the programming established at the national level to distinguish those contents that the student will see at home to send related activities through booklets, guides and / or photocopies. Alternatively, there are those who have been working through smartphone applications such as WhatsApp, Facebook, Messenger and Telegram, among other applications that are widely used at an educational level in the current scenario as a means of linking and monitoring (del Rosario Zamora -Betancourt, 2021).

There are other programs that allow the development of reports for the information system, such as SYNTHESIS. The preview function in this program allows users to download the generated report in the desired file format, such as pdf, docx or xlsx. It is used when the report was generated using a template. After downloading the file, the scenarios are completed, as the reports can be exported. (Paterakis, 2021). The reporting service enables clients to receive outbound reports in a single request-response.

The report service is a synchronous request, which means that the caller will be blocked until the report is generated and returned in the response. For large data sets or long reports, the delay can be significant. If you want to use non-blocking (asynchronous) request, the output type are: html, pdf, csv, docx, pptx, xls, xlsx, rtf, odt, ods, xml, metadata output: data_csv, data_xls, data_json (TIBCO, 2021). In 2008 the company Adobe Systems revolutionized the publication of digital documents with a standard format called PDF (portable document format for its acronym in English).

Although it is true that the positive impact of this type of files has been unquestionable, allowing the sharing of all kinds of information for reading, at present the functioning of PDF's is insufficient as we are in a society where users normally adopt the need to become prosumers of their meaning as a consumer of a product or a service that at the same time participates in its production. On the other hand, the Wolfram Research company, noticing these changes and the need for more flexible business requirements for decision making, developed a proprietary file type called CDF (acronym for: computable document format) which establishes a document format capable of run for free, in many cases, through different operating systems. The CDF's can be deployed for use by installing a free multiplatform plug-in (for Windows, MAC and Linux operating systems).

The technological architecture of a document with a computable format is based on the computational power provided by the Wolfram language. With very few exceptions, practically everything that can be developed in a conventional Mathematica notebook will be an easy resource to export as a CDF (Quesada, 2020). Another company that is revolutionizing and is positioning itself in innovation in the requirements of a need in all areas such as scientific, business and education, the MathWorks company with the MATLAB program is very well considered not only as a numerical computing environment commercial, but also as a programming language, contains a standard library, but its uses include matrix algebra and a large network for data processing and plotting. It also contains student toolkits, but this will cost the user more. Although both Python and R are open source programming languages, you don't have to be a programmer to use them. While programs like Excel and SPSS can be simpler and faster to learn, their computational skills are far inferior to Python, R, and MATLAB, which only require basic programming knowledge (Ozgur, 2021), However MATLAB, together with its family of toolbox or toolbox, it is widely used for the analysis and design of a large number of real-life engineering problems covering areas such as signal processing, control system design, etc.

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The result of a problem solved with MATLAB can be included in a Microsoft Word document using the notebook supplied with MATLAB or the MATLAB / Simulink report generator toolbox, available or separately. In academic institutions, documentation is commonly done using LATEX. Although graphics generated by MATLAB can be saved in PostScript format and then included in a LATEX document, there is currently no way to directly include numeric data and text in a LATEX program. Manual inclusion of such data is error prone and time consuming. When data sets or graphics are to be included in a LATEX document, the programming power of MATLAB can be used effectively. There are applications that are being carried out using the MATLAB module of the control systems toolbox and its functionality is increasing (Talole, 2003). For a student who intends to enter a career in some of these areas such as: Physical Sciences, Technology, Engineering and Mathematics, the calculations are relevant, but at the same time they are difficult when the student has a visual disability. That is why research in Educational Mathematics indicates that this subject by itself is complicated for most students.They point out two aspects that are central to the problem of learning the first, that in calculus, objects must be represented graphically, especially graphs. of functions and a second aspect is that you must have an analytical representation of these objects, one of the programs that allow us to generate presentations is LaTeX, that is, it creates documents or reports in PDF format, and respects the syntax of the different areas. Free software has become one of the fastest growing technological movements of the 21st century. Python was created by Guido van Rossum, a Dutch programmer in the late 1980s and early 1990s when he was working on the Amoeba operating system. Firstly. For its development it has been necessary to have a group of tools that make their use optimal and are easy to learn. Python is a programming language that complies with what has been proposed and has been emerging as a recommended option for the development of free software, it is currently counted, it is comparable with that of Java and .NET. Another of Python's main features is the inclusion of a documentation system. The documentation was taken into account when designing the language. For example, all functions and classes have an implicit variable called * .doc commonly called docstring or docstring.

These strings describe the use of that function or classes and the parameters involved in detail. The syntax of these docstring is very similar to that of JavaDoc. These documentation strings can even be called at runtime, so they can be consulted in the interpreter itself using the help function, a model very similar to the one used in MATLAB with toolboxes. The Python standard library was documented using this method (Challenger-Pérez, 2014). Other programs to generate reports and achieve a suitable solution to your design with the least possible effort from your computer, Es Mathcad has greatly expanded its interoperability and connectivity with other very popular packages in complementary applications such as: Microsoft Office, Visio 2000, Auto CAD, MATLAB, SmartSketch. This easy-to-use package combines an intuitive cut-paste diagram block interface with a powerful simulation system that enables fast and efficient feedback. You can select from more than 180 diagram blocks and connect them together using point-and-click commands (Bayarsaikhan, 2009). Mathcad is the standard software for solving, documenting, sharing, and reusing vital engineering calculations. Its easy-to-use instant update and mathematical notation, powerful communication capabilities, and open architecture enable engineers and organizations to optimize critical engineering and design processes. Mathcad Prime, the latest version of Mathcad software, is the most advanced and efficient version yet, and includes the ability to allow users to reuse old worksheets. Mathcad Prime combines ease of use with superior performance and powerful features (Bayarsaikhan, 2009).

The MATLAB Report Builder provides functions and APIs that integrate reporting capabilities into MATLAB applications. The MATLAB Data API enables and provides a way for applications running outside of MATLAB to work with data through a neutral program interface. The API uses C ++ design patterns and semantics, but is not compatible with the API for manipulative matrices in C. You can develop programs that generate reports in PDF, Microsoft® Word, Microsoft PowerPoint®, and HTML. MATLAB Report Generator enables you to dynamically capture the results and figures from your MATLAB code and document those results in a single report that can be shared with others in your organization. You can use the predefined and customizable Word and HTML templates or design reports based on the templates and standards.

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MATLAB Report Generator (MathWorks, 2021) provides another set of objects for generating report content. The Document Object Model (DOM). They implement a model of a document used by html, word, and other document creation software. The model defines a document as a hierarchy of objects commonly found in documents, such as text strings, paragraphs, images, and tables.

In this work, a software available on the portal of the University page was used (DGTIC, 2021). For this particular case in the programming we only generate files with docx or pdf station, if it is modified it can generate the html and ppt extensions, generating the results of the mathematical and graphical calculations during the online class modality of the Electronic Electrical Engineering Career, for him to send documents and carry out the evaluation at the end of the activity.

Objectives

A code will be programmed to develop reports in * .docx or * .pdf files that can help reinforce learning in a practical way with applications in the area of Physical Mathematical Sciences and Engineering to generate mathematical calculations and graphs during the modality of online classes

Hypothesis

Online classes during this SARS CoV2 severe acute respiratory syndrome health contingency. It has become a challenge for academics and students of the Electronic Electrical Engineering Career of the Faculty of Higher Studies Aragón at the National Autonomous University of Mexico. If a code is programmed to develop reports in files with the extension * .docx or * .pdf, where operations can be calculated with mathematical analysis, then the results and graphs corresponding to the activities assigned during the online class mode can be obtained, students will be able to submit their work for evaluation instantly.

Development

It is very important to redirect the route since this can generate an error when generating the report, we must know exactly where the folder is, since there it will generate the file in extension *. pdf, * .docx, *. ppt.

```
C:\Users\My_File\Documents\MATLAB\report_pdf

C:\Users\My_File\Documents\MATLAB\report_docx

C:\Users\My_File\Documents\MATLAB\report_ppt

C:\Users\My_File\Documents\MATLAB\report_html
```

The following commands are important to be able to eliminate any function or class that has been created in ItemType eliminates all variables and frees them from memory all allows you to delete everything, you can use the following depending on the need clear classes, clear all, clear functions , clear import, clear java, clear mex, clear variables the latter can delete specific variables and the code used particularly in this work was the following:

```
clear ItemType; clear all;
```

To create a document that defines the output in html, pdf, Word or ppt, we add the content in the body and we can visualize the information in the file generated for this case we use the following package mlreportgen.dom.

```
import mlreportgen.dom. *

import mlreportgen.report. *

R=Report('Nombre del archivo ','extensión');

open(R);
```

DocObj = Document () creates an HTML document named name.html in the current directory, using the default html template. Add content and use a corresponding close command to generate the document. DocObj = Document (outputPath, type), OutputPath specifies the full path of the output file or folder of this document. type creates a document with the specified extension with its example location (for example, 'NameFile.html', 'NameFile.docx', 'NameFile.pdf', or 'NameFile.ppt'.), in this case the file is generated in the same folder with the specified extension.

A summary can be placed in a report using as an optional form for the report.

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One of the components of the page is the title, this must be a secondary element of the format, for reports in * .docx, * .pdf, * .html, or *. Ppt you can use the style sheet editor to place the elements of the page such as: title, copyright and images) anywhere on the front or back of the page. And you can specify Style You can specify the style such as bold, italic, size, underline, strikethrough and color, in the text. Within the style that we should not ignore is the alignment of the text since it can be centered, left, right and self-aligning.

For this format carried out for delivery of activities, the title can be used at the beginning of the document, but it is omitted so that an image with the logos of the educational institution can be placed. We use Telepate; Text ('The title is written'); To add the header of the report, use Text ('No text is placed') but in this report we do not omit the title, only that in the middle of the parentheses we do not place any text and Style that allows changing the style of the text in this case it can be changed the font, the color and the size, as well as if it is required to be the letter Bold: Italic: Underlined: Strikethrough. It also supports the alignment of reports in * .pdf or *.trf format support this property, the following structure is included.

```
titlepg = TitlePage;

titulo = Text('          ');

titulo.Style = {FontFamily('LMRomanM'),...

Color('red'),FontSize('13pt'),...

HAlign('justify' )}; %center
```

The supported image formats are: * .bmp (Bitmap image), * .gif (Graphics Interchange Format), * .jpg (JPEG image), * .png (PNG image), * .emf (Enhanced metafile), these support and are supported only in * .docx output on Windows operating system platforms, * .svg (Scalable Vector Graphics), * .tif (not supported in * .html output), * .pdf (PDF image) (supported only in PDF output). You can create a custom formal image reporter and its associated default templates. The derived class file can create a specified path in relation to the current working folder, in case the image is in the current folder only the name and extension are placed, in case the image is in another folder the full address of the image is placed as shown below: C: \ Users \ MyFile \ Documents \ image.

At the same time you can create a style for the image in the template. It is the equivalent of changing the style of the typeface only that using Style allows you to change the style of the image, for example, change the width or height of the image, specified as a character vector or a string scalar consisting of a number followed by an abbreviation for a unit of measure. For example, "2 in" specifies two inches. Valid abbreviations are: px (default pixels), cm (centimeters), in (inches), mm (millimeters), pc (spades), pt (points), % (percentage). To create an image in a report, create a mlreportgen.dom.Image object, you can add it to one of these document, group, paragraph, list, table item objects.

```
titlepg.Image = 'cabeza.png'

Image.Style = {Width('2in'),...

Height('2in'),HAlign('center' )};
```

To add the title or header of the report for this particular case, the following command is used since the title is left blank to be able to insert an image and later the title or header is placed using Text ('Header') and consecutively used Style that allows changing the style of the text in this case you can change the font, color and size, as well as if the font is required to be bold or italic, the following declaration is used in the program.

```
textocabeza = Text('Encabezado')

textocabeza.Style = {FontFamily('LMRomanM'),...

Color('red'),FontSize('13pt'),...

HAlign('center' )}; %center
```

To continue the format of the dynamic report and place the author's name, we again use the Text command (['Author's Name']), in addition to using again the ".Style" style command of the Author object, as can be seen in the following box.

```
Autor = Text([' Nombre del Autor ']);

Autor.Style = {FontFamily('LMRomanM'),...

   Color('blue'),FontSize('10pt'),...

   HAlign('justify' )}; %center

titlepg.Author = Autor;
```

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Next, the personal information of the author (user) must be entered, in this section the student enters their identification data or institutional account number, the subject in progress, the group, as well as their address, telephone number and email to facilitate instant evaluation

```
Publicacion = Text(['Información sobre la
publicación ']);

Publicacion.Style = {FontFamily('LMRomanM'),...

   Color('#2C805F'),FontSize('8pt'),...

   HAlign('justify' )}; %center

titlepg.Publisher = Publicacion
```

With the add function, you are able to handle multiple arguments. In this case the first argument will be the definition of the object, 'R', to which the content is added, which was defined previously; the second argument will be a set of two parameters, one to add the header to the report with the command "Text ('Header')" in the variable texthead, and titlepg adds the author's name with the instruction Author = Text (['Name Author ']);.

```
add(R,{titlepg,textocabeza});
```

The flexibility of the dynamic report allows to append the statement of the problem to be solved, using the TEXT instruction (['Write the statement of the problem']); so that the students of the electronic electrical engineering career can read the statement of the exercise, analyze it and obtain the solution within the software in order to append and print only the mathematical analysis and the results for evaluation

```
Enunciado = Text([' Escribir Párrafo ']);

Enunciado.Style = {FontFamily('LMRomanM'),...

   Color('#5B2C6F'),FontSize('12pt'),...

   HAlign('justify' )}; %center

add(R,Enunciado)
```

Within the argument of the statement that must be solved, it is necessary to attach the image of the schematic circuit to be analyzed, in this particular case the electronic circuit is essential to give an idea of the procedure and the mathematical analysis to generate the graphic interpretation of its results that is requested in the statement

```
image = FormalImage()

image.Image = which('Imagen.jpg');

text = Text([' Pie de Imagen ']);

text.Style = {FontFamily('LMRomanM'),...

   Color('red'),FontSize('10pt'),...

   HAlign('center' )}; %center

image.Caption = text;

add(R,image)
```

Through programming we can describe each of the examples, how to design an active low-pass filter of the second order Butterworth type, using an operational amplifier with passive elements such as capacitors and resistors, for this particular case it is intended to work at a frequency of 450 Hz, so you must calculate the missing passive elements and calculate the angular frequency to know exactly where it intersects with the axis of the Magnitude in dB and with the phase if it presents the value of capacitor one of 47nF and capacitor two of 33 nF, its Bode plot must be reconstructed in magnitude and Phase for its graphical interpretation. The statement allows us to understand that the students of the electronic electrical engineering career are being asked where only the data will be modified such as the frequency f in units of [Hz] and the values of the passive elements of capacitor C1 and capacitor C2 to be able to obtain the results and to be able to immediately evaluate the students when a distance communication is being developed

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```
C1=47E-09;

C2=33E-09;

F=450;

Wc=2*pi*F;

RR=sqrt(1/((Wc^2)*(C1*C2)));

R1=RR;

R2=RR;

Num=[0 1];

Den=[(C1*C2*R1*R2) (C1*R1+C1*R2) 1];

Hs=tf(Num,Den);

bode(Hs);

grid;

[mag,ph]=bode(Hs,Wc);

magdb=20*log10(mag);
```

A table is developed using the following commands to locate the data that is provided, in order to develop the mathematical analysis in the programming, only the values are shown and their representation, the value and the unit of the passive elements are placed in each cell, in the table the command "title" is used to place the title in the table header to indicate what it represents.

```
text = Text(['Datos de los componentes...' ...

   'electrónico pasivos dados en el ...' ...

   'ejercicio']);

text.Style = {FontFamily('LMRomanM'),...

   Color('green'),FontSize('10pt'),...

   HAlign('center' )}; %center

Componentes = {'C1';'C2';'F'};

Datos = [C1;C2;F];

Unidades = {'nF';'nF';'Hz'};

table = BaseTable({Componentes, Datos, Unidades});

table.Title = text;

add(R,table);
```

In the following table, the variable Statement1 is generated, and it assigns the desired value through the Text command, and with the Style modifier it is possible to modify the font, color, size, as well as justify the text, to finish using the add function add and through the parameters of the function, specify the "Report" and the newly created variable Statement1 to be able to display the expression.

```
Enunciado1 = Text(['La ecuación obtenida...' ...

   'de la función de transferencia usando...' ...

   'los elementos pasivos se sustituyen ...' ...

   'en la ecuación siguiente para obtener...' ...

   'el diagrama de Bode']);

Enunciado1.Style = {FontFamily('LMRomanM'),...

   Color('#0000ff'),FontSize('12pt'),...

   HAlign('justify' )}; %center

add(R,Enunciado1)
```

When using the command Equ = Equation ("Syntax used by Latex to place the equations"); To indicate the mathematical model and its characteristic equation of the equation that is obtained starting from the mathematical analysis of the electrical circuit represented through a schematic circuit, in order to express an equation in the dynamic report, it is necessary to have a basic knowledge of some LateX command this allows us to express the proper syntax for this particular case in the electronic electrical area at the end it is indicated to load the equation to the dynamic report to view it

```
Equ=Equation("Hs = \frac{1}{R1 R2 C1 C2 s^2 + (C1
R1+C1 R2)s + 1}");

add(R,Equ);
```

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With the variable text1 = Text ('Table Title'); and the modifier .Style we can edit the text, in the variable Data1 we specify the first column of data from the previous table, the second column with the variable Calculations, taking into account that the calculations are made up of numbers, and finally the third Units column 1, then with the variable "table" we can enter all the data through the function table = BaseTable ({Data1, Calculations, Units1}), having as arguments the three previously specified variables, to finish with the edition of the data table we use the modifier table.Title = text1 to add a title to the table and we use the function add (Report, table); to execute the previous modifications

```
text1 = Text('Cálculo de los elementos faltantes');

text1.Style =
{FontFamily('LMRomanM'),Color('green'),...

   FontSize('10pt'),HAlign('center' )}; %center

Datos1 = {'Wc';'R1xR2';'R1'; 'R2';'magdb'; 'ph'};

Calculos = [Wc ;RR;R1;R2;magdb;ph];

Unidades1 = {'rad/seg';'Ohms';'Ohms'; 'Ohms';'dB';
'°'}

table = BaseTable({Datos1, Calculos, Unidades1});

table.Title = text1;

add(R,table);
```

To obtain the graphic representation in the dynamic report, it is required to generate it and export the image file with any of the following extensions * .jpg ';' *. Png ';' *. Tif ';' *. Pdf ';' *. eps' in this case the extension * is used. "Jpg" using the following command exportgraphics (gcf, 'Graphic name.jpg'); In order to use it and create a report for an image with a caption, the report properties are used to set the image font, title, height, width, etc. The report can be formatted as enumerating the title and placing it in the image caption, using the image.Caption = text object; In case it is required to use the value of a data or calculation that is required to be placed in the image footer, the analysis is first developed and later the number is changed to a string of characters, in this particular case two data is used, one that comes from the value of the magnitude and the other from the value of the phase between these two data is handled characters.

```
exportgraphics(gcf, 'BodeMagnitudFase.jpg');

image = FormalImage();

image.Image = which('BodeMagnitudFase.jpg');

text1 = Text(['Diagrama de Bode en Magnitud y fase '
...

   'donde la frecuencia angular Wc = '])

text1.Style = {FontFamily('LMRomanM'),...

Color('red'),FontSize('10pt'),HAlign('left' )};

text2 = Text(char(num2str(Wc)))

text2.Style = {FontFamily('LMRomanM'),...

Color('blue'),FontSize('10pt'),HAlign('left' )};

text3 = [text1;text2]

text4 = Text(' rad/seg y la fase ph = ')

text4.Style = {FontFamily('LMRomanM'),...

Color('red'),FontSize('10pt'),HAlign('left' )};

text5 = [text3;text4;]

text6 = Text(char(num2str(ph)))

text6.Style = {FontFamily('LMRomanM'),...

Color('blue'),FontSize('10pt'),HAlign('left' )};

text7 = [text5;text6;]

text8 = Text('°')

text8.Style = {FontFamily('LMRomanM'),...

Color('red'),FontSize('10pt'),HAlign('left' )};

text9 = [text7;text8;]

image.Caption = text9;

add(R,image)
```

With the command "close (R)" we end the editing process of the file, now the dynamic report is already with the calculations, the mathematical analysis, and the graphic expression so that the student of the electronic electrical engineering career can send the report immediately and be evaluated.

```
close(R);
```

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The command “rptview ('Amplifier', 'pdf')” is capable of interacting with programs that allow the preview of the dynamic report such as: * .html, * .pdf, * .docx or * .ppt, this instruction uses two arguments, which will be used to specify the name of the file and the extension with which the report was generated.

```
rptview('Amplificador','pdf');
```

Results

Implementing templates for the generation of dynamic reports allows a simpler result in the development of remote activities, and that there is good oral, written and visual communication of the academic with the students of the Electronic Electrical Engineering Career. The MATLAB program provides a tool to perform the mathematical analysis of a Butterworth type second-order low-pass filter, avoiding recurrent arithmetic or algebraic errors of students, with this, a better way of teaching-learning is transmitted and facilitates the academic establish a better communication, during this contingency the students shared the assigned activities, the dynamic reports were activities in class, homework, expositions and the delivery of projects establishing the norm and using the syntax of the area of physical, mathematical sciences and engineering, this allowed the student had the best results in his evaluation.

Conclusions

The necessary code was developed to use the MATLAB program available free of charge for students of the Electrical and Electronic Engineering Career, provided through agreements with The MathWorks company. In this particular case, students were asked to generate dynamic reports to solve the analysis of a Butterworth-type second-order low-pass filter, obtaining the mathematical calculations, its transfer function and the graphic expression, generating the Bode diagram in magnitude and phase. The method of generating dynamic reports allowed the students of the Electronic Electrical Engineering career to maintain a distance communication with the academic, due to confinement due to severe acute respiratory syndrome (SARS CoV2), due to the above they were used templates for generating reports with extension * .pdf, * .docx for distance classes.

Making it possible for the student to be evaluated immediately, this allows teaching-learning to be simpler.

Annexed

Below is a dynamic report developed by the students of the electronic electrical engineering career implementing an activity to solve a Butterworth type second-order low-pass filter, showing the exercise established in a remote session for the students to use the template that generates a dynamic report in * .docx format where the transfer function, the calculated variables and the graphic expression are shown to be able to visualize the angular frequency and locate the points of intersection with the dB axes and the phase.

Activity 1: Butterworth-type active low-pass filter and its Bode diagram

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It is required to design an active low-pass filter of the second order Butterworth type, using an operational amplifier with passive elements such as capacitors and resistors, for this particular case it is intended to work at a frequency of 450Hz, so the missing passive elements must be calculated. and calculate the angular frequency to know exactly where it intersects with the axis of the Magnitude in dB and with the phase if it presents the value of capacitor one of 47 nF and capacitor two of 33 nF, its Bode diagram must be reconstructed in magnitude and Phase for its graphic interpretation.

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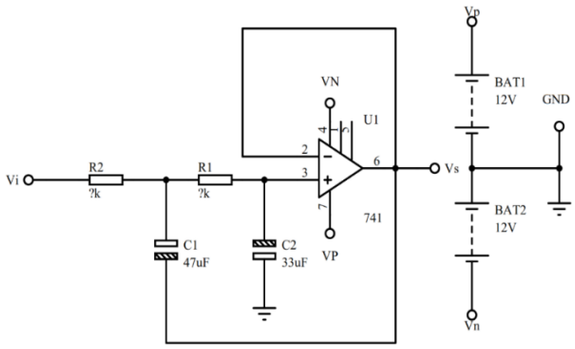

Figure 1 *S*chematic circuit of a Butterworth-type active low-pass filter

C1	4.6999999999999997e-08	nF
C2	3.2999999999999998e-08	nF
F	450	Hz

Table 1 Data of the passive electronic components given in the exercise

$$Hs = \frac{1}{C_1\ C_2\ R^2\ s^2 + (C_1 + C_2)\ R\ s + 1}$$

Wc	2827.4333882308138	rad/seg
R1xR2	8980.5248504331703	Ohms
R1	8980.5248504331703	Ohms
R2	8980.5248504331703	Ohms
magdb	-	dB
ph	7.5564390938579251	°
	-90	

Table 2 Results of calculations and obtaining the missing passive components

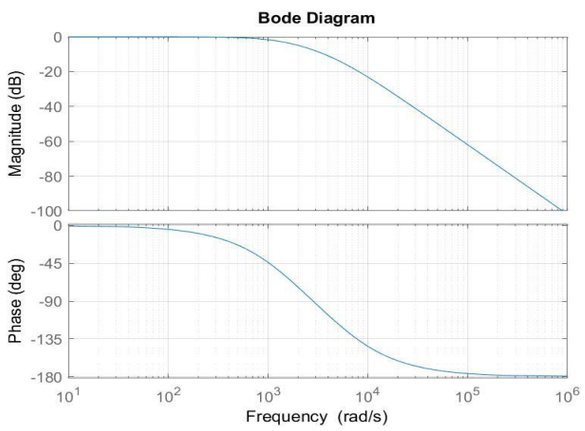

Figure 2 Bode diagram in Magnitude and phase where it is observed that the circuit is a low pass filter and its angular frequency is Wc = 2827.4334 rad / sec and the phase is ph = -90 ° and all higher frequencies are rejected since this is a main feature of this configuration.

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Jonassen model in the development of integrative projects

Modelo Jonassen en el desarrollo de proyectos integradores

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Abstract

Instructional design has been integrated not only in processes for the generation of didactic materials oriented to education but also in other types of projects oriented to industry, the health sector, commerce, etc., where planning is reflected of solving a problem that involves a process of teaching or learning knowledge. This article presents the process of developing a mobile application using as a basis the implementation of the Jonassen Instructional Design model. Being a constructivist model, the reader will be able to observe how diverse knowledge of various methodologies are integrated, such as the Snowflake that is well structured and focuses on planning and creating novels, and the OOHDM that is oriented to the development of web applications using elements of hypermedia, so that in the end you get a useful and versatile mobile application that you can download freely from the Google Play Store.

Instructional design, Jonassen model, App

Resumen

El diseño instruccional se ha venido integrando no solo en procesos para la generación de materiales didácticos orientados a la educación si no también en otros tipos de proyectos orientados a la industria, el sector salud, comercio, etc., en donde se vea plasmada la planificación de la solución de un problema que implique un proceso de enseñanza o aprendizaje de un conocimiento. En este artículo se presenta el proceso de desarrollo de una aplicación móvil utilizando como base la implementación del modelo de Diseño Instruccional de Jonassen. Siendo un modelo constructivista, el lector podrá observar cómo se integran diversos conocimientos de varias metodologías, tales como la Snowflake que esta bien estructurada y se enfoca a la planificación y creación de novelas, y la OOHDM que se orienta al desarrollo de aplicaciones web utilizando elementos de hipermedia, para que al final se obtenga una aplicación móvil útil y versátil que podrá descargar de la Play Store de Google en forma libre.

Diseño Instruccional, Modelo Jonassen, App

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Introduction

This research and development project arises from the pleasure and desire to write a first novel. Considering not having the discipline to write, nor the knowledge of how to structure and plan a novel, as well as the desire to assess the effectiveness of the use of the Jonassen Model in the development of a mobile application (App). As those involved in the development of applications or information systems will advise, projects are usually integrative projects of diverse knowledge and therefore the Snowflake method was applied to write novels within a variety of methods such as "The Thirty Scenes", "Braindumping" or "Zero Draft", (Armedu, 2016), (Campbell, 2019), (Ingermanson R. , 2019), the above due to its way of structuring, for its ease of assimilating the idea of planning a novel and once planned, to be able to develop it in full. Finally, the OOHDM methodology was applied which allows planning both the backend and the frontend, that is, views and interfaces are considered with the user. A type of mobile programming based on Java Script and Android was also used utilizing the Ionic V4 development platform, which has the feature of being flexible when implementing the application both on a mobile device, as on a desktop computer and can be used anywhere at any time where there is internet.

Jonassen Model application

In many of the educational programs, students are asked to prepare a final project, a project to conclude the bachelors program, or a thesis. This projects allow the student to develop skills and abilities for their professional performance. Therefore the student or professor must propose an integrative project in which the skills acquired during their career are reflected.

The present project is based on a challenge, desire or concern to develop a tool to facilitate the writing of a novel, but at the moment of wanting to achieve that goal, questions begin to arise about the need to have acquired certain previous knowledge, what makes questioning the feasibility of solving the problem, knowledge ranging from maturity in programming, use of technological tools, to development methodologies and the lack of skills to write a novel.

So far, it is only the desire to develop a useful tool and the idea of being able to acquire the necessary knowledge in the course of the project. However, the desire or the idea of being able to assimilate a knowledge, to make it own, is a typical characteristic of constructivist models.

Several questions that need to be resolved before embarking on development begin to appear such as: Is there a model that can guide me with so many shortcomings? , Is that model enough? , Is there a willingness to learn new tools? , Will I be able to achieve my goal? In the face of such questions it is best to organize ideas and plan tasks, so a model of instructional design was selected, a model that will help us to detail and clarify ideas in a free way but without losing the goal, therefore the Jonassen Instructional Design model was chosen, (Belloch, 2017), (Lagunes, Diaz, & Guerrero, 2014), (Vergel, 2021), which shall be described below and in accordance with the activities of the project.

- Phase 1: Questions / cases / problems / projects.
- Phase 2: Related cases.
- Phase 3: Information resources.
- Phase 4: Cognitive tools.
- Phase 5: Conversation / Collaboration tools.
- Phase 6: Social /Context support.

Phase 1: Questions/cases/problems/projects

Initially it must be clear what the main problem to solve, there must be sufficient motivation to set the objectives, so that in the end we can assess whether the project is functional according to the stated objectives.

The question, problem or project that arises must be attractive enough to motivate participants to get involved in the project, to make the problem their own, so that participants are willing to explore new tools, to look for similar proposals, or different from those initially proposed in order to obtain the best result.

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In the first phase, the creation of a question, case, problem or project must be proposed, which in turn will be part of the objective. For the project that we present, in this phase the development of a mobile application is proposed that facilitates the creation of a sketch of novel.

The process of creating a novel can be long and exhausting, in which you can have a fleeting idea in your mind, little fragments rambling, and yet you still don't have a structure that gives you a view of it, that is why methods are often used to plan a novel.

The questions that arise are: Can we make a mobile app that helps the planning of a novel? How can we build it?, Is there a method of planning novels?.

The App today is a tool that we have at our fingertips, this because you can find a large number of cell phones among the population. That is why the creation of a mobile app to perform this task is proposed, that allows users to create their novel from scratch, integrating a planning method. After questioning and visualizing the problem, the objectives can be set.

The objective is: To develop and provide an App as a useful tool, that serves as an aid to the creation of a sketch novel that is attractive to users.

Phase 2: Related cases

At this stage it is considered to look for cases related to the problem to be solved. The search for examples or similar cases makes it possible to acquire heuristic knowledge based on analogies, knowledge that will allow reasoning or procedures to be deduced and subsequently applied to new or similar situations.

At this point they looked for the types of writers, the methods that are commonly used to write a novel and the systems or technological tools that help the writer to plan the novel.

Within the types of writers, three categories were found: compass writers, map writers and hybrids.

Some methods to plan and write a novel are: traditional, of the three acts, hero trip, zero draft, of the three cubes, of the 30 scenes, braindumping and snowflake.

There are native applications that only run according to the operating system that have the mobile either Android or iOS, there are also applications that run on the computer according to your operating system such as Windows, Linux or MacOs. Among the applications that are used for this approach are usually varied, both for mobile and computers, so the development of a hybrid application was chosen, which can be run on various operating systems.

The tools that are available for desktop are those that must be previously installed on a computer, and viewing on that device is only allowed as long as the progress is saved in a local file, while mobile applications, that are installed on our mobile device, usually files are saved in the cloud.

Below are some of the applications found related to the project:

- iAwritter
- Ulysses
- StoryPlanner
- yWriter
- Plume Creator
- Focus Writter
- Bibisco
- Manuskript
- Jotterpad
- Scrivener

There are few software applications that are available for both mobile devices and computers, and the only ones that usually include a planning method within their operation are Manuskript, StoryPlanner and Bibisco, as shown in *Figure 1*, (BigThink, 2019), (Feccomandi, 2019).

Software name	Software					Planning Method
	Mobile		Application		Web	
	Android	iOS	Windows	MacOS		
¡Escribelo!	X				X	X
iAwriter	X	X	X	X		
Ulysses		X				
Story Planner		X				X
yWriter	X	X	X	X		
Plume Creator		X	X			
Focus Writer			X	X		
Bibisco			X	X		X
Manuskript			X	X		X
Jotterpad	X					
Scrivener		X	X	X		

Figure 1 Comparative table of applications for writing novels

Phase 3: Information resources

This requires a more detailed understanding of the problem, and for this we ask: Who can provide us with this information?, How can I get the information?, What is the profile of the users?

It requires direct information from users, and what better than asking experienced writers, that is why information is collected from surveys of different writers that were presented at the University Book Fair organized by the Autonomous University of the State of Hidalgo. Part of the survey is shown in *Figure 2*, in which the result of the question that was asked is highlighted, "What technological tool did you use during the development of your last work?", 90% responded that the most commonly used tool is Word, the other 10% used Scrivener. When questioned about the reason they used to use this software their response was for ease and sometimes because they did not know a different software, (Chimal, 2019), (Quezada, 2020), (Valderrama, 2019).

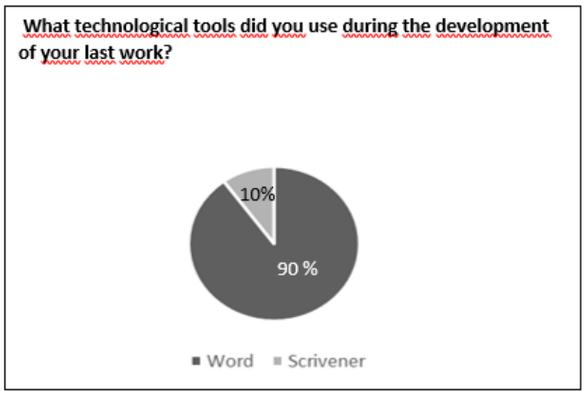

Figure 2 Graphic of the technological tools used by writers

According to this question it can be understood that writers do not usually use other type of software for lack of knowledge, rather because of a lack of attraction to new technologies and sometimes the experience they have gained over the years only uses basic tools such as word processors. Perhaps they focus their attention on the creative process and minimize new tools. However, this does not usually happen with beginning writers or people who start to venture into this area.

Phase 4: Cognitive tools

Each project has a specific cognitive demand, which can be simple or complex, for which the trainee or developers have or do not have, to a greater or lesser degree, the appropriate competencies, which must first recognize themselves and then know how to apply with proficiency. The predominant cognitive demand must be identified, because there can be multiple demands. For example, in this project you have two demands, one is how to write a novel and the other is how to develop the App. For this project, technological demand predominates. Thence in this phase more time and effort was spent in the search and knowledge of informatics or computer tools that allow visualizing and modeling the Snowflake method.

For the development of this phase, different points were analyzed, such as the planning methods that exist, the frameworks and development environments for mobile applications, as well as the databases that can be integrated within mobile applications.

For the methods that allow the planning of a novel, were found those with information resources, well organized, in addition to the sustenance that counts for its authors, such as books or blogs focused on novel writing, (BigThink, Las mejores aplicaciones móviles para guinistas y escritores., 2019), (Feccomandi, Aplicación de escritorio, 2019), (Ingermanson R. , The Snowflake Method For Designing A Novel, 2019) these methods are the following:

- Thirty Scenes Method by C.S Lankin

- Braindumping Method by Chandler Bolt

- Snowflake Method by Randy Ingermanson

Among these planning methods, the Snowflake Method was chosen, which has ten steps, among which the following points can be outlined:

- Have a well-defined plot of the novel.

- The creation of well-structured characters, this means that they must have the characteristics and history clearly reflected.

- Sequence of events within the novel.

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These three points form one of the fundamental parts during the process of planning and creating a novel.

For the choice of the development environment of the mobile application, it can be native, hybrid or web-oriented, that is why it was selected to choose the hybrid application, which allows the generated application to be targeted not only to a single mobile operating system, but also to be accessed through a web browser.

Among the tools that allow us to generate these applications are the following:

- React Native.
- Flutter.
- Ionic.

For the integration of the database, it is necessary to take into account the time and scope you want to obtain with this application, based on the following tools:

- MySql.
- SQLite.
- MongoDB.

Firestore de firebase.

For the choice of development tools, previous knowledge, the possible learning curves and the scope of the project were taken into consideration, which is why the selected tools are:

- Ionic: this framework in its version 4, allows the generation of hybrid applications, which results in the final application could be run on mobile devices with Android, iOS, operating system and web browsers (AndroidDeveloper, 2020), (Griffith, 2019), (Studio, 2019).
- Firebase: Firebase: this API allows us to develop projects in an agile way. In addition it allows us to integrate Firebase Cloud Firestore (NoSQL database), Firebase Authentication (authentication) and Firebase Hosting (web storage), among others, (GoogleDevelopers, 2020) .

This phase focused on the development of the application, OOHDM methodology was incorporated integrating hypermedia. This methodology as a tool allows to make a visual representation of the snowflake method.

The OOHDM proposes four stages, each consecutive from the previous one, this methodology allows designers or developers to specify the running of the application, the stages are the following, (Vilariño, 2010):

- Conceptual design.
- Navigational design.
- Interface design.
- Implementation.

Conceptual design

The conceptual design consists of representing two types of objects, those that will be perceived as nodes in the navigation model and those that support the application, encapsulating behaviors such as algorithms, databases, etc. (Schwabe & Rossi, 2019). *Figure 3* shows the conceptual design of the application.

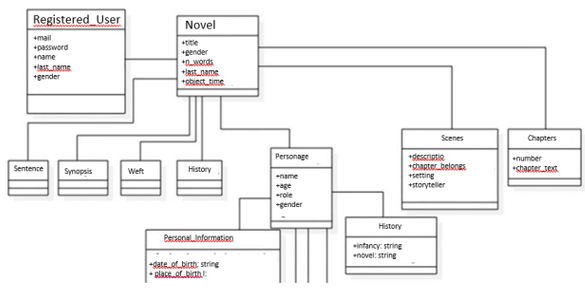

Figure 3 Diagram of Stage 1: Conceptual Design

Navigational design

For navigational design it is taken as a reference the conceptual design, this stage serves to reorganize the information and the it will way be displayed to users.

In this stage, class and context diagrams are integrated. In this way you can establish the possible views through predefined classes, also called navigational classes, these integrate: nodes (information containers) and links (relationship in navigation).

In *Figure 4*, the class diagram made for this application is shown.

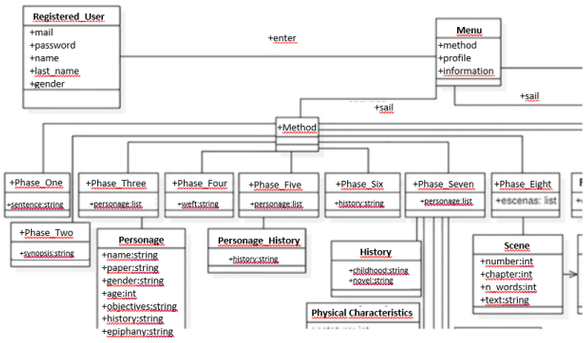

Figure 4 Diagram of Stage 2: Navigational Class Design

Since it allows us to show the links available once an object is accessed, in this case a node in a context, the context diagram is shown in *Figure 5*, characterized by showing in a more precise way how the navigation will be within the application.

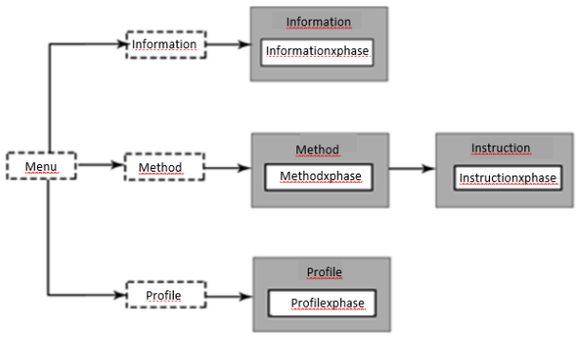

Figure 5 Diagram of Stage 2: Navigational Class Design

Interface design

This stage defines how objects will be presented through the user interface, appearance and distribution. It is important to note that at this stage the objects that are responsible for mediating the user's interaction with the navigation objects are specified.
The application is divided into three main sections: method, planning and profile. These can be seen at the bottom of the *Figure 6*.

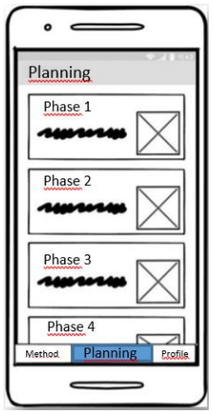

Figure 6 Application interface

Implementation

Supported by the selected designs and tools, the App was developed and shown in *Figure 7*, which can be used for Android and iOS operating systems, and this type of application can be run from any web browser.

Figure 7 Final view of the application interface

Figure 8 shows some of the logos of the tools used for this project.

Figure 8 *Tools used for application development*

Phase 5: Conversation / Collaboration tools

The work and learning environments are supported by ICT to facilitate the work of development, review, discussion and improvement, in short, a collaborative work.

In this new normality in which mobility has been restricted, it is important to promote communication through the computer tools available to us.

During the development of the project, the following tools were necessary:

- GitHub and Reply: Allow you to upload projects and maintain a version control, which in turn are synchronized both in the cloud and in our computer.
- Google Drive: The use of this tool allowed the storage of documents and information.
- Google Forms: For the storage and distribution of forms or surveys, which were submitted for the System Evaluation.
- Google Play Store: For storage and distribution of the app for mobile devices with Android operating system.
- Firebase: Data storage through your API.

The use of these tools allowed communication and collaboration by sharing information, experiences, work between the people involved in the development of this project and the people who have evaluated the application.

Phase 6: Social /Context support

One of the goals was to create a useful tool for the planning of novels, so, the best option to fulfill the social phase was to make it available for free so that they will use it and evaluate it, so it was published in the Google Play Store, (GoogleDevelopers, 2020) .

The above could be verified through the graphs and statistics of downloads not only at the locallevel , but also internationally as shown in *Figure 9*, in addition to the comments of acceptance of the writers who had participated in the first survey.

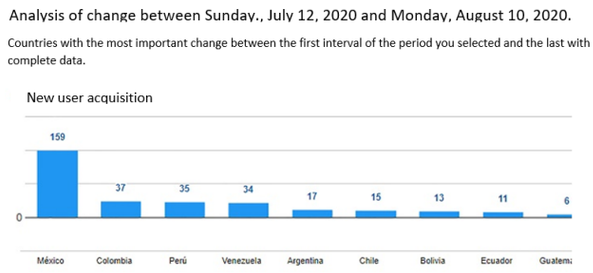

Figure 9 New User Adjection Chart for the App in the Play Store "¡Escríbelo!

The application was tested by sixty users, who were provided with the links of the application and the form in which they expressed their views and assessments.

Results

The main results obtained are (Quezada, Tesis, 2020)

A mobile application was created as a technological aid for the planning of a novel, following Jonassen's Instructional Design model.

- For the sketch of the novel was implemented the method of planning and creation of novels Snowflake and for the design of the user interface was carried out following the methodology OOHDM. *Figure 10* shows a final view of the application on various devices.

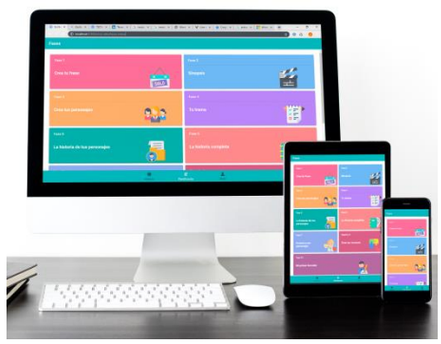

Figure 10 View of the application via mobile devices, tablet and desktop PC

- Since the Jonassen Instructional Design model allowed the analysis and incorporation of ideas from different areas such as the Snowflake planning method, or the OOHDM methodology to construct the application, we can say that the Jonassen model is useful in the development of integrative projects.

The app is available in the Play Store under the name *"¡Escribelo!"*, for which before publication you had to pass quality tests by Google. *Figure 11* shows the logo of the application *"¡Escribelo!"* which means "Write it!" in Spanish (GoogleDevelopers, 2020).

Figure 11 *Publication of the application "¡Escríbelo!" in Play Store*

- The percentage of downloads has been increasing as shown in *Figure 12.*

Figure 12. *Statistics on the acquisition of new users in the Play Store*

Conclusions

- Several of the characteristics of the Jonassen model were found, such as: a). Development of autonomous skills of the participants since it is a constructivist model. b). Learning - doing allows one to acquire solid and meaningful knowledge. c). The use of new tools, which can be applied in future projects.

- Having planned an attractive, useful and current challenge/project allows to encourage not only the reflection, search, assimilation and acquisition of a knowledge, but also the adaptation of ideas and concepts of other people to the problem to be solved, thus encouraging the creation of meta-knowledge for the participants involved.

- The use of information and communication technologies, applied to the development of novel planning, has proved to be a paradigm for exploiting resources in the cloud and on the web, in favor of the current demands of the demanding society.

In relation to future work, the application has a growth potential in which complementary topics to the writing of novels can be addressed such as the incorporation of new planning methods, and even addressing new genres of writing, as the production of theatrical scripts, among others. Being an opportunity for the incorporation of new projects, the technological tools that at the time appear such as: new development platforms.

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Development of a practical module created with 3D printing for the education and training of students in the oil area maintenance career

Elaboración de un módulo práctico creado con impresión 3D para la formación y capacitación de alumnos en la carrera de mantenimiento área petróleo

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Abstract

This article is based on an experience carried out in the classroom for the drilling of wells in the Oil Area Maintenance career. The creation of this practical module was carried out thanks to the design and 3D printing and its objective is to motivate in the search for new teaching strategies using technology that is currently available, with this module it is intended that the student visualize the process to follow for the correct assembly of a preventive safety system used in the oil and gas industry in order to make classroom classes more dynamic and practical and make the process easier to understand as opposed to just looking at images on slides which is the most common method of teaching for a career that is new to an institution. The contribution of this method in teaching and learning is reflected through the practices and the exams that the students take and it is demonstrated that it is no longer just about memorizing a process, but about knowing the why of the steps to follow the process.

PLA, 3D Printing, Preventor

Resumen

El presente artículo parte de una experiencia llevada a cabo en aula para la materia de perforación de pozos en la carrera de Mantenimiento Área Petróleo. La creación de este módulo práctico se realizó gracias al diseño e impresión en 3D y tiene como objetivo motivar en la búsqueda de nuevas estrategias de enseñanza utilizando tecnología que se encuentra actualmente al alcance, con este módulo se pretende que el alumno visualice el proceso a seguir para el correcto armado de un sistema de seguridad preventor utilizado en la industria del petróleo y gas con la finalidad de hacer más dinámicas y prácticas las clases en aula y que el proceso sea más fácil de comprender a diferencia de solo mirar imágenes en diapositivas que es el método más común de enseñanza para una carrera que es nueva en una institución. La contribución de este método en la enseñanza y aprendizaje se ve reflejado en las prácticas y en los exámenes que los alumnos realizan y queda demostrado que ya no se trata solo de memorizar un proceso si no de saber el porqué de los pasos para seguir el proceso.

PLA, Impresión 3D, Preventor

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Introduction

Teaching in our country has been stagnant in some practical aspects, especially in universities that are just developing or that are practically new, the resources that reach them are often insufficient to be able to acquire laboratory material. That is why, based on this need presented in the Oil area Maintenance career of the Universidad Tecnológica de Xicotepec de Juárez, the creation of didactic material was proposed, this material can be considered as an industrial layman since from different pieces made with a 3D printer, the sequence of a practice can be shown starting from a real case regarding the assembly of a preventive security system.

Currently there are no practical modules in public institutions that serve as a guide for the assembly of a preventive system or any process in the oil industry, in cases like this the traditional method is used, which is teaching through slides and images, there are also Simulators, but these are out of the reach of most institutions since their cost is very high and only oil companies can afford to acquire them for their personnel training.

Taking into account the above, the practical module was designed and built, which in addition to having an accessible cost for its elaboration, is intuitive for the student since it allows them to visualize the sequence of the assembly of a preventer starting from a real practical case step by step. The module has the characteristic of being made of plastic (PLA) polylactic acid which is a thermoplastic biopolymer whose precursor molecule is lactic acid. Due to its biodegradability, barrier properties and biocompatibility, this biopolymer has found numerous applications since it has an unusual wide range of properties, from the amorphous state to the crystalline state; properties that can be achieved by manipulating mixtures between the D (-) and L (+) isomers, molecular weights, and copolymerization. (Serna & Albán, 2003)

Methods

The use of 3D printing or additive manufacturing is not new, however, it has not been taken advantage enough of it to create solutions in the educational field, although it is known that 3D printing has been among us for more than 35 years, many institutions and people are unaware of this technology and how interesting can be to find solutions to everyday problems. The first variables to consider are those related to cost, the acquisition of a 3D printer machine may consider an outlay for the institution, however, the benefits will be greater taking into account the amount of teaching material that can be made with it.

Other variables to take into account are:

- Print volume.
- Material.
- Accuracy.
- Technology.

Regarding the volume of printing, we must consider the size of the pieces to be printed so based on that we can choose a printer with adequate printing volumes to fullfill the needs, once we know the most suitable size according our needs, we must analyze which is the most feasible material for the realization of the pieces, in the market there are different materials used for 3D printing such as ABS, PLA, PETG, TPU, among others, for this case PLA will be used. The precision of the printing will depend on the type of nozzle that is going to be used, normally 3D printers come with a standard nozzle size of 0.4mm, this can be changed for a smaller nozzle if a finish with thinner layers is required. or a larger nozzle when no detail is needed when printing, it is also advisable to take into account that if the piece or pieces to be printed are very large, they may take longer if the nozzle is smaller than 0.4mm although the quality will be higher. If what is needed is speed and not quality, it is advisable to use a 0.6mm nozzle or biggers, in the case of this practical module a 0.4mm nozzle will be used, which is the standard measure and the pieces are not of considerable dimensions.

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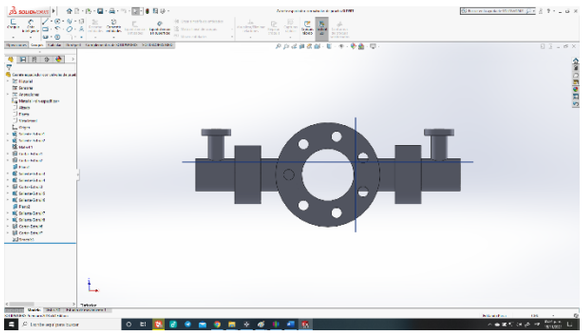
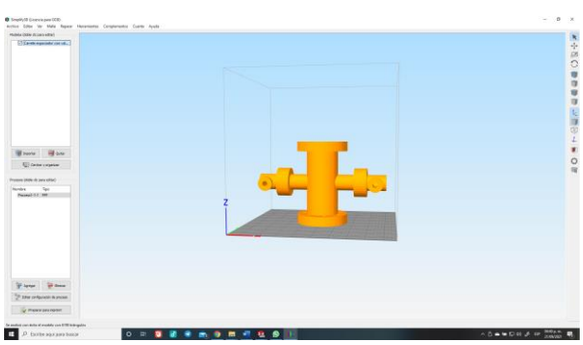
Finally, we must consider the type of technology in the machine, there are machines that support network connections and can be manipulated remotely, in the same way the type of machine must be taken into account, if it is delta or Cartesian in this case, the printer used for the module was an Ender 3 Cartesian printer with a printing volume of 230mmx230mmx250mm, which has an approximate cost of 250 USD. For the realization of the module, the design that will be made in the Solidworks program must be taken into account, in this program, we will design the necessary parts of the module.



Graphic 1 SolidWorks interface, plan view of a spacer spool with test valves.
Source: Author´s contribution (October 2021)

Each of the pieces to be made are different in shape and the dimensions of them must be accurate on detail since they fit one with another.

Once the pieces have been designed, we will proceed to verify if there is any design error through the laminator that will be used to print them, the laminator or printing program is Simplify 3D, this laminator is one of the best laminators on the market because the quality with which parts are printed. This laminator has its own characteristics that not other program has, such as allowing different printing processes that change according to the height.



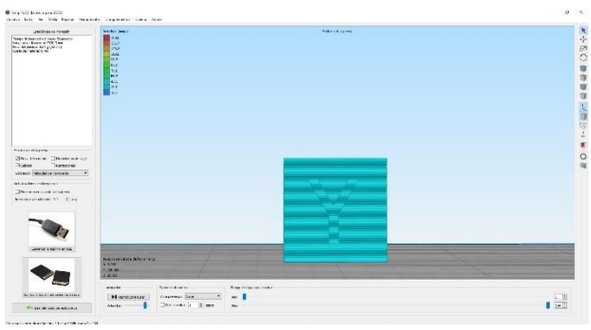
Graphic 2 Preview of a spacer spool with test valves in Simplify 3D
Source: Author´s contribution (October 2021)

Print parameter settings

Once the design has been stablished in the laminator program, the printing parameters must be configured, such as:

- Layer.
- Infill.
- Support.
- Temperature.
- Cooling.
- Speeds.
- Addition.

Each of the aforementioned parameters has to be tested before starting with the module parts, in the same way the printing platform has to be calibrated and the axes adjusted, for this reason a calibration cube must be printed.



Graphic 3 Preview of the calibrator cube in Simplify 3D
Source: Author´s contribution (October 2021)

In the preview of the laminator, we can observe how the cube is forming layer by layer and thus correct errors in the configuration if there were any, once the simulation was run in the preview, the file must be saved in a format called G code so the printer can recognize it and start the printing process.

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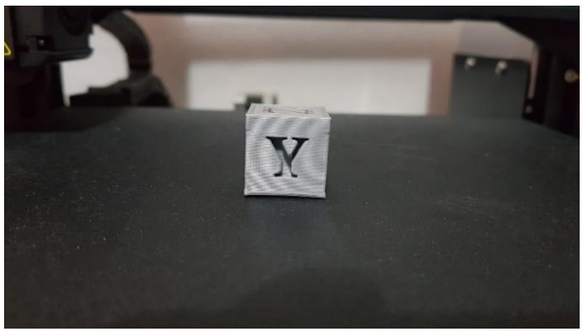
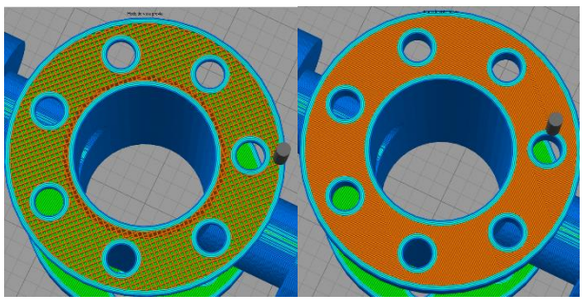


Graphic 4 Printed calibrator cube
Source: Author´s contribution (October 2021)

Thanks to the printed cube it can be observed in which sectors there are errors or if there was any part that detached from the printing platform, we can even observe problems that have to do with temperature or printing speed, this first printed cube will help us to improve some parameters that we consider have an opportunity area.

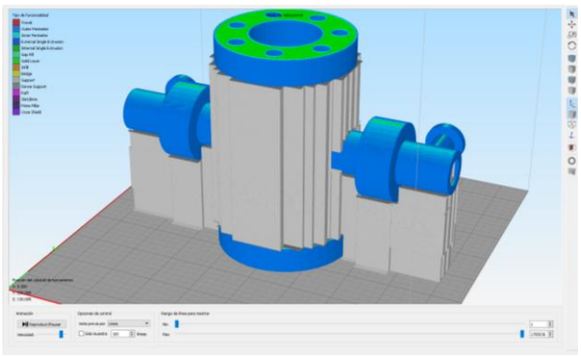
Once the parameters have been improved and the check with a second calibration cube has been made, we will proceed to load the part or parts of the module to the laminator program this will depend on whether we want to print separately or several parts at the same time, in this case each part will be printed separately. To start we must add a process and make specific configurations for the piece to be printed, these configurations will already be minor thanks to the fact that the calibration cube was previously printed.

The first configuration to take into account for the module piece is the layer height and the infill, it will work with a layer height of .2mm and the infill section indicates whether the piece will be hollow, semi-solid or solid through an infill indicator ranging from 1 to 100, for the module pieces an infill of 30% will be used.



Graphic 5 Example: 30% fill (left) 100% fill (right)
Source: Author´s contribution (October 2021)

The second parameter that must be configured is the support, this parameter is important because there are parts of the pieces that protrude, in the same way there is an indicator from 1 to 100 that will allow to choose how dense the support will be, it must also be enable the raft section that will allow the support to be generated on top of it to prevent it from collapsing.



Graphic 6 Support (gray color)
Source: Author´s contribution (October 2021)

The third parameter to configure is the temperature, both the temperature of the nozzle and the temperature of the printing platform must be taken into account to prevent the piece from peeling off, these parameters vary according to the material, in this case as the material is PLA It will start with a 190 ° C nozzle temperature that will gradually increase in the first layers, until it reaches 210 ° C, the platform temperature will remain at 60 ° C.

Layer	Temperature	Platform
First layer	190°C	60°C
Second layer	195°C	
Third layer	200°C	
Fourth layer	205°C	
Fifth layer	210°C	

Table 1 Temperature scales per layer
Source: Author´s contribution (October 2021)

The fourth parameter will be the cooling, that is, the speed with which the fan will cool the layer, normally the first layer does not cool down in order to obtain a better grip on the printing platform, after the first layer the fan will gradually increase its speed.

Layer	Cooling speed
First layer	0%
Second layer	50%
Third layer	100%

Table 2 Cooling rates per layer
Source: Author´s contribution (October 2021)

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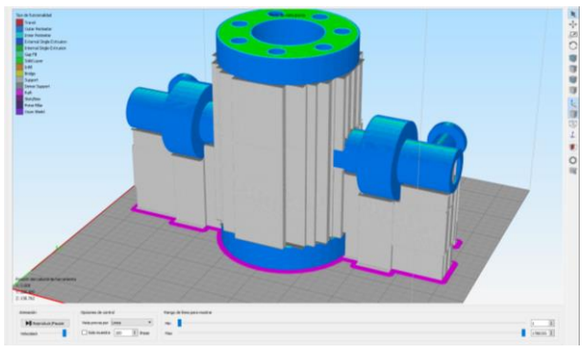
The fifth parameter is the printing speed, the quality of the part also depends on this parameter, at a higher speed detail can be lost and imperfections can be generated.

Contour speed	75%
infill speed	90%
Support speed	85%
X / Y axis speed	150mm/s
Z axis speed	16.7mm/s

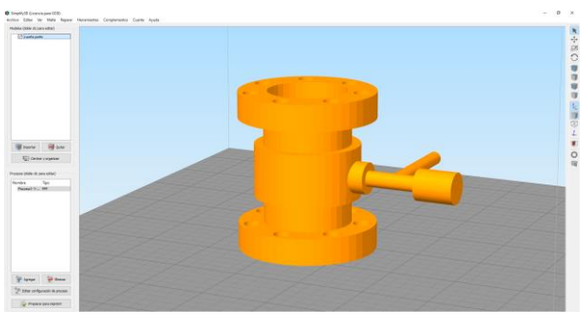
Table 3 Print speeds.
Source: Author´s contribution (October 2021)

The sixth parameter is the addition, this allows us to create a raft which will serve to adhere the piece and the supports to the printing platform and prevent the piece from falling or any support from collapsing during the printing process.

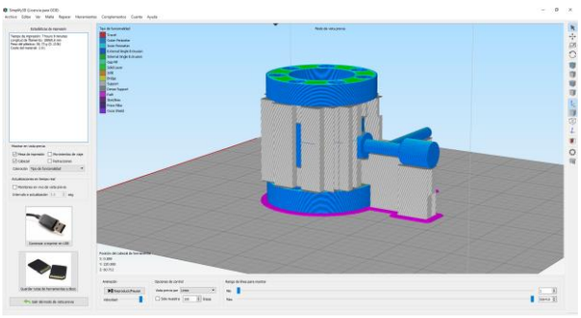


Graphic 7 Raft (pink color)
Source: Author´s contribution (October 2021)

Once all the configurations have been made, each of the pieces will be printed, repeating or improving the parameters as the case may be, since each piece can demand specific requirements that must be established to avoid errors during printing.



Graphic 8 Spool with test valves without support configuration and addition
Source: Author´s contribution (October 2021)



Graphic 9 Spool with test valves configured
Source: Author´s contribution (October 2021)

Results

All the designed pieces were printed, the parameters were the same for all the pieces, the printing times were as follows.

Part	Time
Double ram	10 hrs
Simple ram	7 hrs
Campaign	3 hrs
Spacer spool	4 hrs
Valve spool	6 hrs
Annular preventer	18 hrs
Casing pipes	3 hrs
Drill Pipes	2:30 hrs
Drill Collars	2 hrs
Test valves	3:30 hrs

Table 4 Printing times by pieces.
Source: Author´s contribution (October 2021)

Once all the pieces of the module are printed, we proceed to sand the parts where they fit each with other so that the assembly is easier to carry out and the student does not use excessive force and can break them.

This module works through practical cases that are made known to the student, depending on each case the student will carry out the corresponding assembly of the pieces and the teacher in charge of the subject will proceed to review the assembly, giving feedback if necessary, in the same way, this module can be used for personnel training in the oil and gas industry, with this we not only limit ourselves to looking at images through slides, but we can interact in real time with something that is tangible and easier to understand.

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Graphic 10 Spacer spool
Source: Author´s contribution (October 2021)

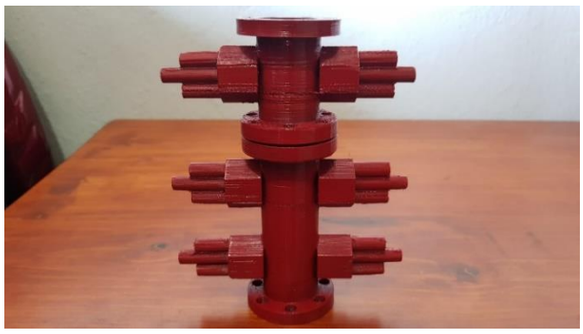
Graphic 11 Annular preventer
Source: Author´s contribution (October 2021)

Graphic 12 Simple ram
Source: Author´s contribution (October 2021)

Graphic 13 Double ram
Source: Author´s contribution (October 2021)

Basic assembly of the module

Depending on the practical case, the assembly may be different. The basic assembly of the module is shown below.



Graphic 14 Double and single ram socket
Source: Author´s contribution (October 2021)

Graphic 15 Double and single ram socket with spool
Source: Author´s contribution (October 2021)

Graphic 16 Double and single ram socket with annular preventer spool
Source: Author´s contribution (October 2021)

Graphic 17 Double and single ram socket with spool and waterline.
Source: Author´s contribution (October 2021)

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Conclusions

The teaching process is a very complex path, new ways of teaching have to be explored so that the student can understand situations from practical cases and these can serve in the future to have a broad overview in the productive sector.

With the proposal of this teaching strategy, discussions that favor the comprehension of the topics in students are generated, it fosters also the exchange of ideas and points of view that broadens the knowledge providing a new source of information and generating a more meaninful learning process.

The teaching environment that is intended to be built with this module not only refers to the means or resources, but also the forms of interaction and exchanges in a group.

This module is only a part of what is desired to create in the future, more pieces will be added and in the same way it is intended to be replicated in other subjects that do not have the necessary equipment to carry out practices, there are areas for improvement in terms of materials and the time consumption, the use of recycled material is considered, it is considered also to take this module to companies that carry out work in the oil sector in order to adequately train their personnel.

Acknowledgment

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Also, we thank Rocio Santos Martínez for her support in the translation of this work.

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Web system for monitoring physical variables in aeroponic crops

Sistema web para el monitoreo de variables físicas en cultivos aeropónicos

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Abstract

This article presents the design, development and simulation of a web system for aeroponic crops that allows the registration of users, crops, nebulization cycles and planting and crop periods. In relation to these, the averages, graphs and reports of physical variables that intervene in the monitoring process are generated, in addition backups are generated and the database is restored, as well as the tracking of the history of the actions performed by the user. The simulation of data collection was carried out using a prototype (electronic circuit) in order to evaluate the functionality of the system.

Aeroponics, Monitoring, Web system, Physical variables

Resumen

En este artículo se presenta el diseño, desarrollo y simulación de un sistema web para cultivos aeropónicos, que permite el registro de usuarios, cultivos, ciclos de nebulización y periodos de siembra y cultivos. En relación a estos se generan los promedios, gráficas y reportes de variables físicas que intervienen en el proceso del monitoreo, además se generan respaldos y se restaura la base de datos, así como el seguimiento del historial de las acciones que realiza el usuario. Se llevó a cabo la simulación de la obtención de datos mediante el uso de un prototipo (circuito electrónico) con el fin de evaluar la funcionalidad del sistema.

Aeroponía, Monitoreo, Sistema web, Variables físicas

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Introduction

Aeroponic cultivation takes place in a closed or semi-closed environment, which presents multiple benefits for crops; the need to supervise and control the monitoring of physical variables (ph, humidity, temperature, electrical conductivity) arises. As well as the automation of the misting process using electrical systems. Currently it is essential to use technology and systems that allow managing the information of these processes from anywhere, generating support and interaction tools for users.

Due to the above, a web system was designed and developed that allows the creation of two types of users (Administrator and Teacher or Student), for the registration of aeroponic crops, planting dates and establishment of optimal intervals of change variables, as well as generation of reports in pdf, excel and graphs (cake / bars) to visualize the censuses obtained every 12 hours, you also have the option to back up data and log user activity within the system.

Methodology

The methodology applied for the development of the system was SCRUM, developing the following phases: planning, implementation, review and launch. Once the phases were applied, a system in a web environment was obtained as a result, which allows to monitor the physical variables (ph, humidity, temperature, electrical conductivity) that are controlled in an aeroponic culture for this particular case, and thus perform nebulization. Below is a describe of what was done in each phase.

– **Planning Phase:** In this, the design of the database (see figure 1), the circuit (see figure 2) and the system interfaces (see figure 3) was carried out.

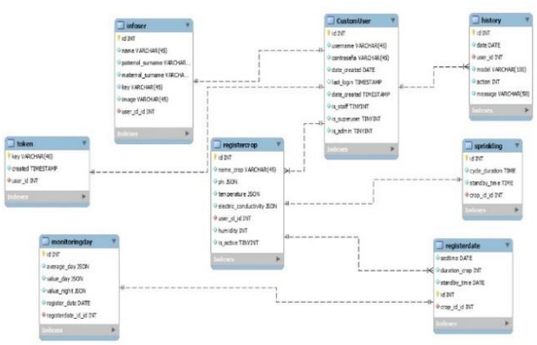

Figure 1 Database
Source: *Own elaboration*

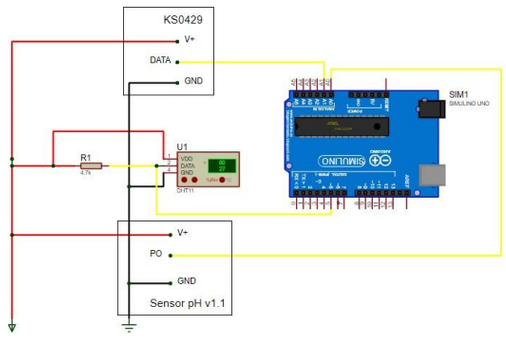

Figure 2 Sensor Circuit (Arduino)
Source: *Own elaboration*

Data collection was also performed (see figure 3) and task lists were established (see table 1) to define the iteration planning (sprint).

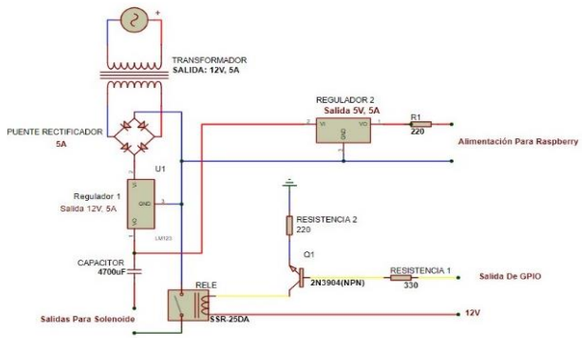

Figure 3 Valve Circuit (Raspberry)
Source: *Own elaboration*

Activities	Chores	Sprint
1	Make user stories	1
2	Design low-fidelity displays of the system.	1
3	Design the administrator and student use cases.	1
4	Design the entity relationship diagram of the database in MySQL Worbench	2
5	Design the module's high-fidelity displays.	2
6	Create modify and display user data in their accounts.	3
7	Register crops with their corresponding variables then activate it with their planting and harvest date.	3
8	Schedule a spray cycle for each crop.	3
9	View daily monitoring.	3
10	Generate reports with the data obtained from the monitoring.	3
11	Make recommendations regarding the analyzes performed (usability tests).	4
12	Develop user manual.	4

Table 1 List of Tasks (BackLog)
Source: *Own elaboration*

– **Implementation Phase:** Once the activities of the planning phase had been carried out, the View Controller Model (MVC) was implemented, thus allowing the identification of the Back End and Front End jobs. Likewise, the configuration of the server in the cloud and local was carried out. Simulation software connected to the Arduino and the Raspberry was used to read the data.

Figure 4 presents an interface for the development of the Front End and Figure 5 shows the Back End of the system. Figure 6 shows the layout of the project folders in the cloud.

Figure 4 Sensor Circuit (Arduino)
Source: *Own elaboration*

Figure 5 Front End Login
Source: *Own elaboration*

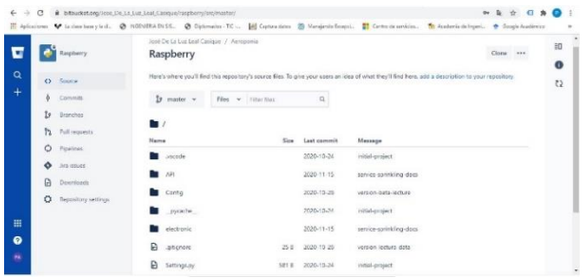

Figure 6 Folders in the cloud.
Source: *Own elaboration*

– **Review Phase:** Software and circuit tests were carried out. The first consisted of evaluating functionality, security through tokens, access points, and response time. Reports were also generated in pdf and Excel formats to validate their download (see figure 7).

Figure 7 Reports
Source: *Own elaboration*

In the circuit tests, data readings and nebulization times were established (figure 8).

Figure 8 Nebulization Process
Source: *Own elaboration*

– **Launch Phase:** The server was configured, in the cloud to host the System code and the Database. Once the process was finished, an integration validation was carried out. This also included the development of system documentation, such as: technical and user manual.

Discussion of results

Different verifications were carried out in the establishment of the nebulization duration, as well as the data of the physical variables (see figure 9) were census during a period of two months, which allow generating averages, type graphs and pastel bars (see figure 10), reports by day, week and month.

There is a web platform, which has two roles: administrator and students or teacher for interaction with the user. This tool allows the registration of crops, as well as the reading of physical variables (temperature, humidity, pH, electrical conductivity) in which their maximum, optimum and minimum values are established, in addition to assigning the sowing and cultivation dates.

Two relevant functionalities of the platform are the support of monitoring and the history of changes made by users. A relevant feature in terms of security is that the transaction of information from the server to the clients is carried out through the creation and use of tokens (avoiding the loss of data and unwanted access by users outside the system).

Figure 9 Monitoring per month
Source: *Own elaboration*

Figure 10 Pie charts
Source: *Own elaboration*

Conclusions

Cultivating aeroponically reduces the use of space, water and nutrients necessary for a crop, improving its production and quality. The automation of the fogging process supports the crops inside the greenhouse, since the possibility of altering the physical variables is minimized.

Controlling a greenhouse from anywhere, saves time and personnel involved, so this web system automates the following activities: crop registration, optimal intervals of physical variables, sowing and cultivation date, as well as the establishment of spray periods. If there is, a need to view the changes made by a user in the web system, this allows to explore the records or modifications that a user made in the crop fogging processes and present the information from the monitoring of physical variables inside the greenhouse in different formats.

Currently, it was necessary to implement the use of new technological tools such as the use of tokens, to prevent other users from modifying the records without having a username and password in the system, which provided security in the treatment of information in the application.

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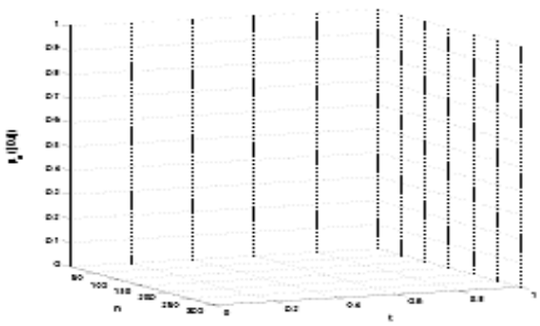

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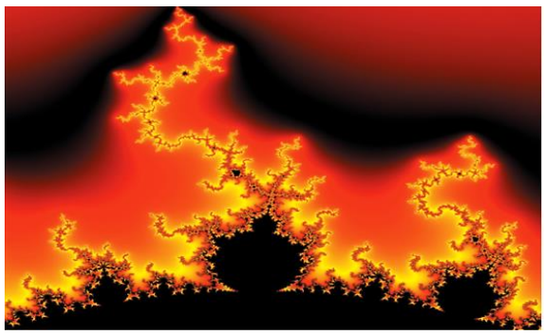

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