ISSN 2531-2952

Journal Applied Computing

Volume 9, Issue 20 — January — June — 2023

ECORFAN®

ECORFAN-Spain

Chief Editor
VALDIVIA - ALTAMIRANO, William Fernando. PhD

Executive Director
RAMOS-ESCAMILLA, María. PhD

Editorial Director
PERALTA-CASTRO, Enrique. MsC

Web Designer
ESCAMILLA-BOUCHAN, Imelda. PhD

Web Diagrammed
LUNA-SOTO, Vladimir. PhD

Editorial Assistant
TREJO-RAMOS, Iván. BsC

Philologist
RAMOS-ARANCIBIA, Alejandra. BsC

Journal Applied Computing, Volume 7, Issue 20, June - 2023, is a biannual Journal edited by ECORFAN-Spain. Matacerquillas Street 38, CP: 28411. Moralzarzal-Madrid. WEB: http://www.ecorfan.org/spain/rj_arquitectura_dis.php, revista@ecorfan.org. Editor in Chief: VALDIVIA - ALTAMIRANO, William Fernando. PhD. ISSN: 2531-2952. Responsible for the last update of this issue ECORFAN Computer Unit. ESCAMILLA-BOUCHÁN, Imelda. PhD. LUNA-SOTO, Vladimir. PhD. Updated as of June 30, 2023.

The opinions expressed by the authors do not necessarily reflect the views of the publisher of the publication.

It is strictly forbidden the total or partial reproduction of the contents and images of the publication without permission from the Spanish Center for Science and Technology.

Journal Applied Computing

Definition of the Journal

Scientific Objectives

Support the International Scientific Community in its written production of Science, Technology in Innovation in the Humanities and Behavioral Sciences Area, in the Sub-disciplines of international architecture, technological innovation in architecture, industrial design, business design techniques, multimedia design, advertising design, web system design, residential architecture.

ECORFAN-México SC is a Scientific and Technological Company that contributes to the formation of Human Resources focused on continuity in the critical analysis of International Research and is attached to the RENIECYT of CONAHYCYT with number 1702902, its commitment is to disseminate the research and contributions of the International Scientific Community, academic institutions, agencies and entities of the public and private sectors and contribute to the linking of researchers who carry out scientific activities, technological developments and training of specialized human resources with governments, companies and social organizations.

Encourage the dialogue of the International Scientific Community with other study centers in Mexico and abroad and promote a broad incorporation of academics, specialists and researchers to the Serial publication in Science Niches of Autonomous Universities - State Public Universities - Federal IES - Polytechnic Universities - Technological Universities - Federal Technological Institutes - Normal Schools - Decentralized Technological Institutes - Intercultural Universities - S&T Councils - CONAHCYT Research Centers.

Scope, Coverage and Audience

Journal of Applied Computing is a Journal edited by ECORFAN-México S.C in its Holding with a repository in Spain, it is a peer-reviewed and indexed scientific publication on a quarterly basis. It supports a wide range of contents that are evaluated by academic peers by the Double-Blind method, around topics related to the theory and practice of systems theory, networks, interconnectivity of companies, corporate governance, satellite communication, connectivity, TV transmitters and transmission, microwave links, radio communications and radio receivers, radiocommunication, radio receivers, TV receivers, Telephony, Radio and TV transmitters with diverse approaches and perspectives, which contribute to the dissemination of the development of Science Technology and Innovation that allow arguments related to decision-making and influence the formulation of international policies in the Field of Engineering Sciences and Technology. The editorial horizon of ECORFAN-México® extends beyond academia and integrates other segments of research and analysis outside of that field, as long as they meet the requirements of argumentative and scientific rigor, in addition to addressing topics of general and current interest of the International Scientific Society.

Editorial Committee

CENDEJAS - VALDEZ, José Luis. PhD
Universidad Politécnica de Madrid

DE LA ROSA - VARGAS, José Ismael. PhD
Universidad París XI

DIAZ - RAMIREZ, Arnoldo. PhD
Universidad Politécnica de Valencia

GUZMÁN - ARENAS, Adolfo. PhD
Institute of Technology

LARA - ROSANO, Felipe. PhD
Universidad de Aachen

MEJÍA - FIGUEROA, Andrés. PhD
Universidad de Sevilla

RIVAS - PEREA, Pablo. PhD
University of Texas

RODRIGUEZ - ROBLEDO, Gricelda. PhD
Universidad Santander

TIRADO - RAMOS, Alfredo. PhD
University of Amsterdam

VAZQUES - NOGUERA, José. PhD
Universidad Nacional de Asunción

Arbitration Committee

ANTOLINO - HERNANDEZ, Anastacio. PhD
Instituto Tecnológico de Morelia

CASTRO - RODRÍGUEZ, Juan Ramón. PhD
Universidad Autónoma de Baja California

OLVERA - MEJÍA, Yair Félix. PhD
Instituto Politécnico Nacional

HERNÁNDEZ - MORALES, Daniel Eduardo. PhD
Centro de Investigación Científica y de Educación Superior de Ensenada

PEREZ - ORNELAS, Felicitas. PhD
Universidad Autónoma de Baja California

HERNÁNDEZ - HERNÁNDEZ, José Luis. PhD
Instituto Tecnológico de Chilpancingo

FLORES - FLORES, Mercedes. PhD
Tecnológico de Estudios Superiores de Ecatepec

MAYA - PÉREZ, Petra Norma. PhD
Universidad Tecnológica del Valle de Toluca

HERRERA, Beatriz. PhD
Universidad Autónoma del Carmen

CASANOVA - VALENCIA, Salvador Antelmo. PhD
Universidad Michoacana de San Nicolás de Hidalgo

GUTIERREZ - CARREON, Gustavo Alfonso. PhD
Universidad Michoacana de San Nicolás de Hidalgo

Assignment of Rights

The sending of an Article to Journal of Applied Computing emanates the commitment of the author not to submit it simultaneously to the consideration of other series publications for it must complement the Originality Format for its Article.

The authors sign the Authorization Format for their Article to be disseminated by means that ECORFAN-Mexico, S.C. In its Holding Spain considers pertinent for disclosure and diffusion of its Article its Rights of Work.

Declaration of Authorship

Indicate the Name of Author and Coauthors at most in the participation of the Article and indicate in extensive the Institutional Affiliation indicating the Department.

Identify the Name of Author and Coauthors at most with the CVU Scholarship Number-PNPC or SNI-CONAHCYT- Indicating the Researcher Level and their Google Scholar Profile to verify their Citation Level and H index.

Identify the Name of Author and Coauthors at most in the Science and Technology Profiles widely accepted by the International Scientific Community ORC ID - Researcher ID Thomson - arXiv Author ID - PubMed Author ID - Open ID respectively.

Indicate the contact for correspondence to the Author (Mail and Telephone) and indicate the Researcher who contributes as the first Author of the Article.

Plagiarism Detection

All Articles will be tested by plagiarism software PLAGSCAN if a plagiarism level is detected Positive will not be sent to arbitration and will be rescinded of the reception of the Article notifying the Authors responsible, claiming that academic plagiarism is criminalized in the Penal Code.

Arbitration Process

All Articles will be evaluated by academic peers by the Double-Blind method, the Arbitration Approval is a requirement for the Editorial Board to make a final decision that will be final in all cases. MARVID® is a derivative brand of ECORFAN® specialized in providing the expert evaluators all of them with Doctorate degree and distinction of International Researchers in the respective Councils of Science and Technology the counterpart of CONAHCYT for the chapters of America-Europe-Asia- Africa and Oceania. The identification of the authorship should only appear on a first removable page, in order to ensure that the Arbitration process is anonymous and covers the following stages: Identification of the Journal with its author occupation rate - Identification of Authors and Coauthors - Detection of plagiarism PLAGSCAN - Review of Formats of Authorization and Originality-Allocation to the Editorial Board-Allocation of the pair of Expert Arbitrators-Notification of Arbitration -Declaration of observations to the Author-Verification of Article Modified for Editing-Publication.

Instructions for Scientific, Technological and Innovation Publication

Knowledge Area

The works must be unpublished and refer to issues of systems theory, networks, interconnectivity of companies, corporate governance, satellite communication, connectivity, TV transmitters and transmission, microwave links, radio communications and radio receivers, radio communication, radio receivers. radio, TV receivers, Telephony, Radio and TV transmitters and other topics related to Engineering Sciences and Technology.

Presentation of the Content

In Issue 18, is presented article *Science education using Kaanbale virtual reality* by HERRERA-RODRÍGUEZ, Mariel, GUZMÁN-MUÑOZ, Marcela Yunuent, RAMIREZ-TURRUBIARTES, Felipe de Jesús and MARTÍNEZ CARREÓN María de Jesús, with adscription at Universidad Tecnológica Cadereyta and Universidad Autónoma de Nuevo Leon, in the next artricle presnt *Computational algorithm for search and detection of metabolites in CDF(GCxGCxMS) files*, by AMARO-RODRÍGUEZ, Isidro, with adscription at Tecnológico Nacional de México / Instituto Tecnológico de Durango, in the next artricle presnt *HabitFun videogame as a tool to support the generation of good hygiene habits in elementary school children* by LUNA-CARRASCO, Claudia Yadira & LUNA-TREJO, Cupertino, with adscription at Tecnológico Nacional de México/Instituto Tecnológico Superior de Huauchinango, in the last artricle presnt *Analysis of Undamped Free Vibration Parameters using GeoGebra* by VALDEZ-APARICIO, María Magdalena, SANDOVAL-HERNÁNDEZ, Marco Antonio CRUZ-GOMEZ, Ángela and MORELOS-CUEVAS, Rogelio, with adscription at Universidad Tecnológica de Xicotepec de Juárez.

Content

Article
Journal Applied Computing
June, 2023 Vol.7 No.20 1-5

Science education using Kaanbale virtual reality

Enseñanza de las ciencias utilizando Kaanbale realidad virtual

HERRERA-RODRÍGUEZ, Mariel´†, GUZMÁN-MUÑOZ, Marcela Yunuent´*, RAMIREZ-TURRUBIARTES, Felipe de Jesús´ and MARTÍNEZ-CARREÓN, María de Jesús´,´´

´ Universidad Tecnológica Cadereyta, Carretera a Chihuahua km 4.1 Cadereyta Jiménez, Nuevo León. CP 67450, Mexico.
´´ CICFIM Facultad de Ciencias Físico Matemáticas, Universidad Autónoma de Nuevo Leon, San Nicolas de los Garza, Nuevo Leon, CP 66455, Mexico.

ID 1st Author: *Mariel, Herrera-Rodríguez* / **ORC ID:** 00009-0006-6178-7966, **CVU CONAHCYTD ID:** 1302868

ID 1st Co-author: *Marcela Yunuent, Guzmán-Muñoz* / **ORC ID:** 0009-0003-6810-7787, **CVU CONAHCYTD ID:** 1297348

ID 2nd Co-author: *Felipe de Jesús, Ramirez-Turrubiartes* / **ORC ID:** 0009-0001-3676-4454, **CVU CONAHCYT ID:** 1302874

ID 3rd Co-author: *María de Jesús, Martínez-Carreón* / **ORC ID:** 0000-0002-9283-7857, **CVU CONACYTD ID:** 290939

DOI: 10.35429/JCA.2023.20.7.1.5 Received January 10, 2023; Accepted May 30, 2023

Abstract

Virtual Reality (VR) is an emerging technology that has gained a significant role in the instruction of science because in contrast to text and face to face learning, has a positive impact on their contents learning, generating positive emotions for comprehending physics concepts. Kaanbale is a Virtual Reality system designed with Kanban and MeISE methodologies that provides an captivating and immersive experience for students and allows them to view and understand science subjects and topics through a personal virtual environment. The concept used in this work was Uniform Motion, which is defined as the motion of an object in which the object travels in a straight line and its velocity remains constant along that line as it covers equal distances in equal intervals of time, irrespective of the duration of the time; but through Kaanbale is possible simulate other physics motion concepts like uniformly acceleration, parabolic and free-fall. This paper intends to demonstrate that the immersion and engagement that high school students gain from Kaanbale VR significantly enhances their ability to understand and retain information.

Virtual Reality, Simulator, Emerging Technology

Resumen

La Realidad Virtual (VR) es una tecnología emergente que ha ganado un papel sustancial en la enseñanza de las ciencias, porque a diferencia del aprendizaje presencial o a partir de textos, tiene un impacto positivo en el aprendizaje de sus contenidos, generando emociones positivas para la comprensión de los conceptos de física. Kaanbale es un sistema de Realidad Virtual diseñado con las metodologías Kanban y MeISE que brinda una experiencia atractiva e inmersiva para los estudiantes y les permite ver y comprender materias y conceptos científicos a través de un entorno virtual personal. El concepto utilizado en este trabajo fue el Movimiento. Rectilíneo Uniforme, que se define como el movimiento de un objeto que se desplaza en línea recta y su velocidad permanece constante a lo largo de esa línea mientras recorre distancias iguales en intervalos iguales de tiempo; cabe destacar que a través de Kaanbale es posible simular otros conceptos de movimiento como el movimiento uniformemente acelerado, el tiro parabólico y la caída libre. Este trabajo tiene como objetivo mostrar que la inmersión y el compromiso que los estudiantes de preparatoria obtienen con Kaanbale RV aumenta considerablemente su capacidad para comprender y retener información.

Realidad virtual, Simulador, Tecnología emergentes

Citation: HERRERA-RODRÍGUEZ, Mariel, GUZMÁN-MUÑOZ, Marcela Yunuent, RAMIREZ-TURRUBIARTES, Felipe de Jesús and MARTÍNEZ CARREÓN María de Jesús. Science education using Kaanbale virtual reality. Journal Applied Computing. 2023. 7-20:1-5.

* Corresponding autor: (E-mail: m.guzman@utcadereyta.edu.mx)
† Researcher contributing as first author.

Introduction

Physics is a science discipline considered by high school students as the most challenging subject (Trumper, 2006). This preconceived notion that physics is a demanding course has impacted the performance of students in physics, which is well-known for a lack of enthusiasm towards learning physics concepts (Guido, 2013).

Bozalek and colleagues (2013) explored how emerging technologies are utilized in innovative pedagogical practices to revolutionize teaching and learning across higher education institutions. Some emerging technologies include blockchain (Shah, 2021), internet of things (Suaad, 2023) and Virtual Reality (Hamilton, 2021).

Virtual Reality (VR) has been highly recommended as a significant development in emerging technology that can support the teaching-learning process. Students can virtually engage with the content provided to carry out real-life activities, and it is possible to present dynamic scenarios as in real life (Daniela & Lytras, 2019). In this way, students can experience an event firsthand and enhance their knowledge more effectively than in non-VR environments (Jeong, 2020).

Universidad Tecnológica Cadereyta introduced Kaanbale, an interactive learning environment utilizing Virtual Reality, to inspire students in their understanding of physics concepts that are not easily attainable through traditional methods.

Methodology

The project aims to create a simulator to facilitate the process of teaching and learning in the field of science, starting with Uniform Motion with the assistance of Virtual Reality technology. It has been observed that subjects like Chemistry and Physics pose challenges for students to comprehend at any grade level (Ahmed et al., 2022), hence there is a need to innovate new methods of teaching and learning using emerging technologies, such as immersive ones. For the realization of this project, the Educational Software Engineering Methodology “MeISE” (Abud, 2009) serves as a point of reference, which proposes a life cycle divided into two stages:

The initial stage encompasses the definition of requirements and the preliminary analysis and design, during which the desired characteristics of the product, the pedagogical and communication requirements, and the overall software architecture are determined; It concludes with an iteration plan carefully programmed to ensure that the product released at the end of each iteration is fully comprehensive, covering specific educational objectives. Once these guidelines are established, the second stage commences, in which the product is developed. The team takes each iteration, designs it, builds it, tests it, and implements it, evaluating the feasibility of continuing with subsequent iterations until a complete product is achieved" (Abud, 2009). For the development of Kaanbale, the MeISE methodology was combined with Kanban Agile methodologies (Leon & Checa, 2022) according to the diagram depicted below.

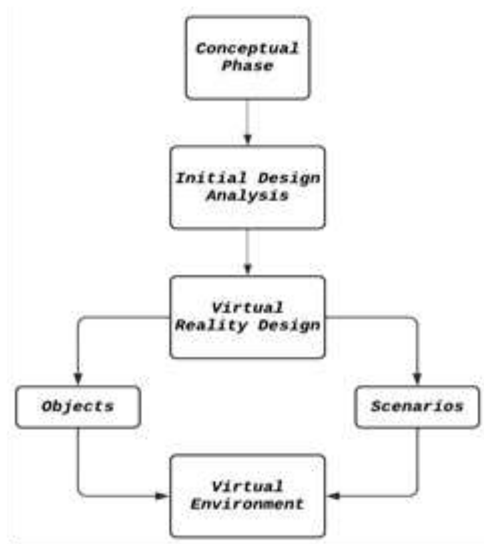


Figure 1 Kaanbale process diagram

Experimental

The Kaanbale Simulator has been created according to the process diagram shown in Figure 1. In the conceptual phase, the Uniform Motion was defined. In the initial design analysis phase, the requirements were established, where the Unity real-time development platform will be utilized, along with the design of the object and scenario models that will be worked on in Autodesk Maya software. The scripts generated in the C# language were also specified, which will execute the actions of each object. They will be exported to Unity (Unity, 2023) for development in the virtual environment for Uniform Motion through a menu with a graphical interface.

ECORFAN ® All rights reserved.

In the virtual reality design phase, the objects were modeled in Autodesk Maya software, where measurements were taken from different vehicles such as a golf cart, a Volkswagen, a motorcycle, among others. These will act as the foundation for the simulation of Straight-line Constant Velocity. Then, the scenarios were created where the distances to extract the necessary data for the simulation will be covered. Afterwards, the scripts in C# are programmed, defining within each of them the actions so that the formulas calculate the values of the established variables of Uniform Motion in the objects. Finally, the login menu for the simulator was designed.

To accomplish the virtual environment phase, the Kanbale system is implemented. To make it feasible, the student will don virtual reality goggles produced by Oculus and utilize 2 Touch controllers. Subsequently, the application is executed from the computer (refer to Figure 2), showcasing the menu.

First, the operator selects the Physics topic, in this case, it is Uniform Motion. The next step is to choose the object with the Touch controllers, whether it is a car, a golf cart, or a motorcycle, with which the student wants to simulate the Uniform Motion exercise. Then, is necessary to input the values of the formula, according to which the Simulation will be performed. Finally, the user is placed in the scenario so that the undergraduate has the immersive experience and achieves meaningful learning with it.

Figure 2 Implementation of the Kaanbale system

Results

When executing the Kaanbale system, the initial display that is observed through the virtual glasses is depicted in Figure 3. The user must select the "Uniform Motion" choice from the simulation panel situated on the left-hand side.

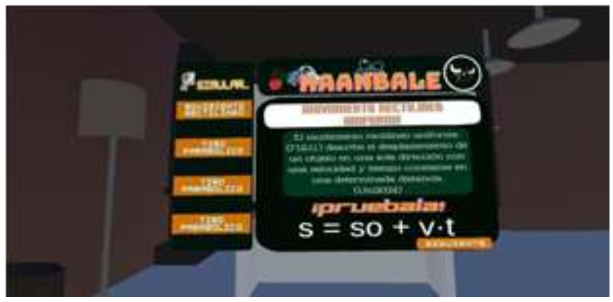


Figure 3 Primary display of the simulator

Afterwards, the user should choose the item they want to use for the simulation. These choices are displayed in figure 4.

Figure 4 Object selection for performing the MRU simulation

Following the vehicle selection, the simulator will present a window (refer to figure 5) where the values of the identified variables need to be inputted in order to execute the application.

Figure 5 Inputting data into variables for the Execution of Simulation

The figures 6, 7, 8 and 9 show the different camera placements to view the starting point of diverse object models.

ISSN-2531-2952
ECORFAN ® All rights reserved.

Figure 6 General overview position

Figure 7 Subjective angle position

Figura 8 High angle position

Figura 9 Top view position

After finishing the simulation, the program shows the object from different camera positions, as can be seen in figures 10 and 11.

Figure 10 Final view of uniform motion simulation

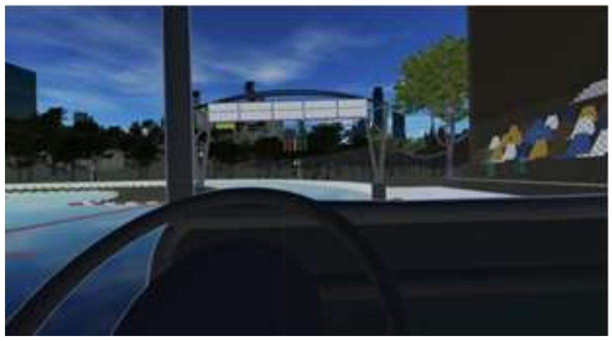


Figure 11 Final view simulation

The various camera angles contribute to the immersion of the student in the virtual world of Kaanbale, sparking curiosity in the physics subject being explored.

Acknowledgments

We thank the entrepreneur, Eng. Francisco Treviño, for the support provided with the Virtual Reality glasses, as well as the students who participated in the design and development of this project.

Conclusions

At the end of this project, the Virtual Reality Simulator Kaanbale was developed, which enables students to be fully immersed in solving problems in the field of Physics related to Uniform Motion. This immersive experience enhances the learning process, improves understanding and retention of information, and ignites interest in the subject of physics, overcoming the general lack of enthusiasm towards the topic.

A future opportunity lies in expanding the simulator to include additional topics in Physics, such as Projectile Motion, Free Fall, Uniformly Accelerated Motion, and even other areas of knowledge, providing students with a highly interactive learning experience.

ISSN-2531-2952
ECORFAN ® All rights reserved.

References

Abud Figueroa M.A. (2009). MeISE: Metodología de Ingeniería de Software Educativo. Revista Internacional de Educación en Ingeniería 2, 1: 10-18. [online] Available: http://www.academia.edu/6834077/P_a_g_i_n_a_MeISE_Metodología_de_Ingeniería_de_Software_Educativo

Ahmed, S., Tukur, U. & Ahmad, M. (2022). Effect of Virtual Reality-Based Instructional Strategy on Secondary School students in physics in Dutsin-Ma educational quality assurance zone, Katsina state. Al-Hikmah Journal of Education, 9, 2, 157-164. [online] Available:https://alhikmahuniversity.edu.ng/centralJournal/my_port al/user/event/bookUrl521.pdf

Bozalek, V.G., Ng'ambi, D., and Gachago, D. (2013). Transforming teaching with emerging technologies: Implications for higher education institutions. [online] Available: https://journals.co.za/doi/epdf/10.10520/EJC144269

Daniela, L. and Lytras, M.D. (2019). Editorial: themed issue on enhanced educational experience in virtual and augmented reality. Virtual Reality 23, 325–327. https://doi.org/10.1007/s10055-019-00383-z

Guido, R. M. D. (2013). Attitude and motivation towards learning physics. International Journal of Engineering Research & Technology (IJERT) 2, 11, 2087-2093. [online] Available:

Hamilton, D., McKechnie, J., Edgerton, E. et al. (2021) Immersive virtual reality as a pedagogical tool in education: a systematic literature review of quantitative learning outcomes and experimental design. J. Comput. Educ. 8, 1–32. https://doi.org/10.1007/s40692-020-00169-2.

Jeong, S.H., Kim, S., Yum, J-Y. and Hwang, Y. (2020). Effects of virtual reality news on knowledge gain and news attitudes. International Journal of Mobile Communications. 18:3, 300-313. https://doi.org/10.1504/IJMC.2020.107098

León Yacelga, A. R.,& Checa Cabrera, M. A.(2022).Uso de tableros Kanban como apoyo para el desarrollo de las metodologías ágiles. Revista Universidad y Sociedad,14(S2),208-214. [online] Available: https://rus.ucf.edu.cu/index.php/rus/article/view/2760/2735

Shah, D., Patel, D., Adesara, J. et al. (2021). Exploiting the Capabilities of Blockchain and Machine Learning in Education. Augment Hum Res 6, 1. https://doi.org/10.1007/s41133-020-00039-7

Suaad, H.H.A., Kanber, H.A. and Al-Dulaimi W.A.M. (2023) “The importance of using the internet of things in education,” International Journal of Emerging Technologies in Learning (iJET), vol. 18, no. 01, pp. 19–39. https://doi.org/10.3991/ijet.v18i01.35999

Trumper, R. (2006). Factors Affecting Junior High School Students' Interest in Physics. Journal of Science Education and Technology, 15, 47–58, https://doi.org/10.1007/s10956-006-0355-6

"Unity Learn", January 2023, [online] Available: https://learn.unity.com/pathway/vrdevelopment.

ECORFAN ® All rights reserved.

Journal Applied Computing
June, 2023 Vol.7 No.20 6-11

Computational algorithm for search and detection of metabolites in CDF(GCxGCxMS) files

Algoritmo computacional para la búsqueda y detección de metabolitos en archivos CDF (GCxGCxMS)

AMARO-RODRÍGUEZ, Isidro†*

Tecnológico Nacional de México/Instituto Tecnológico de Durango, México.

ID 1st Author: *Isidro, Amaro-Rodríguez* / **ORC ID:** 0000-0001-7502-2894, **CVU CONAHCYT ID:** 398361

DOI: 10.35429/JCA.2023.20.7.6.11 Received January 15, 2023; Accepted June 30, 2023

Abstract

Metabolomics is the most novel of the omic sciences, which is responsible for the study and comparison of metabolites. In this study, gas chromatography mass spectrometry (GC-MS) and two-dimensional gas chromatography time-of-flight mass spectrometry (GCxGC-TOFMS) were used for the identification of metabolites found in the blood, which, throw their results in CDF files for further analysis. Metabolic profiles of healthy patients were analyzed using multivariate data analysis techniques, which showed clear differences between the metabolites found, and compared with the universal Golm Metabolome Database (GMD), allowing them to be identified with a high percentage of coincidence. The results found reinforce the advantages of GCxGC-TOFMS and the role of metabolomics in the characterization of metabolites useful for different areas of biology.

Chromatography gas, Mass spectrometry, Metabolomics

Resumen

La metabolómica es considerada la más novedosa de las ciencias –ómicas, la cual se encarga del estudio y comparación de los metabolitos. En este estudio, la espectrometría de masas de cromatografía de gases (GC-MS) y la espectrometría de masas bidimensional de tiempo de vuelo de cromatografía de gases (GCxGC-TOFMS) se emplearon para la identificación de metabolitos que se encuentran en la sangre, las cuales arrojan sus resultados en archivos con formato de documento computable (CDF), para su posterior análisis. Se analizaron perfiles metabólicos de pacientes sanos mediante técnicas de análisis de datos multivariantes, los cuales mostraron diferencias claras entre los metabolitos encontrados, y comparados con la Base de datos universal Golm Metabolome (GMD), lo que permitió identificarlos con un alto porcentaje de coincidencia. Los resultados encontrados refuerzan las ventajas de GCxGC-TOFMS y el papel de la metabolómica en la caracterización de los metabolitos útiles para diferentes áreas de la biología.

Cromatografía de gases, Espectrometría de masas, Metabolómica

Citation: AMARO-RODRÍGUEZ, Isidro. Computational algorithm for search and detection of metabolites in CDF(GCxGCxMS) files. Journal Applied Computing. 2023. 7-20:6-11.

* Correspondence to the Author (E-mail: iamaro@itdurango.edu.mx)
† Researcher contributing as first author.

Introduction

Metabolomics is the study of chemical processes involving all the endogenous and exogenous metabolites in a cell or body fluid. Conventionally speaking, metabolomics studies all the metabolites with molecular mass below 5000 Da, which represents and reflects the functional activities of biological processes. A metabolomic study should, in theory, be able to detect, identify and quantify all the metabolites present in each sample at a given moment; the metabolomic map that is obtained is the representation of biological processes which, in turn, are influenced by individual tissue genetic features, regulation of gene expression, protein abundance and environmental influences (Troisi et al., 2020).

The use of GCxGC-TOFMS offers some advantages compared to the classic one-dimensional GC-MS technique, including improved chromatographic resolution (no increase in analytical execution time), increased sensitivity, improved metabolite identification and separation of reactive artifacts from metabolite peaks (Pasikanti et al., 2010).

By studying metabolic profiles, diseases, risk factors and/or biomarkers (Villavicencio et al.,
2012) can bediscovered,and for this purpose, one of the ways to separatemetabolites from fluids is by using the two-dimensional gas chromatography method coupled to flight-time mass spectrometry (GCxGC-TOFMS), and then switch to detecting them; for which an application was developed, which is designed to process CDF files, from which the characteristics of the profiles are extracted in order to detect their peaks and compare them with the GOLM database (Golm Metabolome Database), and identify the possible metabolites found.

Bioinformatics has brought with it a new mindset and way of carrying out research in biological processes, this has generated new concerns and new sciences that have been developed in order to cover as much as possible the biological elements that surround each process generated in the organisms.

Thus, when trying to analyze large volumes of data generated by complex methods that yield raw signals such as the use of gas chromatograph or mass spectrometry make bioinformatics gain strength. One of the sciences that has been put to work with these elements is so-called cosmic science, which incorporates disciplines such as genomics, proteomics, transcriptomics and metabolomics (Patti et al., 2012).

What is considered to be the most novel is the metabolomic which is responsible for the study and comparison of metabolites, which are molecules of low molecular weight present in each cell, tissue or organism, which are involved in biological processes; it generally studies the set of metabolites present in a biological system, particularly in biofluids such as urine, blood, cerebrospinal fluid, saliva or even in cellular tissues or cultures.

Metabolites are low- and medium molecular weight molecules, less than 1,500 on the Dalton scale, which are involved in cellular processes and reveal how metabolism is working in a given organ. The absence or presence of some metabolites, as well as the relative concentration between them, may be an indicator of disease states or predisposition factors (Díaz, 2016).

Many of today's approaches to metabolomics are characterized by an ongoing transition from qualitative to quantitative methods, similar to the prior development of genomics, transcriptomics and proteomics. Applying the state of the most advanced high-performance technologies as a result of significant growth in the size and complexity of the data generated that leads to increased demand for computational methods of visualization, annotation, and data mining.

Two-dimensional gas chromatography coupled with flight time mass spectrometry (GCxGC- TOFMS) is a maturation technique that stands out for its ability to analyze complex mixtures and has been successfully applied in metabolic research (Gutiérrez, 2002).

ECORFAN ® All rights reserved

Objective and goals

This research makes use of an image processing-based algorithm, used for peak detection, which was adjusted with conventional statistics for the purpose of identification.

In addition, the information produced by the CDF files, which extracts the main components of mass, intensity and time, is interpreted and graphs are made for optional representation; detects the peaks found in the signals and compares them with the GOLM database, of the German Research Foundation, with the mixtures obtained in the blood (serum or plasma as treated), which will allow to detect the certain components and thus be able to detect the metabolites, in certain projects, locate anomalies for further analysis and classification, which is the main objective of the research.

Within this research, too, the suitability of different computational programs of processing biomedical signals was analyzed, to obtain relevant information from different metabolic samples, the purpose of which was the development of an application that allowed the reading of files (NCDF or CDF) generated by a gas chromatograph and mass spectrometer.

Methods and materials

Processing algorithms seek to extract characteristics by converting fixed-size signals into vectors, which helps pattern detection, and in this case the peaks that characterize each signal.

When using an image recognition algorithm, applied to signal recognition, it requires an adequacy in the form of the application of the same.

According to Hidalgo (2015) image recognition as a scientific field is considered part of computer vision studies, which in turn is part of a larger field such as artificial intelligence. Its main objective is to identify specific contours, shapes and objects that are performed on tasks such as identifying and classifying images and localizing areas in an image.

A. Algorithm

The developed system presents analysis, search and navigation functionalities through cdf files generated by the chromatograph; this system makes use of signal characteristics such as intensity, and spatial location of signals in the matrix.

The algorithm consists of searching for the maximum elements, in relation to the intensity of the signals, within the array of coefficients,

by doing this, we detect a possible peak, and a search is performed towards the adjoining corners, to determine whether the data belongs to the peak in question or to an independent peak; ana adaptation to the Binarization algorithm, so that it seeks to find behaviors in the sequence ofsignals, to be classified as elements of the same peak or not.

B. Standardization

An improvement in algorithm usage optimization is normalization, transforming the studied variable into a similar variable that has the same proportions, but on a standard scale. The most common form used was to obtain the mean of the signal intensities and divide them by their respective standard deviation.

Another way wasto convert the signals to a unit scale, giving the highest signal strength the value of 1 and converting the other data to its equivalent ratio.

C. Materials

In the development of the application, computer equipment was used, with great information processing capabilities; using basic software such as Excel, and specialized such as R and Matlab, where different algorithms and applications were programmed and tested for the realization of research.

Development

The research was descriptive transsectional, where ten files were available, which were obtained through the blood treatment, obtained by clinically healthy patients and passed by a GCxGC-TOFMS chromatograph.

ECORFAN ® All rights reserved

Files containing information from the different compounds, of which it was required to identify the metabolic footprint, which allowed for different specific tests for pattern detection. This opted for an algorithm based on digital image processing, developingan application in the R Language for reading the generated CDF files.

The application developed is divided into four phases: 1) Reading and interpreting the CDF files, coming from the blood treatise by means of the gas chromatograph. 2) Generation of graphical representations; coupled with the loading of the GOLM database, which is the Knowledge Database. 3) Detection of spikes of uploaded files. 4) Comparison between signals obtained in the study against GOLM, to determine their similarities. 5) Concentrate of the results and their export for interpretation.

From its reading and interpretation, graphs are generated that can help the detection of peaks, visually, and thus look for similarities with the metabolites of GOLM. See figures1 and 2 (a) and (b).

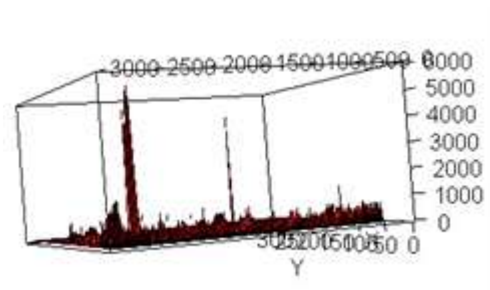
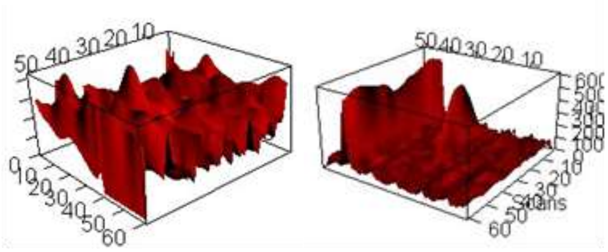


Figure 1 Plot a sample file with all its variables
Source: (Own elaboration, with the use of the R-Studio program)



(a) (b)

Figure 2 Graph of totals and maximums per observed cycle
Source: (Own elaboration, with the use of the R-Studio program)

The application also carries out an updated GOLM Metaboloma database load, which facilitates the search and dissemination of reference mass spectra of biologically active metabolites quantified by gas chromatography (GC) coupled to mass spectrometry (MS), which is a public BD supported by a Very Reliable German Research Foundation (Deutsche Forschungsgemeinschaft, DFG), and comprises mass spectra and retention time rates of pure reference substances and frequently observed mass spectrum labels. This GMD spectral mass library with built-in decision trees is freely accessible for non-commercial use in http://gmd.mpimp-golm.mpg.de/ (Hummel, 2008)

With the help of this database it is possible to compare the signals it has and those obtained in the study, and thus look for similarities between the different metabolites found. see Figure 3.

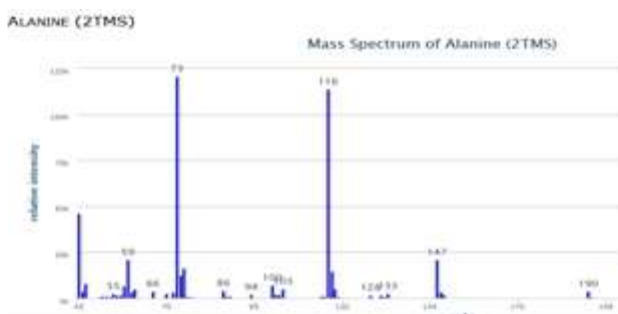


Figure 3 Example graph shown by GOLM on the intensity and m/z ratio of the Alanine compound (2TMS).
Source: http://gmd.mpimp-golm.mpg.de/Spectrums/fca40e62-fe2f-47b7-b20b-f66766c1343d.aspx

With all the above information, loaded in the application, we proceed to the detection of peaks of the desired files or files, which need a minimum height factor for the peaks, which is given according to the standard deviation. At this point we make use of the developed algorithm, which emphasizes image processingalgorithmof binarization for imageprocessing es, which helps in the detectionof peaks in the file and performs an approximation of the computational time that the machine will need to be able to find the metabolites.

ISSN-2531-2952
ECORFAN ® All rights reserved

The peaks found are generated in a list, shown in a csv file, where the peaks with their similarity percentage and the most similar metabolite of GOLM are found along with their name for quick identification, this for each file analyzed, thus achieving the identification of the metabolites contained in the sample.

Results

Using the developed software, the following results were obtained, ascan be seen in Table 1, the percentage of similarities of the peaks found, as well astheir identification, isobserved, thus finding the metabolites existing in the samples studied.

N CICLO	N SCAN	PICO	SEMEJANZA	N GOLM	Nombre GOLM
7	13	373	98%	27	Pyridine, 2-hydroxy- (1TMS)
N CICLO	N SCAN	PICO	SEMEJANZA	N GOLM	Nombre GOLM
6	49	349	98%	27	Pyridine, 2-hydroxy- (1TMS)
N CICLO	N SCAN	PICO	SEMEJANZA	N GOLM	Nombre GOLM
6	15	315	98%	27	Pyridine, 2-hydroxy- (1TMS)

Table 1 Results generated on peaks in a given sample
Source: (Own elaboration)

In the end, the results are concentrated on the similarities with the highest percentage with the metabolites recorded in goLM, for each of the files, which are presented in a csv file, which shows the percentage of similarity of the metabolites found, as well as their position and name, as seen in table 1.

With the help of normalization, it is possible to improve the results obtained by the system. The results show each of the analyzed files, with their respective peaks found and their percentage of similarity to the GOLM database, allowing to determine the name of the metabolite in question.

With these results, it will be possible to identify the different types of metabolites found in blood samples, and thus be able to determine characteristic patterns that help in the diagnosis of diseases, for early detection or improvement of treatment.

	A	B	C	D	E	F	G
1	Archivo	N CICLO	N SCAN	INTENSIDAD	SEMEJANZA	N GOLM	Nombre GOLM
2	Bichexa0_1	7	13	373	0.97834011	27	Pyridine, 2-hydroxy- (1TMS)
3	Bichexa0_1	6	49	349	0.97872032	27	Pyridine, 2-hydroxy- (1TMS)
4	Bichexa0_1	6	15	315	0.97509308	27	Pyridine, 2-hydroxy- (1TMS)
5	P100_2	456	36	27336	0.98121521	27	Pyridine, 2-hydroxy- (1TMS)
6	P100_2	448	25	26845	0.9808469	27	Pyridine, 2-hydroxy- (1TMS)
7	P100_2	440	1	26341	0.9783675	27	Pyridine, 2-hydroxy- (1TMS)
8	P100_2	431	34	25834	0.98011476	27	Pyridine, 2-hydroxy- (1TMS)
9	P100_2	414	35	24815	0.97861593	27	Pyridine, 2-hydroxy- (1TMS)
10	P100_2	405	53	24293	0.97829138	27	Pyridine, 2-hydroxy- (1TMS)
11	P100_2	335	2	20042	0.96963412	27	Pyridine, 2-hydroxy- (1TMS)
12	P100_2	282	54	16914	0.97195077	27	Pyridine, 2-hydroxy- (1TMS)
13	P100_2	281	7	16807	0.97396309	27	Pyridine, 2-hydroxy- (1TMS)
14	P100_2	253	36	15156	0.97401007	27	Pyridine, 2-hydroxy- (1TMS)
15	P100_Splitless_1	901	9	54009	0.96061033	27	Pyridine, 2-hydroxy- (1TMS)
16	P100_Splitless_1	880	29	52769	0.97009218	27	Pyridine, 2-hydroxy- (1TMS)
17	P100_Splitless_1	826	44	49544	0.97694491	27	Pyridine, 2-hydroxy- (1TMS)
18	P100_Splitless_1	788	52	47272	0.98002499	27	Pyridine, 2-hydroxy- (1TMS)
19	P100_Splitless_1	754	0	45240	0.98132733	27	Pyridine, 2-hydroxy- (1TMS)
20	P100_Splitless_1	703	56	42176	0.9828819	27	Pyridine, 2-hydroxy- (1TMS)
21	P100_Splitless_1	639	16	38296	0.98367766	27	Pyridine, 2-hydroxy- (1TMS)
22	P100_Splitless_1	102	54	6114	0.98397625	27	Pyridine, 2-hydroxy- (1TMS)
23	P100_Splitless_1	92	39	5499	0.98591489	27	Pyridine, 2-hydroxy- (1TMS)
24	P100_Splitless_1	86	49	5149	0.98562764	27	Pyridine, 2-hydroxy- (1TMS)
25							

GOLM / Bichexa0_1 / P100_2 / P100_Splitless_1

Figure 5 Concentrated results on metabolites found in the samples analyzed
Source: (Own elaboration)

Conclusions

In this study, the advantages of using the GCxGC-TOFMS tool for metabolic fingerprint detection were demonstrated. In addition, with the development of the application, it was possible to characterize metabolites in a biological sample, the results of which when compared to the GOLM database yield useful results in comparing the different metabolites found in a sample, which will help to detect patterns and thus have the ability to make decisions according to the type of research. It should be noted the use of these tools have numerous applications such as the detection of biomarkers in oils (Silva, 2011) detection of tissue biomarkers (Welthangen, 2005), detection and confirmationof drugs, among others.

In addition, the possibility for the application of different mathematical, computational and bioinformatics tools for the exploration and integration of large heterogeneous atomic data sets is left open, with the intention of improving what has been achieved to this day, and thus providing a reliable tool to be able to diagnose or detect predisposition factors on a disease specific to a human being. Since by knowing more accurately each of the metabolites found in a sample, it will be possible to make comparisons between the population of control patients, those who are already sick or have any symptoms, and thus generate a model capable of making a reliable diagnosis.

ECORFAN ® All rights reserved

Future jobs

There are some points to be modified to maximize the optimal operation of the application, one of which is the improvement of the algorithm, which could be done by removing the baseline from the signals from the sample, which is equivalent to the elimination of the "noise" generated by the procedure itself; another would be the parallelization of the routine to find similarities more quickly, since depending on the number of peaks found, it is the amount of time to find its similarity in comparison with the metabolites recorded in GOLM.

Another important point is the being able to generate a package for the R statistical language, useful in the detection of spikes in files generated by the GCxGC-TOFMS process, which is available on the CRAN (http://cran.r- project.org) platform, for use and modification by researchers who require it.

References

Díaz Fernández, Usnavia, & Rodríguez Ferreiro, Annarli Olivia. (2016).

“Biotechnology applications in the development of personalizedmedicine". MEDISAN, 20(5), 678-687.

Gutierrez Bouzán, Ma Carmen Droguet, Marta. (2002). "Gas chromatography and mass spectrometry: identification of odor-causing compounds". Institute of Textile Research and Industrial Cooperation, num. 122, 35-41.

Hidalgo, I., and Sanchez, R. (2015). "Character recognition using images on gas meters in real-world environments (End-of-Grade Work)".Complutense University of Madrid, Spain.

Hummel, J., Selbig, J., Walther, D., & Kopka, J. (2008). "The Golm Metabolome Database: A database for GC-MS based metabolite profiling".In J. Nielsen & M. Jewett (Eds.), Metabolomics a powerful tool in systems biology. Topics in current genetics Vol. 18 (pp. 75–96). Berlin, Heidelberg, New York: Springer.

Kumar Pasikanti, Kishore & Rahmat, Juwita & Cai, Shirong & Mahendran, Ratha & Esuvaranathan, Kesavan & C Ho, Paul & Chun Yong Chan, Eric. (2010). "Metabolic footprinting of tumorigenic and nontumorigenic uroepithelial cells using two-dimensional gas chromatography time-of-flight mass spectrometry".Analytical and bioanalytical chemistry. 398. 1285-93. 10.1007/s00216-010-4055-3.

Patti GJ, Yanes O, Siuzdak G. (2012). "Innovation: Metabolomics: The Apogee of the Omic Trilogy".Nature Reviews Molecular Cell Biolog. 263-269. doi: 10.1038/nrm3314.

Schmidt, C. W. (2004). "Metabolomics: what's happening downstream ofDNA." Environmental Health Perspectives, 112(7), A410–A415.

Silva, Raphael & G. M. Aguiar, Helen & D. Rangel, Mário& A. Azevedo, Débora &Radler de Aquino Neto, Francisco. (2011). "Comprehensive two-dimensional gas chromatography with time of flight mass spectrometry applied to biomarker analysis of oils fromColombia"..Fuel. 90. 2694-2699. 10.1016/j.fuel.2011.04.026. JC Lindon, JK Nicholson, E Holmes. (2007). Handbook of Metabonomics and Metabolomics, Elsevier.

Troisi, J., Cavallo, P., Colucci, A., Pierri, L., Scala, G., Symes, S., Jones, C., & Richards, S. (2020). Metabolomics in genetic testing. Advances in clinical chemistry, 94, 85–153. https://doi.org/10.1016/bs.acc.2019.07.009

Villavicencio, Btglaudia&Colmenarez, Luis& Rivero, Yliana. (2012). "Genomic, Metagenomic, Metabolomic and GenomicS SCIENCES". Lascienciaosmicas.blogspot.mx. Recovered from http://lascienciaosmicas.blogspot.mx/

Welthagen, W., Shellie, R. A., Spranger, J., Ristow, M., Zimmermann, R., &Fiehn, O. (2005). "Comprehensive two-dimensional gas chromatography-time-of-flight mass spectrometry (GC- GC-TOF) for high resolution metabolomics: Biomarker discovery on spleen tissue extracts of obese NZO compared to lean C57BL/6 mice". Metabolomics, 1(1), 65-73. DOI: 10.1007/s11306-005-1108-2

ECORFAN ® All rights reserved

Article

Journal Applied Computing

June 2023, Vol.7 No.20 12-17

HabitFun videogame as a tool to support the generation of good hygiene habits in elementary school children

VideoJuego HabitFun como herramienta de apoyo a la generación de buenos hábitos de higiene en niños de primaria

LUNA-CARRASCO, Claudia Yadira†* & LUNA-TREJO, Cupertino

Tecnológico Nacional de México/Instituto Tecnológico Superior de Huauchinango

ID 1st Author: *Claudia Yadira, Luna-Carrasco* / **ORC ID**: 0000-0002-4092-9987, **CVU CONACYT ID**: 368419

ID 1st Co-author: *Cupertino, Luna-Trejo* / **ORC ID:** 0000-0001-5898-8486, **CVU CONACYT ID:** 904398

DOI: 10.35429/JCA.2023.20.7.12.17 Received January 25, 2023; Accepted June 30, 2023

Abstract

This research addresses the development of a video game in Unity compiled for execution on devices with Android Operating System, said video game as a support tool for elementary school children to acquire good personal hygiene habits. Sometimes, children can be careless when it comes to their personal hygiene, and pediatricians recommend from a very young age the hygiene habits that they should follow daily, thus reducing the risk of contracting any disease. On the other hand, it is sought that the child is more organized, careful and self-demanding with himself. The Unity engine and the agile Scrum methodology were used for the development of the video game. Personal hygiene can be more interesting if it is taught through play, helping to demonstrate its importance, whether in the classroom or at home, children can learn about hygiene and find the right way to stay clean, neat and healthy. Therefore, the video game presents in text and audio, hygiene tips and each level is an area of the home that represents a hygiene challenge that the child must meet in order to move to the next level.

Hygiene, Videogame, Children

Resumen

La presente investigación aborda el desarrollo de un videojuego en Unity compilado para su ejecución en dispositivos con Sistema Operativo Android, dicho videojuego como herramienta de apoyo para que niños de primaria adquieran buenos hábitos de higiene personal. En ocasiones, los niños pueden ser descuidados en lo que respecta a su higiene personal, y pediatras recomiendan desde muy pequeños los hábitos de higiene que deban seguir a diario, y con ello se reduzca el riesgo de contraer alguna enfermedad. Por otra parte, se busca que el pequeño sea más organizado, cuidadoso y autoexigente consigo mismo. Para el desarrollo del videojuego se utilizó el motor Unity y la metodología ágil Scrum. La higiene personal puede ser más interesante si se enseña a través del juego, ayudando a demostrar su importancia, ya sea en el salón de clases o en el hogar, los niños pueden aprender acerca de higiene y encontrar la manera indicada de mantenerse limpios, aseados y saludables. Por ello, el videojuego presenta en texto y audio, consejos de higiene y cada nivel es un área del hogar que representa un reto de higiene que el niño debe cumplir para poder pasar al siguiente nivel.

Higiene, Videojuego, Niños

Citation: LUNA-CARRASCO, Claudia Yadira & LUNA-TREJO, Cupertino. HabitFun videogame as a tool to support the generation of good hygiene habits in elementary school children. Journal Applied Computing. 2023. 7-20:12-17.

* Correspondence to the Author (E-mail: claudia.lc@huauchinango.tecnm.mx)

† Researcher contributing as first author.

Introduction

For Unicef, important hygiene behaviors are difficult to practice without adequate knowledge and skills, community support and the conviction that personal behavior can really make a difference (Unicef, 2017).

Children can sometimes be careless when it comes to personal hygiene, especially during cold and flu seasons when failure to wash hands and cover coughs can lead to transmission of this disease. (Unicef, 2000).

Hygiene habits allow us to be away from diseases and avoid bad odors, infections, poor presentation, risks of the appearance of diseases and health complications. Having personal hygiene depends on oneself (Lombeida, 2020).

Personal hygiene can be more interesting if it is taught through play, helping to demonstrate its importance. The game favors sociability, develops the creative, critical and communicative capacity of the individual, stimulates action, reflection and expression (Pinto Yépez, 2015).

Technology plays a stellar role in society today, video games are great learning motivators, through them, children can develop good hygiene habits with a less routine and, above all, less authoritarian environment.

Taking into account the above, a video game was developed that presents a series of personal hygiene guidelines that guide the child towards basic hygiene standards, making the child understand the comfort of being clean.

The video game aims to reinforce the development of hygiene habits in children from 6 to 8 years of age, facilitating their learning with different mini-games that will help strengthen their memory, attention, and perception in terms of hygiene.

This document explains the analysis, design and development of the HabitFun video game as a support tool for the generation of good hygiene habits in elementary school children.

Analysis

The final product is a video game that serves as a tool to reinforce the development of hygiene habits in children from 6 to 8 years of age.

The game has 5 levels and 8 mini-games, which address different topics regarding hygiene; these levels will be unlocked once the minimum score established by the minigames in the current level has been reached.

In this first stage, the survey of functional requirements for the subsequent development of the video game was carried out. Table 1 presents these functional requirements, while Table 2 presents the non-functional requirements.

CLUE	NAME	DESCRIPTION
ReqF01	Create Account	A new user will be able to register a new account to be able to play the video game.
ReqF02	Login	A registered user will be able to login.
ReqF03	Services	The video game will use backend services that will be developed independently.
ReqF04	levels	The video game will be composed of 5 3D levels in its initial phase.
ReqF05	Minigames	The video game will have a total of 8 2D minigames.
ReqF06	Main character	The video game will have a main character who can move in any direction of the scenarios.

Table 1 Functional Requirements
Source: Own elaboration

CLUE	NAME	DESCRIPTION
ReqNF01	Responsive	The video game must adjust to different screen sizes.
ReqNF02	Intuitive	The video game will have intuitive user interfaces that are easy to use for children.

Table 2 Non-functional Requirements
Source: Own elaboration

Design

At this stage, a video game design document was drafted, where all its characteristics were defined, from how it is going to be played to how it will look, the tools to be used, etc.

Concept: A child character with the ability to move in all directions of the different scenarios of a house, where each room or area of the house represents a level of the video game and in each area or level there will be minigames, which the character must beat to unlock the next levels. Text and audio tips will be provided to support the generation of hygiene habits.

ECORFAN® All right reserved

Style: The main setting will be a 3D house, and the minigames in each level will be 2D.

Story: The main character is a boy between 6 and 8 years old, who is at home, starting in his room and who will receive recommendations on hygiene habits to keep his room and himself clean, highlighting at all times the importance of personal hygiene and the place where you are. The main character will move to other rooms in his home, as long as he has done the necessary hygiene tasks in the previous room or level.

Characteristics: the main character must be a child to achieve empathy with end users, the language to be used must be simple and easy to understand. The interfaces must be attractive and striking for children, the use of the video game must be intuitive for the public for which it is directed. Aspects of personal hygiene should be considered, but also for hygiene of the place where it is located.

Game mechanics: the main objective is to highlight hygiene habits and for this, recommendations will be used in all rooms of the main character's home, as well as challenges or mini-games to playfully highlight the importance of personal cleanliness and our home. The main character will be able to move in all directions from his home and in his path, he will find different obstacles to overcome.

Levels: 5 levels are considered in this first stage:

- Level 1 The room, the importance of keeping our room clean is highlighted to avoid the accumulation of dust, germs, bad odors and thus prevent diseases. Tips such as making your bed, ventilating the room, etc. are included. A mini memory game with images of hygiene habits is included.

- Level 2 The bathroom, the relevance of being careful with hygiene in the bathroom is highlighted, since activities such as showering, brushing teeth and other physiological needs are carried out there. It is also the area of the house where the greatest number of water points are concentrated, making it the place most prone to humidity. In this level, tips about removing waste, cleaning and disinfecting the toilet are added and two mini-games are added, one of washing hands and another of cleaning teeth.

- Level 3 The kitchen, care is emphasized when preserving and preparing food to maintain its nutritional quality and avoid possible health risks. Advice on washing food properly, washing hands before cooking, and a minigame on washing dishes are included.

- Level 4 The backyard, the importance of washing the clothes we wear is enhanced, as it is like our second skin. Sufficient time should be spent on washing, drying and storing it. After the shower or bath, you have to dress in clean clothes. Two mini-games are attached, one about washing clothes and another about separating the garbage.

- Level 5 The school, hygiene in the school stands out, since it is important for the health of all, since it is a place of great circulation of people and, due to this, germs and bacteria abound. As efficient as cleaning services are, it is necessary to take certain precautions to prevent diseases. The importance of washing hands regularly, of keeping our chair or workplace clean, is highlighted, and a memory mini-game is included with school tools that we must keep clean.

Development

Once the scheme of the different levels was made, we proceeded to the design of the interfaces and the necessary coding to make each level work.

Figure 1 shows the stage layout for Level 1The room. Figure 2 shows the stage design for Level 2 El Baño. Figure 3 represents the layout of Level 3 The Kitchen, while Figure 4 represents the layout of Level 4 The Backyard, and finally Figure 5 presents the layout of Level 5 The School.

ECORFAN® All right reserved

Figure 1 Design Level 1 The room
Source: Own elaboration

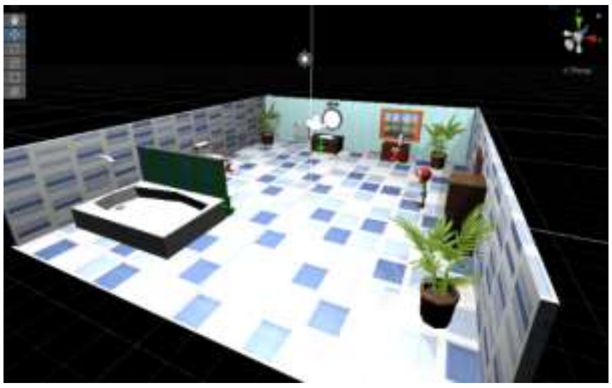


Figure 2 Design Level 2 The bathroom
Source: Own elaboration

Figure 3 Design Level 3 The kitchen
Source: Own elaboration

Figure 4 Design Level 4 The backyard
Source: Own elaboration

Figure 5 Design Level 5 The school
Source: Own elaboration

Results

After the first 5 levels of the HabitFun video game, part of its interfaces is presented. Figure 6 shows the HabitFun home interface, which has 4 main options, the option to log in with an already registered user, or register a new user, log in as a guest, and log out.

Figure 6 Main interface
Source: Own elaboration

When a new user (recently registered or invited) enters the video game, it only presents level 1 enabled (figure 7).

Figure 7 Levels enabled
Source: Own elaboration

Each time a new level is started, an initial tip or recommendation is presented, which can be in text or audio, as shown in figure 8.

ISSN-2531-2952
ECORFAN® All right reserved

Figure 8 Hygiene recommendation
Source: Own elaboration

In each of the levels, you can find additional hygiene recommendations to the minigames, and they are identified with an i, as shown in figure 9.

Figure 9 Additional hygiene recommendations
Source: Own elaboration

If it is required to go to another room (level), but the mini-games corresponding to the current level have not yet been cleared, the next level will be blocked, this is shown in figure 10.

Figure 10 Level locked
Source: Own elaboration

When starting a minigame, hygiene tips are also presented, like the one shown in figure 11.

Figure 11 Hygiene advice in minigame
Source: Own elaboration

At the end of each minigame, the score obtained and more tips on hygiene are shown, that is, during the game, the child is insisted on the importance of maintaining his personal hygiene and that of the place that surrounds him.

In this phase of the project, only 5 levels of the game were considered, but more levels may be developed in a next phase and improve the existing ones.

Gratitude

Express gratitude to the academic body of Intelligent Computing (ITESHUAU-CA-3) of the Instituto Tecnológico Superior de Huauchinango for the facilities provided for the development of this project.

Conclusions

It was possible to develop a video game that promotes the development of hygiene habits in children between 6 and 8 years old, with an intuitive, minimalist and appropriate user interface for children of that age. The information presented is clear, concise and in simple language so that children can understand it.

The video game developed by HabitFun is visually pleasing and fun to play, and in this way the player can enjoy it without complications and learn while having fun, since hygiene issues are not addressed in a rigid environment, full of stress and scolding.

With HabitFun, children can learn in a less routine and, above all, less authoritarian environment, which allows their psychosocial development, and articulates the cognitive, affective and emotional aspects to achieve their integral development.

References

[I] Unicef (2017) Higiene, Una mejor higiene conduce a una mejor salud, confianza y crecimiento general. Recovered from: https://www.unicef.org/es/higiene (Retrieved on: 21/08/2023)

[II]Lombeida Vera, K.E. (2020). Estrategias educativas, para la formación de hábitos de higiene en los niños/as de 4 o 5 años de edad de la unidad educativa “San Jacinto de la Búa” de la parroquia San Jacinto de la Búa Cantón Santo Domingo en el periodo de noviembre 2019 – abril 2020. Repositorio digital Instituto Superior Japón. Ecuador. (Retrieved on: 06/07/2023) URL: http://190.57.147.202:90/xmlui/handle/123456789/2974

[III] Pinto Yépez, M. A. (2015). La lúdica como herramienta de aprendizaje que fomenta hábitos de higiene en los niños de los primeros años de Educación Básica de la Unidad Educativa Aída León de Rodríguez de la ciudad de Ibarra, provincia de Imbabura durante el año lectivo 2012-2013. Propuesta alternativa. [Tesis de pregrado, Universidad Técnica del Norte]. Recuperado de http://repositorio.utn.edu.ec/handle/123456789/4194

[IV] Unicef. (2000). Los hábitos de higiene. Venezuela**.**

Article **Journal Applied Computing**
June 2023, Vol.7 No.20 18-25

Analysis of Undamped Free Vibration Parameters using GeoGebra

Análisis de parámetros de la vibración libre no amortiguada utilizando Geo Gebra

VALDEZ-APARICIO, María Magdalena*†, SANDOVAL-HERNÁNDEZ, Marco Antonio CRUZ-GOMEZ, Ángela and MORELOS-CUEVAS, Rogelio

Universidad Tecnológica de Xicotepec de Juárez

ID 1st Author: *María Magdalena, Valdez-Aparicio* / **ORC ID**: 0009-0000-2381-1146

ID 1st Co-author: *Marco Antonio, Sandoval Hernández* / **ORC ID**: 0009-0005-9062-7409

ID 2nd Co-author: *Ángela, Cruz Gómez* / **ORC ID**: 0009-0001-7494-3277

ID 3rd Co-author: *Rogelio, Morales-Cuevas* / **ORC ID**: 0009-0006-2563-6162

DOI: 10.35429/JCA.2022.18.6.18.25 Received January 30, 2023; Accepted June 30, 2023

Abstract

Through this article, a teaching methodology will be designed using a simulation in Geo Gebra, arose due to the need to contribute to the achievement of significant learning in the field of Mechanical Predictive Maintenance of the Industrial Maintenance Career at the Technological University of Xicotepec de Juárez, In this research, a teaching methodology was designed using a simulation in Geo Gebra since the university students could not understand the concepts about simple harmonic motion (MAS) as it is also known as undamped free vibration. Vibrations occur in systems that try to return to their state of rest or equilibrium when they are disturbed, or move away from their equilibrium state. It is about presenting how a simple harmonic motion problem was solved, highlighting the physical characteristics of the phenomenon. The current educational format has led teachers to use GeoGebra to analyze the behavior of some physical variables, proposing to students to interact with a simulation. With this it can be verified that, in relation to a simulation, it helps to facilitate the understanding of the concepts.

Methodology, Geo Gebra, Vibrations, Predictive, Technological, Variables, System, Significant, Simulation

Resumen

Mediante este artículo se diseñara una metodología de enseñanza utilizando una simulación en Geo Gebra, surgió debido a la necesidad de contribuir al logro de aprendizaje significativo en la materia de Mantenimiento Predictivo Mecánico de la Carrera de Mantenimiento Industrial en la Universidad Tecnológica de Xicotepec de Juárez, en esta investigación se diseñó una metodología de enseñanza utilizando una simulación en Geo Gebra ya que los alumnos universitarios no lograban comprender los conceptos acerca del movimiento armónico simple (MAS) como también se le conoce a la vibración libre no amortiguada. Las vibraciones ocurren en sistemas que intentan regresar a su estado de reposo o equilibrio cuando se perturban, o se alejan de su estado de equilibrio. Se trata de presentar como se resolvió un problema de movimiento armónico simple, que resalten las características físicas del fenómeno. El formato educativo actual ha llevado a los docentes a usar GeoGebra para analizar el comportamiento de algunas variables físicas, proponiendo a los estudiantes interactuar con una simulación. Con esto se puede comprobar que, en relación con una simulación, ayuda a facilitar la comprensión de los conceptos.

Metodología, Geo Gebra, Vibraciones, Predictivo, Tecnológica, Variables, Sistema, Significativo, Simulación

Citation: VALDEZ-APARICIO, María Magdalena, SANDOVAL-HERNÁNDEZ, Marco Antonio CRUZ-GOMEZ, Ángela and MORELOS-CUEVAS, Rogelio. Analysis of Undamped Free Vibration Parameters using GeoGebra. Journal Applied Computing. 2023. 7-20: 18-25

* Correspondence to the Author (e-mail: magdalena.valdez@utxicotepec.edu.mx)
† Researcher contributing as first author.

Introduction

The teaching of the exact sciences with emphasis on mechanical predictive maintenance, as in the case of other areas of knowledge, continues to be a task for the transmission of knowledge in the use of new technologies and novel didactics in the school.

The pedagogical work of teachers is confronted with the search for tools to improve the learning motivation of students (Díez, 2015), who are observed with less commitment to learning through traditional teaching methods. According to the above and taking into account the current position after the pandemic of new technologies in society and particularly in the lives of young people, it is necessary to incorporate them into the educational system, in order to achieve a transformation of the current teaching approach (Huapaya et al., 2005) towards a system that is easily assimilated by any student, regardless of their characteristics. Generally, teaching is based on traditional systems where the student is only a passive receiver of knowledge (Zuluaga, 2016).

The objective of this paper is to present a theoretical analysis and simulation in Geo Gebra to understand the behavior of simple harmonic motion.

Our purpose is to support the training of engineering students, in particular for those who are pursuing the educational experience called mechanical predictive maintenance. The underlying philosophy guiding our efforts is problem-based learning.

Mechanical vibrations are usually addressed as an example of the application of higher order linear differential equations in a university differential equations course.

Therefore, we wanted to present a practice performed in the computer laboratory, which is part of the performance criteria of the educational experience of differential equations, which in turn serves as a basis for further studies in the study of mechanical vibrations.

The instructional objective of this practice is that the student builds his learning from the experience of this practice, which solves the problem of quantifying the effect on a mass-spring system.

The authors discuss the activity proposed here, taking into account that traditional education can be complemented by the didactic strategy of project-based learning, which contributes to consolidate significant learning that in turn translates into the desired skills, such as: analysis of the solution of the case, mathematical analysis and analysis of the experiment.

1. Analysis of the case solution

In the field of physics, simple harmonic motion (S.H.M.) is a periodic back-and-forth motion in which a body oscillates back and forth from its equilibrium position at equal time intervals. Examples of this motion are the motion of a simple pendulum or the motion of an oscillating particle attached to a spring that has been compressed.

This exercise was applied to the subject of mechanical predictive maintenance of the Industrial Maintenance Engineering course in the ninth quarter of the Technological University of Xicotepec de Juárez during the pandemic, these strategies were adapted to improve the performance of the subject and are oriented according to the curricular guidelines of the technological universities and the internal instructional design.

For this research Geo Gebra was selected, a free software used to teach and learn mathematics, it allows its users to create models and interact with them, Geo Gebra accepts commands related to geometry, algebra and calculus; it enables the interactive application of different topics, presenting them in the form of animations and allowing a visual and dynamic exploration (Caligaris et al., 2015). This tool allows the familiarization of the student with the subject of study, through the visualization of the results of measurements performed (León, 2017). The simulations were designed and are described in Fig. 1 through basic programming used for their construction.

ECORFAN® All rights reserved.

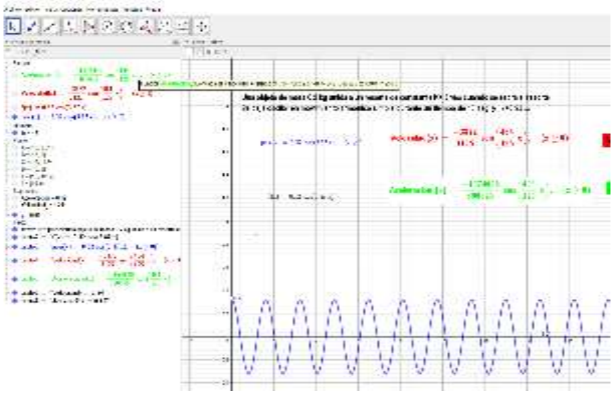


Figure 1 Programming used to build the simulations in Geo Gebra
Own Elaboration

Most of the research oriented to the implementation of software in classrooms focuses on the use of simulations, little use is given to computational modeling activities, probably because it implies apart from the knowledge of mathematical models knowledge in the use of a specific programming language (López et al., 2016). In this sense, the research presented in this article contains modeling elements since the scenarios of the phenomena studied were built from scratch from their mathematical models; however, the product of these computational models is presented to the student as a series of simulations, in which he/she must manipulate variables and observe the behavior presented.

2. Mathematical analysis

The following is how the analysis is incorporated: To perform the exercise it is necessary to understand that the elements of a simple harmonic motion (MAS): which focuses on the free vibrations that occur when the motion is maintained due to gravitational or elastic restoring forces in the exercise presented are calculated undamped vibrations that exclude the analysis the effects of friction on the system.

In very simple terms a vibration is an oscillatory motion of small amplitude. It is represented by an object attached to a spring, the system oscillates vertically and its motion moves horizontally.

A particle has an oscillatory motion when it moves periodically around an equilibrium position. Its study is essential to understand the simple harmonic motion.

As we can observe it is periodic back-and-forth motion in which a body oscillates back and forth from its equilibrium position and at equal time intervals.

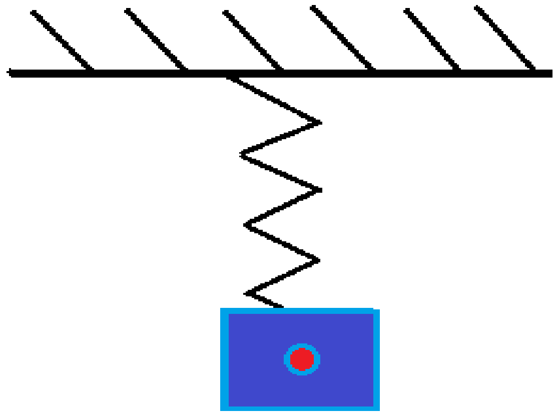


Figure 2 Periodic movement of shock absorber
Own Elaboration

This is produced by an elastic restoring force that originates when the body separates from its equilibrium position, we will explain the formulas applied to perform the simulation.

3. Characteristic vibration parameters

Displacement: Indicates the amount of motion that the mass experiences with respect to its rest position.

Period: The time it takes for a complete oscillation to be completed. Its unit of measurement in the International System is the second (s). It is the time it takes for the mass to make a complete cycle.

Frequency: It is the number of cycles that occur in a unit of time. It is the number of times an oscillation is repeated in one second. Its unit of measurement in the International System is the hertz (Hz).

Velocity: Refers to the ratio of change of position to time.

Acceleration: Provides the measure of the change in velocity with respect to time.

4. Equations of motion

Applying Newton's second law, simple harmonic motion is then defined in one dimension by the differential equation:

ISSN-2531-2952
ECORFAN® All rights reserved.

$$m\frac{d^2x}{dt^2} = -kx \quad (1)$$

$$F = ma$$

Equation of the elastic constant

x= elongation or displacement with respect to equilibrium point
t = time
K = elastic constant N/m
m = masd
a = aceleration

Being m, the mass of the body in displacement. Writing $\omega^2 = k/m$ we obtain the following equation where ω is the angular frequency of the motion:

$$\frac{d^2x}{dt^2} = -\omega^2 x \quad (2)$$

Angular frequency equation

Equations of a MAS: the same mass-spring system of the simulation is used.

The instantaneous oscillation of a material point executing a simple harmonic motion is obtained therefore by deriving the position with respect to time we obtain the velocity equation:

$$v = \frac{dx}{dt} = -\omega Asen\ (wt + \varphi) \quad (3)$$

Velocity equation

Acceleration is the variation of the velocity of motion with respect to the waiting time and is therefore obtained by deriving the equation of the velocity with respect to the time of as shown in the following figure:

$$a(t) = \frac{dv(t)}{dt} = -\omega^2 Acos(wt + \varphi) \quad (4)$$

Acceleration equation

5. Solution of the exercise

This section describes the exercise performed for the analysis. An object of mass 0.2 kg attached to a spring of constant K= 3N/m when the spring is stretched. It is allowed to oscillate in simple harmonic motion for a time of 15 sec. and A=0. 32m.

It is important to identify the following parameters:

- The equation predicting the motion of the particle
- The period
- The equation of position
- Velocity
- Acceleration

The equation that predicts the motion of the particle.

As a first step we must obtain the angular frequency in order to determine the period:

$$\omega = \sqrt{\frac{K}{m}} = \sqrt{\frac{3\frac{N}{m}}{0.2kg}} = 3.872\frac{rad}{seg}$$

Period

Once we know the value of the angular frequency we can calculate the period and frequency as a complement.

$$f = \frac{\omega}{2\pi} = \frac{3.87\ rad/seg}{2\pi\ rad/ciclo} = .616\ Hz$$

$$T = \frac{1}{f} = \frac{1}{.616\ ciclos/s} = 1.623\ seg$$

The position equation

$x = A\cos(wt + \varphi)$
$x=$ 0.32 m cos ((3.872 rad/seg)(15seg)) =0.01m

Velocity

We can also look up the value of the velocity, which is given by the following equation:

$$\boldsymbol{v}(t) = -A\omega * Sen(\omega t + \varphi) \quad (3)$$

$\boldsymbol{v}(t) = -0.32m$ (3.872 rad/seg) $*$
Sen (3.872 x 15)

$v(t)$ = -1.24 m/s

Acceleration

Substituting the values

$$a(t) = -A\omega^2 * Cos(\omega t + \varphi) \quad (4)$$

ECORFAN® All rights reserved.

$a(t) = -0.32m\ (3.872\text{rad/seg})^2 *$
$\cos(3.872\text{rad/seg} * 15seg)$

$\text{a}(t) = -.1892\ m/s^2$

6. Simulation in Geo Gebra

This section describes how the Geo Gebra simulation was performed.

Add the following function in the program:

f(x) = 0.32cos (3.872 x) as shown in the figure.

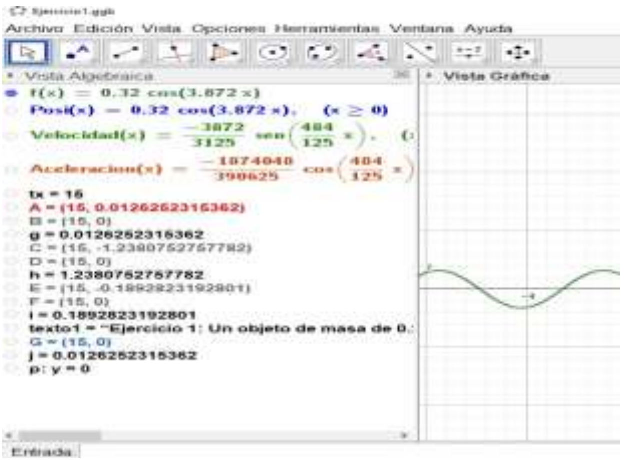


Figure 3 Geo Gebra simulation of the function
Own Elaboration

The previously added function must be conditioned in a new one so that it can start from zero, since there is no negative time. So a new constraint function must be added that has a condition with the following code: If(x ≥ 0, f(x)), we will name this function as "Posi Function" as shown in Figure 4. We can observe that the graph starts from the straight line x=0 so that real values can be read.

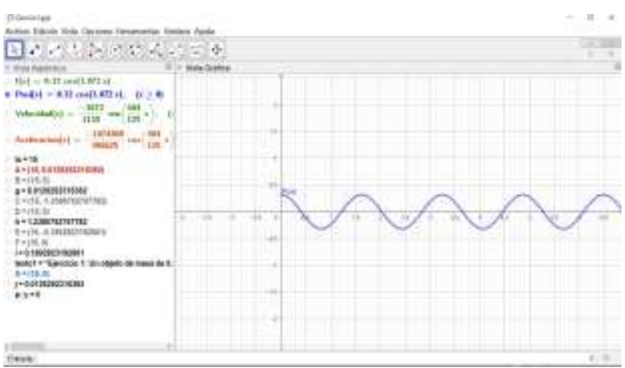


Figure 4 Geo Gebra simulation of the condition function
Own Elaboration

The next step is to add the function that will be used to obtain the velocity: this will be posed as the derivative of the "Posi Function" which will be the following, Derivative(Posi(x)) which in turn will be called "Velocity Function" as shown in the figure.

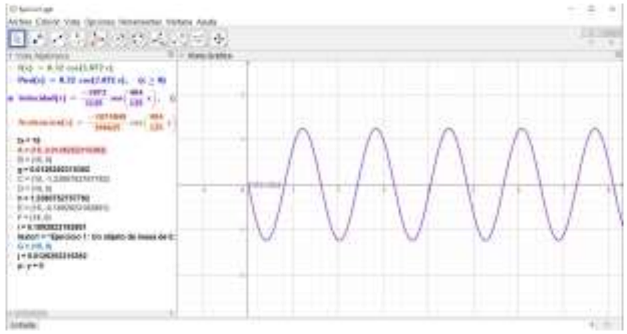


Figure 5 Simulation in Geo Gebra position function
Own Elaboration

To continue with the simulation we will use a slider that will represent the time units, where it will be modified to take the values from 0 to 15 in increments of 1 unit, it will be called "tx" shown in the figure.

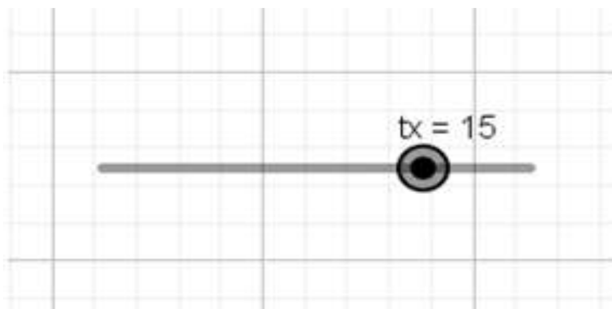


Figure 6 Simulation in Geo Gebra of the slider representing time
Own Elaboration

To find the distances in the different graphs you must choose each one, for example: to calculate the distance from the x-axis to a point of the position function, so we must add a point so that it moves on the "Posi Function".

ECORFAN® All rights reserved.

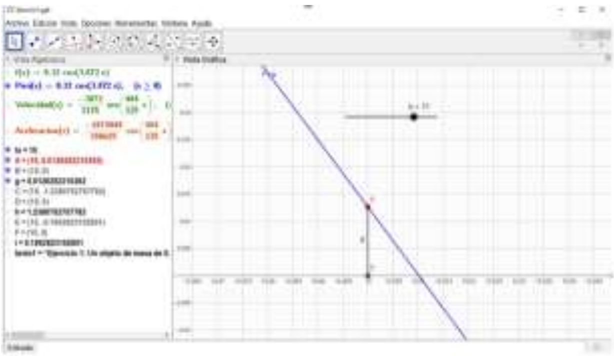


Figure 7 Simulation in Geo Gebra of the length 1 of the position function at 15 seconds
Own Elaboration

If you want to obtain the result of velocity and acceleration you must put the derivative of the position function and then the derivative of the velocity.

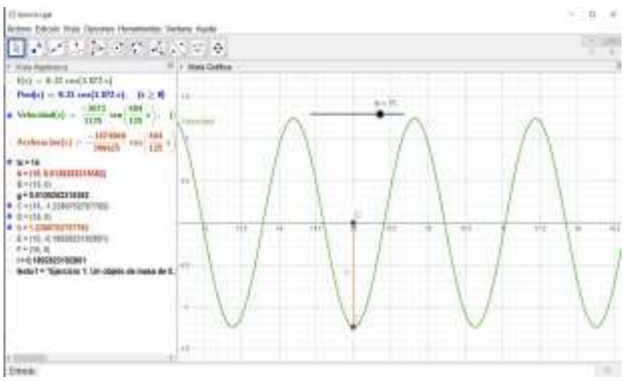


Figure 8 Simulation in Geo Gebra of maximum length of the Velocity function at 15 seconds
Own Elaboration

It is important to add the problem written with the text tool of the same system, to indicate which exercise we are performing.

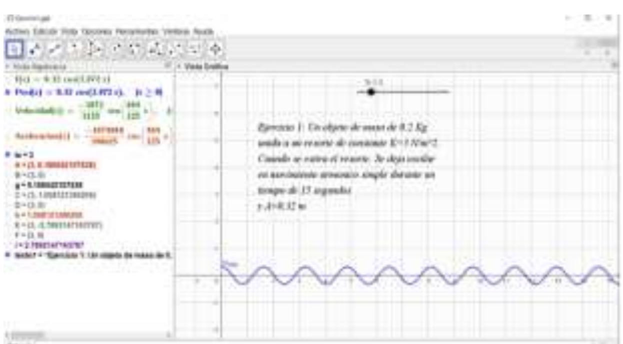


Figura 9 Writing the problem in a text box
Own Elaboration

With this simulation we were able to compare and check that the results did indeed coincide with the analytical procedure.

Finally, the following questions were posed to complement the learning 1. What is the displacement in f(x) in 15 sec, 2.When is the velocity at maximum or minimum acceleration, and 3.When is the acceleration at maximum or minimum velocity?

With the simulation of this exercise, they were adequately answered since they had the graphic support.

In the figures it was possible to observe the reading of the time elapsed from the beginning of the start-up and at 15 seconds after the start-up. The result for the first question is 0.01 m. which coincides with the result of the problem that was performed analytically for the answers of the following questions the behavior of the speed is maximum or minimum when the acceleration is zero and when the acceleration is at the ends of the trajectory the speed is in equilibrium position.

Conclusion

An oscillating system has an undamped free vibration only if the restoring force is directly proportional to the displacement. To solve an exercise, it is necessary to make sure that this is true in the problem scenario by identifying the unknowns.

In this article we rely on Geo Gebra to explain the behavior of an object in the exercise, thus, a simulation was made to support the teaching process. It is noticeable that, in the simulations, the motion described by the mass-spring system corresponds to the graphs that are described when an object moves following the pattern of simple harmonic motion.

This allows the student to design hypotheses and exchange data and to be able to verify or discard them, through the complete analysis of the results that can be obtained by manipulating the parameters relevant to the study being carried out. With this, we can conclude that Geo Gebra allows them to visualize in a simple way the graphical results obtained by solving the different exercises of damping systems, velocity and mass of the system.

ECORFAN® All rights reserved.

The methodology is simple and provides a sense of satisfaction among the students, which allows them to better understand the fundamental concepts of mechanical vibrations, which can be checked at any time analytically.

Finally, it is important to mention that the process of vibration analysis in industry is indispensable to monitor and control machines and thus effectively plan maintenance activities without interrupting the operation of the production plant or compromising the service life of the machines.

Funding statement

The authors did not receive any funding.

References

Arnal, J.; del Rincón, D and Latorre, A. (1992). Educational research. Fundamentals and methodology. Barcelona: Ed. Labor.

Beer, Johnston, Mecánica Vectorial para Ingeniero, Dinámica, Editorial McGraw Hill, Edición 10ma; México DF, 2012.

C. Garcia, C. Milton Knowledge management from simulation-supported reality-based learning: Application Cases (2015).

Cornejo, M. C., Villalobos, E. B., Quintana, P.A. (2008). Methods of solution of differential equations and applications. Mexico: Editorial Reverte.

F.H. Fernández and J.E. Duarte, Formation university 6, 5 (2013) 29.

Gamboa Araya, Ronny (2007). Use of technology in the teaching of mathematics. Cuadernos de investigación y formación en educación matemática, Number 3. Pp.11-44. School of Mathematics. National University.

García P. J. Predictive Maintenance in Industry. Industry. Colombia. 2000

Glen White (1990). Introduction to vibration analysis. U.S.A.: DLI Azima DLI.

Hibbeler.R.C, Mechanical Engineering. Dynamics. Fourteenth Edition, Parson Education, 2016.

J. Ariel, F. (2021). Teacher motivation to obtain educational quality in higher education institutions. https://www.redalyc.org/journal/1942/194267200007/html/

Jain, V., & Kumar, R. (2023). Geometrically nonlinear dynamic analysis of a damped porous microplate resting on elastic foundations under transverse patch loadings. Mechanics of Advanced Materials and Structures, 1-24.

Malik, F. N., & Kolay, C. (2023). Optimal parameters for tall buildings with a single viscously damped outrigger considering earthquake and wind loads. The Structural Design of Tall and Special Buildings, 32(7), e2003.

María Beatriz Escobar Medina "Influence of student-teacher interaction in the teaching-learning process", Paakat. Journal of technology and society. Retrieved from http://www.udgvirtual.udg.mx/paakat/index.php/paakat/article/view/230/347

Ortega, Manuel R. (1989-2006). Lecciones de Física (4 volumes). Monytex. ISBN 84-404-4290-4, ISBN 84-398-9218-7, ISBN 84-398-9219-5, ISBN 84-604-4445-7

Patil, M. A., & Kadoli, R. (2023). Effect of two-parameter partial foundation and viscoelastic supports on free vibration of Terfenol-D layered functionally graded fluid conveying pipe using domain decomposition technique. Mechanics of Advanced Materials and Structures, 30(22), 4685-4697.

Santos, M. (2001). Didactic potential of dynamic software in the learning of mathematics. mathematics. Avance y perspectiva, Vol. 20, pp.247-258.

Suárez Díaz Reinaldo. Education “Teaching-learning strategies, educational theories” 2nd ed. Trillas, Mexico2002

Villa-Ochoa, J.A., Bustamante, C., Berrio, M., Osorio, J., Ocampo, D. (2009). Sense of reality and mathematical modeling: the case of Alberto. Alexandria. Revista de Educação em Ciência e Tecnologia, 2(2), 159-180.

ECORFAN® All rights reserved.

Yonezawa, A., Yonezawa, H., & Kajiwara, I. (2023). Experimental study of model-free vibration control based on a virtual controlled object considering parameter uncertainty of actuator. Proceedings of the Institution of Mechanical Engineers, Part C: Journal of Mechanical Engineering Science, 237(12), 2665-2674.

Yu, X., & Dan, D. (2023). Structural modal parameter identification based on 2D spectral analysis. Journal of Sound and Vibration, 552, 117638.

Zill, D., & Cullen, M. (2009). Differential equations with boundary value problems. 7th Edition. CENGAGE Learning Publishing.

ISSN-2531-2952
ECORFAN® All rights reserved.

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

Surname (IN UPPERCASE), Name 1st Author†*, Surname (IN UPPERCASE), Name 1st Co-author, Surname (IN UPPERCASE), Name 2nd Co-author and Surname (IN UPPERCASE), Name 3rd Co-author

Institutional Affiliation of Author including Dependency (No.10 Times New Roman and Italic)

ID 1st author: (ORC ID - Researcher ID Thomson, arXiv Author ID - PubMed Author ID - Open ID) and CVU 1st author: (Scholar-PNPC or SNI-CONAHCYT) (No.10 Times New Roman)

ID 1st co-author: (ORC ID - Researcher ID Thomson, arXiv Author ID - PubMed Author ID - Open ID) and CVU 1st co-author: (Scholar or SNI) (No.10 Times New Roman)

ID 2nd co-author: (ORC ID - Researcher ID Thomson, arXiv Author ID - PubMed Author ID - Open ID) and CVU 2nd co-author: (Scholar or SNI) (No.10 Times New Roman)

ID 3rd co-author: (ORC ID - Researcher ID Thomson, arXiv Author ID - PubMed Author ID - Open ID) and CVU 3rd co-author: (Scholar or SNI) (No.10 Times New Roman)

(Report Submission Date: Month, Day, and Year); Accepted (Insert date of Acceptance: Use Only ECORFAN)

Abstract (In English, 150-200 words)

Objectives
Methodology
Contribution

Keywords (In English)

Indicate 3 keywords in Times New Roman and Bold No. 10

Abstract (In Spanish, 150-200 words)

Objectives
Methodology
Contribution

Keywords (In Spanish)

Indicate 3 keywords in Times New Roman and Bold No. 10

Citation: Surname (IN UPPERCASE), Name 1st Author†*, Surname (IN UPPERCASE), Name 1st Co-author, Surname (IN UPPERCASE), Name 2nd Co-author and Surname (IN UPPERCASE), Name 3rd Co-author. Paper Title. Journal of Applied Computing Year 1-1: 1-11 [Times New Roman No.10].

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

Introduction

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

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

What is your added value with respect to other techniques?

Clearly focus each of its features

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

Explanation of sections Article.

Development of headings and subheadings of the article with subsequent numbers

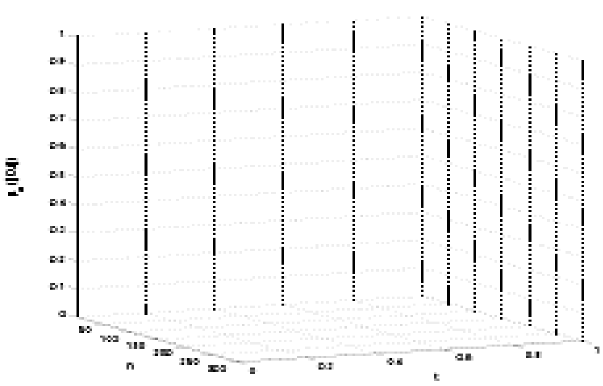
[Title No.12 in Times New Roman, single spaced and bold]

Products in development No.12 Times New Roman, single spaced.

Including graphs, figures and tables-Editable

In the article content any graphic, table and figure should be editable formats that can change size, type and number of letter, for the purposes of edition, these must be high quality, not pixelated and should be noticeable even reducing image scale.

[Indicating the title at the bottom with No.10 and Times New Roman Bold]



Graphic 1 Title and *Source (in italics)*

Should not be images-everything must be editable.

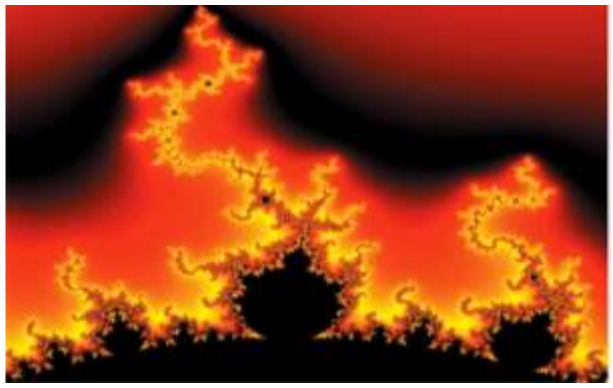


Figure 1 Title and *Source (in italics)*

Should not be images-everything must be editable.

Table 1 Title and *Source (in italics)*

Should not be images-everything must be editable.

Each article shall present separately in **3 folders**: a) Figures, b) Charts and c) Tables in .JPG format, indicating the number and sequential Bold Title.

For the use of equations, noted as follows:

$$Y_{ij} = \alpha + \sum_{h=1}^{r} \beta_h X_{hij} + u_j + e_{ij} \qquad (1)$$

Must be editable and number aligned on the right side.

Methodology

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

Results

The results shall be by section of the article.

Annexes

Tables and adequate sources thanks to indicate if were funded by any institution, University or company.

Conclusions

Explain clearly the results and possibilities of improvement.

ISSN-On line: 2531-2952
ECORFAN® All rights reserved.

References

Use APA system. Should not be numbered, nor with bullets, however if necessary numbering will be because reference or mention is made somewhere in the Article.

Use Roman Alphabet, all references you have used must be in the Roman Alphabet, even if you have quoted an Article, book in any of the official languages of the United Nations (English, French, German, Chinese, Russian, Portuguese, Italian, Spanish, Arabic), you must write the reference in Roman script and not in any of the official languages.

Technical Specifications

Each article must submit your dates into a Word document (.docx):

Journal Name
Article title
Abstract
Keywords
Article sections, for example:

1. Introduction
2. Description of the method
3. Analysis from the regression demand curve
4. Results
5. Thanks
6. Conclusions
7. References

Author Name (s)
Email Correspondence to Author
References

Intellectual Property Requirements for editing:

- Authentic Signature in Color of Originality Format Author and Co-authors.

- Authentic Signature in Color of the Acceptance Format of Author and Co-authors.

- Authentic Signature in blue colour of the Conflict of Interest Format of Author and Co-authors.

ECORFAN® All rights reserved.

Reservation to Editorial Policy

Journal of Applied Computing reserves the right to make editorial changes required to adapt the Articles to the Editorial Policy of the Journal. Once the Article is accepted in its final version, the Journal will send the author the proofs for review. ECORFAN® will only accept the correction of errata and errors or omissions arising from the editing process of the Journal, reserving in full the copyrights and content dissemination. No deletions, substitutions or additions that alter the formation of the Article will be accepted.

Code of Ethics - Good Practices and Declaration of Solution to Editorial Conflicts

Declaration of Originality and unpublished character of the Article, of Authors, on the obtaining of data and interpretation of results, Acknowledgments, Conflict of interests, Assignment of rights and Distribution

The ECORFAN-Mexico, S.C Management claims to Authors of Articles that its content must be original, unpublished and of Scientific, Technological and Innovation content to be submitted for evaluation.

The Authors signing the Article must be the same that have contributed to its conception, realization and development, as well as obtaining the data, interpreting the results, drafting and reviewing it. The Corresponding Author of the proposed Article will request the form that follows.

Article title:

– The sending of an Article to Journal of Applied Computing emanates the commitment of the author not to submit it simultaneously to the consideration of other series publications for it must complement the Format of Originality for its Article, unless it is rejected by the Arbitration Committee, it may be withdrawn.

– None of the data presented in this article has been plagiarized or invented. The original data are clearly distinguished from those already published. And it is known of the test in PLAGSCAN if a level of plagiarism is detected Positive will not proceed to arbitrate.

– References are cited on which the information contained in the Article is based, as well as theories and data from other previously published Articles.

– The authors sign the Format of Authorization for their Article to be disseminated by means that ECORFAN-Mexico, S.C. In its Holding Spain considers pertinent for disclosure and diffusion of its Article its Rights of Work.

– Consent has been obtained from those who have contributed unpublished data obtained through verbal or written communication, and such communication and Authorship are adequately identified.

– The Author and Co-Authors who sign this work have participated in its planning, design and execution, as well as in the interpretation of the results. They also critically reviewed the paper, approved its final version and agreed with its publication.

– No signature responsible for the work has been omitted and the criteria of Scientific Authorization are satisfied.

– The results of this Article have been interpreted objectively. Any results contrary to the point of view of those who sign are exposed and discussed in the Article.

Copyright and Access

The publication of this Article supposes the transfer of the copyright to ECORFAN-Mexico, S.C. in its Holding Spain for its Journal of Applied Computing, which reserves the right to distribute on the Web the published version of the Article and the making available of the Article in This format supposes for its Authors the fulfilment of what is established in the Law of Science and Technology of the United Mexican States, regarding the obligation to allow access to the results of Scientific Research.

Article Title:

Name and Surnames of the Contact Author and the Co-authors	Signature
1.	
2.	
3.	
4.	

Principles of Ethics and Declaration of Solution to Editorial Conflicts

Editor Responsibilities

The Publisher undertakes to guarantee the confidentiality of the evaluation process, it may not disclose to the Arbitrators the identity of the Authors, nor may it reveal the identity of the Arbitrators at any time.

The Editor assumes the responsibility to properly inform the Author of the stage of the editorial process in which the text is sent, as well as the resolutions of Double-Blind Review.

The Editor should evaluate manuscripts and their intellectual content without distinction of race, gender, sexual orientation, religious beliefs, ethnicity, nationality, or the political philosophy of the Authors.

The Editor and his editing team of ECORFAN® Holdings will not disclose any information about Articles submitted to anyone other than the corresponding Author.

The Editor should make fair and impartial decisions and ensure a fair Double-Blind Review.

Responsibilities of the Editorial Board

The description of the peer review processes is made known by the Editorial Board in order that the Authors know what the evaluation criteria are and will always be willing to justify any controversy in the evaluation process. In case of Plagiarism Detection to the Article the Committee notifies the Authors for Violation to the Right of Scientific, Technological and Innovation Authorization.

Responsibilities of the Arbitration Committee

The Arbitrators undertake to notify about any unethical conduct by the Authors and to indicate all the information that may be reason to reject the publication of the Articles. In addition, they must undertake to keep confidential information related to the Articles they evaluate.

Any manuscript received for your arbitration must be treated as confidential, should not be displayed or discussed with other experts, except with the permission of the Editor.

The Arbitrators must be conducted objectively, any personal criticism of the Author is inappropriate.

The Arbitrators must express their points of view with clarity and with valid arguments that contribute to the Scientific, Technological and Innovation of the Author.

The Arbitrators should not evaluate manuscripts in which they have conflicts of interest and have been notified to the Editor before submitting the Article for Double-Blind Review.

Responsibilities of the Authors

Authors must guarantee that their articles are the product of their original work and that the data has been obtained ethically.

Authors must ensure that they have not been previously published or that they are not considered in another serial publication.

Authors must strictly follow the rules for the publication of Defined Articles by the Editorial Board.

The authors have requested that the text in all its forms be an unethical editorial behavior and is unacceptable, consequently, any manuscript that incurs in plagiarism is eliminated and not considered for publication.

Authors should cite publications that have been influential in the nature of the Article submitted to arbitration.

Information services

Indexation - Bases and Repositories

LATINDEX (Scientific Journals of Latin America, Spain and Portugal)
EBSCO (Research Database - EBSCO Industries)
V|LEX (Global Legal Intelligence Platform)
RESEARCH GATE (Germany)
GOOGLE SCHOLAR (Citation Indexes-Google)
MENDELEY (Bibliographic Reference Manager)
REDIB (Ibero-American Network of Innovation and Scientific Knowledge- CSIC)
HISPANA (Bibliographic Information and Guidance-Spain)

Publishing Services:

Citation and Index Identification H
Management of Originality Format and Authorization
Testing Article with PLAGSCAN
Article Evaluation
Certificate of Double-Blind Review
Article Edition
Web layout
Indexing and Repository
ArticleTranslation
Article Publication
Certificate of Article
Service Billing

Editorial Policy and Management

38 Matacerquillas, CP-28411. Moralzarzal –Madrid-España. Phones: +52 1 55 6159 2296, +52 1 55 1260 0355, +52 1 55 6034 9181; Email: contact@ecorfan.org www.ecorfan.org

ECORFAN®

Chief Editor
VALDIVIA - ALTAMIRANO, William Fernando. PhD

Executive Director
RAMOS-ESCAMILLA, María. PhD

Editorial Director
PERALTA-CASTRO, Enrique. MsC

Web Designer
ESCAMILLA-BOUCHAN, Imelda. PhD

Web Diagrammed
LUNA-SOTO, Vladimir. PhD

Editorial Assistant
SORIANO-VELASCO, Jesus. BsC

Philologist
RAMOS-ARANCIBIA, Alejandra. BsC

Advertising and Sponsorship

(ECORFAN® Spain), sponsorships@ecorfan.org

Site Licences

03-2010-032610094200-01-For printed material ,03-2010-031613323600-01-For Electronic material,03-2010-032610105200-01-For Photographic material,03-2010-032610115700-14-For the facts Compilation,04-2010-031613323600-01-For its Web page,19502-For the Iberoamerican and Caribbean Indexation,20-281 HB9-For its indexation in Latin-American in Social Sciences and Humanities,671-For its indexing in Electronic Scientific Journals Spanish and Latin-America,7045008-For its divulgation and edition in the Ministry of Education and Culture-Spain,25409-For its repository in the Biblioteca Universitaria-Madrid,16258-For its indexing in the Dialnet,20589-For its indexing in the edited Journals in the countries of Iberian-America and the Caribbean, 15048-For the international registration of Congress and Colloquiums. financingprograms@ecorfan.org

Management Offices

38 Matacerquillas, CP-28411. Moralzarzal – Madrid-España. Phones: +52 1 55 6159 2296, +52 1 55 1260 0355, +52 1 55 6034 9181; Email: contact@ecorfan.org www.ecorfan.org.

Journal of Applied Computing

"Science education using Kaanbale virtual reality"

HERRERA-RODRÍGUEZ, Mariel, GUZMÁN-MUÑOZ, Marcela Yunuent, RAMIREZ-TURRUBIARTES, Felipe de Jesús and MARTÍNEZ CARREÓN María de Jesús
Universidad Tecnológica Cadereyta
Universidad Autónoma de Nuevo Leon

"Computational algorithm for search and detection of metabolites in CDF(GCxGCxMS) files"

AMARO-RODRÍGUEZ, Isidro
Tecnológico Nacional de México
Instituto Tecnológico de Durango

"HabitFun videogame as a tool to support the generation of good hygiene habits in elementary school children"

LUNA-CARRASCO, Claudia Yadira & LUNA-TREJO, Cupertino
Tecnológico Nacional de México/Instituto Tecnológico Superior de Huauchinango

"Analysis of Undamped Free Vibration Parameters using GeoGebra"

VALDEZ-APARICIO, María Magdalena, SANDOVAL-HERNÁNDEZ, Marco Antonio CRUZ-GOMEZ, Ángela and MORELOS-CUEVAS, Rogelio
Universidad Tecnológica de Xicotepec de Juárez

2531 2952
ISSN 2531 - 2952
www.ecorfan.org