DEVELOPMENT OF A PENSION SIMULATOR AS A KNOWLEDGE MANAGEMENT TOOL BASED ON THE SIMULATION OF EXPERIENCES

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Resumen

El objetivo de esta investigación es aplicar los conocimientos pertinentes para desarrollar una propuesta de Simulador de Pensiones, utilizada como Herramienta de Gestión del Conocimiento, que permita a los usuarios realizar el cálculo de su propia pensión futura y al mismo tiempo les proporcione más Información para la toma de decisiones. Los primeros pasos para determinar las características del Simulador de Pensiones consistieron en entender cómo calcular una pensión, en base a la regulación laboral, en este paso consultamos con muchos expertos del campo de Recursos Humanos. En segundo lugar, hemos integrado una matriz de trazabilidad de requisitos (RTM), alineada con la norma ISO / IEC / IEEE 29148: 2011 para validar los requisitos de la plataforma, así como los atributos de calidad (QA). En la tercera fase, integramos las especificaciones de requisitos de software (SRS) para desarrollar nuestro simulador propuesto, utilizando métodos ágiles para llevar a cabo este proyecto. Finalmente, validamos el simulador con algunos expertos. De las primeras ideas sobre este proyecto podemos inferir que las experiencias simuladas mejoran el proceso de toma de decisiones y su calidad, principalmente porque los usuarios pueden explorar muchos escenarios y ponerse en situaciones futuras pero reales.

Abstract

The objective of this research is to apply relevant knowledge in order to develop a proposal for Pension Simulator, used as a Knowledge Management Tool, that allows users to carry out the calculation of their own future pension, and at the same time provides them with more information for decision making. The first steps in determining the characteristics of the Pension Simulator involved understanding how to calculate a pension, based on labor regulation, in this step we consulted with many experts from Human Resources field. Secondly, we integrated a requirements traceability matrix (RTM), aligned with the ISO/IEC/IEEE 29148:2011 standard in order to validate the requirements of the platform as well as the quality attributes (QA). In the third phase, we integrated the software requirements specifications (SRS) to develop our proposed simulator, using agile methods to carry out this project. Finally, we validate the simulator with some experts. From early insights about this project we can infer that simulated experiences improve decision making process and its quality, mainly because users can explore many scenarios and put themselves into future but real situations.

Key Words | Pensions; Knowledge Management; Simulation; Human Resources

INTRODUCTION

The future of Social Protection Systems, specially the pensions issue is gaining attention all around the globe [1]. Not only as an issue to be addressed but as a real threat to social protection systems and national finances, in fact the World Economic Forum (WEF), identified this issue as one of the main global risks [2].

This research is a software development report, in which we have addressed an organizational issue, using available technologies, knowledge and expertise in many areas. In the first section of this research we characterized the problem to solve, then applying relevant knowledge and agile methods we designed and developed a Knowledge Management Tool [3], particularly a pension simulator, based on simulated experiences [4].

We divided our development in three phases: (1) first we determined the system architecture design, obtained information about pensions calculations through experts in the area of human resources; (2) then we integrated a requirements traceability matrix (RTM), aligned with the ISO/IEC/IEEE 29148:2011 standard [5], for software requirements specification (SRS), in order to validate the requirements of the platform as well as the quality attributes (QA) required; (3) finally, we iterated our software validation among software development experts and users. In this research, we present the software development process and some early insights about using simulated experiences.

Literature review

We faced the fourth industrial revolution, that is threatening to bring this evolution full circle: severely underfunded state social systems are at a breaking point, employers are backing away from traditional employment models and social protection contributions, and individuals once again are shouldering a larger share of the risks. Pension systems in OECD countries still focus on the challenges of population aging, the financial and economic crisis and the low-growth economic environment and low interest rates [6].

As longevity trends continue to increase and the threat of automation of jobs becomes very real, the sharing of this risk needs careful rebalancing in order to minimize potential human suffering intense pressure on pension and healthcare systems, and are spurring countries to increase retirement ages and encourage older workers to remain economically active for longer [2].

Indeed, it is expected that in Mexico by the year 2050 the number of retired workers constitutes 25% of the total population [7], reason why it has become an important subject for all public or private institutions. At the moment, the organization where we perform this project is in a scheme that does not reflect the current situation for pensions and retirements future viability. That is probably the main reason why this issue needs to be address as soon as possible, in order to support this pensions system through clear strategies to ensure financial viability of the organization, as a whole.

Therefore, it is needed to develop and implement approaches to better handle this problem, through information-based decisions. For this reason, we decided to used knowledge management tools (KMT) as a strategy for better decision making. Applying IT-based solutions such as a simulation platform, managers and workers can get the necessary information to take the appropriate measures to ensure that their savings are sufficient enough at the time of retirement.

This project is part of a greater one in a Public Higher Education Institution in Mexico. Consequently, after regard a variety of available options, we decided to develop a pension simulator that allows anyone to make their own pension calculation, from almost any computer or digital device, based on legal requirements and administrative provisions.

MATERIALS AND METHODS

Our role as a IT consultants was to develop a project related to useful information systems for data analysis and support decision making process within the institution. The objective of this work is to describe the software development process, passing from design phase to implementation.

About the project

Simulation is a key tool to knowledge management as it permits to take better decisions [4], data-models help to form organization strategies as well as allow the user get a clear view of the their results at any given values in time. This enables intuitive interpretation of the information as it allows interaction between the user with presented data. Simulated experiences exploit our natural ability to transform complicated information into actionable knowledge. KM itself can help to take better decisions [8] but when we rich KM Tools with simulated experience we can deliver better, ad-hoc, and accurate information for decision-making process.

Simulated Experiences allow user to analyze, simulate, interact and experience a more comprehensive and useful information about each particular case. So, they can reach better, more accurate information for decision making. As far no decision has a completely foreseeable set of outcomes, simulated experiences should be user-friendly, permit interaction, cheap and easy replicable, also we believe that they can be used as a communication tool. In sum, simulated experiences help people to understand the results of an analysis, but it does not prove the reliability of the analysis.

Proposal and software architecture

The simulator was developed using web technologies, a web-based application offers a lot of advantages over traditional desktop applications as it uses a website as the user interface. Through this technology anyone can access the application from any computer connected to the Internet using a standard browser in any operating system, instead of using an application that has been installed on their local computer, making it accessible also through mobile devices. It represents a cost-effective solution that can be updated and maintained in a single location and are scalable so can easily grow over time.

The simulator uses PHP programming language framework. It is a small footprint framework that its clearly structured and well documented as it uses a MVC model.

Based on guidelines for software development, recommended by World Wide Web Consortium (W3C) we tried to make it useful and easy to use, as an integral part of the simulation is the user experience.

(1) First, we conducted requirements elicitation as an iterative process thru simulations, prototyping and modelling.

(2) Then we validated those requirements by integrating a requirement traceability matrix (RTM) into the use of these simulations under defined conditions to show theoretical compliance. As it is showed in table 1.

(3) Consequently, we defined operational scenarios to bound a range of anticipated uses of the software, the intended operational environment and the user interface.

(4) According with, we logically modulate inputs and outputs of the systems and also user's interaction, considering legal restrictions and administrative provisions.

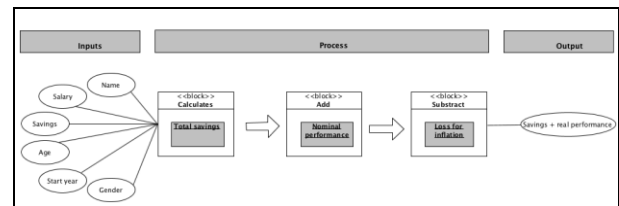(5) Finally, we developed the software under a common structure in which it could be easily maintained.

IMAGE 1: Logical model of entries - ends and user interaction

RESULTADOS Y DISCUSIÓN

Software aim and scope

Provide an estimate of the income to be obtained by the workers of the University of Guanajuato at the time of retirement, including savings plus actual return and total amounts due to liquidation or retirement.

System design

The simulator development process was carried out using a prototype methodology, where requirements were taken and software modeling was done based on the elaboration of a prototype. In this case, feedback was obtained from each version of the prototype in a process of continuous iterations until obtaining a final product that complies with the objectives of the institution and with the quality standards defined by the Department of Information Technology and Services) of the institution.

Table 1: Requirement Traceability Matrix

Requirement Type	Requirement Description
External interfaces	All inputs into and outputs from the software system: Inputs, Outputs
Functions	Fundamental actions that have to take place in the software in accepting and processing the inputs and in processing and generating the outputs: Validations, calculations, data visualization, error handling.
Usability	Measurable effectiveness, efficiency, and satisfaction criteria in specific contexts of use: Data consistency, adaptiveness compatibility, reliability.
Performance	Static and the dynamic numerical requirements placed on the software or on human interaction with the software as a whole: Capacity, running times.
Logical database	Information that is to be placed into a database.
Design	Constraints on the system design imposed by external standards, regulatory requirements, or project limitations: Standards, responsiveness, UI.
Software system attributes	Required attributes of the software product: System reliability, availability, security, maintainability, portability.

Structure

Based on the requirements defined for the calculation of the proposed figures and use cases, it was decided to divide the simulator into 3 modules: Pension, Liquidation and Retirement.

(A) A form is presented in which the user must enter his data, these fields are validated to ensure the integrity of the information entered.

(B) The calculation of the data is done through formulas with variables and constants defined by the human resources area of the institution.

(C) It shows the figures in a table ordered by item and amount to provide a total outstanding amount and the process that involved its calculation.

Technical details

Front-end: was developed using HTML technologies, JavaScript and CSS stylesheet (bootstrap), following the institutional guide of image.

Back-end: was developed using the PHP object-oriented programming language and a relational database in MySQL.

Implementation: The software is hosted on a cloud server solution using Apache web server with the PHP and MySQL language installed. The website is accessible through a sub-domain of on a static IP address.
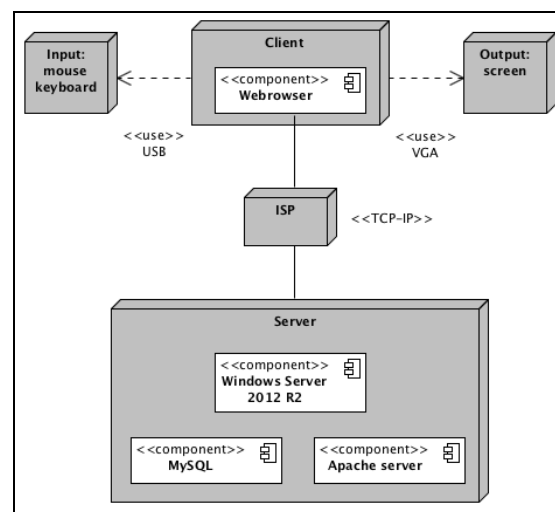
IMAGE 2: Component model

IMAGE 3: Landing page

CONCLUSIONS

The development of a pension simulator represents a crucial tool to fulfill the strategies proposed for the strengthening of the pension and retirement system of the organization. With the implementation of this software, it is hoped to provide the necessary validation to generate a comprehensive information system that allows us to reach the objectives and overcome the challenges posed by the social security issue in the institution.

i. Simulated experiences could improve the quality of the information that people obtain with respect to topics that are highly important for the future.

ii. KM tools can help to provide better consultancy to people, mainly because of the expert knowledge obtained from experts in the selected field.

Future work

This simulator sets the standard for creating a comprehensive pension, liquidation and retirement system for public institutions that are governed by federal and state social security laws. The benefits of a simulated experience are that they allow the use of these tools at any time and by anyone.

i. Decision makers should be advised about how the simulation works and how it calculates the outcomes given their inputs.

ii. Decision makers should be given time to interact with the simulation and make up their minds at their own pace.

iii. The simulation should incorporate uncertainties. For example, it should allow decision makers to experience different results given the same inputs when there is randomness in the underlying process.

ACKNOWLEDGEMENT

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