Electronic Urn - Technological Adoption To Improve Electoral Processes

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Abstract- Currently, with the use of technologies, the aim is to generate an environmental, economic and social impact that leads to a transformation and adoption in the improvement of operational processes within organizations and institutions. This project proposes an information system called Electronic Urn (SIUE,For its acronym in Spanish), which was designed with two objectives: Improve electoral operational processes of the Higher Education Institution, Unidad Central Del Valle Del Cauca, (UCEVA,for its acronym in spanish) using a development methodology called ICONIX1, with which it was possible to execute the stages that allowed to carry out the development of the application and support the learning and awareness of the policies in the good management of public resources, using strategies to comply with the policy of zero paper. The structure of the document starts from an introduction to the problem and justification of the reasons why it is proposed. The methodology summarizes the process of the technology used and the advantages of the application. The design shows the advantages of using the Laravel framework and the Vista Controller Model (MVC, for its acronym in Spanish,). Finally, the impact of the results of this project (SIUE).

Key-Words: Software Electronic Voting, ICONIX. Laravel, Electoral Processes.

[1] ICONIX It is a simplified process compared to other more traditional ones, which unifies a set of object orientation methods with the aim of covering the entire life cycle of a project.

1 INTRODUCTION

Currently there are many processes that are executed manually, as is the case of the election process. Through the academy, strategies are being generated to motivate, teach and promote the promotion of the cultural processes of elections. This type of process generates a series of activities that require both financial and human resources and that guarantee the continuous improvement of the institution.

The office of general secretary of the UCEVA, supports all the processes of elections like: election of representatives of students before the directive council, election of representatives of students before the council of faculty, election of representatives of teachers before the directive council, election of full-time teachers' representatives before the academic council and the designation for the UCEVA rectory [1]. Each of these processes requires participation, generation of time, logistics, financial and human resources, as well as responsibility for the preservation and security of information. Each call demands a series of internal procedures that generate manual processes, which do not contribute to the good management of Public resources and the strategy of zero paper [2].

The institution as a public entity must be aligned within the strategic plans of the national government, in the article "Online Government as a Good Government Strategy" that seeks to find different ways for management in public entities to be optimal thanks to the strategic use of technology and guarantee the security and privacy of information [3]. This means that all entities of the public administration must advance the respective actions indicated by the National Government and through the Ministry of ICT, that their policies can be integrated into the strategy in order to guide best practices, guides, standards that they will facilitate the adequate use of technology to support the different services to the entities and the fulfillment of their mission. A process of elections within the UCEVA must carry out (7) institutional activities organized in the following sequence: Call, Candidate registration, Organization and coordination, Elections process, Partial scrutiny, General scrutiny and Declaration of the winning candidate.

1.1. Justification

There are two basic reasons to point to the use of the web application: first, to reduce the costs associated with the logistics required by an election process, especially when counting the votes and publicizing the final scrutiny ; secondly, to comply with zero-paper policies in public institutions, providing an innovative and agile solution, leaving aside the physical cards and promoting the provision of a more dynamic service for the sufferers of the academic community; law 892 of 2004 the Government seeks to establish electronic voting, in addition to article 39 of Law 1475 of 2011 that reiterates this obligation [4].

1.2. General Objective

Implement a web information system that allows contributing to support the electoral processes of the Unidad Central Del Valle Del Cauca.

2. METHODOLOGY

The Electronic Urn Information System (SIUE), consists of 4 roles: system administrator, candidates, juries and suffragers, the SIUE system allows the administration of users with their respective roles, generating a more efficient and secure control.

The system allows candidates to be registered in a process where data is uploaded

to the application and the administrator user carries out the verification according to the order of arrival, automatically assigning a number as a candidate.

The system does not allow to see results of the votes towards the candidates until the administrator closes the election process, it also has a graphical interface that allows the juries to take control of the total of voters, total of voters, total amount and those who are in voting processes.

In the reports, the application allows to save the historical graphs of the election processes that are made over time, the results can be carried as support for the same institution.

The Database will carry encryption passwords configured through a local area network (intranet) and https protocol (Hyper Text Transfer Protocol Security) [5], where the suffragans are validated through the delivery of a document which is enabled in the system by a jury, from their rating they have a certain time (20 seconds) to make their vote in the digital cubicle, later when their vote is registered successfully the subscriber is blocked. The use of this type of technology, proposes to improve the processes that are carried out manually, decreasing costs, time and resources in the institutions.

For the development of the Electronic Urn Information System (SIUE), an Iconix software development methodology [6] was followed, which includes: Requirements Analysis, Preliminary Design and Analysis, Design and Implementation.

a) Analysis of Requirements: In this phase the actors were identified with their respective processes and activities, through meetings with the main user in the General Secretary office.

Table I. Actors involved in SIUE

ACTORS	OBJECTIVE
Administrator	Module Elections (Elections, Closing of Elections, Faculties, Program, Juries) Module Calls (Candidates) Voting Module (Suffragers, Import Suffragers) Reports module.
Juries	Jury Module (Validation of Suffragettes)
Suffragers	Voting module.

b) Analysis and Preliminary Design: In this phase, each of the system requirements was modeled, taking it to a use case diagram in which it describes the functions of each one of the actors.

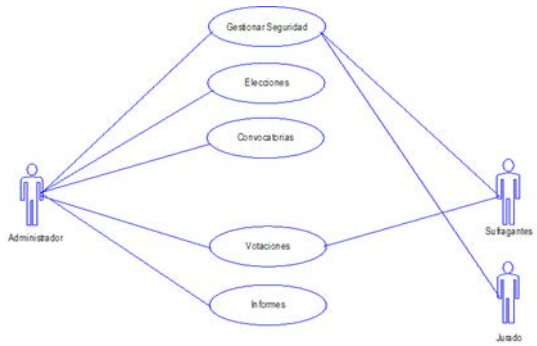

Figure 1. Diagram of use cases

c) Design: In this phase the sequence diagrams were made for each use case and thus the messages between the different objects were identified and then the different classes were created to represent the structure of the system.

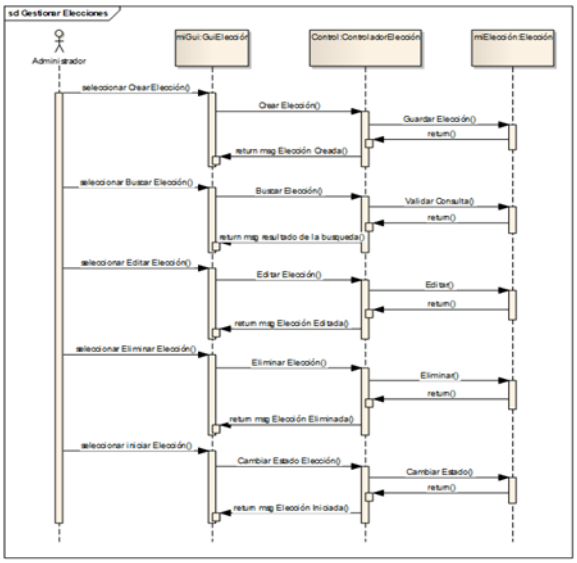

Fig. 2. Sequence diagram

d) Implementation: In this phase the component diagrams were made, in order to show the physical distribution of the elements that make up the internal structure of the system. Field tests were performed to measure the performance of the application.

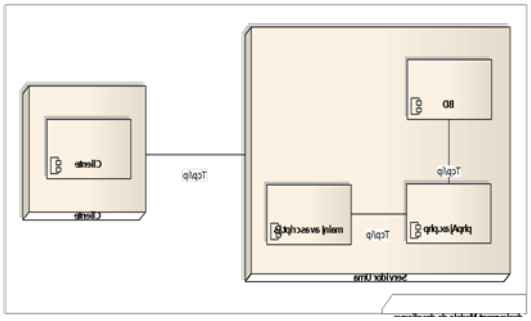

Fig. 3. Components diagram

3. DESIGN

For the realization of the design of the SIUE system, it was taken into account the most punctual characteristics to be optimized, such as verification of the sufferer's identity, the casting of the vote, the counting of the votes and the transmission of the results. Electronic voting is classified according to the technology used. In this way, three types are identified: (a) the automation of processes carried out on paper (for example, reading votes using optical mechanisms), (b) direct electronic registration (RED), where digital voting machines are used and includes embedded voting systems known as kiosks or ballot boxes and (c) online voting, online [7]

The automation process began with online voting, as shown in Figure 4. System architecture.

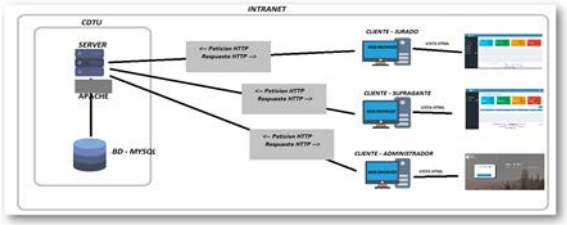

Fig. 4. Architecture of the SIUE information system

This technology is the one that presents bigger and more complex challenges. For example, voter identification involves offering reliable solutions to prevent a person from voting several times and having no identity theft. In addition, given the operation of the system, the server in which the votes cast will be stored will keep a trace of each person avoiding violating the secrecy of the vote.

To provide security to the information system, the internal or intranet network of the Unidad Central Del Valle Del Cauca is used. The suffragette will have to be validated by the jury consulting the database of SIUE; which is subsequently authorized. The voter moves to the cubicle where there is a touch screen, where you can vote. If the voter attempts to vote again, the system controls and denies access as it cannot be authorized by the jury.

The Electronic Urn Information System (SIUE) implements the proposed client server model in the Laravel Framework [8], which is illustrated more explicitly in

Figure 4. Where the system allows three different types of interfaces for the jury, administrator and suffragers.

4. RESULTS

The results of the development of the electronic information system (SIUE) can be seen in the application of the tests in the election process of student representative before the board of directors in the periods 2017-1 and 2017-2, which show below.

Fig 5. electronic greeting card

Development results: SIUE is installed on a server located in the Technological Development Center UCEVA (CDTU[2],for its acronym in Spanish), using the private network infrastructure, the clients of the application make https requests to the APACHE web server, later the request is sent to SIUE and then communicates with the Databases, if necessary; Finally, the web server returns the https response to the client, the application currently provides three (3) access levels, a sworn client who is in charge of enabling the voters to perform the vote, administrative client, is in charge of the general administration of the application as to create elections, users, suffragers, generate reports, among others and its fragrant client, which is responsible for making the vote after being activated by the jury.

[2] CDTU - Technological Development Center UCEVA, created in 2008. Technological space that contributes to the accompaniment of the degree works and research projects of the Systems Engineering program.

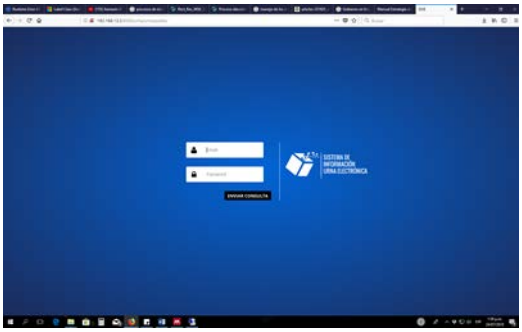

Fig. 6. Start or login interface.

SIUE, it has a Dashboard, see figure 6, or main screen, which shows on the screen the election that is in execution status, providing information about the voters who are enrolled in that election, voter registration, registration of voters pending to vote, among others. The administrator can create elections, create candidates, import list of voters through Excel files, this can also start the election process and in turn has the necessary permissions to close it. Likewise, he generates reports and statistics automatically at the close of each election.

Fig. 7. Administrator user dashboard

Once the subscriber enters their identity document and accesses the application, the virtual card will appear (Figure 7), in which the candidates appear. The voter must select an option to be able to vote; once the candidate for which he is going to vote has been selected, the system displays a pop-up window asking the voter to carry out a verification of the vote. In terms of security,

there were some local protection services against attacks or entry attempts: traffic filtering, intrusion detection and prevention (IPS), part of the Fig. 7. Virtual card.

The balancing of traffic was not taken into account due to the low participation of students, and as regards the application Firewall, the main server used by the institution was used [9].

Evidence: In the tests carried out in the 2017 elections with the student representatives before the board of directors, the database of all the students of the institution (4289 students of the different programs), two candidates and one vote in white, allowing to test the scalability and security of the system. At the end of the closing of the electronic ballot box the system showed the results and it was possible to show the respective winning candidate figure 8.

Figure 8. Electronic simulation report Urn.

Currently, the platform is being used in the classrooms, creating microworlds of learning in the management and administration of information systems, where students participate with roles such as juries, administrators, suffragers and candidates. By having this type of applications, spaces can be created of teaching where the learning about the Information System is strengthened, how it works and the handling of the information.

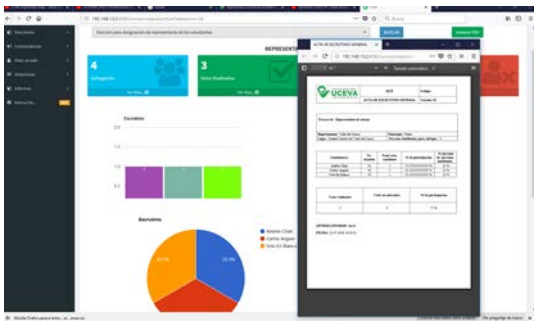

Figure 9. Final scrutiny.

The importance of final scrutiny is the most crucial stage where results are transmitted in a timely, transparent and accurate manner to make visible the confidence of the elections and above all in the integration with technologies [10].

Figure 9 shows the final report after the close of an example election and the close scrutiny act in which the percentages per candidate and blank vote are summarized.

5. CONCLUSIONS

Through the Information System Electronic Urn, it was possible to address a problem of practice and learning that led to integrate the application of development methodologies between their phases resulting in; a system that helped to improve electoral processes, make visible a right and a duty as citizens, especially in students. The ICONIX methodology was used for development, in a client-server model, expanding a practical and rigorous solution, complying with the requirements set and demanded; from the cognitive point of view and from a practical point of view. We lived an enriching knowledge with new practices and an experience on this type of technologies, allowing to exploit the potential as a professional future in the areas of engineering.

The electoral scenarios within the institution may have an Information System that allows access to the improvement of

electoral processes, Electoral accessibility and participation of the community, in addition to contributing to good government policies in terms of: good management of resources public and zero paper strategies. Regarding the design of SIUE, with the new Frameworks technologies it allowed that the model seen controller, was more organized intuitive and safe at the time of developing each one of the layers of the software.

In the results of the election where SIUE was tested, it was found that the system has an advantage over the manual system, generating a decrease in administrative, financial and logistical efforts, because a manual election process incurs more costs, time and resources that SIUE. In the manual system, official results are given the following day, in SIUE the results are immediate at the close, In the manual system, the cards must be printed, listings and the cubicles rented, with SIUE being invested in equipment only once and used for each election .

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