Computer Room Failure Reporting System for a Higher Education Institution

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Abstract. Computer rooms are essential spaces in higher education institutions, they are used for classes, laboratories, and practice sessions related to the various academic programs. In order for students to be able to use computer room equipment without any inconvenience, it must be in perfect working order. Nevertheless, it is very common for computer room equipment to experience malfunctions as a result of excessive or improper use. Therefore, it is essential that these malfunctions are identified and communicated promptly so that they can be resolved by those responsible for equipment maintenance. To address this need, SisReport is proposed as a platform that allows students affected by device failures to make a direct report to the maintenance area. The proposed system will be evaluated from the point of view of user experience. The evaluation of the first version of SisReport involved students, teachers, and the Information and Communications Technology (ICT) team of the Institución Universitaria Colegio Mayor del Cauca. The findings of the evaluation showed that the proposed system is effective for notifying equipment failures in computer rooms compared to the current manual way. The system described in this article can be used by other institutions of higher education to facilitate students' reports of failure of computer equipment in the computer rooms.

Keywords: Web Development · Failure Reporting · User Experience · Computer Rooms

1 Introduction

Higher Education Institutions must comply with the standards established by the Ministry of Education or similar entities in each country in order to provide a quality education service. One of the items to be considered is the technological resources, and it is the obligation of the institutions to guarantee the

Supported by Institución Universitaria Colegio Mayor del Cauca.

M. Tabares et al. (Eds.): CCC 2023, CCIS 1924, pp. 35–44, 2024.
https://doi.org/10.1007/978-3-031-47372-2_4

number and availability of equipment to carry out educational activities such as classes, practices, and laboratories. Ensuring the availability of computer equipment involves preventive and corrective maintenance. Systematization of the maintenance management processes is an existing need in these institutions, in order to facilitate communication and the sending of fault reports between equipment users and the people in charge of their maintenance.

1.1 Problem Description

The computer rooms of a higher education institution are one of the most important tools and spaces to carry out classes, laboratories, and practices of all programs. In most of these institutions, the computer rooms are shared by the different academic programs offered, therefore the use of computer equipment is constant and demanding. It is important that this equipment is in perfect condition in order to guarantee its availability. However, in several of the institutions, the procedure to report failures by teachers or students is not clear, in some cases, it is not known who should address a failure report. Therefore, it happens very often that equipment can remain damaged for weeks, without the people who make up the maintenance team being aware of the damage and therefore it is not being repaired.

Given the importance of the equipment in the computer rooms of higher education institutions, there is a need to implement maintenance actions for the equipment in order to guarantee its availability and permanence over time. This makes it necessary to implement tools to improve administration and management. Several questions arise: Does a web application that allows notification of damaged equipment in computer rooms facilitate the reporting of damages and the attention to them? What is the information needed to make a report? and what is the easiest and most efficient way to report a computer equipment failure?

2 Related Works

A review of the literature on the "Computer Room Fault Reporting System" was conducted using Google Scholar, Springer and IEEE Xplore as sources. Specific keywords related to the topic were used and studies published in the last ten years, related to computer room equipment, were prioritized. The information obtained was organized and analyzed in a synthesis matrix. Keywords: Web Development, Fault Reporting, User Experience, Computer Rooms.

Search string: "Web Development" or "Bug Reporting" and "User Experience" and "Computer Rooms", other string: "User Experience" and "Computer Rooms" or "Web Development" and "Bug Reporting". The results obtained from the search strings were refined, initially by reading the abstract of the papers. As inclusion criteria, articles and papers related to computer rooms or laboratories were considered. Papers related to other types of equipment were excluded.

Table 1. Synthesis matrix results of the literature review.

Paper title	Description
Web control system for requests and failure reporting in the computer equipment of module 4	The objective of this project was to improve the reporting of failures that were done manually and without adequate follow-up. The problem posed is similar to the one presented in this article. They propose an administrative module to obtain a history of requests and reports. This element will be considered in the design of the proposed solution
Development of maintenance management system for computer equipment in the Educational Unit El Triunfo	It proposes to implement a management and maintenance control system for computer equipment, automating processes and improving incident management. An interesting feature of this proposal is that the software product considers the status of the report and which person is responsible for performing the maintenance
Control and management tool for computer classrooms at Universidad Minuto de Dios (CMAC)	This work coincides with the proposal being presented in that the authors identified the need for software to optimize the operation of computer rooms. Similarly, it also uses a web platform to facilitate reporting
Implementation of a failure a reporting system that allows of failure analysis to improve the machine reliability index	This system allows recording failures, classifying them by systems and subsystems, and obtaining monthly reports to analyze the progressive behavior of the machines. In the work presented in this paper, the aim is to make monthly reports on the reports and the maintenance performed
Improved failure reporting through an app	In this project, it detects that one of the drawbacks is the inaccurate information in the report made by the users of the equipment that fails. In this work, we propose as a solution the categorization of the possible failures that an equipment can suffer. The maintenance team will be consulted to see if they use categories for the types of failures

The most important findings are summarized in Table 1. The results found in the literature review evidenced the importance of systematizing the failure-reporting procedure in computer rooms. Applying technologies such as the web, artificial intelligence or the Internet of Things can help to improve the equipment maintenance procedure. The projects have shown that by automating this procedure, problem detection and resolution can be accelerated, downtime can be reduced and user experience can be improved. However, the specific conditions of each institution require the adaptability of the software to different environments and the long-term evaluation of its effectiveness and sustainability.

2.1 Similar Software Products

A non-systematic search was carried out in the Google search engine and in mobile application stores for software products similar to the one that is to be developed in this work. Four web applications similar to the one to be developed were explored. These applications were ServiceNow [6], Spiceworks [7], Asset Panda [8] and GLPI [9]. The Table 2 shows a comparison between the four products explored and eight characteristics identified.

Unlike these applications, the proposed system focuses exclusively on the reporting and tracking of laptops, computers and peripherals in the university environment. This allows for a focused and simplified experience for the users: students and university professors. From this review, it is sought that the report information is complete so that the maintenance team can identify the equipment to be repaired and the failure it presents. The importance of the functionalities for the administrator and for the maintenance team that should be included is evident.

Table 2. Comparison of similar software products.

Characteristics	ServiceNow	Spiceworks	Asset Panda	GLPI
Incident management	Included	Included	not included	Included
Change management	Included	not included	not included	Included
Problem management	Included	not included	not included	Included
Configuration management	Included	not included	not included	Included
Asset management	Included	not included	Included	Included
Code labels	not included	not included	Bars and QR code	not included
Life cycle of assets	not included	not included	Included	Included
Web platform	Included	not included	Included	not included

3 Methodology

The methodology used is based on a five-phase approach, which seeks to integrate different procedures proposed by Viloria [?] for conducting applied research. The phases of preliminary, organization, development/execution, completion and maintenance will be followed, adapting them to the needs of the project. In the preliminary phase, a diagnosis of the problem, characterization of the target audience, and background review were carried out. The second phase, called organization, defined the problem, the objectives and the planning of the project. The development and execution phase involved the definition of the elements of the equipment failure reporting procedure. In this phase the Scrum management framework was followed. A sprint 0 was performed where the requirements were defined and 3 sprints were proposed, each one with an objective and an evaluation focused on the user experience. The last phase called culmination is projected to evaluate the project and its achievements.

4 Results

At the Institución Universitaria Colegio Mayor del Cauca, it was identified that the process of reporting equipment failures in the computer rooms is manual. The problem identified was the lack of knowledge of the failure reporting process and the lack of accurate and complete information on the reports made. These two shortcomings were identified in several of the higher education institutions in the city of Popayán. The equipment failure reporting procedures observed showed long repair times since the failures were not reported and the few reports made did not have the necessary information for the maintenance team. The problem identified can be seen Fig. 2. The elements identified to systematize the process of reporting equipment failures have been included in a web application that allows students and university teachers to make the reports and facilitate the entry of the correct and necessary data. The proposed system has been named SisReport.

4.1 SisReport

This is a software product oriented to students and professors of a higher education institution, who face problems and technical failures in the equipment belonging to the computer rooms of the institution. The SisReport product is a web-based system that facilitates the reporting of failures, which seeks to improve the efficiency and speed in responding to requests for maintenance of computer room equipment. Unlike manual ways of fault reporting such as mail or voice-to-voice notification to the support team, this product is faster to use and does not require travel or search of the personnel in charge, allowing users to quickly notify the support team about any technical problem. In addition, our product provides real-time information on the status of service requests, ensuring efficient communication between users and the support team, adapting them to the needs of the project (Fig. 1).

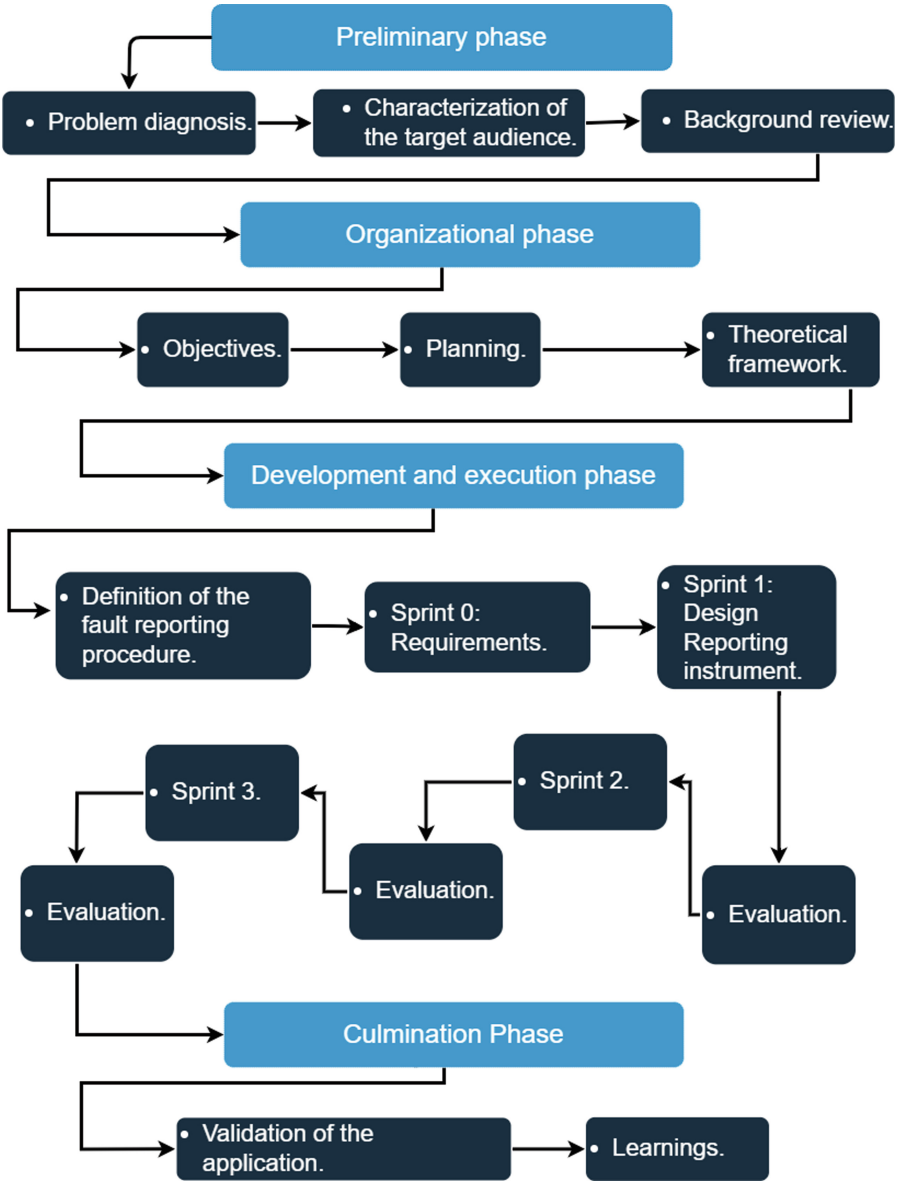


Fig. 1. Phases and activities of the methodology

In the SisReport requirements approach, seven user stories were initially identified, and 2 to 4 acceptance criteria were associated per story, see Table 3. Three iterations were planned with an approximate duration of two months. At the end of each iteration, acceptance tests were carried out with a group of student users and directors of the information and communication technologies management team of a higher education institution in the city of Popayán.

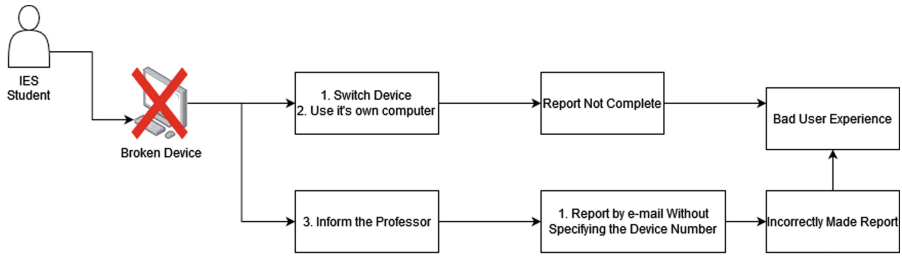


Fig. 2. Problem statement

Table 3. User Stories of the first version of SisReport.

User stories	User	Priority
Report Failure	student or professor	7
Receive Failure Report	Maintenance Team	6
Modify Report Status	Maintenance Team	5
Assignment of reporting responsibility	Maintenance Team	4
Importance Report Rating	Maintenance Team	3
Query report status	student or professor	2
Supplemental Report	student or professor	1

For the first iteration, the test report histories and the visualization of the report by the maintenance team were considered. The user experience is considered to seek ease of use, seeking to meet the needs and expectations of users, reducing the possible difficulties that may arise when reporting a failure of computer equipment. The Fig. 3 shows a basic schematic of the SisReport architecture.

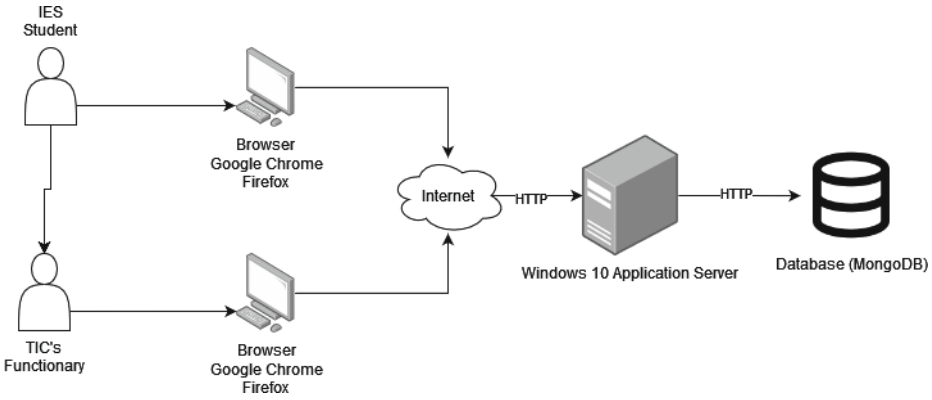


Fig. 3. SisReport Schematic

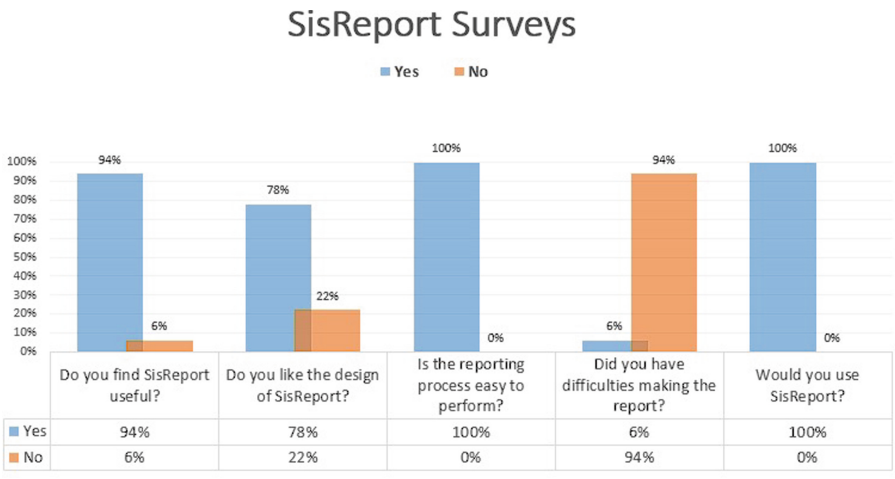
4.2 Evaluation of the First Version of SisReport

The first iteration of development lasted three weeks, and a first evaluation of the product was planned to estimate the following items: Usefulness of the proposed product, The information required in a bug report, and identify difficulties of this information, in addition to evaluate the usability and interface design of the product.

The evaluation was carried out within the framework of an academic event where the results of academic projects of the faculty of engineering are presented. Eighteen students and professors from the Institución Universitaria Colegio Mayor Del Cauca participated in the evaluation, who were able to get to know and interact with the SisReport prototype and then evaluate it through the application of a survey. The questions asked were: Do you find SisReport useful? Do you like the design of SisReport? Is the reporting process easy to carry out? Did you have difficulties in making the report? What suggestions do you have for SisReport? Would you use SisReport? Would you recommend the use of SisReport for the institution?

Of the eighteen students and university professors surveyed 94%find SisReport useful. 78% like the design, 94%consider that it is not difficult for them to make a report. 100%would use SisReport. Among the suggestions they made was to make it easier to enter the team identifier, since the report asks for the room number and the team number, the latter of which is not always known by the student. One possible solution that the development team is going to consider is to use a QR code to increase the reliability of the information in the report and facilitate the entry of the information, improving the user experience.

A second evaluation was carried out with the participation of three members of the management team. In this evaluation we considered the correctness of



	Do you find SisReport useful?	Do you like the design of SisReport?	Is the reporting process easy to perform?	Did you have difficulties making the report?	Would you use SisReport?
Yes	94%	78%	100%	6%	100%
No	6%	22%	0%	94%	0%

Fig. 4. Results of the SisReport version 1 surveys

the information considered in the report of the failure of a computer equipment and the usefulness of the report to initiate the maintenance required by the equipment to be repaired (Fig. 4).

Regarding the appreciation of the support team members, the surveys revealed that SisReport is considered very useful by the ICT team. In addition, they are satisfied with the design and find it easy to use. They recommend its implementation in the institution. Some difficulties identified include user verification, report validation and status verification. They suggest improving the system with a mobile version, email alerts of report status, and the ability to add observations by the maintenance team. These suggestions will help strengthen the system and meet user needs.

5 Preliminary Conclusions and Future Work

The need for software systems in higher education institutions is constant, especially for systems that support the performance of daily tasks and facilitate communication. The system development process involves requirements identification techniques and technical tasks. It is considered that the evaluation of the quick versions allows improving the quality of the product and refining requirements and validating the data in the reports to achieve a functional product with a good user experience. The evaluation of the first version shows that SisReport would facilitate the correct and prompt notification of damaged equipment, which would allow the maintenance group to attend to requirements more promptly, providing satisfaction to students and teachers when their requests are attended to.

The project will continue to be developed. SisReport will include a form that facilitates reporting, specifically the recognition of each piece of equipment without the need to enter the number or code, thus avoiding errors. The implementation of a QR code to identify the equipment and its location within the institution will be evaluated, as well as the development of a mobile version. In addition, notifications to the student's email facilitating the interaction and solution of the ICT team. Future versions should consider how to validate the student making the report to avoid false reports. These improvements will contribute to optimize the reporting process, ensure efficient communication, and provide users with a more pleasant and satisfactory experience.

Eventually the product is proposed to expand to other entities outside the IES, such as banks, offices, or other institutions that need to strengthen communication with their technical service, for this a user identification system (Login) can be implemented based on the environment where the software is required. When the software is integrated into other environments it is necessary to have a ChatBot, which can give possible quick solutions, depending on the problem that is described, as there are situations where the technical service can not come instantly, these improvements will help ensure the adaptability of the software in new environments where it is very demanding.

Acknowledgements. We are grateful for the support of the research system of the Institución Universitaria Colegio Mayor del Cauca for the realization of this project url: https://unimayor.edu.co/web/.

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