Development of an inventory system for the control of fixed assets based on RFID technology

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Abstract. Radio frequency identification technology allows remote information to be obtained through radio waves between two or more objects. This technology is based on a tag that is attached to the back of the elements, it contains the information of the Fixed Assets and emits radio signals that are sent to a server to enter that information into a database that is housed in an application and from there take a control. This project manages to develop a system of inventory of fixed assets in the laboratory of biochemistry of the University of Santander, Bucaramanga headquarters using RFID technology (radiofrequency identification) through passive tags that work at ultra-high frequencies (UHF) purpose, reduce costs, time and make the inventory process more efficient, it also allows a traceability of Fixed assets, avoiding losses and allowing a better control of them.

1. Introduction

Currently, RFID systems allow a wide range of applications and their multiplicity is expected towards other solutions within companies [1-3]. One of the applications of this system is the control of inventories with RFID technology, the tracking of assets rises to a new level, end users enjoy faster and more integrated services, and are safer than the systems used in the process present.

The large companies of production, commercialization and other sectors that possess the technology of identification by radiofrequencies manage to take advantage of obtaining information safe, these systems have been of great support in the control of inventories thanks to his capacity of identification and automatic traceability [4]. Today losses in the inventory are not admissible, just the RFID technology helps to reduce these inconveniences and increase the efficiency and lightness of the processes, by means of the exact handling of the information [5-7].

The management of information is one of the most important resources of companies, the need to improve conditions and optimize processes has led companies to depend in some way on technology to help maintain control of information. It results in the development of information systems that help generate a competitive advantage in a company through technological and systematic processes [8].

This project responds to a problem that was presented in the taking and control of the inventory of the Biochemistry laboratory of the University of Santander, generated primarily by the control of its fixed assets, this project helps and improves the development of the processes by means of RFID technology, and it is expected that it will not only be implemented in the Biochemistry Laboratory but will also be extended to other dependencies of the university so that it can optimize the taking of inventories of its fixed assets and thus significantly improve its processes.
2. Methodological design

To comply with the objectives and the proposal of the present project, an investigation was carried out that had a qualitative approach, because the data collection technique was qualitative research. This research was participatory because it sought to improve the process of inventory verification and was conducted to identify in depth the different elements that responded to the problem, allowing to have clear concepts and knowledge necessary for the development of this.

In the first phase the current inventory process of the biochemistry laboratory at the University of Santander was diagnosed. It was carried out by three specific activities as it follows: a dynamic check list was created according to the process, then the main data was obtained and processed and investigated the inventory process, and at the end the information was analyzed and interpreted.

In the second phase an action plan was drawn up through the guidelines established in the ISO 28000 standard to implement continuous improvement processes in the inventory area. In this phase were developed the next three activities: the ISO 28000 standard was revised to establish the aspects to take into account for the preparation of the plan, then the improvement processes to be implemented were defined and finally an action plan table was drawn up, which defined the modifications, activities to be carried out, the time it would take and the necessary resources.

In the third phase the pilot test was carried out using simulation software that demonstrated the feasibility of RFID technology in the inventory. For this phase the following actions were considered: first, the Zebra team was trained, then the tags used for metallic assets and non-metallic assets were known and the management software of the Zebra team was known.

Finally, the phase number four was developed, in this one the RFID technology was implemented in the current inventory process of the biochemistry laboratory to optimize the process, reduce time and improve the traceability of inventories. Four activities were carry out: first the tags were adhered to the fixed assets that corresponded to the biochemistry laboratory that would replace the bar codes in which it had been worked, then the tags were read with the Zebra team, next the inventory previously registered was compared with the assets read by the Zebra team and its management software and at last the system efficiency was determined with RFID versus efficiency with the bar code system.

The instruments used for the development of the project were: Checklists used to diagnose and collect information about the inventory verification process in the Biochemistry Laboratory and diagnose compliance with the safety management system NTC-ISO 28000 [9]. Interview direct personal interview with the director of fixed assets, two assistants of this department and the head of logistics at the University of Santander, creating an interaction that allowed obtaining appropriate information for the development of the project. This research technique was used to analyse the functioning of the bar code system in the biochemistry laboratory of the University of Santander, which gave us important results for the realization of this project.

3. Results and discussion

The current inventory process of the biochemistry laboratory of the University of Santander was diagnosed, through management tools such as dynamic checklists that allowed the detection of critical control points. Among the main ones we can highlight the following items: inventory taking, inventory verification, asset news, bar codes.

It was determined that the radio frequency identification system could significantly contribute to the process in terms of the aspects that were determined to improve. The system has a range of operation of three meters which indicates that the assistants could perform the verification without having direct contact with the assets or require physical effort, the system has a function that allows an asset to be searched quickly, better control of assets [10].

The system allows the verification of the inventory in an automatic way, significantly reducing the time of the process as well as when a personnel change is made, due to the efficiency it allows to increase the frequency with which this process is carried out. This system has a software that allows to compare the inventory that is verified with the previous inventory and allows detecting differences in the amount of assets quickly, reduces errors in coding and allows the reuse of TAGS since it can be
modified the information and be assigned to another Asset when required. A pilot test was carried out in the Biochemistry Laboratory of the University of Santander, using simulation software that demonstrated the applicability of RFID technology in the inventory. Reference equipment RFID 8500 brand Zebra was the reader selected for the development of this project, this is compatible with the UHF RFID (Ultra High Frequency) technology. For its operation was necessary to connect Bluetooth with a device mobile which had this type of connection and its Android system, has a range of operating frequency from 902MHZ to 928MHZ and its distance reading range depends on the quality of the TAG, generally 3m.

The labels used were white thermo-printable labels for various applications, which allowed the control and traceability of fixed assets. Within the technical specifications we find that they have an operating frequency of 840MHz to 960MHz. This type of tags has a considerable speed and gather the characteristics that were required to perform the reading of fixed assets efficiently. Similar results were obtained in relation cost-benefit [11-12].

The 62 tags were adhered to the fixed assets, which were located next to the barcodes. Subsequently we proceeded to read the tags with the Zebra team and the mobile device in which he read all those that had adhered. The time it took to verify the inventory of the 62 assets was one minute twenty-four seconds. At the end of this phase it was determined that the tests carried out in this project were carried out successfully. Making a complete comparison of the technology used previously, for example, the technology of bar code versus RFID technology was determined to significantly improve the inventory verification process of fixed assets, since it went from having a duration of 20 minutes to a duration of 1 minute 24 seconds, decreasing the verification time 18 minutes 76 seconds, the 93% were showed in Figure 1.

![Average inventory verification time of 62 fixed assets (min)](image)

**Figure 1.** Verification times with the two technologies.

4. **Conclusions**
RFID technology has a wide variety of applications to improve processes within companies, from the supply chain management to the inventory processes of Fixed Assets. It was concluded that the efficiency of RFID technology is greater than that of bar codes, optimizes the times in the execution of fixed asset inventories. RFID-based systems provide a simple and effective way to ensure that data in the field is captured and transmitted in real time with accuracy, eliminating human errors. The verification with RFID technology provides an easier and more practical way of doing the work, knowing what time / date the activities are carried out, tracking and localization, in such a way that it executes a constant audit. The RFID system allows obtaining information in real time, obtaining updated information for analysis and decision making. RFID technology can be used in any unit and area of the university to improve its processes.
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