A WEB INFORMATION SYSTEM FOR BASIC INDUSTRIAL TECHNOLOGY (METROLOGY)

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Abstract: This article deals with the development of a metrological infrastructure Web system. This is the first system developed for universities and research and development institutions in Brazil. This system is a first module the of this Web system in Federal Center for Technological Education of Minas Gerais (CEFET-MG) called "Basic Industrial Technology" - TIB (Portuguese acronym).

Keywords: metrology, basic industrial technology[1], Web system.

1. INTRODUCTION

The "Basic Industrial Technology" –TIB (Portuguese acronym) [2, 3, 4] is a government program that includes a set of tools that provide the[2] technological basis for the development, enhancement, creation and innovation of products, processes and services. TIB's tools involve techniques in common use by the various economic sectors from our society: industry, commerce, agriculture and services. The main TIB's tools are: metrology, conformity assessment, technical standards, intellectual property, and information technology.

In recent years, Basic Industrial Technology and Metrology have been the target of several Brazilian government actions, such as:

The construction of a strategic document to promote the use of TIB in State of Minas Gerais [5]. This strategic plan was built based on: a) A survey of 526 small enterprises in several segments: biotechnology, liquor, shoes, electronics and telecommunications, fruit, casting, dairy products, furniture; b) A set of proposals resulting from a collective work of experts from TIB.

New research funds for investing in TIB, promoted by FAPEMIG [6] (foundation of the state government for promoting scientific and technological development).

3. The construction of a Web Education Center, in 2007, called ENTIB [7], by INMETRO (National Institute of Metrology, Quality and Technology), SBM (Brazilian Society of Metrology), FINEP (Financier of Studies and Projects in Brazil), and other institutions.

4. The construction in 2007 of SIBRATEC - Brazilian System Technology - in order to support the technological development of the sectors, especially metrology and testing [8].

5. STRATEGIC GUIDELINES FOR BRAZILIAN METROLOGY 2008 - 2012. Document [9].

6. ODSLEC Project. Study of Supply and Demand for Laboratory Services Calibration and Testing in Brazil, held by INMETRO, in 2009 [10].

7. The implementation of a pilot program, named BITIB, between the INMETRO and FAPEMIG for the purpose of the popularize TIB in the universities. This work is a result of this program.

CEFET-MG [1] is a public institution that comprises technical courses, undergraduate and postgraduate courses. Moreover, CEFET-MG is involved in several projects in different areas, such as: materials, electronics, automation, computing, chemistry, civil and mechanical engineering.

In this context, we propose and implement a structured system of basic industrial technology and developed the first module that handles the infrastructure of metrology. A Web information system for Basic Industrial Technology (TIB) in academy is necessary for:

- Disseminate and manage demands and supply of information about tools for TIB in each 12 campus and of the various business segments of CEFET-MG;

- Optimize and avoid duplication of testing machines, equipment and measuring instruments in the various laboratories of the existing institution units;

- Provide information to support the decisions of policymakers of CEFET-MG (directors, researchers and professors) on TIB issues, in particular about metrology, so that scarce resources are allocated more efficiently;

- Expand the supply of measurement, calibration and testing services;

- Enable integration with other databases that will be available later in other institutions of the same nature.

Thus, in the work we propose the design and implementation of a web based information system for Basic Industrial Technology, which will be very useful in order to attend these explained needs and benefits.

The remainder of this paper is organized as follows. Section 2 describes some related work. Section 3 presents the description of the web information system for TIB, explaining the organization and technical details of it. Finally, Section 4 presents our conclusions and future work.

2. RELATED WORK

Studies about information systems for TIB showed that a significant number of them are related to the area of metrology. We did not find out any system comprising more than two distinct tools (or modules) for TIB.

The existent systems developed for metrology are designed to achieve certain standards (e.g., ISO 9000, ISO 10012-1, ISO17025, ISO GUM) and some specific segments, such as: industrial laboratories and accreditation institutions [14, 15, 16, 17, 18, 19]. In the segment of universities In Brazil, we did not find out any related work.

Some works [20, 21, 22, 23, 24, 25, 26, 27] present important technical information that should be take into account in order to develop a metrology system.

Our system was designed and implemented considering the main needs of a university or research center, including activities related to teaching, research and consultancy services. From the main sets of data that the system can manage, we could cite:

i. Indicators of the quality and the services provided by each laboratory (type, range, uncertainty and standard);

ii. All data necessary to ensure the maintenance, quality, reliability and traceability of instruments;

iii. Location via web and accreditation of each laboratory;

iv. Information about students, teachers and researchers working in the laboratory. Thus, the system, besides providing the supply of existing services, it enables to identify the demand for laboratory services by researchers.

3. THE WEB INFORMATION SYSTEM FOR BASIC INDUSTRIAL TECHNOLOGY

The project of the Basic Industrial Technology web system (called Portal TIB of CEFET-MG) aims to map and provide information about the infrastructure of the laboratory services in our institution. Basically, the project consists of the following stages:

1. Map the potential demand for laboratory services for testing and calibration in the research groups of the departments of the institution;

2. Identify and map the institution infrastructure by identifying the ability to offer laboratory services for testing and calibration, including specification of the tests, quantities, measurement ranges and measurement uncertainties inherent;

3. Design and construct a database of laboratory services of the institution, providing a web system for teachers and researchers.

As a result, this procedure will provide an opportunity to broaden the scope of work and will thus allow an improvement in the quality of the researcher's activities. Finally, it is important to note that this is not a simple database of measuring equipment, but a web-based system for organize and qualify metrology services.

3.1. SYSTEM MODELING

For correct modelling of the system, we work with an expert in basic industrial technology, with her support we were able to build a consistent model for the system. This model is very complete and robust, which allows multiple data to be searched, and also provide usability to the system. The relational model of the database of the web system can be seen in the Figure 01.

As can be seen in this figure, the database consists of various information, which is provided according to the logic and necessity of the system's user. For a better visualization of the model presented in Figure 01 and due to space constraints, we omitted all attributes of the entities.

Some of the main entities of the database are:

Laboratory: entity responsible for storing all records from the institution's laboratories. Here we can find information such as name of the laboratory, its location, building, telephone contact, etc.

Equipment: entity responsible for storing all information about equipments that the institution has, and the laboratory that it is associated. Here we can find information such as product name, manufacturer, purchase date, height, width, weight, model, etc.

Team: entity responsible for recording all teams that perform some activity in the laboratories. Here we can find information such as name of the team and the people who are part of it.

Responsible: entity that stores the people who are responsible for certain teams and departments. Here we can find information, such as the name of a function, among others.

Department: this table is stored in all departments of the institution that have laboratories under its control. In this entity we can find a contact phone number, e-mail contact, department name, and other information.

3.2. RESULTS

As a final result, we obtained a System, which allows full management of data about metrology in an easy, intuitive and efficient way. The System has an administrative area that allows only authorized persons to have access to the data, only those people pre-registered in the system is allowed to access the database to create new entities and add or modify data.

In order to develop the system we use Python[30, 31], which is a dynamic object-oriented programming language. It is a general-purpose programming

language. It can be used for many kinds of software development. The design purpose of the Python language emphasizes programmer productivity and code readability.

We used the Django framework. This is a high-level Python Web framework that encourages rapid development, clean, and pragmatic design. Django was designed to handle two challenges: the intensive deadlines of a newsroom and the stringent requirements of the experienced Web developers who wrote it. It lets you build high-performing and elegant Web applications quickly.

As a database system, we adopt MySQL. The MySQL database has become the world's most popular open source database because of excellent high performance, high reliability and ease of use. It is also the database of choice for a new generation of applications built on the LAMP stack (Linux, Apache, MySQL, PHP / Perl / Python.) Many of the world's largest and fastest-growing organizations including Facebook, Google, Adobe, Alcatel Lucent and Zappos Rely on MySQL to save time and money powering their high-volume Web sites, business-critical systems and packaged software.

In Figure 02 we see the homepage of the web system. This page allows the common users to search for all the information they want to know about the basic industrial technology.

In Figure 03 we see some fields of the equipments that can be inserted at the web system. This screen examples how the entities can be manipulated in the web system. The other entities can be added, changed or deleted in the system in a similar way, following a set of standard interfaces and functionalities.

Finally we see the administration page of the system (see Figure 04), which shows all the characteristics of the system, allowing the various data to be registered, changed and deleted.

The information system is available on the web in the following address: http://tib.decom.cefetmg.br.

The next section presents our conclusion and future work.

4. CONCLUSION

In this work we propose and develop a web-based system of basic industrial technology and developed the first module that handles the infrastructure of metrology. In recent years, Basic Industrial Technology and Metrology have been the target of several Brazilian government actions, which motivates our project and emphasize the importance of it.

Our project aims to model, map and provide information about the infrastructure of the laboratory services in our institution, considering the area of metrology. The implemented system allows full management of data about metrology in an easy, intuitive and efficient way.

In order to evaluate the system, we perform a cooperative work with different areas of our institution, including materials, electronics, chemistry, civil and mechanical engineering.

As results of this work, we can highlight: a better management of the demands and supply of information about tools for TIB in the different institution campus; Optimization of the use and management of the testing machines, equipments and measuring instruments in the various laboratories of the institution; and provide information to support the decisions of policymakers on TIB issues, in particular about metrology.
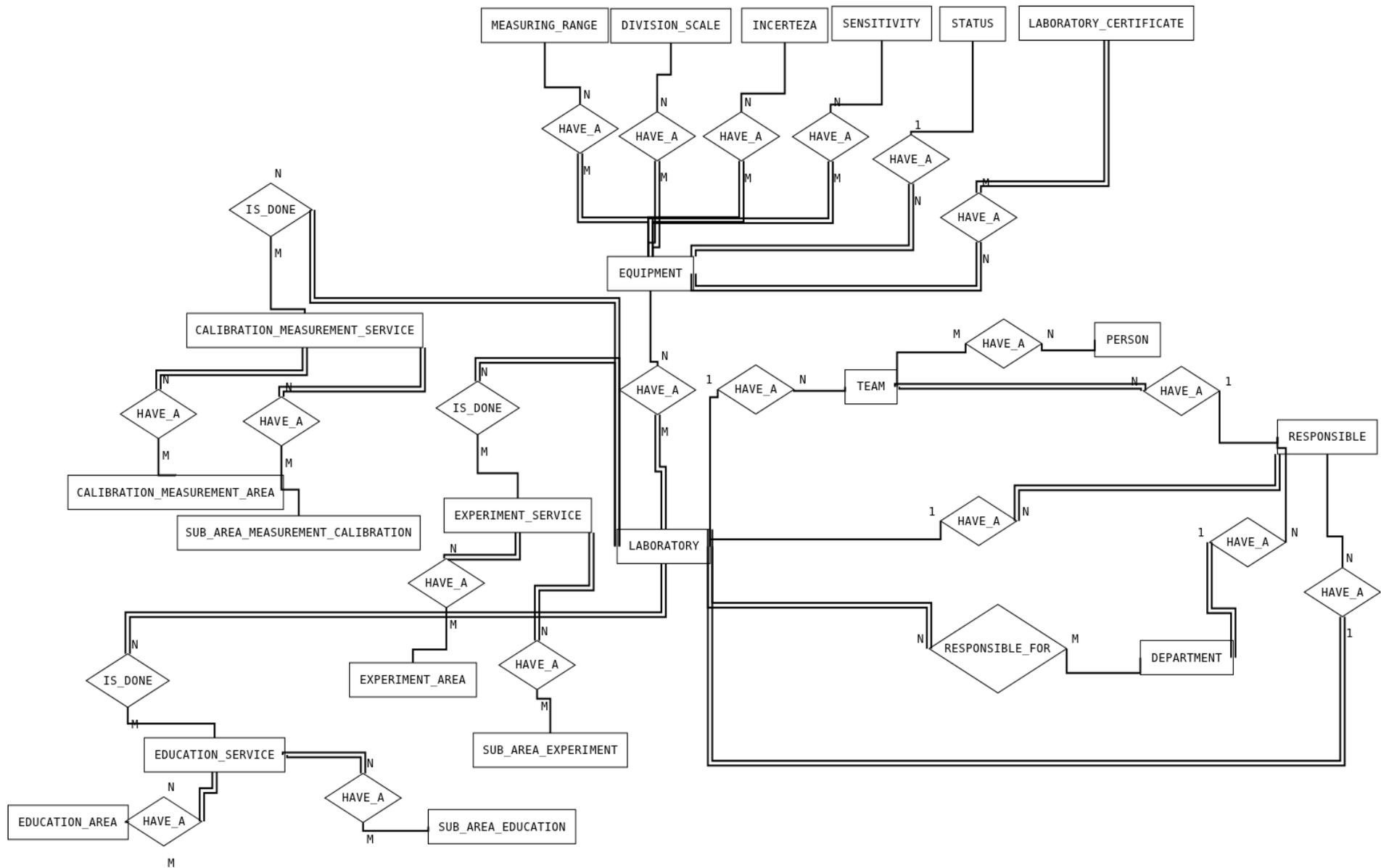
As future work we want to improve the system, providing new features and information retrieval tools to make easier the use and management of the metrology resources. Moreover, we plan to design and implement new modules in the system, considering the other areas of basic industrial technology.

5. ACKNOWLEDGMENTS

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Figure 01 – Database modeling
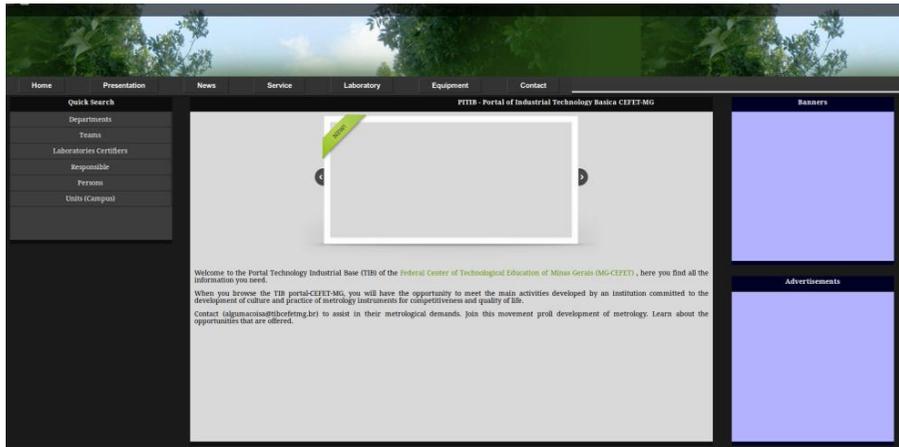
Figure 02 – Homepage of Portal

Figure 03 – Web system – example of a functionality

Figure 04 – Web system - administrative functionalities