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COMPUTER AIDED LABORATORY ACCREDITATION PROCESS. MEASUREMENT DATABASE AS AN INITIAL STAGE OF SOFTWARE APPLICATION

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Abstract

The problem of quality of laboratory test results is essential in the context of their future application for example in machine design. Usually quality of test results means their reliability. To achieve it laboratories often tend to accredit their tests in national accreditation bodies. For example in Poland PCA (Polish Centre for Accreditation) is the national governmental body that controls the process and states that a laboratory fulfills the requirements of the PN-ISO/IEC 17025 standard. To fulfill the requirements means to introduce a lot of effort in technical and organizational areas of activity. In order to help and support such activities the attempt of elaboration of computer aided accreditation software is being developed. One of the key issues of the problem is to maintain measurement processes on the proper level. Measurement database can be a useful tool at the initial stage of accreditation activities. The paper presents its assumptions with reference to the management system.

Keywords: *quality, accreditation, reliability of tests, measurement data base*

1. Introduction

Testing laboratory is a place that connects worlds of science and engineering. Performance and conclusions obtained from research activities are a base for descriptions created by science and innovations implemented in engineering. Without dividing customers into categories with reference to a branch a laboratory has to deliver service characterized by the best quality. It was assumed, basing on own experience and references, that creation of customer's satisfaction in laboratories is possible by the usage of ISO/IEC 17025:2005 standard [4]. According to [2] the practical benefits of technical and management quality improvements are seen on a daily basis in the laboratory. Faster identification and resolution of issues regarding methods, personnel or equipment, improved customer satisfaction, meeting quality requirements of specialized customers, and overall increased laboratory business are all the result of implementing an effective quality system.

As it was mentioned the problem of accreditation based on the consists of two parts: technical and management. While the second one is usually referred to well known ISO/IEC 9000 standard series and it is possible to find a lot of information on the issue so the first one has not been described sufficiently enough. As a result an author of the paper, supported by scientists working

in the environment of strength and fatigue testing laboratories, decided to elaborate and develop software tools to implement, maintain and manage the quality system in accredited testing laboratories with a special reference to strength laboratories. The main aim of the work is to develop the methodology of implementation of quality system with accordance to ISO/IEC 17025:2005 standard on the base of propose software. Additionally, the aim of software is to face the most often problems connected usually with documentation, both traditional and electronic. Moreover the system will help in exchanging experience of laboratory specialists by communication with authors.

What is more important in the context that modern generations communicate and work usually with usage of IT tools. While in the 1960s computers started to be implemented step by step in industry systems of files started to remove traditionally gathered and processed data. Since then database systems have started to become a standard tool [5][6].

The goal of this paper is to present the basic assumptions for computer aided laboratory accreditation process with a special reference to measurement database as its initial stage.

2. Basic assumptions for designed software

Designed software consists of 7 modules that are able to work independently. They can be a part of the management system (8^{th} application – as in the algorithm) built in a different way what can increase the number of potential users. On the other hand the efficient working of individual modules can lead to implementation of all modules that support the system in the whole.

System based on the proposed software can eliminate present problems, especially in the area of traditional and electronic documentation, facilitate the fulfilling of accreditation requirements, and enhance exchange of experience [5].

Software, referring to requirements of ISO/IEC 17025:2005 standard, was divided into two groups:

1) Requirements referring to management system (documentation, internal audits, corrective and preventive actions, management system reviews).

2) Requirements referring to technical area (testing method, measurement database, personnel)

To facilitate the programming process (especially in the context of application of object-oriented programming) the above division was presented in fig. 1.

There are a lot of available applications connected with the management area but with reference to the designed software they have a number of disadvantages. First of all such applications are usually connected with ISO 9000 quality standard series. Second of all, as a consequence, they are not focused on technical requirements. Moreover, both areas are not connected so such applications are not efficient from the point of view of successful accreditation process [5].

Proposed system fully reflects requirements specific for electronic systems, i.e.:

- digital signature,
- backup copies,
- data integrity.

Fig. 1 shows also relations among individual modules.

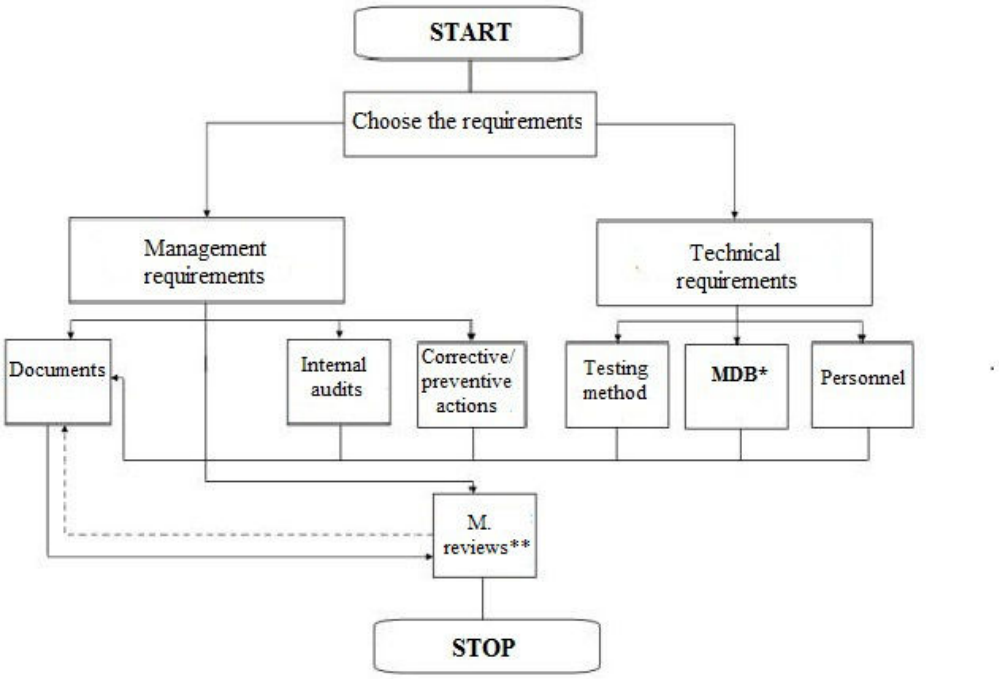

*Fig. 1. Algorithm of computer aided accreditation software in testing laboratories, *MDB – measurement database, ** M. reviews – management reviews [5]*

3. Measurement database as a part of designed software

3.1. Goal of the database design

Databases are likewise found at the core of many scientific investigations. They represent the data gathered by astronomers, by investigators of the human genome, and by bio-chemists exploring the medicinal properties of proteins, along with many other scientists [5].

The power of databases comes from a body of knowledge and technology that has developed over several decades and is embodied in specialized software called a database management system, or DBMS, or more colloquially a „database system." DBMS is a powerful tool for creating and managing large amounts of data efficiently and allowing it to persist over long periods of time safely. These systems are among the most complex types of software available. The capabilities that a DBMS provides the user are [1]:

a) Persistent storage. Like a file system, a DBMS supports the storage of very large amounts of data that exists independently of any processes that are using the data. However, the DBMS goes far beyond the file system in providing flexibility such as data structures that support efficient access to very large amounts of data.
b) Programming interface. DBMS allows the user or an application program to access and modify data through a powerful query language. Again, the advantage of a DBMS over a file system is the flexibility to manipulate stored data in much more complex ways than the reading and writing of files.

c) Transaction management. A DBMS supports concurrent access to data, i.e.: simultaneous access by many distinct processes (called "transactions") at once. To avoid some of the undesirable consequences of simultaneous access, the DBMS supports isolation, the appearance that transactions execute one-at-a-time, and atomicity, the requirement that transactions execute either completely or not at all. A DBMS also supports durability, the ability to recover from failures or errors of many types.

Having in mind the above definitions the main goal of the designed database has to be fulfillment of direct requirements of the standard [4] with the special emphasis put on the chapter 5. Moreover a manager of a laboratory has to have in mind such documents as ISO 10012:2004 „Measurement management systems — Requirements for measurement processes and measuring equipment" and proper documents of governmental accreditation bodies on the topic. They have to be associated with documentation of laboratory management system (quality manual, procedures etc.). It is essential for the laboratory to describe the process of hardware and software maintenance.

At this stage it is worth to add that the standard [3] defines measuring equipment as „measuring instrument, software, measurement standard, reference material or auxiliary apparatus, or a combination thereof, necessary to realize a measurement process".

Measuring equipment should be properly identified and consequently followed by certain information that can be processed. One can not divide metrological processes from other activities so measurement database seems to be an essential part of the whole computer aided accreditation software [5].

3.2. Measurement database in the management system

With accordance to the proper levels of management, taking into consideration information transformed with the usage of the database, on individual levels of management following actions are taken:

a) laboratory manager – decisions on purchasing of measuring equipment and usage of reference/ calibration equipment,
b) quality manager – management on proper maintenance, service and proper usage of measuring equipment as well as issues connected with metrological confirmation,
c) each laboratory technician – realization of individual activities resulting from suitable documentation on measuring equipment with reference to own scope of responsibilities.

Assuming that one of the issues in the measuring process is calibration different people are responsible for different actions. Laboratory manager decides if one can use for example gauge blocks or a calibrating thermometer in individual cases, but the quality manager makes a decision about time intervals between calibrations. He or she also decides about service activities while action can be taken directly by a laboratory technician.

In the process of calibration the above mentioned people, everyone in a different range, have to deal, at least, with following documents of the management system:

a) measuring system maintenance procedure,
b) calibration procedure,
c) lists of measuring equipment,
d) charts of calibrations,
e) equipment card,
f) unit list,

g) equipment labels,
h) schedule of calibrations,
i) calibration reports.

Working on example on the base of instruction on calibration of thermometers as an output information one will receive a report.

In the context of creating of the database it is essential to build connections and interactions among suitable data i.e.:

a) block gages and Vernier caliper, calibrating and calibrated thermometers etc.,
b) assignment of responsibilities directly for equipment in the context of people/ places/ functions/ rooms, ,
c) customer's requirements and measurement ranges and time intervals of calibrations,
d) customer's requirements and information obtained from measurement maintenance and service (i.e. Analysis of trends with reference to previous calibrations) ,
e) choice of subcontractors in the range of calibration services.

4. Summary

In the paper basic assumptions or initial works connected with design of the database of measurement equipment working as a one of the modules of computer aided accreditation software were presented.

Information connected with individual measuring tools and relations among them, depending on a laboratory unit, can be different. But even in the case of a small laboratory it is impossible to analyse data gathered within years of activity without an influence on realization of other activities and responsibilities. Application of databases gives more possibilities in the context of making strategical decisions. If, in the context, one considers an accreditation of testing laboratories it seems as an efficient step not to ignore any experience in the range of database systems.

Complete software, basing on the knowledge and experience in the range of accreditation of testing laboratories should be an essential support for scientific and industrial organizations that will to increase reliability of performed tests.

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