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Instytut Spawalnictwa Computer Welding Platform (ISCWP)

Abstract: The article presents stages dedicated to creating, developing and implementing an integrated IT solution of Instytut Spawalnictwa, i.e. Computer Welding Platform (ISCWP). A Computer-Aided Welding Personnel Management System, being one of IWP modules, has introduced a new standard of information exchange in the system of personnel training and certification. The article also describes the remaining IWP modules, i.e. Welding Engineer Website and Knowledge Base. These modules enable collecting and sharing information related to the research potential of domestic and overseas research establishments as well as to innovative technological solutions developed in such establishments. All the modules make up a modern system of communication between innovators and users of welding technologies. Due to Internet-based solutions, Computer Welding Platform can be accessed at any time from any place in the world.

Keywords: Instytut Spawalnictwa, computer welding platform, KSOP, welding personnel management;

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In 2003, the then Marketing Centre of Instytut Spawalnictwa expressed the necessity of starting a CRM system (i.e. Customer Relationship Management). In addition to standard requirements set for systems supporting contacts with clients, the CRM system was expanded in accordance with the Centre's needs by incorporating modules for managing seminars and conferences. At the stage of formulating assumptions for the system development, it was agreed that the system should be based on Internet technologies, i.e. technologies used by IT specialists developing applications used over the Internet. Back then, over 10 years ago, such solutions were not very popular. Most software programmes addressing multiple users were created in order to be applied in Local Area Networks, using client-server solutions requiring client software to be installed on each client computer. From today's perspective, the choice of such an approach was undoubtedly correct, as the system expanded in subsequent years with new modules led to the creation of an integrated IT solution, i.e. the Instytut Spawalnictwa Computer Welding Platform (ISCWP).

Since the beginning of the 21st century, the solution has evolved in many directions, yet always the primary goal of changes has been to create new, previously unavailable, solutions allowing work to be done faster and easier, and to provide "computer-based" integration of widely defined Polish welding personnel. For 10 years works have been performed in stages, with every stage being dedicated to one specific issue [4].

Stage I: 2005-2007

Stage I was concerned with the creation a system for information and communication,

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concerning the education of welding personnel and NDT personnel being an element increasing competitiveness of welding engineering companies. Stage I involved the creation of databases containing directives, harmonised standards, guidelines and product-related standards in the part concerned with training and qualifying welding personnel and NDT personnel as well as a database of educational centres and forms meeting international requirements. Stage I also involved the development of an Internet-based communication system providing access to the network of centres educating in accordance with international requirements and continuous knowledge development through "newsletters" and a question-answer system.

The stage involved the creation of the website *http://www.spawcity.is.gliwice.pl* enabling access to collected and subject-based information in relation to welding education. The resources can be accessed by all visitors without having to log in to the website. It should also be mentioned, that the main website has also been provided with a zone for logged in users enabling logging into the Instytut Spawalnictwa Computer Welding Platform (ISCWP) (Fig. 1).

Fig. 1. SPAWCITY website

Instytut Spawalnictwa's education activity requires methodical and very accurate documentation of all training-related actions taking place both at Instytut Spawalnictwa (at the Centre for Welding Personnel Training and Supervision and at the Certification Centre) as well as in all outside training centres collaborating with Instytut Spawalnictwa. For many years, documenting records has been done traditionally, i.e. by a group of workers filling out paper forms. Presently, the amount of circulating documents is too large to be processed manually both in terms of increasingly strict quality and time-related requirements. For this reason, it was necessary to take advantage of computer-aided methods [5].

While creating a computer system, it is possible to use ready-made (so-called off-the-shelf) software, modifying it to meet one's own needs. In such situations, software development is obviously easier. However, the specific character of courses conducted at Instytut Spawalnictwa, and particularly of the harmonised EWF/IIW Training and Qualification System performed in accordance with international standards, has excluded the use of software available on the market as such software simply did not exist. Therefore, it was necessary to develop an entirely new proprietary system [2].

Stage II: 2008-2010

Many years of research and experience have enabled the development of the Computer-Aided Welding Personnel Management System (CAWPMS). The major assumption of the CAWPMS was its versatility and eliminating the necessity of installing software on client computers (some centres do not allow users to interfere with installed software). Therefore, the Internet was used, as due to such a solution the CAWPMS can be accessed via any internet browser from anywhere in the world.

The first module developed contained a welder training system with two major processes, i.e. the management of courses and course participants (training centres, preparation of examination reports) as well as the management and generation of documents at Instytut Spawalnictwa (Certificates and Welder's Books). The CAWPMS operation was described in detail in issue no. 5/2013 of the Bulletin of Instytut

Spawalnictwa. For present users, the description presented can be some kind of a manual, whereas for those who have not yet used the solution in the training centre, the description can encourage and inspire a decision to implement the system. Since 2009, all documents have been created in the newly-developed system. After a one-year waiting time, dedicated to in-depth testing and detecting errors (if any) in this, still, complicated system, it started being implemented, first, in outside training centres [1].

Providing training centres with the possibility of accessing the CAWPMS on-line has significantly reduced (even to just one week) the time elapsing between the issue of a post-examination report and the reception of related documents confirming obtained qualifications. It has become possible to significantly reduce error-related problems which usually resulted in extending the time which participants had to wait for their new documents. Centres using the CAWPMS can view all entries related to qualifications, courses and course participants (collected in this very centre). The system helps manage qualifications, allowing the creation of various tables and lists based on, e.g., methods, expiry dates etc. It should also be emphasized that the system helps reduce delivery costs connected with documents sent via post or courier mail, which is the case in centres not connected to the system. Presently, over 400 welder training centres use the CAWPMS; in 2014, the number of centres using the system on an on-line basis exceeded 100 and continues to grow.

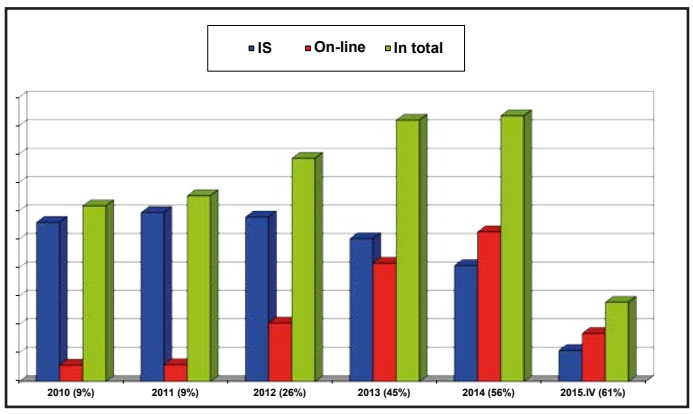

Fig. 2. Number of reports sent on-line via the CAWPMS

Figure 2 presents the trend of growth in the number of reports sent on-line.

The extension of the CAWPMS included adding a module for managing courses addressed at NDT personnel; the module is significantly more complicated to manage than that for managing welder courses. The module is responsible for the organisation of groups of course participants, verification and qualification for courses, admission to examinations and issuance of documents (such as course completion certificates, certificates of competence, NDT personnel ID cards) as well as for the whole system of supervision over qualifications and certificates. The NDT personnel management system includes all levels of qualifications and the BASIC course for all testing methods. All courses for NDT personnel end with the issue of documents generated in the CAWPMS, which also enables complete supervision over certificates.

The third CAWPMS module is dedicated to welding personnel training at an international level and is used in collaboration with universities being ATBs (i.e. Approved Training Bodies). The welding personnel management system according to international requirements, though to some extent similar (in terms of IT) to the NDT personnel management system, contains many different and separate processes, such as, for instance, the process of qualifying and admitting participants to courses and examinations (preconditions). Also the system of issuing documents is different as the first document received by a course participant after passing a related examination is a diploma (Polish or European). Afterwards, the participant can apply for a certificate of competence (Polish or European). As diplomas and certificates are of two kinds (i.e. Polish or European), it is necessary to prepare the system for issuing documents in various combinations.

Following the NDT personnel training principles and those formulated in international requirements, in the computer system there is

also a strict division into training and certification centres.

Stage III: 2011-2013

During many years of its research and implementation activity as a research centre, Instytut Spawalnictwa has collected hundreds of developments and publications. For this reason, the next stage of the system extension involved creating an IT solution enabling digital gathering and sharing of research resources in the form of the Base of Knowledge. At the very beginning of the solution development it was assumed that resources collected in the database would be divided into such areas as research works and technological solutions, technological needs of enterprises, research potential of research centres, structural materials, fatigue tests, environmental engineering in welding and education.

Integrating the Computer-Aided Welding Personnel Management System with bases of knowledge for research environment led to the creation of the Instytut Spawalnictwa Computer Welding Platform (Fig. 3).

Stage III also involved the creation of the Welding Engineer Web Portal enabling logged users to access resources collected in the database (e.g. personal qualifications). The Portal can be used for checking expiry dates of qualifications and information about completed courses. The modularity and flexibility of applied solutions make it possible to adjust configuration for individual users having varied rights to access data (Fig. 4).

Stage IV: 2014-2015

In 2003-2004, within the Multi-Annual Programme "Adaptation of Working Conditions in Poland to European Union Standards" coordinated by CIOP-PIB, in collaboration with Department of Resistance and Friction Welding and Environmental Engineering and with the Information Technology Department, a database at Instytut Spawalnictwa was created, containing characteristics of welding processes and of filler metals in terms of the size and type of pollutant emissions – Eco-Welding (Eko-Spawanie). In Poland, the programme developed at Instytut Spawalnictwa is the only source of information concerned with indexes of pollutant emissions in welding processes. The database is used by welding technologists, services responsible for health and safety at work and by designers of ventilation systems. The project-related assumptions involved making a single-station database installed on users' computers supporting the Windows operating system. The database implementations in industry are now counted in the hundreds. However, the greatest limitation of the solution dating back to 2004 is the lack of automatic update of results of subsequent tests concerning other materials and welding processes.

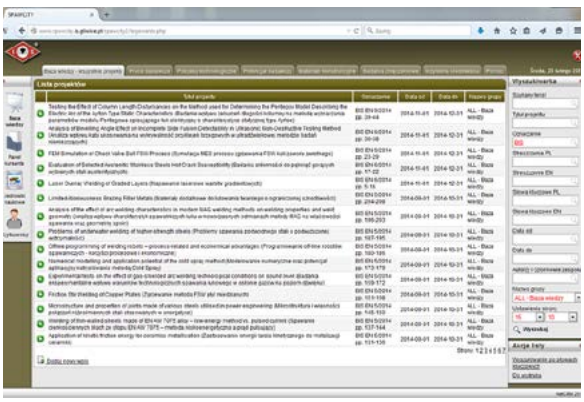

Fig. 3. Exemplary window of Base of Knowledge with a list of retrieved projects

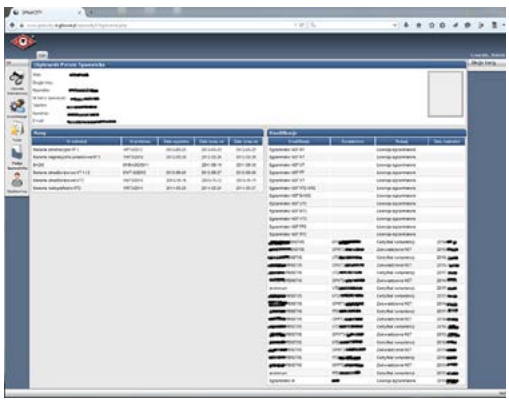

Fig. 4. Exemplary window of Welding Engineer Web Portal with a list of completed courses and obtained qualifications along with expiry dates

For this reason, in order to eliminate the inconvenience mentioned above, works which are presently in progress aimed to create the advisory system i-EcoWelding (i-EkoSpawanie) enabling the access via the Internet (through the

Computer Welding Platform). All logged in users will be able to access updated information at the same time. The start of the advisory system is planned to take place at the beginning of 2016. In relation to the Eco-Welding software, the new advisory system will be extended and provided with computational modules facilitating decision-making as regards the selection of methods and joining process conditions aimed at reducing pollutant emissions into the work environment. The previous division into covered electrodes, solid wires, flux-cored wires and filler/brazing metals, i.e. welding consumables, will undergo modification and extension. The modification will be connected with introducing the main division (in the database) into welding processes (i.e. fusion welding, weldbrazing, pressure welding, cutting and brazing). Since the recent update of the EcoWelding programme, the Department of Resistance and Friction Welding and Environmental Engineering has performed many tests with new filler metals and welding consumables. These research efforts will provide the advisory system with new tests results concerning pollutant emissions accompanying welding and allied processes [3].

Summary

The Instytut Spawalnictwa Computer Welding Platform was developed and implemented due to two large IT projects performed at the Information Technology Department of Instytut Spawalnictwa. The first project entitled "System for Information and Communication in Education of Welding Personnel and NDT Personnel as an Element Improving Competitiveness of Welding Engineering Companies" was conducted in 2006-2008, within Priority 2 – Strengthening the Human Resources Development in Regions of the Integrated Regional Operational Programme 2004-2006.

The second project, i.e. POIG.02.03.00-00-003/10 "Computer Welding Platform of Knowledge and Research Potential with the Extension of the IT Infrastructure of Instytut Spawalnictwa", was conducted in 2011-2013. The Computer-Aided Welding Personnel Management System has introduced a new standard of information exchange between welding personnel training centres and Instytut Spawalnictwa. Since the formulation of initial assumptions and throughout the system development, the authors of the solution have meant to create an open and expandable system. As a result, the system can be extended further and supplemented with new areas subject-related to welding engineering.

The Computer Welding Platform presented is the only known solution administering personnel training and certification as well as providing access to qualification information and to a welding knowledge database in such a complex manner.

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