Robotics Technologies on Knowledge Management Information Tool (KM-IT) Platform – 16465

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ABSTRACT

The Knowledge Management Information Tool (KM-IT) is a web-based system developed to maintain and preserve the deactivation and decommissioning (D&D) knowledge base across the Department of Energy (DOE) complex. The system was developed by the Applied Research Center (ARC) at Florida International University (FIU) with the support of the D&D community, including the DOE Office of Environmental Management (DOE EM), and with the active collaboration and support of the DOE's Energy Facility Contractors Group (EFCOG). The KM-IT system is a D&D community driven system tailored to serve the technical issues faced by the D&D workforce across the DOE Complex.

New information, including vendors and technologies related to D&D, are researched and added to KM-IT on an ongoing basis. In late 2014, DOE EM provided a database of 471 robotic technologies, originally developed by NuVision Engineering and Cogentus Consulting, with a request to evaluate the potential for integrating the data into the KM-IT framework for ongoing hosting/maintenance of the information. All of the data from the original database as well as photographs, documents, and videos are now available on KM-IT.

INTRODUCTION

The KM-IT web-based interactive system is operational and available for use at www.dndkm.org (m.dndkm.org for mobile devices). KM-IT makes excellent use of the knowledge that exists within the D&D community by allowing D&D project managers around the DOE complex to collaborate by sharing innovative ideas, past experiences, and practices. The system is currently composed of the following modules:

> Web Crawler - Searches and retrieves information from D&D related websites.

> Hotline - Questions from the D&D community and solutions from subject matter specialists.

> Technology - Directory of D&D technologies, from PPE to remote controlled heavy equipment.

> Document Library - Archive of D&D related documents, including an archive of the former ALARA Centers at Hanford and Savannah River Sites.

> Specialist Directory - Directory of registered subject matter specialists and their areas of D&D expertise.

Lessons Learned and Best Practices - Archive of lessons learned and best practices relevant to the D&D community.

Video/Picture Library - Image library, including photographs and videos from technology demonstrations, past and present.

Vendors - Directory of commercial vendors who provide D&D related technologies, supplies, and services.

Training - Catalog of training opportunities, conferences, and related material in the area of D&D.

Collaboration Tools - Information sharing mechanisms to promote conversation among the D&D community.

Industry News – Links to recent news articles related to the D&D industry.

Knowledge management (KM) is the practice or process responsible for gathering, analyzing, storing and sharing insights, experiences, knowledge, and information within an organization or community. The main focus of KM-IT for the D&D community is to enhance safety through improved efficiencies (e.g., by reducing the need to rediscover the knowledge and experience gained over time and to promote the reuse of the existing knowledge). KM-IT serves as a centralized information repository and a common interface for D&D related activities. It facilitates the gathering, analysis, storage and sharing of knowledge and information within the D&D community and has the ability to define, store, categorize, index and link digital information corresponding to D&D problem areas. The system has the ability to allow users to search for relevant content and presents the content with sufficient flexibility to render it meaningful and applicable across multiple contexts of use.

The KM-IT system is continuously updated and enhanced by incorporating feedback from the D&D community, DOE, and EFCOG. The overall objective is to develop a high-end sophisticated and secured system that will serve as a single large knowledge base for all of the D&D activities across the DOE complex. KM-IT aims to get the right content to the right people at the right time and in the right form. It uses the World Wide Web as the primary source for content in addition to information entered by the subject matter specialists and the D&D community.

DESCRIPTION AND DISCUSSION

The original requirement from DOE Headquarters was to develop a repository and a dynamic system to promote use of the knowledge that exists within the D&D community by allowing D&D project managers around the DOE complex to share innovative ideas, lessons learned, past experiences, and practices.

As there was no off-the-shelf computer application or integrated solution available for building the D&D knowledge base, ARC has built an approach that is servicing the DOE complex with a high performance, n-tier web-based system for capturing the information from the DOE sites/facilities, former ALARA centers, EFCOG and the D&D community as a whole. This system was built using Microsoft.net framework®,

SQL server 2005®, and SQL server reporting services®. Visual Studio 2005™, Dream Weaver® and Photoshop® were also used as development tools to construct the system. KM-IT was developed and deployed in multiple phases, providing solutions to the D&D problems, sharing best practices, a specialist directory of D&D experts, customized web searching, and technology solutions.

After receiving an MySQL database backup of 471 robotic technologies from DOE EM, FIU evaluated the potential for integrating the data into the KM-IT framework for ongoing hosting and maintenance of the information. A MYSQL server was installed on the development server and restored the Robotics database for its integration into KM-IT.

FIU developed the data interface and mapping file for the import process since the two data structures- robotics database on MySQL database and KM-IT database on SQL Server are different. FIU developed the data structure that could import the technology titles and description mapping to KM-IT as well as combined the technology notes and operational experience data sections and mapped it to a new comments section within KM-IT platform. In addition, FIU created a new Group within the D&D KM-IT Technology module for "Robotics." Multiple categories and sub categories were also created for the robotics technology adhering to the KM-IT platform standards.

KM-IT links each technology entry to a specific vendor. Within the original robotics database, the vendor information was included in a column with additional text. There was no easy way to automatically extract that information because of the lack of structure. Identifying and extracting the vendor information had to be a manual process. DOE Fellows from the FIU-DOE Science and Technology Workforce Development Program and other FIU Graduate Research Assistants assisted in manually extracting the vendor information from the original database, creating vendor entries in KM-IT for each, and assigning the technologies to the correct vendor.

A large number of media files were provided by DOE–EM which were imported into the platform and integrated with the KM-IT database. A robotics fact sheet module was created to display the technology and vendor details along with the associated media files. A search feature allows users to search through robotics database and display summary results and factsheet details. After performing quality checks on the new robotics entries, the robotics technology database was made live on the KM-IT production server. All of the data and accompanying information (photos, documents, etc.) within the robotics technology database from NuVision/Cogentus were integrated into the technology datasheets on KM-IT. Figure 1 shows the Technology module homepage highlighting the new robotic technology database and Figure 2 shows a few of the robotic technologies now available in the system.
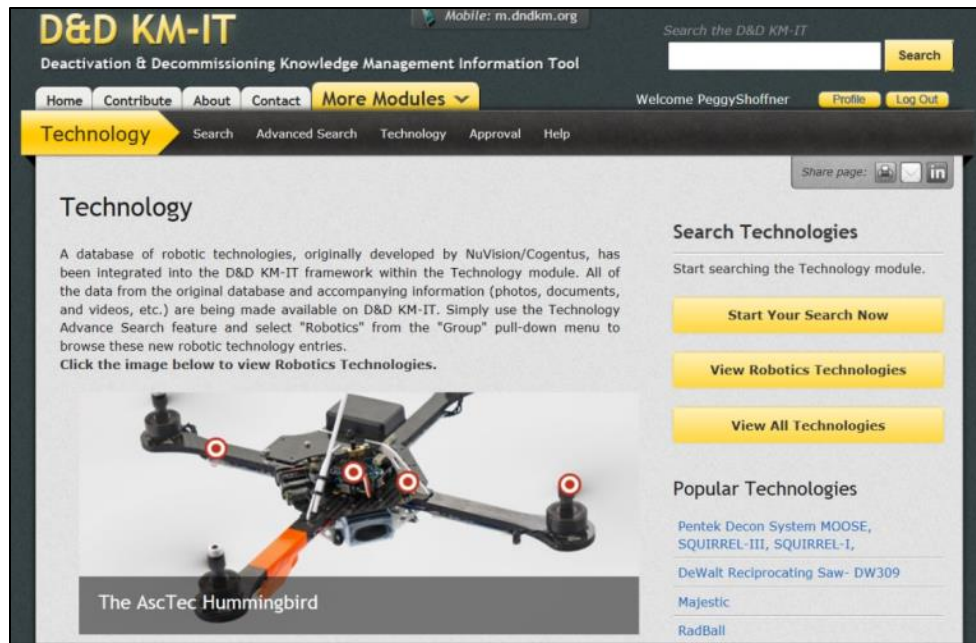
Fig. 1. Technology module homepage showing robotics technologies.

Fig. 2. Robotic technologies newly integrated into D&D KM-IT Technology module. From left: Mighty Mouse by Sandia National Lab, Big Dog by Boston Dynamics, and HRP-3 Promet MK-II by Kawada Industries.

KM-IT users can access the *Technology Advance Search* feature to select "Robotics" from the "Group" pull-down menu to search the new robotic technology entries for specific keywords. They may also simply click on the *Robotics Database* announcement from the *Technology Homepage* to browse all of the robotics entries.

D&D KM-IT has also added a legacy robotics document from 1998 to the D&D Documents Library entitled, *Robotics and Intelligent Machines in the U.S. Department of Energy: A Critical Technology Roadmap (RIM Roadmap).* This legacy document was the result of a six-month, collaborative effort by a team of DOE

representatives and national laboratory scientists, with input from additional DOE plants and sites. It defined, for the first time, a DOE research and development path for RIM through the year 2020.

CONCLUSIONS

DOE faces many challenges in their efforts to D&D unnecessary and/or unusable facilities across the DOE complex. Many of these facilities pose hazards which prevent the use of traditional industrial demolition techniques. Such hazards include radiological, chemical, and hazardous materials contamination and structural instability. Efficient and safe D&D of the facilities will almost certainly require the use of remotely operated technologies.

Remote handling by machines (e.g, robotics) plays a critical role in protecting personnel and the environment during potentially hazardous D&D activities and operations. By utilizing and improving the capabilities of existing remote technologies, DOE can significantly reduce the exposure of its workers to hazards.

Integrating a robotics technology database into KM-IT provides a single point of access to browse and search all 471 of the robotic technologies for applicability to a D&D related activity. Users can access technology descriptions, benefits, limitations, photographs, videos, data specification sheets, vendor descriptions and contact information.

KM-IT is a community driven system that makes D&D knowledge available to the people who need it at the time they need it and in a readily usable format. It brings information in real time through web-based custom search processes and its dynamic knowledge repository. The goal is to deploy a high-end sophisticated and secured system to serve as a single large knowledge base for all the D&D activities. The system consolidates a large amount of information available on the web and presents it to users in the simplest way possible.

REFERENCES

[01] Sanchez, R. (2004). Tacit Knowledge Versus Explicit Knowledge – Approaches to Knowledge Management Practices, Retrieved Jan 15, 2010, from http://www.knowledgeboard.com/download/3512/Tacit-vs-Explicit.pdf

[02] Knowledge Management Information Tool – KMIT. (n.d). Retrieved from www.dndkm.org

[03] The World Wide Web Consortium. (n.d.). Retrieved from http://www.w3.org/

[04] Building Secure ASP.Net Application, *MSDN Library*, http://msdn.microsoft.com/en-us/library/ff649350.aspx

[05] ASP.Net Authorization, *MSDN Library*, http://msdn.microsoft.com/en-us/library/wce3kxhd.aspx

 [06] Security Architecture. (n.d.). *MSDN Microsoft Library.* Retrieved April 24, 2011, from http://msdn.microsoft.com/en-us/library/ms788756.aspx

 [07] ASP.NET Mobile Development Overview. (n.d.). *MSDN Microsoft Library.* Retrieved November 19, 2011, from http://msdn.microsoft.com/en-us/library/ms178619(v=vs.80).aspx

 [08] ASP.NET Websites for Mobile Devices. (n.d.). *MSDN Microsoft Library.* Retrieved January 15, 2012, from http://msdn.microsoft.com/en-us/library/ms178619.aspx

 [09] Unit Testing. (n.d.). *MSDN Microsoft Library.* Retrieved August 3, 2011, from http://msdn.microsoft.com/en-us/library/aa292197(v=vs.71).aspx

[10] U.S. Department of Energy. *Robotics and Intelligent Machines in the U.S. Department of Energy: A Critical Technology Roadmap (RIM Roadmap).* October 1998.