AC 2010-861: AVS: SCIENCE AND TECHNOLOGY VIRTUAL MUSEUM

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AVS: Science and Technology Virtual Museum

Abstract

The American Vacuum Society (AVS) has a desire to create a "virtual museum" as a way to archive historical items. The items were used by vacuum technologists in the past for the manufacture of integrated circuits (ICs). The vacuum related equipment (e.g., pumps, gauges, and meters) represents important information regarding the history of the AVS. The AVS History Committee provided this project as a learning opportunity for a student in the Computer-Based Honors Program at The University of Alabama. The project required the student to create a professional web site with a user-friendly and visually-appealing interface to organize historical information about the relevant equipment. The student developed the web site using Drupal, an open-source web content management system (WCMS). The educational goals of this project include student proficiency using the Drupal software suite and implementation of full functionality to create a web site that meets the needs of the AVS. It is expected that the efforts exerted to give the web site a professional appearance will result in increased interest from members and guests with respect to the history of the technology that stimulated the formation of the AVS. This project is modeled after a similar effort at Harvard in which historical information of technological items is captured in the form of photographs and catalog data that are displayed in a rather passive format. In contrast, visitors to the AVS web site will be encouraged to comment on or to discuss the web content with other visitors. Thus, the project provides an opportunity for a society to archive important historical equipment and to give the virtual guest the experience of viewing historical items, learning about the equipment, and if desired, engaging in discussion. Finally, the endeavor proves to be a valuable learning experience in web site design as well as in acclimating to new tools that provide an innovative way to accomplish a task.

I. Introduction

The AVS: Science and Technology Society, a non-profit organization, has a rich history. Established in 1953 as a Committee on Vacuum Techniques when fifty-six scientists and engineers determined a need for a community of scholars with knowledge centered around vacuum technology and corresponding applications.[1] Understanding how to create, measure, and maintain a vacuum became something of a discipline in itself. The first symposium, held in 1954, attracted 295 participants from several countries.[1] The American Vacuum Society (AVS) evolved from this original group, elected a Board of Directors, and established society by-laws. A unique feature of this initial group, which is still true of the AVS community today, is that symposium participants come from a variety of disciplines in both science and engineering. It is truly a multi-disciplinary society that addresses technological needs that are also quite varied. In addition to diversity in disciplines, the society members are diverse in their affiliations. Members, volunteers, and symposium registrants come from academic institutions, government agencies, national laboratories, and industry. The Industrial Physics Forum (IPF) associated with the AVS brings industry executives, researchers, and science-policy decision makers together to share business knowledge, to assess critical needs, and to determine future directions.[2]

Using vacuum technology for characterizing material surfaces and interfaces was a primary focus in the early days. Controlling the environment in a sample chamber allowed use of various beam technologies for materials characterization. With the invention of the integrated circuit in 1964,[3] interest grew enormously in the use of vacuum techniques to deposit, pattern, and etch

materials for the purpose of fabricating miniaturized electronic circuits. The AVS became a resource for the semiconductor industry and provided a community for scholars and practitioners in the microelectronics area. AVS established divisions and technical groups to address the varied interests in surface science, thin film technology, vacuum technology, electronic materials, and plasma science. Other areas developed over time in response to emerging technologies such as nanometer-scale technology, manufacturing science, magnetic and biomaterial interfaces, and microelectomechanical systems (MEMS).

II. Motivation

The annual symposium continues to be a highlight for the AVS. Held each fall, this symposium has grown to approximately 1,000 participants. Sessions are sponsored by the various divisions and technical groups and several are co-sponsored due to the interdisciplinary nature of many topics. Education of the community at large about vacuum techniques is an important mission of the AVS. The society has an Education committee that oversees both the Short Course Executive Committee and the History Committee. In the past, holding short courses on vacuum technology at the annual symposium and across the country in various regional chapters was a lucrative financial venture. Over the last decade, however, attendance declined and current offerings are much smaller than in the past. Many companies developed their own courses or sometimes hire AVS instructors for specific topics in what the society calls on-site courses. In addition to educating science and engineering technologists, outreach to the community is also important. The AVS holds a workshop for science educators each year at the annual symposium that brings thirty high school science teachers together for participating in vacuum experiments that can be disseminated to a broad audience.[4]

The History Committee is oriented toward both education and archiving historical items. Over the years, the committee has accumulated rare books that are housed in the Jefferson Laboratory in Virginia. In addition to books, many historical vacuum items have been obtained through various means. In 2008, one of the co-authors, a member of the AVS History Committee, was tasked with creating a first draft of a web site providing a "virtual museum" for visitors. A Harvard web site is a model for our work.[5] This paper describes the learning process that evolved from development of the web site template. At the time of this writing, the web site is early in development and the History Committee is attempting to gather more detailed information about the vacuum gauges, meters, and pumps that are housed in AVS storage facilities.

Virtual museums have been a useful method for archiving historical items and providing an experience similar to a museum visit. This type of activity came about for the Spurlock Museum at the University of Illinois when preparing to move the collections (45,000 cultural and ethnographic artifacts) across campus.[6] This integration of collections management with on-line exhibits evolved naturally from the activities involved in the move and proved to be an efficient way to communicate information. Other published activities of this nature include the Kentucky Virtual Library (KYVL),[7] the History of Computing in Education (HCE) Virtual Museum,[8] the Virtual Museum of the University (VMU) archiving optical instrumentation,[9] and the Palladio Web Museum capturing a database of architecture and history.[10] The Institute for Electrical & Electronics Engineers (IEEE) has developed an extensive virtual museum to survey the history of electrical science and technologies and provide outreach in promoting engineering to K-12 students.[11] It is clear that this type of activity provides an excellent way to impact and educate a

broad audience.

III. Initial Tasks

The development of the web site for archiving historical vacuum equipment was part of a UA Computer-based Honors program (CBHP) project in the fall semester of 2009. When the CBHP student and the supervising faculty member in Electrical and Computer Engineering discussed the task, many ideas arose concerning how to best implement the virtual museum highlighting equipment used by the semiconductor industry and storage maintained by the AVS History Committee. However, the team first needed to identify an appropriate software package.

A *content management system* (CMS) is a software system that provides a consistent interface through which users can create, edit, manage, and publish content. A CMS can store all types of data, including web pages, electronic documents, audio files, and videos. Typical features of a CMS include:

- user accounts, which can be assigned specific content management roles;
- version control, which provides tracking and management of multiple versions of a single piece of content; and
- search capabilities, which allows searching for content in the CMS and searching for information in that content.

A CMS is often used to disseminate discipline-specific information such as news articles and training modules.

A *Web content management system* (WCMS) is a CMS implemented as a Web application and provides several advantages over a traditional CMS. The most significant advantage of a WCMS is that, once deployed, it can be managed from anywhere in the world and by non-technical users with little or no training. This level of usability is achieved by using a browser-based interface that hides the low-level HTML, XML, and Perl/PHP/Python/Ruby code from the end-user. In addition, a typical feature of a WCMS is templating, or skinning, which allows the appearance of the web site to be easily and uniformly modified. The most well-known WCMS today is MediaWiki, which was originally written for Wikipedia.

Drupal is a PHP-based WCMS that organizes content using an SQL database. Because Drupal is an open-source WCMS, it is free for anyone to access and use. This interests many users because it can lower web site production costs. The wide and diverse user base has led to countless contributions to the software that other users can access to improve their web sites. Due to its easy accessibility, some might mistakenly believe that it is inferior to other content management systems in the industry. Rather, it is a full-featured program that allows for professional customization of a web site. Many publishers use Drupal to power their web sites, including BBC Magazines, CNN, and Reuters.[12] Drupal's easy access and wide array of features made it the most effective tool for creating a virtual museum to celebrate society history.

IV. Implementation

With Drupal's extensive functionality comes a steep learning curve. Before Drupal can be used

to create an appealing and professional web site such as the one desired by the AVS History Committee, an extensive amount of time is required for the developer to become accustomed to the array of features. The primary author of this paper was assigned the task of gaining proficiency with the Drupal software suite in order to create the virtual museum for the AVS History Committee. Fortunately, open source software communities are often very helpful in educating other users. The community that supports Drupal is certainly no exception.

An important resource for learning Drupal is the web site *Learn By The Drop*. This organization is a small, independent group that is solely devoted to educating other Drupal users. They provide a series of video tutorials that are widely cited and are even endorsed on the Drupal home page. These tutorials are intended to familiarize any new Drupal user with Drupal's most important features.

One of the first things to learn about Drupal is basic site configuration. There is a "Site Information" section in which one can enter their site name, slogan, mission statement, and other important information. *Learn By The Drop* encourages new users to start at this level and then move to other sections such as the "User Management" section, where settings regarding site users and their accounts can be addressed.

Following the initial setup of the site, it is best for new users to become familiar with the overall structure of Drupal and the ways in which it is most easily used. Drupal allows users to create three different types of content, or nodes: pages, stories, and blog entries. Pages are usually static posts that are intended to be permanent. These are very useful for posting information about the web site or the organization that operates the web site, as this type of content is not often changed. Stories are similar to pages, but they have particular settings that make them more suited for information updates as well as content that will be changed or have the ability to receive comments. Finally, blog entries are simply posts to a user's journal and are used by site users who have created an account.

All nodes can be categorized into customizable groups for searching purposes using Drupal's taxonomy features. They can also be organized and displayed differently, depending on which theme, or visual appearance, is chosen for the web site by the administrator. Themes allow for different color schemes, fonts, content layout options, and visual customization options in general. Furthermore, modules, or plug-ins that accomplish particular tasks, can be used to apply more settings to nodes, create different types of content, and perform other tasks to customize the appearance or the performance of the web site. Drupal provides core themes and modules that are automatically installed, but these are only a taste of all the available tools that can enhance a web site. One of the greatest features of Drupal is that users can contribute their own themes and modules for others to use. This is permitted because Drupal's source code is open for public review and use. The main Drupal web site provides access to hundreds of different user-contributed themes and modules for downloading.[13] Figure 1 shows a screen shot of the main page for the virtual museum site, which is currently under construction. A set of tabs allow a user to move between the front page, the page containing historical items, the AVS primary site, and a log in page for potential comment entry.

On any given node, links to other nodes can be posted. From this principle arise many different options for content organization. Most of the content in the virtual museum is information

regarding vacuum-related technological items with which the members of the AVS have expertise from past usage. For this reason, one of the main organizational styles used on the web site was implemented by categorizing all the different items in order to establish a tree-structured hierarchy (see Fig. 2). On an initial page, there is a picture next to a link for a particular category of items. There is one picture and one link for each category of items. On the lower level pages (for the assigned categories), one can either list all the items of this category or post links to subcategories. This is a common web site structure that is simple yet visually appealing, allowing it to be very helpful in capturing visitors' interest in the content of the site.[14, 15]

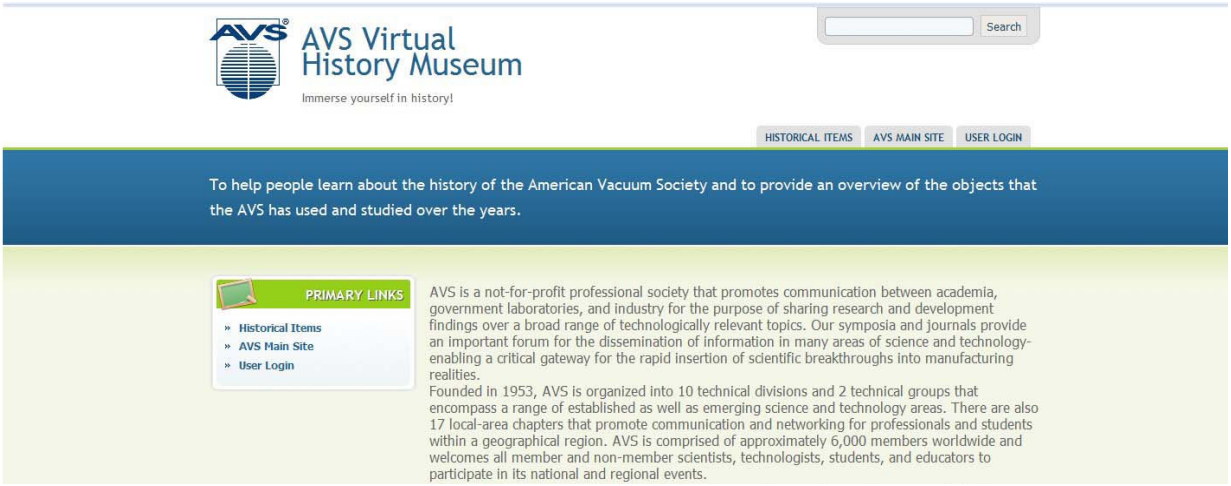

Fig. 1. AVS Virtual Museum web site home page (under construction).

Fig. 2. Gauges and Mass Spectrometers are two categories of technological items and are featured in the virtual museum. This layout is an example of implementing a tree-structured organization scheme. The

links beneath the images take users to different pages in which these two categories can be explored. The second image in this figure is the page that is shown when the "Gauges" link is selected.

Many different site organization options are available and can be tested for this virtual museum. Due to the nature of the content being presented, most of these options will stem from a tree-structured hierarchy of categories, which seems to be the most instinctive way to organize most of the information displayed. It allows for the creation of a simple and comprehensible web site that is also visually appealing to users. However, as more content is added to the web site, different organizational styles could also be applied. Perhaps more static pages will be added concerning the history of the AVS itself, with links posted directly to a sidebar on the front page. Perhaps a series of pages will be added in which a particular order must be followed in order to have a more realistic museum experience. The virtual museum capturing AVS history is currently in its infancy, but there are countless options for expansion and change. Drupal enables the web site developer to achieve virtually any organizational scheme by skillfully utilizing the different content types, modules, and themes provided by both the core installation and other Drupal users.

Summary

This project to create a virtual museum for the AVS: Science and Technology History Committee is a multifaceted endeavor. A thorough knowledge of the AVS and its history is the initial requirement to begin work. One must be comfortably acquainted with the society in order to begin posting relevant information in a manner that is both acceptable to the AVS History Committee and attractive to potential visitors. Additionally, a web content management system must be chosen that is particularly suited to the needs of the web site. In this instance, Drupal presented itself as the best option as there are many resources for learning its proper use, it is very widely used and endorsed, and it provides the proper features to power the desired virtual museum. Even after becoming familiar with this WCMS, there is still a large amount of work remaining. Some aspects of the web site are to be specified by the AVS History Committee whereas others will be left up to the designers and administrators of the site. The ultimate product will be an attractive and informative web site that will draw attention to the rich history of the AVS and garner interest in its current role in the scientific research community. This project is proving to be a valuable learning experience for all persons involved. Finally, the web site design experience is extremely beneficial as it provides a comprehensive understanding of web site functionality that can be used in future projects.

Acknowledgments

The authors would like to thank the AVS: Science and Technology Society History Committee for their input and acknowledge the Computer-Based Honors Program at the University of Alabama.

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