RENOVATING AND UPGRADING THE Web2cToolkit SUITE: A STATUS REPORT

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Abstract

The Web2cToolkit is a collection of Web services. It enables scientists, operators or service technicians to supervise and operate accelerators and beam lines through the World Wide Web. In addition, it provides users with a platform for communication and the logging of data and actions. Recently a novel service, especially designed for mobile devices, has been added. Besides the standard mouse-based interaction it provides a touch- and voice-based user interface. In addition, Web2cToolkit has undergone an extensive renovation and upgrading process. Real WYSIWYG-editors are now available to generate and configure synoptic and history displays, and an interface based on 3D-motion and gesture recognition has been implemented. Also the multi-language support and the security of the communication between Web client and server have been improved substantially. The paper reports the complete status of this work and outlines upcoming development.

INTRODUCTION

The Web2cToolkit [1] is a collection of Web services, i.e. servlet applications and the corresponding Web browser applications, including

1. *Web2cViewer*: Interactive synoptic live display to visualize and control accelerator or beam line equipment,
2. *Web2cViewerWizard*: Graphical WYSIWYG-editor to generate and configure synoptic displays,
3. *Web2cArchiveViewer*: Web form to request data from a control system archive storage and to display the retrieved data as a chart or table,
4. *Web2cArchiveViewerWizard*: Graphical WYSIWYG-editor to generate and configure archive viewer displays,
5. *Web2cGateway*: Application programmer interface (HTTP-gateway) to all implemented control system interfaces,
6. *Web2cMessenger*: Interface to E-Mail, SMS and Twitter,
7. *Web2cLogbook*: Electronic logbook with auto-reporting capability,
8. *Web2cManager*: Administrator's interface to configure and manage the toolkit, and
9. *Web2cToGo*: Interactive display especially designed for mobile devices [2] embedding instances of all kinds of Web2cToolkit services.

The Web2cToolkit provides a user-friendly look-and-feel and its usage does not require any specific programming skills. By design, the Web2cToolkit is platform independent. Its services are accessible through the HTTP/HTTPS protocol from every valid network address if not otherwise restricted. A secure single-sign-on user authentication and authorization procedure with encrypted password transmission is provided.

The Web 2.0 paradigms and technologies used include a Web server, a Web browser, HTML5 (HyperText Markup Language), CSS (Cascading Style Sheets) and AJAX (Asynchronous JavaScript And XML). The interactive graphical user interface pages are running in the client's native Web browser or in a Web browser embedded in a mobile app or desktop application. The interface is compatible with almost all major browser implementations including mobile versions. The Web2cToolkit services are provided by Java servlets running in the Web server's Java container. The communication between client and server is asynchronous. All third-party libraries used by the Web2cToolkit are open-source.

The Web2cToolkit provides interfaces to major accelerator and beam line control systems including TINE [3], DOOCS [4], EPICS [5] and TANGO [6]. The toolkit is capable of receiving and processing video frames or a continuous series of single images.

In addition the toolkit provides an environment to support and test various Human-Machine-Interface (HMI) types including mouse, touch, speech and 3D-gestures depending on the capabilities of the underlying platform [7] and the proper design and handiness of multi-modal accelerator control system applications.

IMPROVED AND NOVEL FEATURES

Recently, the Web2cToolkit suite has been substantially renovated and upgraded. Besides smaller modifications such as supporting IP6-compliant client address encoding the objectives of this process include

- Improving the security of the communication between Web client and server
- Improving the multi-language support of the Web2c Viewer,
- Providing a specific user repository holding all user-defined configurations within the web server's directory structure,
- Supplying wizard applications to graphically design Web2cViewer synoptic displays and Web2cArchiveViewer history pages.
- Redesigning the interface for extending the Web2c Viewer servlet with code provided by the user,
- Redesigning the interface for connecting other accelerator and beam line control systems with the Web2c Viewer servlet, and

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- Designing interfaces for connecting other accelerator archive systems and other video sources with the Web2c Viewer servlet.

Secure Communication

The Web2cToolkit can be configured to enforce secure data communication between client and server application by using the HTTPS protocol standard based on SSL/TSL.

Multi-Language Support

Web2cViewer synoptic live displays and the common login page of the Web2cToolkit can be configured to support more than one language at a time. All Unicode-compliant characters encoded as UTF-8 e.g. to be used for widget captions or tooltip descriptions can be displayed properly including complex characters such as Japanese characters.

User Repository

A repository for user-defined configurations has been added to the Web2cToolkit. It is located within a specific directory of the Web server which also holds the Web2cToolkit initialization files and does not belong to the directory tree of the Web2cToolkit Web server application which is overwritten during the deployment of the application. All user-defined files are restored from the repository at application start-up and saved into the repository when the application is terminating.

Wizards

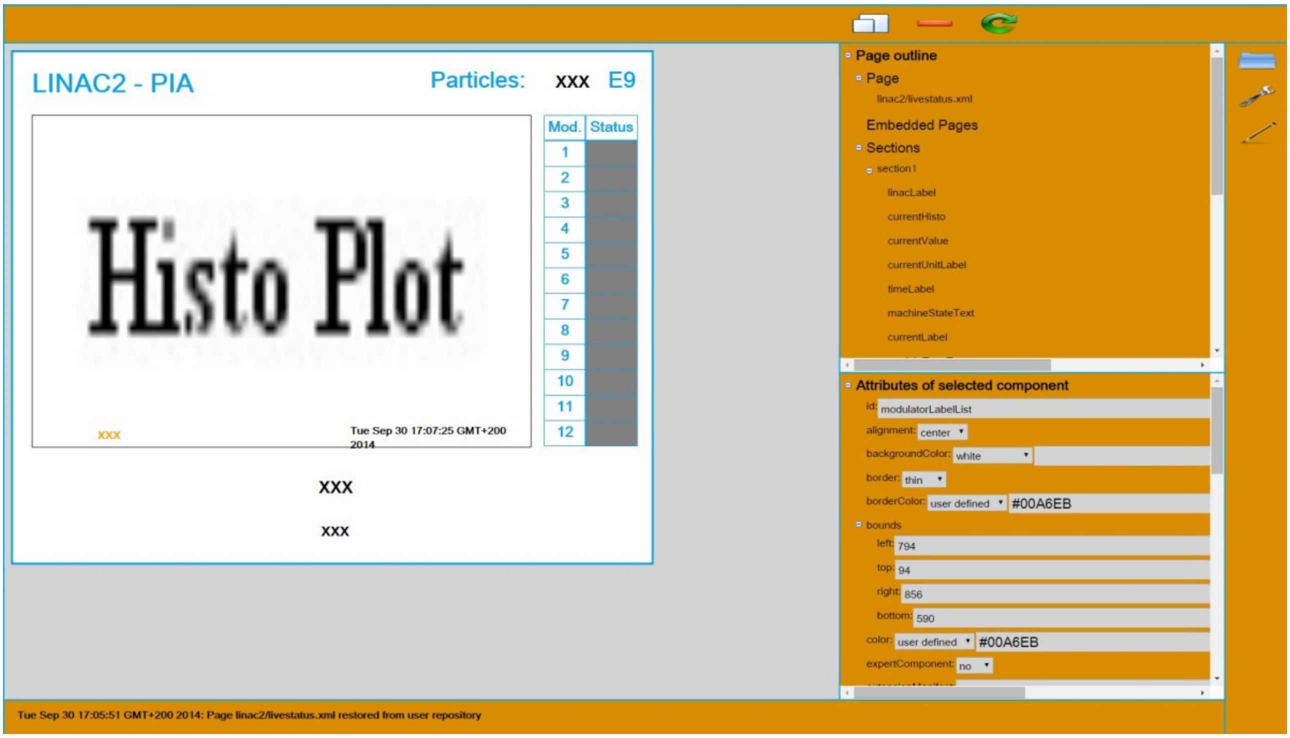
To facilitate the configuration of synoptic live displays as well as generic or pre-defined 24h history displays two real WYSIWYG graphical editor applications have been implemented.

Fig. 1 shows a sample page of the Web2cViewerWizard application. It replaces the deprecated Web2cEditor. The wizard provides different views according to the task currently to be done. Common to each view is the large sketch board whereas the smaller panels on the left side may show a file explorer, a page outline and a list of available widget types or the list of attributes of the currently selected component, respectively.

The Web2cArchiveViewerWizard application is based on a similar lay-out. It hides the complex and error-prone configuration XML-structure of Web2cArchiveViewer pages which has been kept unchanged for compatibility reasons.

Besides creating new pages both wizards can download and parse configuration files which already exist in the user repository located at the Web server. The loaded configurations can be modified and uploaded to the user repository. A full version history of all uploaded configuration files is retained at the Web server.

Finally the page designer can preview newly created or modified Web2cViewer or Web2cArchiveViewer pages without leaving the designing environment.



id: modulatorLabelList
alignment: center
backgroundColor: white
border: thin
borderColor: user defined #00A6EB
bounds
left: 794
top: 94
right: 856
bottom: 590
color: user defined #00A6EB
expertComponent: no

Tue Sep 30 17:05:51 GMT+200 2014: Page linac2/livestatus.xml restored from user repository

Figure 1: Web2cViewerWizard Web application showing an operations overview panel for the LINAC2 pre-accelerator at DESY. The panel is being graphically designed with the wizard. The corresponding configuration file is created by the wizard and uploaded to the user repository at the Web server.

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User-Defined Widget Extensions and Plugs

The standard functionality of many Web2cViewer widgets can be extended by supplemental user-defined features. In particular it might be useful to apply a calibration to some raw data or perform a more complex data manipulation such as a Fourier transformation.

Besides the standard plugs to connect the Web2cToolkit with an external accelerator or beam line control system, archive system or video source interface plugs to other resources can be added. Recently, a plug for the STARS [8] control system used at the KEK Photon factory has been implemented.

Both user-defined extensions and interface plug-in classes have to be provided as Java archive files and added to the deployed Web2cToolkit Web application before application start-up.

ONGOING DEVELOPMENTS

A user can interact with a Web2cToGo application by mouse actions, finger touch gestures, spoken commands and hand or finger 3D-gestures [7]. With the exception of the mouse actions all interfaces are still a subject of research and current implementations and capabilities might change in the future. In particular the combination of all kinds of interfaces in a common multi-modal user application has still to be investigated and suitable use-cases have to be identified and tested.

Interaction by Speech Recognition

The response to spoken commands has been significantly improved. Repetitive client-side audio recording of short half-second audio sequences is performed using the most recent functionalities provided by HTML5. The communication to send a recently recorded audio sequence to the server for a phonetic analysis and to notify the client of the result is based on the bi-directional WebSocket protocol. Speech recognition is performed by the Web2cToolkit server application. The application concatenates the last uploaded audio sequences to a contiguous record which is a few seconds long. Whenever a new audio update is received by the server the leading audio sequence is clipped and the most recent audio sequence is appended to the trailing edge, allowing for almost continuous speech recognition. The application performs a search procedure using the most recent Sphinx-4 [9] speech recognition software. The overall response to a spoken command is almost immediate.

Interaction by Gesture Recognition

Interaction by finger touch gestures is already an established and common feature of modern mobile phones and tablet computers. Web2cToGo provides a set of intuitive application-specific single- and multi-finger gestures, although this set is still somewhat incomplete.

The recognition of real hand gestures has been popularized by game consoles. Web2cToGo uses the LEAP motion controller [10] to detect hand or finger 3D-gestures (Fig. 2). The corresponding sensor is a USB-device. The controller software runs on every PC (Windows, Linux, or MacOS) and provides a Web interface based on the WebSocket protocol. An extensive API facilitates the integration of the LEAP motion controller into a user application.

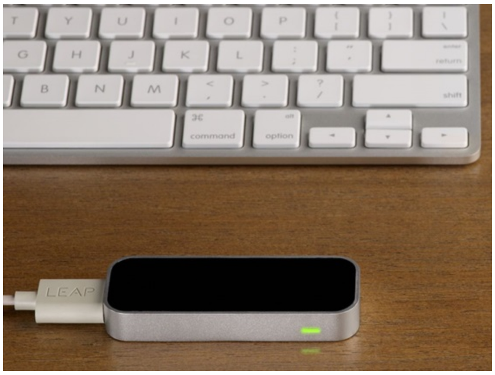

Figure 2: LEAP motion sensor device [10].

The Web2cToGo application displays a virtual cursor on top of the Web2cToGo desktop to guide the user. A preliminary and still incomplete set of finger- and hand-gestures has been implemented. The Web2cToGo application communicates with the local LEAP motion controller Web server and the 3D-gesture recognition does not involve the corresponding Web2Toolkit Web server application. Preliminary performance tests reveal a prompt response to 3D-gestures.

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