

Internet Textbook SARI and Remote Scale Models

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Distance forms of learning are more and more popular mainly with expanding potentials for connection to the Internet. Especially for technical branches there is necessary to prepare their laboratory experiments using remote control through the Internet. Laboratories of Automatic Control Theory of the Department of Control Engineering FEE CTU in Prague [2] are well equipped with standard scale models (Ball and Beam, Couple Tanks, Servos, Helicopter, Thermal system etc). These models are primary controlled by local PC with AD/DA cards using Matlab[®] and Simulink[®] and they are inconvenient for remote control. In cooperation with our students we developed two new systems to fulfill Internet specific requirements - the Levitation and the Lathe. Remote control of these models was built in to the Internet textbook SARI [3].

The Internet textbook SARI was created like a support for basic courses of theory of automatic control "Systems and Models" and "Systems and Control" with a goal to enhanced teaching methods [1]. The Internet textbook (still mainly in Czech language) is available at <http://dce.felk.cvut.cz/sari> and is based on CSS, PHP and SQL technology. This version includes complete publishing system with an integrated discussion forum, control-engineering dictionary, and references on libraries, where the recommended books are available. Online computing of teaching simulation programs is available by implementing Matlab Web Server[®]. The most important part of the design of the Internet textbook is intelligible and fast navigation in the texts and other components like utilities for Matlab. The main tool is the menu on the left side of the page. It's possible to access every page by few clicks, using this tree menu, which is composed to be the most effective by searching for the required page. The second useful part is an m-file downloading page. The user can see dependencies on the other m-files or examples of use. The page offers downloading single file or generates complete pack needed for running. Automatic syntax hi-lighting is also available. This is apt for fast searching inside the m-file.

Web interface with a lot of capabilities was designed for the administration of the textbook. The web interface was chosen to make alternating of the pages most simple, to allow the administration also for not advanced webmasters. The system shows detailed access statistics for each page. Accounts for people creating the pages are divided into groups. This enables them to make different actions like alternating page contents, menu structure or the base system. The root manages these accounts, which shouldn't be unique. The editing of pages is possible in two ways. Profound changes of the textbook can be made by direct HTML or PHP editing, though it places high demands on the users' skills. The minor changes can be achieved via the built-in WYSIWYG editor, which is useful for standard pages but has limited abilities. The page should have set it's description, list of keywords, group allowed to deleting and editing it's content or setting the visibility attribute.

Last but not least topic which is going to improve quality of education is remote control of the physical model experiments. These models are identified and controlled in practical lessons of control engineering. Next two sections depict new scale models.

Primary part of the “Levitation” model [4] is vertically orientated two meters long transparent plastic tube. A flow of the air from a ventilator levitates a body placed inside. Position of the body is mainly continuously measured by a laser sensor, which is placed above the tube. Auxiliary sensors measure pressure in the tube, speed of the ventilator, power voltage of the ventilator, and discrete position of the body by reflex sensors. Power voltage of the ventilator, which is implicating the amount of airflow inside the tube, can be set either manually from control panel or via remote control.

Web camera view of the model is available. The model is controlled either by a programmable logical controller PLC-5 or a personal computer equipped with special measuring card. There were designed two types of visualization accessible through the Internet. The first visualization uses the programmable controller, the second one a personal computer. You can visit both pages using SARI textbook or the address <http://vznaseni.felk.cvut.cz>. The web pages issued by processor of programmable controller are only for process monitoring. Web server that runs on the personal computer enables full control. Measured data are stored to database and subsequently are used for generating visualization on web pages as table, graph or xml files. There is a multi-user system for model access and user authentication. The advantage of using database is a personalized connection to the model for each user. Local control is standard one.

The second one model is multiple axis servo model – the “Lathe”. In practice, it is a model of the lathe, which can only copy surface of the finished workpiece. The position of the slide head is read from two incremental rotary sensors, the distance from the surface is measured by tactile inductive drift meter and rotating speed of spindle by tachodynamo. Motion in axis is driven by 24V DC motor. The slide head movements are directed manually, or by ControlLogix programmable controller equipped with special motion module, or by personal computer. We have designed new control electronic switch with remote changeover. ControlLogix system offers new Ethernet web server module, which also allows full remote access. The process is again monitor by a web camera.

Our new models were ready for teaching in the last semester. We have got a positive acceptance from students which have worked with these models.

References:

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