ABSTRACT

Computer based Laboratory Tools for Teaching Electronic Instrumentation

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This thesis reports on novel, inexpensive, easily accessible and effective technological solutions to reduce the cost of both laboratory tuition and facilities. In particular, the thesis describes the design and implementation of a complete suite of inexpensive hardware and software tools including a laboratory management strategy for efficient, effective and flexible laboratory tuition for engineering students. The hardware toolkit comprises test, measurement and processing components with additional application-specific modules. The software toolkit comprises modules for computer based hardware control, virtual instrument management, data processing, communication, administration, performance reporting and data repository utilities.

Substantial new work includes novel methods for controlling (i) client-side computer attached hardware and (ii) client-side secure execution of virtual instrument applications from scripting code embedded within electronic documents. Server-side work integrates CGI scripts and database structures for

system maintenance. The HTTP TCP/IP network transport protocol is used throughout, supporting both Ethernet and innovative multiplexed serial network topologies, including serial to Ethernet routing.

The tools described in this thesis have been applied and evaluated in courses on campus and have been demonstrated using distance education. The work is motivated by the firm objective of the University of the West Indies [1] to increase enrollment in its Engineering Faculty from 887 in 1995/1996 to 1,487 by 2001/2002, with no additional funding from regional governments beyond levels agreed to for 1996/1997. As the major human resource and direct financial burdens in engineering education lie in laboratory tuition and facilities, this work has been specifically pitched at developing tools to increase the efficiency and efficacy of engineering-based laboratory tuition. The toolkits may be reproduced and installed from comprehensive plans included in the Appendices, or may be obtained from the in-house production facilities of the University of the West Indies.