

Contents

Preface	vii
1. Introduction	1
1.1 A Brief Description of the Internet	1
1.2 World Wide Web	2
1.2.1 HyperText Markup Language	2
1.2.2 Universal Resource Locator	3
1.2.3 Web Browsers and Web Servers	4
1.3 Overview of Web-Based Laboratories	5
1.3.1 The Internet for Education	5
1.3.2 Web-Based Laboratories	8
1.4 Target of the Book	9
1.4.1 Web-Based Laboratories at National University of Singapore	9
1.4.2 Coupled-Tank Experiment	10
1.4.3 Helicopter Experiment	12
1.4.4 Oscilloscope Experiment	13
1.4.5 Frequency Modulation Experiment	14

x Contents

1.4.6	Hardware Structure	15
1.4.7	Software Structure	17
1.5	Organization of the Book	19
2.	Server and Client	21
2.1	Introduction	21
2.2	Network Programming	23
2.2.1	Protocols	23
2.2.2	IP Address	27
2.2.3	Port Numbers	28
2.2.4	Socket Pairs	29
2.3	Double Client/Server Structure	31
2.3.1	Client	31
2.3.2	Server Entity in the Web Server	32
2.3.3	Client Entity in the Web Server	34
2.3.4	Controller	35
2.4	Single Client/Server Structure	37
3.	Client GUI Design	39
3.1	Introduction	39
3.2	Frequency Modulation Experiment	41
3.2.1	Circuit Board	41
3.2.2	Spectrum Analyzer	43
3.2.3	Frequency Counter	45
3.2.4	Signal Generator	46
3.2.5	Voltmeter	47

3.3	Java and OOP	47
3.3.1	Java Applet	47
3.3.2	Class	48
3.3.3	Class Creation	50
4.	Components	51
4.1	Introduction	51
4.2	ImgButton Class	52
4.2.1	Class Definition and Constructor	53
4.2.2	initImage() Method	54
4.2.3	Other Methods	55
4.3	Knob Class	56
4.3.1	Class Definition and Constructor	56
4.3.2	initImage() Method	59
4.3.3	Other Methods	60
4.4	Connector Class	61
4.4.1	Class Definition and Constructor	61
4.4.2	initImage() Method	65
4.4.3	Other Methods	65
4.5	DataDisplay Class	67
4.5.1	Class Definition and Constructor	68
4.5.2	Other Methods	69
5.	Panels	71
5.1	Introduction	71
5.2	Classes for Device Canvases	71

5.2.1	Class Definition and Variables	71
5.2.2	Constructor	73
5.2.3	<code>initImage()</code> and Other Display Methods	76
5.2.4	Methods for Client/Server Communications	77
5.2.5	Methods for Instrument Handling	79
5.2.6	Methods for Switching the Instrument on and off	79
5.2.7	Methods for Connectors	81
5.2.8	<code>update()</code> and <code>paint()</code> Methods	82
5.3	Classes for Devices	82
5.3.1	Class Definition and Variables	84
5.3.2	Overriding the <code>init()</code> Method	85
5.3.3	Methods for Detecting the Mouse over Controls	87
5.3.4	Methods for Mouse Movement and Dragging	91
5.3.5	Methods for Mouse Events	94
6.	Interface Cards	97
6.1	Introduction	97
6.2	LabVIEW	98
6.2.1	Front Panel	99
6.2.2	Block Diagram	100
6.2.3	Subprogram	103
6.3	General-Purpose Interface Bus	103
6.3.1	Data Transfer Signals	103
6.3.2	Network Topology	104
6.3.3	Examples of GPIB Instruments	105

6.3.4	Controlling GPIB Instruments	107
6.4	Data Acquisition Card	113
6.4.1	Drivers	114
6.4.2	Controlling Card	115
6.5	Digital Signal Processing Card	117
7.	Audio and Video	119
7.1	Audio/Video Server	119
7.1.1	H.323 Protocol	119
7.1.2	H.323 Architecture	121
7.2	Microsoft NetMeeting	123
7.2.1	Server and Client Setup	124
7.2.2	Active X Control	127
7.3	Camera Control	131
7.3.1	Client	132
7.3.2	Server	136
8.	Controlling Physical Systems	147
8.1	Introduction	147
8.1.1	Mathematical Model	147
8.1.2	Control System	148
8.2	Modeling of the Coupled Tank Apparatus	149
8.3	Control Algorithms	151
8.3.1	Manual Control	151
8.3.2	PID Control	152
8.3.3	General State-Space Control	154

8.3.4 Fuzzy Knowledge-Based Control	154
8.4 Controlling the Coupled Tank	158
8.4.1 VI Programs	158
8.4.2 MATLAB Script	162
9. Multicast Design	167
9.1 Introduction	167
9.2 IP Multicast	169
9.2.1 Multicast Protocols	169
9.2.2 Multicast Groups	169
9.2.3 Time-to-Live	170
9.2.4 Internet Group Management Protocol	171
9.2.5 Developing Multicast Groups	172
9.3 System Architecture	173
9.3.1 Hardware	173
9.3.2 Software	173
9.3.3 Double Client/Server Mode	174
9.4 System Implementation	175
9.4.1 User Authentication	175
9.4.2 Real-Time Transfer of Spectrum Analyzer Display	178
9.4.3 Real-Time Transfer of Command Strings	180
10. An Implementation Example	183
10.1 Introduction	183
10.2 Camera Control Subsystem	184
10.3 Video Transmission Subsystem	185

10.4 Client Interface	185
10.4.1 index.htm	187
10.4.2 doexp.htm	187
10.4.3 exp1.htm	188
10.4.4 exp2.htm, exp3.htm, and exp4.htm	190
10.4.5 manualcontrol.java	190
10.4.6 pidcontrol.java, generalcontrol.java, and fuzzycontrol.java	192
10.4.7 NetMeeting	193
10.5 Coupled-Tank Control and Algorithm	193
10.5.1 exp1.htm	194
10.5.2 doexp.vi and control.vi	195
10.5.3 fuzzycontrol.m	199
10.5.4 generalpre.m and generalnopre.m	200
Appendix A. Source Codes for Camera Control	201
A.1 camera_control_console.vbp	201
A.2 MainForm.frm	202
Appendix B. Source Codes for Interface Design	207
B.1 index.htm	207
B.2 doexp.htm	209
B.3 exp1.htm	211
B.4 exp2.htm	216
B.5 exp3.htm	220

B.6	exp4.htm	225
B.7	manualcontrol.java	230
B.8	pidcontrol.java	242
B.9	generalcontrol.java	253
B.10	fuzzycontrol.java	262
Appendix C. Source Codes for Coupled-Tank Control		289
C.1	fuzzycontrol.m	289
C.2	generalpre.m	292
C.3	generalnopre.m	293
References		295
Index		299



<http://www.springer.com/978-1-85233-837-4>

Creating Web-based Laboratories

Ko, C.C.; Chen, B.M.; Chen, J.

2004, XVI, 300 p., Hardcover

ISBN: 978-1-85233-837-4