



Human-Computer Interaction in Game Development with Python

Design and Develop a Game
Interface Using HCI Technologies
and Techniques

Joseph Thachil George
Meghna Joseph George

Apress®

Human-Computer Interaction in Game Development with Python

**Design and Develop a Game
Interface Using HCI
Technologies and Techniques**

**Joseph Thachil George
Meghna Joseph George**

Apress®

Human-Computer Interaction in Game Development with Python: Design and Develop a Game Interface Using HCI Technologies and Techniques

Joseph Thachil George
Hannover, Germany

Meghna Joseph George
Hannover, Germany

ISBN-13 (pbk): 978-1-4842-8181-9
<https://doi.org/10.1007/978-1-4842-8182-6>

ISBN-13 (electronic): 978-1-4842-8182-6

Copyright © 2022 by Joseph Thachil George, Meghna Joseph George

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

Trademarked names, logos, and images may appear in this book. Rather than use a trademark symbol with every occurrence of a trademarked name, logo, or image we use the names, logos, and images only in an editorial fashion and to the benefit of the trademark owner, with no intention of infringement of the trademark.

The use in this publication of trade names, trademarks, service marks, and similar terms, even if they are not identified as such, is not to be taken as an expression of opinion as to whether or not they are subject to proprietary rights.

While the advice and information in this book are believed to be true and accurate at the date of publication, neither the authors nor the editors nor the publisher can accept any legal responsibility for any errors or omissions that may be made. The publisher makes no warranty, express or implied, with respect to the material contained herein.

Managing Director, Apress Media LLC: Welmoed Spahr
Acquisitions Editor: Spandana Chatterjee
Development Editor: James Markham
Coordinating Editor: Mark Powers
Copy Editor: Kezia Endsley

Cover designed by eStudioCalamar

Cover image by Jose Gil on Unsplash (www.unsplash.com)

Distributed to the book trade worldwide by Apress Media, LLC, 1 New York Plaza, New York, NY 10004, U.S.A. Phone 1-800-SPRINGER, fax (201) 348-4505, e-mail orders-ny@springer-sbm.com, or visit www.springeronline.com. Apress Media, LLC is a California LLC and the sole member (owner) is Springer Science + Business Media Finance Inc (SSBM Finance Inc). SSBM Finance Inc is a **Delaware** corporation.

For information on translations, please e-mail booktranslations@springernature.com; for reprint, paperback, or audio rights, please e-mail bookpermissions@springernature.com.

Apress titles may be purchased in bulk for academic, corporate, or promotional use. eBook versions and licenses are also available for most titles. For more information, reference our Print and eBook Bulk Sales web page at <http://www.apress.com/bulk-sales>.

Any source code or other supplementary material referenced by the author in this book is available to readers on GitHub (<https://github.com/Apress>). For more detailed information, please visit <http://www.apress.com/source-code>.

Printed on acid-free paper

Table of Contents

- About the Authors.....xi**
- About the Technical Reviewerxiii**
- Introduction xv**

- Chapter 1: Human-Computer Interaction Tools and Methodologies 1**
 - Fundamentals of Human-Computer Interaction..... 1
 - Digging Deeper..... 4
 - Designing the Interface..... 7
 - Adaption and Interfaces..... 10
 - Interfaces of Multi-Device..... 13
 - Evolutionary Trends..... 15
 - Evaluation of Usability 16
 - Bringing Usability and Accessibility Together 18
 - Analysis of Task Situations 19
 - Techniques and Tools for Human-Computer Interaction Development 20
 - Techniques for Defining Specifications 22
 - The Cycle of Tool Life and Methodologies Taxonomy 25
 - Selecting Instruments, Techniques, and Resources..... 26
 - The Eye Tracking Technique and Usability 27
 - Eye Tracking Studies 28
 - User Control..... 28
 - Usability Testing..... 30

TABLE OF CONTENTS

Why Eye Tracking?.....30

Creating an Effective Interface31

Graphical User Interfaces.....32

 Characteristics of User Interfaces32

Summary.....34

Chapter 2: Human-Computer Interaction Tools and Game Development.....35

 Tools and Techniques for General Game Development36

 The Video Game Interface.....36

 Video Game Development and Interaction36

 Video Game Users’ Requirements and Needs37

 Interactive UI Design for a Game38

 Panel Design.....40

 Window Architecture41

 Icon Design.....42

 Color Development43

 Eye-Tracking Techniques45

 The Impact of Eye Tracking in Games.....45

 Eye Tracking in Games.....45

 Face and Eye Recognition.....50

 Modeling and Development.....50

 Conclusions and Problems54

 Creating the Data Structure54

 Modeling and Development.....54

 Conclusions and Problems55

 Applying Photographic Filters55

 Modeling and Development.....55

 Conclusions56

Recognizing the Iris	56
Modeling and Development.....	57
Conclusions and Problems	57
Edge Detection.....	58
Modeling and Development.....	58
Conclusions and Problems	60
Parameter Analysis on Blur, CLAHE, and CANNY Filters.....	60
Modeling and Development.....	61
Analysis	65
Iris Recognition (2).....	65
Modeling and Development.....	65
Conclusions and Problems	66
“Average Color” Recognition.....	67
Modeling and Development.....	67
Conclusions	69
Project Analysis.....	70
Data Analysis	70
Project Conclusions	78
Summary.....	79
Chapter 3: Developing a Video Game.....	81
Roles in the Video Game Industry	82
Producers	82
Publishers.....	84
Game Developers	85
Roles and Processes of Game Development.....	87
Game Design	88
Game Art Design.....	91

TABLE OF CONTENTS

Game Programming.....93

Game Testing97

Software Development.....97

Game Development Phases 101

 Pre-Production Phase..... 101

 Outsourcing 103

 Production Phase..... 104

 Milestones: The Cornerstones of Development 106

Post-Production Phase..... 107

Localization 108

 Fan Translation 109

Summary..... 110

Chapter 4: Turning Points in Game Development 111

Game Engines 111

 Rendering Engine 112

 Indie Video Games 114

 Crowdfunding 116

The Case of Dreams: Developing a Game Within a Video Game 117

Current Problems in the Development of Video Games 118

 Crunch Time 119

 Piracy..... 120

 Programming Stages..... 122

Paradigms and Programming Languages..... 124

Visual Programming..... 128

Summary..... 137

Chapter 5: Developing a Game in Python	139
Python and Pygame	139
Designing the Video Game	140
Development Team.....	141
Game Design Document and Production	142
Game Menu	143
Short Introduction to Pygame	144
Game Interface.....	146
The Player	148
Powering Up.....	151
The Enemies	153
The Bosses.....	155
Collision Management	163
The Levels.....	165
Summary.....	170
Chapter 6: Game Development – Industry Standards.....	173
Game Terminology	173
Overall Design of the Game.....	174
Frontend and Backend in Game Development	174
Verify the Token	175
General Description of the Game’s Services.....	188
Network Interfaces and Sequence Diagram for the Game Development Cycle	193
Game Network Interfaces.....	194
Sequence Diagrams	212

TABLE OF CONTENTS

Security of Online Games Through a Web Portal..... 218

 Secure Code for Games 219

 Secure by Design..... 220

 Security Control 221

Summary..... 221

Chapter 7: Gamification in Human-Computer Interaction223

 Gamification Strategy 224

 Gamification Examples 225

 Common Risks and Mistakes..... 228

 Gamification in Education 232

 Aspects of the Game’s Foundation 232

 The Different Game Categories 233

 Psychology and Motivation in Gamification 235

 The Two Different Types of Motivation..... 235

 Playing and Learning 236

 Gamification in the Classroom..... 237

 Factors that Make Gamification in the Classroom Easier..... 242

 How Can Gamification Help with Learning? 243

 Games-Based Learning vs Gamification..... 244

 Solutions for an Educational Game 246

 Designing a Gamified Application 248

 Math Games for Kids 249

 Gamified Applications Dedicated to Training 251

Methodology for Creating Gamified Applications	254
Web Application	255
Native Application.....	257
Native App vs Web App	258
The PhoneGap Framework.....	259
Why PhoneGap?.....	261
PhoneGap's Architecture	263
Anaconda Python and the PyQt5 GUI Framework	267
Anaconda Installation	267
PyQt5 Installation.....	268
PyQT Events.....	273
Drawbacks to Gamification	284
Avoiding the Drawbacks.....	285
Summary.....	286
Chapter 8: Human-Computer Interaction Research and Development.....	287
Human-Computer Interaction with a Head-Mounted Display	288
Human-Machine Interfaces: Future Development	289
The Touchscreen Revolution	290
Direct Communication with the Mind.....	291
Gesture Engagement Taken to a New Level.....	292
Applications of Spatial Cognition Human Contact Research.....	293
Interaction with the Voice	295
Interactions Between the Brain and the Computer.....	295
Summary.....	299

TABLE OF CONTENTS

Chapter 9: Recommendations and Concluding Comments.....301

 Recommendations 301

 Broad HCI Assessment Criteria 302

 Information and Communication Technology (ICT) Development..... 305

 New Trends 306

 Promising HCI Technologies 308

 Important Considerations for Building a User-Friendly Interface 310

 Final Thoughts on Game Design and HCI 311

 Summary..... 313

Index.....315