

Hands-On Unity Application Development

*Unlock the power of Unity3D for
non-gaming applications*

Puneet Singh Rawat



www.bpbonline.com

Copyright © 2023 BPB Online

All rights reserved. No part of this book may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, without the prior written permission of the publisher, except in the case of brief quotations embedded in critical articles or reviews.

Every effort has been made in the preparation of this book to ensure the accuracy of the information presented. However, the information contained in this book is sold without warranty, either express or implied. Neither the author, nor BPB Online or its dealers and distributors, will be held liable for any damages caused or alleged to have been caused directly or indirectly by this book.

BPB Online has endeavored to provide trademark information about all of the companies and products mentioned in this book by the appropriate use of capitals. However, BPB Online cannot guarantee the accuracy of this information.

First published: 2023

Published by BPB Online

WeWork

119 Marylebone Road

London NW1 5PU

UK | UAE | INDIA | SINGAPORE

ISBN 978-93-55518-477

www.bpbonline.com

Dedicated to

My forever-supporting parents,

Matashri

&

Pitashri

About the Author

Puneet Singh Rawat is a seasoned professional in the digital experience industry with years of experience and a proven track record of delivering interactive applications. His work has been recognized by notable brands such as The International Cricket Council (ICC), Amazon India, Google India, and more. With a focus on creating engaging and memorable experiences, Puneet has shipped amazing phygital experiences all over the globe, including India, South Africa, Europe, the United States, and more. He is highly regarded for his ability to craft engaging and experiential interactive installations, having worked on permanent museum exhibits such as the FSSAI Museum in Delhi and the Sister Nivedita Museum in Kolkata, India.

One of his standout contributions was the award-winning BBC News Initiative mixed-reality film on Warli Tribe, which showcased his expertise in combining experimental technologies with the Unity engine. He is known for his ability to create immersive and memorable experiences that leave a lasting impact.

Acknowledgements

I would like to express my sincere appreciation to my parents for their unwavering support throughout the writing of this book, To Manish, who challenges me every day to be my best. To Anjali, who saw the writer in me and encouraged me to pursue my passion. To Vibha, who pushed me to the finish line and never lost faith in me. And to all my friends, who have been a constant source of support, whether they knew about this project or not. Thank you for being there for me.

I would like to express my gratitude to BPB Publications for their unwavering guidance and expertise that helped bring this book to life. The journey of revising and perfecting this book was long and would not have been possible without the invaluable contributions of the reviewers, technical specialists, and editors.

I am also thankful for the knowledge and feedback that I have received from my colleagues and coworkers in the tech industry throughout my years of work, especially Nikhil Joshi, who has been a great mentor and exceptional leader. Your teachings and insights have been invaluable.

Lastly, I want to extend my heartfelt thanks to all the readers who have shown interest in this book. Your support and encouragement have meant the world to me and made this project a reality. This book is dedicated to each and every one of you.

Preface

In today's fast-paced world, there's a growing demand for innovative and engaging experiences that merge the digital and physical realms. With Unity, the world's most widely-used real-time 3D development platform, developers can bring their imaginations to life and create next-gen experiences that captivate and enthrall users.

This book is designed to help you tap into the multibillion-dollar industry of Extended Reality (XR) and get started with Unity fundamentals. Whether you're a seasoned developer or a beginner, you'll learn how to build exciting and interactive projects that push the limits of what's possible.

Throughout the book, you'll be guided through the process of creating immersive AR experiences, 360-degree mobile experiences, interactive projection mapping, and more. You'll also explore how to integrate cutting-edge technologies like Google Vision AI and OpenAI into your Unity applications and how to network your application with Glitch.

By the end of the book, you'll have a solid foundation in Unity and the skills to create exciting XR experiences that captivate and engage users. So, what are you waiting for? Let's get started!

Chapter 1: Tap into the Multibillion-Dollar Industry- provides a comprehensive overview of Unity's real-world applications and its features that extend beyond video game development. We'll take a closer look at the different industries that are using Unity and what their market requirements are. The chapter concludes with case studies and a discussion of profitable opportunities.

Chapter 2: Getting Started with Unity Fundamentals- serves as an introduction for beginners, providing a step-by-step guide on installing Unity, understanding its interface, and the basics of C# programming.

Chapter 3: Find Success Outside Mobile Games- focuses on the success of non-game applications made with Unity, including tips and tricks for developing mobile apps. We'll discuss how the crowded game industry can be avoided and explore the opportunities that exist in non-game app development.

Chapter 4: Getting Started with AR Foundation- covers AR Foundation, Unity's cross-platform API for augmented reality, and provides a basic setup guide, compatibility check, and step-by-step prototype.

Chapter 5: Model Tracking with Photogrammetry- delves into object tracking with photogrammetry and Vuforia, providing a step-by-step guide on how to track and augment on top of physical objects.

Chapter 6: Create your own Interactive 360° Video Player- explores the creation of 360 experiences for mobile devices, showing how to build interactive apps with 360 video content for Android and iOS.

Chapter 7: Combining Physical with Digital- focuses on combining physical with digital using Arduino and demonstrates how to turn anything into a joystick to feed input to your Unity application.

Chapter 8: Making a 3D Product Visualizer- showcases different types of product visualizers and provides a step-by-step guide on building a 3D product visualizer from scratch.

Chapter 9: Stitching Multiscreen Experiences- explores the possibilities of multiscreen experiences and shows how to run a single Unity application on multiple screens at once.

Chapter 10: Data Collection and Visualization- covers the process of collecting and visualizing data, including a tutorial on connecting to the Twitter API and visualizing data with Unity.

Chapter 11: Interactive Projection Mapping Using Unity- discusses interactive projection mapping using Unity and Madmapper, showing how to stitch and project onto a big surface using multiple projectors.

Chapter 12: Working with Google's Cloud Vision API- examines the Google Vision AI service and demonstrates how to integrate it with Unity to add Artificial intelligence to your application.

Chapter 13: Integrating OpenAI with Unity- provides an in-depth look at integrating OpenAI models like Chat-GPT and DALL-E with Unity and its use cases.

Chapter 14: Networking Your Application with Glitch- covers how to network your Unity application using servers from services like Glitch, including a step-by-step guide on writing server code and integrating it with Unity.

This book is for anyone looking to expand their Unity skills and explore the limitless potential of this versatile tool. Get ready to unleash the full power of Unity and bring your ideas to life.

Code Bundle and Coloured Images

Please follow the link to download the *Code Bundle* and the *Coloured Images* of the book:

<https://rebrand.ly/cuu159w>

The code bundle for the book is also hosted on GitHub at **<https://github.com/bpbpublications/Hands-On-Unity-Application-Development>**. In case there's an update to the code, it will be updated on the existing GitHub repository.

We have code bundles from our rich catalogue of books and videos available at **<https://github.com/bpbpublications>**. Check them out!

Errata

We take immense pride in our work at BPB Publications and follow best practices to ensure the accuracy of our content to provide with an indulging reading experience to our subscribers. Our readers are our mirrors, and we use their inputs to reflect and improve upon human errors, if any, that may have occurred during the publishing processes involved. To let us maintain the quality and help us reach out to any readers who might be having difficulties due to any unforeseen errors, please write to us at :

errata@bpbonline.com

Your support, suggestions and feedbacks are highly appreciated by the BPB Publications' Family.

Did you know that BPB offers eBook versions of every book published, with PDF and ePub files available? You can upgrade to the eBook version at www.bpbonline.com and as a print book customer, you are entitled to a discount on the eBook copy. Get in touch with us at :

business@bpbonline.com for more details.

At www.bpbonline.com, you can also read a collection of free technical articles, sign up for a range of free newsletters, and receive exclusive discounts and offers on BPB books and eBooks.

Piracy

If you come across any illegal copies of our works in any form on the internet, we would be grateful if you would provide us with the location address or website name. Please contact us at business@bpbonline.com with a link to the material.

If you are interested in becoming an author

If there is a topic that you have expertise in, and you are interested in either writing or contributing to a book, please visit www.bpbonline.com. We have worked with thousands of developers and tech professionals, just like you, to help them share their insights with the global tech community. You can make a general application, apply for a specific hot topic that we are recruiting an author for, or submit your own idea.

Reviews

Please leave a review. Once you have read and used this book, why not leave a review on the site that you purchased it from? Potential readers can then see and use your unbiased opinion to make purchase decisions. We at BPB can understand what you think about our products, and our authors can see your feedback on their book. Thank you!

For more information about BPB, please visit www.bpbonline.com.

Join our book's Discord space

Join the book's Discord Workspace for Latest updates, Offers, Tech happenings around the world, New Release and Sessions with the Authors:

<https://discord.bpbonline.com>



Table of Contents

1. Tap into the Multi-billion-Dollar Industry	1
Structure	1
Objectives	2
Unity, I choose you.....	2
What is a real-world application	3
<i>Case study in the retail industry.....</i>	<i>3</i>
<i>The problem it solves</i>	<i>4</i>
<i>How it works</i>	<i>4</i>
<i>The technology used</i>	<i>4</i>
Ease of creation: mobile applications	4
<i>Availability</i>	<i>5</i>
<i>Possibility.....</i>	<i>5</i>
Lead the XR revolution.....	5
<i>What is Augmented Reality?</i>	<i>6</i>
<i>Case study in the fashion industry:</i>	<i>6</i>
<i>What is Virtual Reality?</i>	<i>7</i>
<i>Case study in the aviation industry.....</i>	<i>7</i>
<i>What are 360 experiences.....</i>	<i>8</i>
<i>Case study in the media and entertainment industry:.....</i>	<i>8</i>
<i>What is computer vision.....</i>	<i>10</i>
<i>Case study in the beauty industry:.....</i>	<i>10</i>
The Impact of COVID-19	10
Conclusion	11
<i>Join our book's Discord space.....</i>	<i>12</i>
Questions.....	12
2. Getting Started with Unity Fundamentals	13
Structure	13
Objectives.....	14
Installing Unity Hub	14
Choosing Unity License	15
Installing the Unity Editor	16
Creating your first Unity Project.....	18

Understanding the interface	20
Creating your first GameObject	22
Essential Unity shortcuts.....	22
The flow of Unity life cycle.....	24
Creating your first script in Unity.....	25
Writing your first C# script in Unity	26
Conclusion	33
Questions.....	33
<i>Join our book's Discord space.....</i>	34
3. Find Success Outside Mobile Games	35
Structure.....	35
Objectives.....	36
Prerequisites.....	36
<i>Status of the game industry</i>	37
Unity for application development	37
<i>Rapid development.....</i>	37
<i>Ready-to-go user interface.....</i>	38
<i>Cross-platform nature.....</i>	38
Accessing native features with a custom plugin.....	39
Case studies of Unity applications	53
<i>BMW autonomous driving training application</i>	53
<i>The jigsaw virtual room: a first-of-its-kind VR ad</i>	53
<i>CAE VimedixAR with HoloLens.....</i>	54
Pros and cons.....	54
Key points.....	55
Conclusion	55
<i>Join our book's Discord space.....</i>	56
Questions.....	56
4. Getting Started with AR Foundation	57
Structure.....	57
Objectives.....	58
Prerequisites.....	58
Setup project with AR foundation	59
1. <i>Installing AR foundation.....</i>	59

2. <i>Basic scene setup</i>	60
3. <i>Creating a prefab</i>	61
4. <i>Creating placement indicator</i>	62
5. <i>Writing AR foundation script</i>	63
6. <i>Configuring player settings</i>	66
Building and running application.....	69
Importing 3D models	71
Key points.....	71
Room to grow	71
<i>Join our book's Discord space</i>	72
Conclusion	72
Questions.....	72
5. Model Tracking with Photogrammetry.....	73
Structure	73
Objectives.....	74
Prerequisites.....	74
Why Photogrammetry?.....	74
Creating a 3D model using Photogrammetry	75
<i>Step 1: Choosing an object for Photogrammetry</i>	75
<i>Step 2: Clicking the photos</i>	75
<i>Step 3: 3DF Zephyr Setup</i>	76
<i>Step 4: reviewing and editing the generated model</i>	78
<i>Step 5: exporting the model</i>	79
How to create a Model Target.....	80
Creating your first Model Target AR application.....	84
Points to remember.....	94
Conclusion	95
Questions.....	95
<i>Join our book's Discord space</i>	96
6. Create your own Interactive 360° Video Player.....	97
Structure	97
Objectives.....	98
Prerequisites.....	98
Importing 360° videos into Unity	98

Basic scene setup	99
Version 1: 360° video player with mouse control.....	102
Version 2: 360° video player using mobile gyroscope	104
Version 3: 360° video player with click and drag control.....	106
Version 4: 360° video player using Gaze interaction	110
Key points.....	113
Conclusion	113
<i>Join our book's Discord space</i>	114
Questions.....	114
7. Combining Physical with Digital	115
Structure.....	115
Objectives.....	116
Prerequisite	116
What is Arduino.....	116
Components of Arduino	117
Why Arduino	117
What is Arduino UNO	118
How to set up Arduino IDE.....	118
<i>Connecting Arduino UNO to IDE</i>	120
<i>Testing our Arduino UNO-IDE connection</i>	121
Connecting Arduino to Unity	123
Send and receive data	127
Case study	131
Key points.....	132
Conclusion	132
Questions and assignment	133
<i>Join our book's Discord space</i>	134
8. Making a 3D Product Visualizer	135
Structure.....	135
Objectives.....	136
Prerequisite	136
Why 3D product visualizer	136
Basic Unity scene setup	136

<i>Importing 3D models and textures</i>	137
Scripting the 3D product visualizer	138
<i>Smooth 360° Camera orbit rotation</i>	138
<i>Handling camera zoom</i>	143
<i>Handling camera rotation</i>	143
<i>Handling camera position</i>	143
<i>Switching product models</i>	145
Testing the application	148
Key points	148
Conclusion	149
Questions and assignment	149
<i>Join our book's Discord space</i>	150
9. Stitching Multiscreen Experiences	151
Structure	151
Objectives	152
Prerequisite	152
What is a multiscreen experience	152
Multi-display versus stitched-screen	153
What is multi-display experience	154
<i>Creating multiplayer experiences without server code</i>	154
<i>How to set up multi-display inside Unity</i>	154
<i>Extending display to mobile or tablet</i>	159
What is stitched-screen experience	162
<i>Case study</i>	162
Key points	164
Conclusion	164
Questions and assignment	165
<i>Join our book's Discord space</i>	166
10. Data Collection and Visualization	167
Structure	167
Objectives	168
Prerequisites	168
What is data visualization?	168
Need for data visualization	168

Visualizing tweets from Twitter	169
<i>Registering as a Twitter developer</i>	169
<i>Registering your Twitter application</i>	170
<i>Understanding the Twitter developer portal</i>	172
Data collection using Twitter API.....	173
<i>Search tweets (GET)</i>	173
<i>Sample Request (GET)</i>	173
<i>Sample Result (JSON)</i>	174
<i>Tweets lookup (GET)</i>	174
<i>Sample request (GET)</i>	175
<i>Sample result (JSON)</i>	175
Data collection and visualization in Unity.....	176
Case study	191
Key points.....	192
Conclusion	192
Questions and assignment	192
<i>Join our book's Discord space</i>	194

11. Interactive Projection Mapping using Unity.....	195
Structure.....	195
Objectives.....	196
Prerequisites.....	196
What is interactive projection mapping.....	196
Benefits of interactive projection mapping.....	197
Understanding the hardware and software.....	198
Introduction to MadMapper	198
<i>Installing MadMapper</i>	200
<i>Setting up MadMapper</i>	201
Streaming live Unity Scene to MadMapper	203
<i>KlakSpout</i>	204
<i>How to setup</i>	204
Possibilities with Unity.....	208
Cross-industry use cases	209
General best practices and tips.....	210
Case study	212

Conclusion	213
<i>Join our book's Discord space</i>	214
Questions and assignment	214
12. Working with Google's Cloud Vision API.....	215
Structure.....	215
Objectives.....	216
Prerequisites.....	216
What is Cloud Vision API?.....	216
Setting up a Google Cloud account	217
<i>Enabling Cloud Vision API</i>	218
<i>Setup Cloud API keys</i>	219
Basic Unity scene setup	220
Integrating Google Cloud Vision API with Unity	222
Getting Webcam feed inside Unity	227
Running the application and troubleshooting	230
Key points.....	233
Conclusion	233
Questions and assignment	233
<i>Join our book's Discord space</i>	234
13. Integrating OpenAI with Unity	235
Structure.....	235
Objectives.....	236
Prerequisites.....	236
What is OpenAI	236
Understanding NLP models	237
<i>Chat GPT</i>	237
<i>DALL-E</i>	239
Benefits of using OpenAI with Unity	240
Integrating OpenAI with Unity.....	241
<i>Step 1: Creating the API key</i>	241
<i>Step 2: Integrating with the Unity application</i>	243
Understanding OpenAI APIs	249
Industries impacted with OpenAI × Unity.....	254

Key points.....	255
Conclusion	256
Questions and assignment	257
<i>Join our book's Discord space</i>	258
14. Networking your Application with Glitch.....	259
Structure	259
Objectives.....	260
Prerequisites.....	260
Introduction to Glitch	260
Setting up the Server on Glitch	260
Connecting to the server from Unity	263
Sending and receiving data from Glitch.....	264
Use cases of integrating Glitch servers within Unity applications.....	269
Key points.....	270
Conclusion	271
Questions and assignment	271
<i>Join our book's Discord space</i>	272
Index.....	273

CHAPTER 1

Tap into the Multi-billion-Dollar Industry

If you are reading this, you are serious about building a career with Unity. There is no better platform for developing meaningful real-world applications.

In this chapter, we will learn about what are real-world applications, go through various case studies from different industries, and look at how they are using these emerging technologies to grow their multi-billion-dollar businesses.

After reading this chapter, you will have clarity on some of the most popular buzzwords and learn about their use cases in the real market. You will have your foundation set for detailed, in-depth chapters to come.

You will have a better understanding of how industries all around you are using new innovative technology and coming up with marketing ideas to wow their customers.

Structure

In this chapter, we will cover the following topics:

- Unity, I choose you.
- What is a real-world application?
- Ease of creation: mobile applications
- Lead the XR revolution

- What is Augmented Reality?
- What is Virtual Reality?
- What are 360 experiences?
- What is computer vision?
- The impact of COVID-19

Objectives

After reading this chapter, you will have clarity on some of the most popular buzzwords and learn about their use cases in the real market. You will have your foundation set for detailed, in-depth chapters to come.

You will have a better understanding of how industries all around you are using new innovative technology and coming up with marketing ideas to wow their customers.

Unity, I choose you

Unity was solely responsible for revolutionizing game development by making its game engine free for all. Once again, Unity is revolutionizing application development by making it even more accessible than ever to create immersive experiences. Also, with the rise of opportunities in AR and VR, there is no better time to jump in and be at the forefront of this revolution.

Gone are the days when Unity was used just for game development. Since its launch, it has come a long way, and now it is more ready than ever with all the crucial tools required for non-game application development, whether it be for Android, iOS, or Desktop.

A common question that pops into one's head is, *why Unity? Why not develop it natively?* To answer simply—Unity has the best build and packaging support, which makes it possible to deploy on more than 15 most popular platforms with a single codebase.

Let us discuss in detail the reasons why Unity has the upper hand:

- The majority of **third-party SDKs** are all Unity first. If they are anywhere near the release phase, you bet they have a Unity Extension ready at launch.
- The **Community** is super helpful around Unity Forums and has probably already solved all the issues you are ever going to face in getting started with your Unity Journey.

- **Multi-platform:** Reach the widest audience with minimal additional porting work. Deploy across all major AR, VR, mobile, desktop, console, wearables, Web, and TV platforms to captivate audiences across platforms such as mobile (android/iOS), Windows, Mac, PlayStation VR, Oculus, Microsoft HoloLens, Magic Leap, Windows Mixed Reality, and more.
- **Developer friendly:** Unity supports c# rather than Java, which is considered to be a little simpler and more beginner-friendly.

Are you new to Unity? Do not worry; we will walk through the basics:

- How to set up the Unity development environment
- Learn about the Unity interface and understand its various features
- Essential shortcuts and basic functions

What is a real-world application

Real-world application means an application that solves a real-world problem, whether it is enhancing convenience, driving sales, interactive marketing for a product or service, using education tools for learning, or training. It continually engages and immerses a person in the experience.

Case study in the retail industry

A really good example of a real-world application is **IKEA Place**, which is made for one of the most Iconic Swedish furnishings and home adornment brands, **IKEA**, and is used for Augmented Reality Furnishing. Shown in *figure 1.1* is an example of how an Augmented Reality application looks on an iPad:



Figure 1.1: Augmented item in the real space before purchasing

The problem it solves

Spark ideas to make better-personalized choices from the comfort of your home. The application consequently scales items, given room measurements. Permits clients to picture the furniture in their homes before settling on the purchase decision.

How it works

IKEA place essentially lets you visualize furniture in your home or office setting by simply tapping and placing the furniture using your mobile. You can also swipe through various available textures on different offerings, such as sofas, chairs, and so on, and see what color or texture matches your space. Using the latest AR innovation, it is easier than ever to experience IKEA's smart home solutions.

The technology used

ARKit and ARCore are being used for iOS and Android, and respectively, both are used to the same effect to detect the ground plane and augment the 3D model of the furniture on top of it.

Ease of creation: mobile applications

Unity empowers you to make staggering, performant, and adaptable mobile experiences effortlessly and straightforwardly. With Unity's Canvas UI, you can rapidly create responsive interfaces for mobile applications.

At any point when you are making content for cell phones, you need to test and change your project to ensure it works with an immense assortment of devices. Getting a feeling of how your project will run on every available device is a tedious task. With features like **Device Simulator** built inside Unity, it is easier than ever. It cuts down your building, deploying, and testing workflow by a significant amount. Check *figure 1.2*: