

Introduction to Windows® and Graphics Programming with Visual C++®

with Companion Media Pack

Second Edition

Roger Mayne



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**Introduction to
Windows[®] and Graphics
Programming with Visual C++[®]**

with Companion Media Pack

Second Edition

Preface

This is the second edition of a book originally developed from a set of programming examples for the introduction of Microsoft's Visual C++ to engineering students studying computer graphics. The book has also been found useful for engineers and scientists interested in writing their own computer programs for stand-alone personal computing in the Windows environment. The step-by-step sequence of examples used in the book and the tutorial presentation have proven to be especially effective for teaching Visual C++ programming and the basic ideas of computer graphics. This second edition continues the spirit of those original example programs while covering many features of Visual C++ and the Microsoft Foundation Classes (MFC). All of the examples in the book have been updated to the current version of Visual C++ at this writing (Version 2013). We have also added two new chapters to provide coverage of touch screen programming. The presentation requires only a modest level of mathematical and programming expertise and should provide a useful learning experience for anyone with a serious interest in Visual C++ and MFC Applications.

We begin only with the assumption that the reader has a basic familiarity with C/C++ programming. A traditional "Hello World" program serves as a starting point. And the sequence of example programs proceeds from relatively simple programming to arrays and pointers and on to object-oriented concepts before entering the "Windows World". Each example program is discussed completely and in the early chapters every line of program code is listed and numbered so it can be easily discussed. If you have had only modest exposure to C/C++ you should be able to follow the material but you will find it helpful to have an introductory programming book at hand to review syntax and language details.

The focus of this work is on programming with Visual C++ to develop computer programs which include the Windows graphical interface, graphics components and the touch screen. We attempt to move through these topics with just the right amount of detail. We emphasize the presentation of concepts and program code to accomplish programming tasks. We also try to avoid the detailed discussions of computer language typically present in texts on computer programming. By striking this balance, we are able to progress quickly from the alphanumeric world to the Windows environment and on to touch screen programming. The Microsoft Foundation Classes and the programming tools which are part of MFC are an important part of the presentation. This provides an approach to Windows programming and touch screen operations that should be easily understandable. And that can be extended to a wide range of applications, including tablets, as your programming skill increases.

Chapters 1–3 begin this adventure with the introduction of Visual C++ organization and a review of C++ programming including arrays, pointers, data structures and classes. These later topics form the basis of the object-oriented concepts at the heart of C++ and Windows programming. Chapters 4–7 move the focus to Windows programming with MFC Applications. We consider the document/view architecture, mouse drawn graphics, file storage and printing of drawings. A step-by-step presentation is used to describe programming for the user interface including menu items, tool bar buttons, dialog windows, scrolling, etc. Chapters 8 and 9 develop object-oriented programming to introduce customized classes for two-dimensional objects and graphs in MFC Applications. Animation examples, including a robot simulation, are presented. A strategy for color contour plotting is also described and demonstrated. Chapters 10 and 11 are new chapters on the touch screen interface and introduce the basic gesture and touch input functions available in MFC. Drawing, animation, graphs and tablet friendly examples are included.

When you finish your study of this book and our collection of example programs, you should be well equipped to continue your own exploration of the extensive capabilities of Visual C++. The example programs have been selected to cover many common tasks of interest in

Windows programming and you should find them useful for a variety of applications. The program files included with the book are available as templates for you to adapt to your own purposes, and the various classes and functions for handling two-dimensional objects, graphs and touch screen programming may be used directly in your own programs.

Writing a book about modern computing environments is much like shooting at a moving target since trends change quickly. Considering these dynamics, however, the Visual C++ and MFC programming environments have been remarkably stable. Our introductory level programs have operated in many versions of Visual C++ with only modest modifications needed as new versions have been introduced. Certainly, the basic programming concepts of Visual C++ and MFC applications are now well established and have persisted as Visual C++ has evolved. This second edition presents fully updated projects for Visual C++ Version 2013. Based on our experience for more than a decade, we expect that this full update will be useful for several years to come. The additional chapters provided on the touch screen should be especially important for programs including this now familiar interface.

All of book's projects are contained in its "Companion Media Pack" available on the World Scientific website. Instructions for accessing the media pack and downloading the projects are described in the Appendix. We anticipate that the example programs available in the media package will be upward compatible and that readers will readily adapt to modest changes in the environment. In the event that new versions of Visual C++ do require adjustments of the example projects we intend to provide that information and, if necessary, access to updated versions of the projects. Information on updating may be found on the World Scientific website or obtained by Email to the author at mayne@buffalo.edu.

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*Roger Mayne
Buffalo, NY
January, 2015*

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Chapter 1

Basic Concepts

Microsoft's Visual Studio provides a full package of tools for Windows and web programming within a comprehensive development environment. Visual C++ is one of the component languages of Visual Studio along with Visual Basic, Visual C# and Visual F#. It is the most standard of the Visual Studio languages and is reasonably, but not fully, compatible with ISO/ANSI C++ standards. The C++ language contained in Visual C++ produces the fast and efficient programs that are often required for use in scientific, engineering and computer graphics applications. These applications typically involve repetitive computations, iterative calculations, extensive data sorting and graphics operations that are all handled well by C++. At this time, and for the foreseeable future, C++ is the most generally useful programming language for scientific and engineering applications ranging from interactive graphics and automated design to numerical simulation.

This book is focused on the use of Visual C++ and the Microsoft Foundation Classes for the development of Windows programs — that is, for programs intended to operate on a personal computer using the Windows operating system. The book introduces Windows programming at a level that is accessible to people of many technical backgrounds. Through its eleven chapters and an extended series of examples, you can expect to learn how to write your own programs combining the convenience and graphics capabilities of Windows with the utility of C++ programming. You should become well prepared to develop programs for engineering or scientific applications or to move on to more advanced topics in computer graphics programming.

The Companion Media Pack that accompanies this book is available from the publisher's web page following the directions shown in the

Appendix. The media pack contains the complete project files for all of the example projects in the book and also a series of selected executable files which illustrate the scope of the book's contents. The project files are used in each chapter and provide all of the programming code necessary to compile and build the projects. The code for each project is discussed in detail in the text. The example projects provide the basis for developing competency with Visual C++ and the ability to write meaningful programs including graphics and touch screen capability. The selected executables presented in the media pack are organized by chapter and may be executed directly, with or without the installation of Visual C++ on your computer. They illustrate the step-by-step progress that takes place as we move from chapter to chapter.

Before discussing the example projects of the media pack in more detail, the sections below introduce Visual C++ and provide an initial introduction to programming in the Visual C++ environment. Readers interested in a quick-start can page forward to Section 1.7 where the media pack is more thoroughly described.

1.1 Background

Within Microsoft's Visual Studio, the Visual C++ module makes the management of Windows programming a convenient task. It provides an organizational structure, as well as editing, compiling, linking and debugging capabilities in a single package. Of course, library functions, the Microsoft Foundation Classes (MFC) and a wide range of resources are also part of the package. These make it possible for an application programmer to produce extensive programs with full Windows functionality while having less than a complete mastery of the computer science behind the Windows operating system. The organizational features and available programming tools offered within Visual C++ have made it the environment of choice for an impressive number of engineering application programs including, for example, computer aided design packages.

Compared to the dynamics of the computing world in past years, the programming environment offered by Visual C++ and MFC