GLFW

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http://www.glfw.org/

GLFW is an open-source, multiplatform library for OpenGL, OpenCL, ESSL, and Vulkan development. It provides a simple API for creating window contexts and surface, recovering input events, and more.

GLFW is written in C/Assembler and comes with support for Windows, macOS, and many Unix-like systems, including the X Window System, such as Linux and FreeBSD.

GLFW is licensed under the zlib/libpng license.

- Gives you a window and OpenGL context with just two function calls.
- Support for OpenGL, OpenCL, ESSL, Vulkan, and related options, flags, and extensions.
- Support for multiple windows, multiple monitors, high DPI, and gamma ramps.
- Support for keyboard, mouse, mouse, and window event input, via polling or callbacks.
- Comes with guides, tutorials, reference documentation, examples, and build programs.
- Open source with an OSI certified license allowing commercial use.
- Access to native inputs and complete option for platform-specific features.
- Community-maintained bindings for many different languages.

http://www.glfw.org/
Setting Up GLFW

```c
#define GLFW_INCLUDE_VULKAN
#include "glfw3.h"

uint32_t Width, Height;
VkSurfaceKHR Surface;

void InitGLFW()
{
    glfwInit();
    if( !glfwVulkanSupported() )
    {
        fprintf( stderr, "Vulkan is not supported on this system!\n" );
        exit( 1 );
    }
    glfwWindowHint( GLFW_CLIENT_API, GLFW_NO_API );
    glfwWindowHint( GLFW_RESIZABLE, GLFW_FALSE );
    MainWindow = glfwCreateWindow( Width, Height, "Vulkan Sample", NULL, NULL );
    VkResult result = glfwCreateWindowSurface( Instance, MainWindow, NULL, OUT &Surface );
    glfwSetErrorCallback( GLFWErrorCallback );
    glfwSetKeyCallback( MainWindow, GLFWKeyboard );
    glfwSetCursorPosCallback( MainWindow, GLFWMouseMotion );
    glfwSetMouseButtonCallback( MainWindow, GLFWMouseButton );
}
```

You Can Also Query What Vulkan Extensions GLFW Requires

```c
uint32_t count;
const char ** extensions = glfwGetRequiredInstanceExtensions( &count );

fprintf( FpDebug, "Found %d GLFW Required Instance Extensions:\n", count );
for( uint32_t i = 0; i < count; i++ )
{
    fprintf( FpDebug, "\t%s\n", extensions[i] );
}
```

Found 2 GLFW Required Instance Extensions:
- VK_KHR_surface
- VK_KHR_win32_surface
GLFW Keyboard Callback

```c
void GLFWKeyboard( GLFWwindow * window, int key, int scancode, int action, int mods )
{
    if( action == GLFW_PRESS )
    {
        switch( key )
        {
            case GLFW_KEY_M:
                Mode++;
                if( Mode >= 2 )
                    Mode = 0;
                break;
            default:
                fprintf( FpDebug, "Unknown key hit: 0x%04x = '%c'
", key, key );
                fflush(FpDebug);
                break;
        }
    }
}
```

GLFW Mouse Button Callback

```c
void GLFWMouseButton ( GLFWwindow *window, int button, int action, int mods )
{
    int b = 0;              // LEFT, MIDDLE, or RIGHT
    switch( button )
    {
        case GLFW_MOUSE_BUTTON_LEFT:
            b = LEFT;               break;
        case GLFW_MOUSE_BUTTON_MIDDLE:
            b = MIDDLE;             break;
        case GLFW_MOUSE_BUTTON_RIGHT:
            b = RIGHT;              break;
        default:
            b = 0;
            fprintf( FpDebug, "Unknown mouse button: %d
", button );
            break;
    }
    // button down sets the bit, up clears the bit:
    if( action == GLFW_PRESS )
    {
        double xpos, ypos;
        glfwGetCursorPos( window, &xpos, &ypos);
        Xmouse = (int)xpos;
        Ymouse = (int)ypos;
        ActiveButton |= b;              // set the proper bit
    }
    else
    {
        ActiveButton &= ~b;             // clear the proper bit
    }
}
```
void
GLFWMouseMotion( GLFWwindow *window, double xpos, double ypos )
{
    int dx = (int)xpos - Xmouse;            // change in mouse coords
    int dy = (int)ypos - Ymouse;

    if( ( ActiveButton & LEFT ) != 0 )
    {
        Xrot += ( ANGFACT*dy );
        Yrot += ( ANGFACT*dx );
    }

    if( ( ActiveButton & MIDDLE ) != 0 )
    {
        Scale += SCLFACT * (float) ( dx - dy );
        // keep object from turning inside-out or disappearing:
        if( Scale < MINSIZE )
            Scale = MINSIZE;
    }

    Xmouse = (int)xpos;                     // new current position
    Ymouse = (int)ypos;
}

while( !glfwWindowShouldClose( MainWindow ) )
{
    glfwPollEvents( );
    Time = glfwGetTime();          // elapsed time, in double-precision seconds
    UpdateScene( );
    RenderScene( );
}

vkQueueWaitIdle( Queue );
vkDeviceWaitIdle( LogicalDevice );
DestroyAllVulkan( );
glfwDestroyWindow( MainWindow );
glfwTerminate( );
If you would like to block waiting for events, use:

```c
glfwWaitEvents();
```

You can have the blocking wake up after a timeout period with:

```c
glfwWaitEventsTimeout( double secs );
```

You can wake up one of these blocks from another thread with:

```c
glfwPostEmptyEvent();
```