Tilengine

A 2D graphics engine with raster effects

http://www.tilengine.org

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Introduction

Tilengine is a free graphics library inspired by the design of the 2D graphics chips found in videogame systems of the 80s and 90s, called VDP (Video Display Processor). In these systems there is no framebuffer where to draw images. Instead, the graphics controller has a set of registers describing the attributes of the playfield layers (scrollable backgrounds) and objects (also called sprites), which in turn are composed of small square tiles arranged in an array. The chip composes the final image on the fly, scanline by scanline from top to bottom synchronised with the beam on the screen. The true power of this graphics system is achieved by reprogramming the image attributes mid-frame, between scanlines. This allows for a wide array of special effects called “raster effects”.

Tilengine works with the same principle, but it's not an emulator of a particular VDP. It mixes the scaling sprites of Sega's SuperScaler arcade board with the Super Nintendo affine transformed backgrounds (mode 7) and blending effects; and enhances upon it by adding more blending modes, sprites of any size, and unlimited 256-color tables for all elements.

Instead of the terse regsiter-based programming of actual chips, Tilengine features a modern C API with comprehensive functions and data types. Besides the C language, several bindings exist for other languages like Python, C#, Java and Pascal.

Tilengine is also cross-platform and doesn't depend on any external component or OS feature. There are available builds for Windows (both 32 and 64 bits), Linux, Raspberry Pi (Raspbian) and Android.

Enjoy!

Package contents

Tilengine.pdf

This file.

Makefile

Build and install script for Linux (see Installing in Linux)

/src_samples

- Source code of the C samples
- Makefile and MS Visual Studio projects for building the samples

/src_library

Partial source code of the library. The windowing system and asset loaders are provided, to serve as an example on how to implement custom loaders or integrate rendering into another framework.

/bin

- Graphics assets used by the samples (tmx, tsx, png, sqx, txt…)
- Prebuilt libraries and executables for the Windows platform

/lib

Prebuilt tilengine binaries and development files

bindings/python

Python wrapper and sample scripts (see Python)

bindings/csharp

C# 2.0 wrapper, sample program and prebuilt assembly (see C#)

bindings/java

Java JNI wrapper and sample programs, both source and binaries (see Java)

bindings/pascal

FreePascal / ObjectPascal binding unit source code, without samples

Installing

Extract the files in any directory of your convenience (preserving the structure of directories) and open a command window in the root folder of the pack.

Installing in Windows builds (win32 and x64)

Windows doesn't require installing, just navigate to **\bin** directory and run the prebuilt sample binaries that are already there.

Installing in Linux (x86 and Raspberry Pi)

Linux requires a small install. Once the package is uncompressed, open a terminal window inside the root directory of tilengine and type:

```
> sudo make
```

This script does the following:

- Copy the shared library **libTilengine.so** and development header file **Tilengine.h** to the default system search paths, and assign execute and read permissions.
- Build the C sample programs and place the resulting binaries inside **Tilengine/bin** directory

Once the install is complete, just navigate to the **/bin** directory and run the samples

Running the samples

Binaries for the C samples are already precompiled for Windows and Linux. To run them, open a console in **/bin** directory and run their executables or double-click their icons from the file manager.

List of samples

There are eight samples:

Name	Description
barrel	Sidescroller with barrel-distortion effect similar to SNES Super Castlevania IV and basic character control (jumping, tile collision)
mode7	Classic 2D perspective projection to simulate a 3D floor, similar to SNES Super Mario Kart
platformer	Sidescroller with palette animation and linescroll to simulate depth using only two layers. Similar to Sega Genesis Sonic
racer	Fake 3D road using linescroll, floor palette switching and scaling sprites. Similar to Sega Super Hang On
scaling	Combination of layer scaling and alpha blending
shooter	Complex example with intense use of raster effects for sky gradient, linescroll and layer multiplexing. Basic shooter engine similar to Sega Genesis Thunder Force IV
tutorial	Basic sample on how to setup the engine, load a tileset/tilemap and make a scrolling layer
wobble	Water-like distortion effect combining linescroll and column offset mode to create an ondulating effect
ColorCycle	Color cycling animation
SeizeTheDay	Color cycling animation with palette interpolation

User input

All samples use the same input:

- Use keyboard cursor arrows or joystick d-pad to move
- Press ‘z’ key or joystick button 1 to fire in the shooter example or jump in the barrel example

Python

Tilengine can be accessed from Python through the provided **Tilengine.py** module wrapper. It uses the ctypes feature in Python to interface with native libraries. It is just a barebones wrapper, with all the functions in a single module.

Basic usage

To use the wrapper, you have to import the corresponding module, for example:

```
import tilengine as tln
```

Now all the API is available through the **tln** namespace, and removing the original "TLN_" prefix. For example, to initialise the engine:

```
# create a 400x240 pixels renderer with 2 layers and 80 sprites
tln.Init (400,240, 2,80,0)

# create a window with a scanline overlay and v-sync
tln.CreateWindow ("overlay2.bmp", tln.CWF_VSYNC)

#load some resources and setup layer
tileset = tln.LoadTileset ("mytileset.tsx");
tilemap = tln.LoadTilemap ("mytilemap.tmx", "Layer 1");
tln.SetLayer (0, tileset, tilemap);
```

Interactive mode and multithreading

The default windowing system in tilengine is single-threaded: the game main loop is responsible of attending the event queue of the window and updating the screen, calling the functions `ProcessWindow()` and `DrawFrame()`:

```
# main loop
while tln.ProcessWindow():

    # do game stuff (read inputs, update logic...)

    tln.DrawFrame (frame)
    frame += 1

# deinitialise
tln.DeleteWindow ()
tln.Deinit ()
```

However, during an interactive session in the interpreter, the window gets unattended (nobody is calling `ProcessWindow()` and `DrawFrame()` periodically) so the window doesn't refresh and suffers a "non responding" state.

To solve this problem, a secondary windowing mode has been implemented. Instead of the previous `CreateWindow` function, you have to use:

```
# create a multithreaded window with a scanline overlay
tln.CreateWindowThread (“overlay2.bmp”, 0)
```

This function creates the window in its own thread, which has a loop that attends events and updates it at 60 Hz (always v-sync) in the background. In this mode you don’t have to call `ProcessWindow(), DrawFrame()` and `DeleteWindow().`

Sample scripts

Some of the original samples written in C have been ported to python. These are **platformer.py**, **mode7.py** and **scaling.py**. To run them just open a python console in the samples directory and type any of these:

```
import platformer
import mode7
import scaling
```

To finish the script just press Esc or close the window

Interactive sample scripts

Each one of the three sample scripts listed above have a tweaked version intended to be played with interactively. These are **platformer_test.py**, **mode7_test.py** and **scaling_test.py,** To run them just open a python console in the samples directory and type any of these:

```
import platformer_test as t
import mode7_test as t
import scaling_test as t
```

The `as t` sentence is just for shortening the namespace. Each sample has some prebuilt functions for easy interaction, and from any of them you can access directly tilengine.

C#

The C# wrapper allows applications targeting the .NET Framework 2.0 (Windows) or Mono (Linux) to use Tilengine.

Unlike the other bindings, that are direct translations of the original C API, the C# binding is a “C#-ified” binding, that uses all the features that a programmer for this language expects to find: classes, objects, properties...

The binding and a sample using it can be found in the **/bindings/csharp** directory. The wrapper itself is the **Tilengine.cs** source, whereas the sample itself is Platformer.cs

A more complex example of the C# wrapper can be found in the SuperMarioClone demo here:

https://github.com/megamarc/SuperMarioClone
https://www.youtube.com/watch?v=WLhqazQGrGw

Java

Tilengine can be accessed from Java through the provided JNI wrapper: the java class **Tilengine.java** which in turn accesses the engine through two native bridges: **TilengineJNI.dll** (windows) and **libTilengineJNI.so** (linux).

This wrapper is just a barebones bridge to the native Tilengine API, which doesn't use classes or other Java-like features. All the functions are contained in a single class, and all the object references are plain integers.

Files

File	Description
Tilengine.java	Java side source of the JNI wrapper
TilengineJNI.c	Native side source of the JNI wrapper
Makefile_*	Makefiles for building the JNI bridge
TestWndow.java	Java sample that uses Tilengine internal windowing
TestPanel.java	Java sample that uses an AWT JPanel as a rendering target

Basic usage

To use the wrapper, first create an instance of the Tilengine class:

```
Tilengine tln = new Tilengine();
```

Then you can access all the functions in the tln variable. For example for setting up a basic layer yo can do:

```
// init a 400x240 display, 1 layer and 0 sprites
tln.Init (400,240, 1,0,0);
tln.CreateWindow ("overlay.bmp", tln.CWF_VSYNC);

// load some resources and setup renderer
int tileset = tln.LoadTileset ("mytileset.tsx");
int tilemap = tln.LoadTilemap ("mytilemap.tmx", "Layer 1");
tln.SetLayer (0, tileset, tilemap);
```

Included samples

There are two sample programs that show how to use the wrapper. They're not an example of Java best practices, but just a simple way to setup a basic game loop and rendering with Tilengine. **TestWindow** uses the internal windowing (SDL) as the C or Python samples. **TestPanel** shows how to use Tilengine as a backend renderer, drawing inside an AWT Jpanel

To run the samples in windows, type:

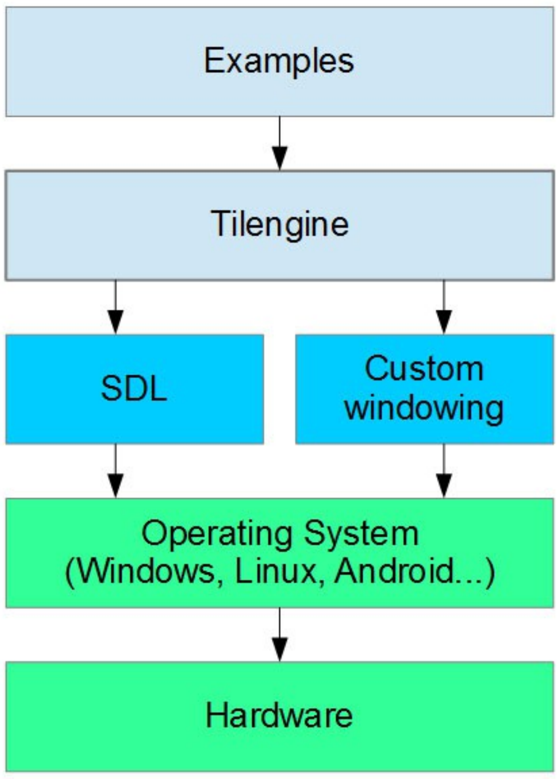
```
> java TestWindow
```

To run from Linux:

```
> java -Djava.library.path=. TestWindow
```

Layer stack

The following chart shows how the examples, Tilengine, and other components are laid out for easy porting and integration:



- **Examples** (or games) are at the top-most layer. They use Tilengine for rendering and its built-in windowing environment. They are open source.
- **Tilengine** provides the 2D scanline-based rendering and optional windowing environment. It is freeware closed source.
- In order to build on as many platforms as possible, built-in Tilengine windowing system uses **SDL** (Simple DirectMedia), an open-source cross-platform library that provides windowing and rendering on many platforms. As long as there is a build of SDL on a given platform, Tilengine and its examples can run there.
- Below SDL there are the underlying **operating system** and **hardware**.

Acknowledgements

Tilengine wouldn't be possible without these work previously created by other generous people. Thanks to all of you!

Tiled

Tiled is a fantastic open-source tilemap map editor by Thorbjørn Lindeijer. Tilengine reads the maps created with Tiled. http://www.mapeditor.org

Spritesheet packer

This tool created by Nick Gravelyn takes a list of independent graphics and outputs a single image with all the original images inside it with their coordinates. Tilengine reads spritesheets for the sprites. https://spritesheetpacker.codeplex.com/

Libpng

Libpng the reference library for reading png image files, open source by many authors. http://www.libpng.org/pub/png/libpng.html

SimpleXML

SimpleXML is a tiny XML parser for embedded systems. Tilengine uses it to read the Tiled maps, which are in XML format. http://simplexml.sourceforge.net/

LibSDL

LibSDL is a cross-platform windowing and user input library, among other things. The built-in windowing environment in Tilengine uses SDL. https://www.libsdl.org/

Mark Ferrari

Mark Ferrari is a pixel art illustrator (among other things), who drew and animated all the awesome images in ColorCycle and SeizeTheDay examples and gave his permission to use them here. http://markferrari.com/