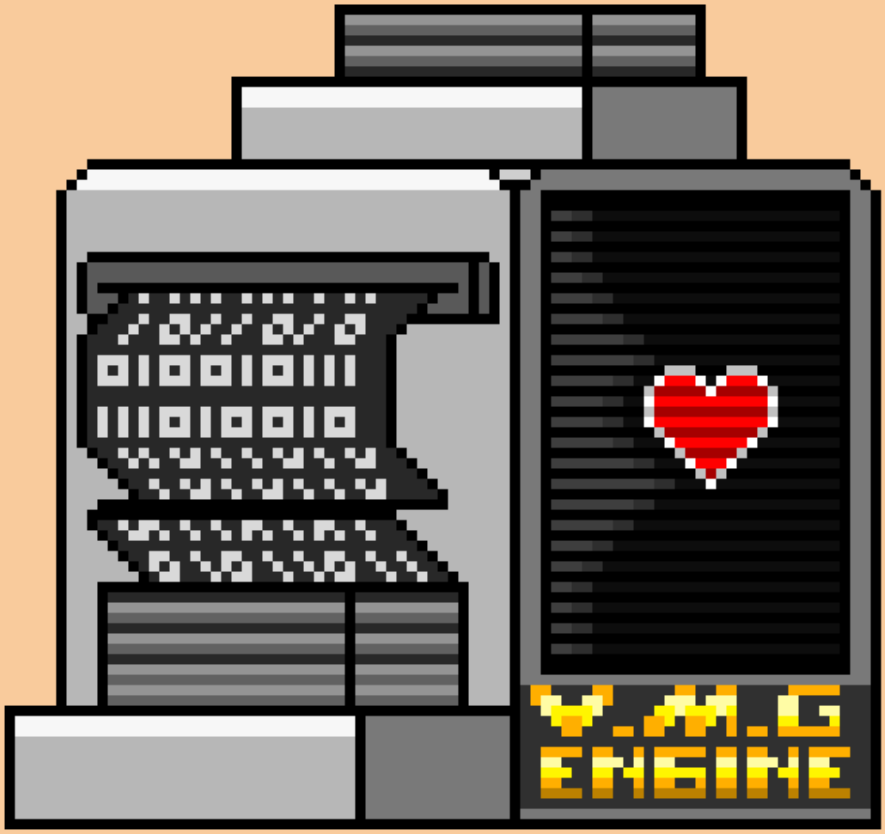
VALLES' MINIMALIST GAME ENGINE

USER MANUAL AND CODE DOCUMENTATION

Version : 1.XX.XX



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Contents

Know the engine.

This engine is a set of tools for 2D game development, created by Jorge Valles. It is a core in constant improvement, intended for covering most of the main aspects involved in classic-retro arcade games. It offers easy ways for managing game entities, their behaviors/states, their animations, scenes, cameras, collision detection, inputs, timing,and so on...

This is a project about the fun and the beauty of programming games out of the black box, and about the challenge of improving it as well as keeping it simple and compact.

Using V.M.G.E you can create nice looking and well polished retro games; but keep in mind that this engine is currently in a primitive version,there is a lot of work ahead to turn it into a professional tool.

Main characteristics

- Core configuration
- Graphics configuration
- Asset loaders
- Scenes
- Cameras
- Game entities
- Collision detection tools
- Animation tools
- Behavior states for entities.
- Sound effects management
- Background music management
- Keyboard input detection
- Timing tools
- Memory management tools
- Useful prefabricated structures for math
- File finder

Create a project

Projects in vminimalist are made over the engine's directory. So just make a clean copy of the directory and name it as you want. Keep in mind the following points:

- The engine already has an entry point. A file with the main function configured to start the engine loading a default empty scene. But of course you can also delete this file and start running the engine from any point on your own project.

- The engine's folder already offers you a directory structure for storing your code sources and assets. But nothing limits you to create your own structure. It is recommended not to change the location and names of folders and files that belongs to the engine's core.

Configuring the engine

There is a header file located on the root/Core directory of the engine, called "Config.h". This file contains a set of C definitions that configure distinct aspects of the game engine and game entities.

Initializing the engine

The following functions are already written in the engine´s default entry point "main.c". Here is how they work. You must use these functions if you are going to write your own entry point.

FUNCTION	PARAMETERS	DESCRIPTION
void START_ENGINE();		This function initializes all the internal modules of the engine, leaving it ready for managing graphics, collisions, animations… Basically all the internal modules involved.
void LOAD_LEVEL(void (*pfn_level)(void));	A pointer to a function that creates a scene.	This function tells the core the current loaded scene (if there is already one) must be deallocated from memory. Then executes the function sent as parameter where the new scene is described.

		Read more about scenes here
void RUN_ENGINE();		This function triggers the main core loop. The engine starts working.
void CLOSE_ENGINE();		This function prepares the engine to deallocate all the used memory. This function

Scenes

Scenes are functions created by the user where the initial game entities and cameras are described. Scene are loaded with a core function that prepares the memory for allocating the new contents of the new scene.

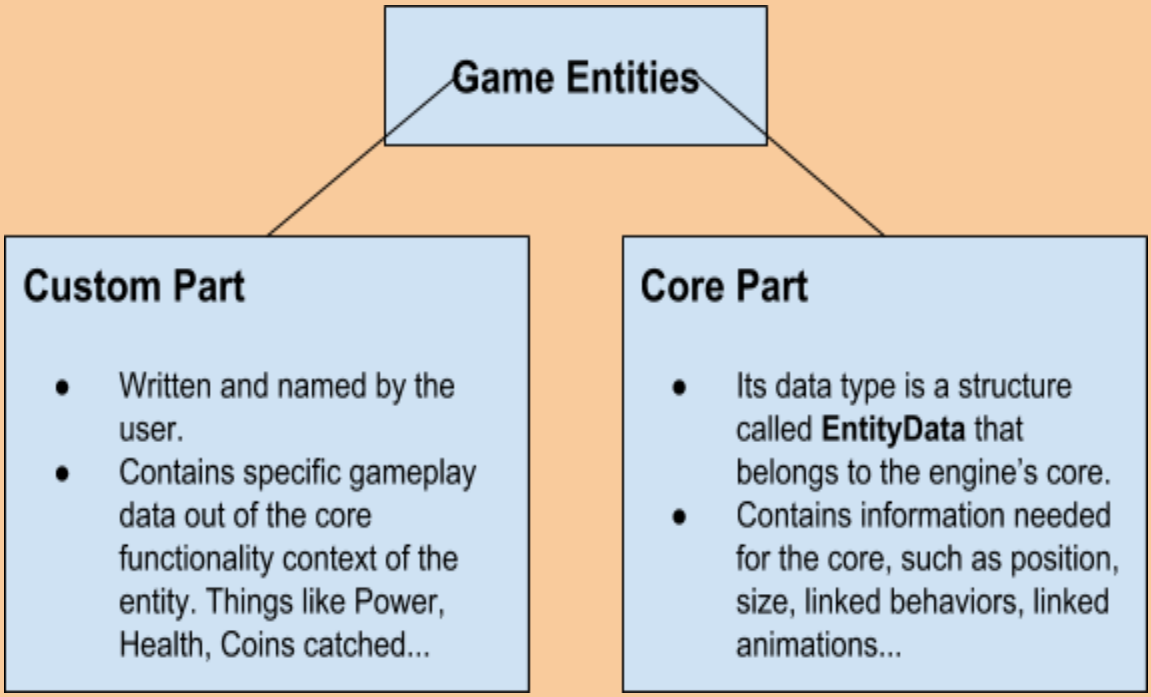
Here is how you must create scene functions and how you must load them.

FUNCTION	PARAMETERS	DESCRIPTION
Void CustomSceneName()		Your scene functions must return void and receive no parameters
void LOAD_LEVEL(void (*pfn_level)(void));	A pointer to a function that creates a scene.	This function tells the core the current loaded scene (if there is already one) must be deallocated from memory. Then executes the function sent as parameter where the new scene is described.

Game Entities

Game entity is a concept with which all objects in a scene are represented. Anything that exist on a scene (with the exception of cameras) are game entities.

Game entities are formed by two parts; a customized part and a core part. The customized part is a structure created by the user that contains specific gameplay information for the entity, while the core part contains just information needed by the game core to communicate with the entity for its management.



Creating game entities

Once you have a structure that represents the customized part of your entity use the functions listed below in order to create and configure your entity.

FUNCTION	PARAMETERS	DESCRIPTION
void CONFIG_ENTITY_DATA(EntityData * _EData);	The pointer to the EntityData structure of the entity,	This function set internal values of the entity, needed for its correct performance. You should use this function immediately before reserving the memory for the EntityData. If you configure your EntityData before calling this method, all your previous configuration will be erased.
void LINK_AND_STORE(void * _ptrEntity, EntityData * _ptrEntityData);	1. The pointer to the customized part of the entity 2. The pointer to the EntityData part of the entity.	This function links the customized part of the entity with the EntityData and stores the entity in the engine's core. At this point your entity becomes managed by the engine.

Deleting game entities

FUNCTIONS	PARAMETERS	DESCRIPTION
void DELETE_ENTITY(EntityData * _EData);	The EntityData structure of the entity	This method calls the destructor (read about destructors here) of the customized part of the entity, and then releases the memory used by the EntityData structure

Destructors

All EntityDatas must have a destructor attached for deallocating memory reserved by the custom entities. If your custom entities do not reserve memory, just leave the destructor empty.

IMPORTANT NOTE:

Inside destructors you must deallocate memory reserved by the custom entities, but NOT the actual custom entities. This is done by the memory manager of the engine.

Destructors must have the following syntax:

```
void DestructorName(void * entity)
```

When an entity is destroyed, the game engine will call the destructor function linked to that entity.

Use the following function in order link a destructor to an entity.

FUNCTION	PARAMETERS	DESCRIPTION
void SET_DELETION_FUNCTION(EntityData* _EData, void(*ptrFN)(void * entity));	1. The EntityData structure where the destructor is going to be linked. 2. A pointer to the destructor function.	Links the destructor function to the EntityData that is related to the customized structure you want to deallocate

Accessing the custom game entity

FUNCTION	PARAMETERS	DESCRIPTION
void * GET_CUSTOM_ENTITY(EntityData * _EData)	The EntityData that is linked to the custom entity of which you want to get its pointer	This function returns a void pointer to the custom entity linked to a EntityData in context.

Names and Class names.

Game entities can be organized in classes and they can be identified with a specific name. For example, you could have vehicles of different types. You should assign them a class name called “Vehicle” and specific names like “Tank”, “Car”, “Bike”. Doing this could be useful, for example in the case of detecting a collision where you need to know what kind on object your entity crashed with.

FUNCTIONS	PARAMETERS	DESCRIPTION
void SET_NAME(EntityData * _EData, char * name);	1. The EntityData that will receive the name. 2. The name	Sets the name
char * GET_NAME(EntityData * _EData);	1. The entity data of which you want to know its name	Gets the name
void SET_CLASS_NAME(EntityData * _EData, char * name);	1. The EntityData that will receive the class name 2. The class name	Sets the class name
char * GET_CLASS_NAME(EntityData* _EData);	1. The EntityData of which you want you know its class name	Gets the clas name

Identification Number

When a game entity is stored in the core, a unique identification number is assigned to it. You can obtain this identification number with the following function:

FUNCTION	PARAMETERS	DESCRIPTION
int GET_ID(EntityData* _EData);	The entity data of which you want to know its ID.	Gets the ID

Position and size.

Set and get the position and size of an entity using the following functions. Position pivot is always the top-left corner of the entity.

FUNCTIONS	PARAMETERS	DESCRIPTION
void SET_SIZE(EntityData* _EData, double w, double h);	1. The EntityData of which you want to assign a size. 2. The width in pixels 3. The height in pixels	Set the width and height
double GET_WIDTH(EntityData* _EData);	1. The EntityData of which you want to get its width	Gets the width
double GET_HEIGHT(EntityData* _EData);	1. The EntityData of which you want to get its height	Gets the height
void SET_POS(EntityData* _EData, double x, double y);	1. The EntityData of which you want to set its position 2. The position in the X axis using pixel units 3. The position in the Y axis using pixel units	Sets the position
double GET_POS_X(EntityData* _EData);	1. The EntityData of which you want to know its position on the X axis.	Gets the position in the X axis
SET_POS_X(EntityData * _EData, double pos_x)	1. The EntityData of which you want to set its X position. 2. The X position.	Sets the X position.
SET_POS_Y(EntityData * _EData, double pos_y)	1. The EntityData of which you want to set its Y position. 2. The Y position.	Sets the Y position.

double GET_POS_Y(EntityData* _EData);	1. The EntityData of which you want to know its position on the Y axis.	Gets the position in the Y axis

Collisions

Collision detection is performed using a structure called Collider that can represent boxes or circles that are attached to the game entities. So when the colliders of two different game entities touch, a collision event is notified to both entities, telling them with which entities they crashed.

Use the following functions in order to add colliders to an entity, to manage detected collisions, and some other useful things.

Important note:

Colliders are always positioned in relative position to the owner entity pivot.

FUNCTIONS	PARAMETERS	DESCRIPTIONS
void ADD_COLLIDER_RECT(EntityData* _EData, int x, int y, int w, int h);	1. The EntityData of which you want to add a box collider. 2. The relative X position of the collider 3. The relative Y position of the collider 4. The width of the collider 5. The Height of the collider	Adds a box collider
void ADD_COLLIDER_CIRCLE(EntityData* _EData, int x, int y,int r);	1. The EntityData of which you want to add a circle collider 2. The X position of the collider 3. The Y position of the collider 4. The radius of the collider	Adds a circle collider
EntityData * POLL_COLL_ENTER(EntityData* contextEntity);	1. The EntityData of which you want to know with which other entities it just crahed	Obtains all the entities the context entity just crashed with. The function returns the entities as a poll. The function will return Null when there are no more entities to return.

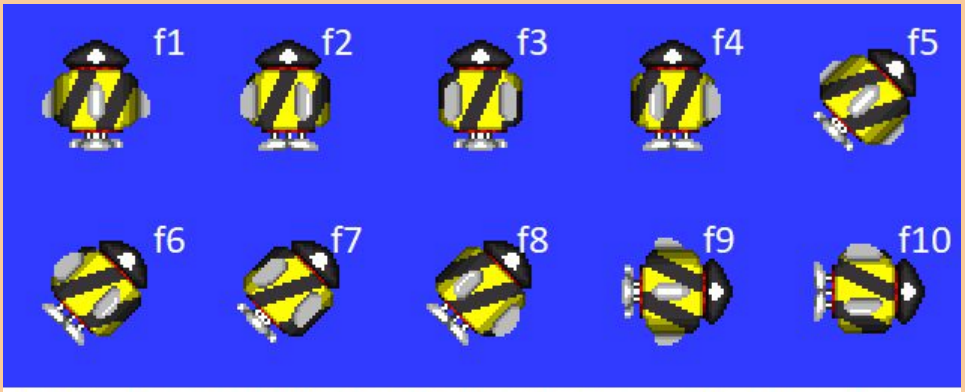
EntityData * POLL_COLL_STAY(EntityData* contextEntity);	1. The EntityData of which you want to know with which other entities it remains crashing	Obtains all the entities the context entity remains crashing with. The function returns the entities as a poll. The function will return Null when there are no more entities to return.
EntityData * POLL_COLL_EXIT(EntityData* contextEntity);	1. The EntityData of which you want to know with which other entities it stopped crashing	Obtains all the entities the context entity just stopped crashing with. The function returns the entities as a poll. The function will return Null when there are no more entities to return.
void SET_COLL_DETECTABLE(EntityData* entity, int mode);	1. The EntityData of which you want to set its detectable mode. 2. The detectable mode (1 for detectable, 0 for not detectable)	This function sets the detectable mode. If the mode is turned off, the entity will be ignored by the collision system
int IS_COLL_DETECTABLE(EntityData* entity);	1. The EntityData of which you want to know if it is detectable by the collision system	Asks if an entity is being ignored by the collision detection system
void SET_COLL_WEIGHT(EntityData* entity, double weight);	1. The EntityData of which you want to set its collision weight 2. The collision weight	Sets a weight to the entity. This weight can be used in many contexts. For example it can be an impact force, or a damage value, or points.
double GET_COLL_WEIGHT(EntityData* entity);	1. The EntityData of which you want to know its collision weight	Obtains the collision weight of an entity.

Animations

Importing Animations.

1. Create a sprite sheet, a PNG image containing all the frames of the animation. Frame must be ordered from left to right and from top to bottom. An example is shown below. Store this sprite sheet inside the ANIMATIONS folder on the root folder of the engine. Inside the ANIMATIONS folder you can create your own sub directories.
2. Create a text file (.txt) with the exact same name as your sprite sheet; the name is case sensitive so be careful. That file must contain a line of text indicating the number of frames and their size. The animation system will read these values and use them to cut the sprite sheet into individual frames.

Example:



Sprite sheet called **SheetTorpedo.png** containing 10 frames with a size of 128 by 128 pixels. So the data file alongside this sprite sheet must be as the following example:

File name: **SheetTorpedo.txt**
Content: **w** 128 **h** 128 **f** 10

Considerations.

1. You must not have more than one sprite sheet with the exact same name. So I recommend you to use notation based names in order to avoid this problem.

Implementing Animations.

- Use the following functions to assign animations to your game entities, as well to obtain information about those animations.

FUNCTIONS	PARAMETERS	DESCRIPTIONS
void SET_ANIMATION(EntityData* _EData, char * _animName, short _continuous);	1. The EntityData for which you want to assign an animation. 2. The name of the **Sprite Sheet** without file extension and without the file path. 3. Is continuous? If 1, the set animation will start exactly one frame forwards the last animation was. If 0 the new animation will start from frame 0	Sets an animation.
int GET_FRAME_COUNT(char * name);	1. The Name of the spritesheet of which you want to know how many frames it has.	Gets how many frames an animation has.
int GET_FRAME(EntityData* entity);	1. The EntityData that has the animation of which you want to know which frame is being shown.	Gets which frame of the animation of an entity is being shown.
void SET_FRAME(EntityData* entity, int frame);	1. The EntityData of which you want to set its animation frame. 2. The frame number.	Set the animation frame.
char * GET_ANIMATION_NAME(EntityData* _EData);	The EntityData of which you want to know its animation name.	Returns the animation name of an EntityData.
void PAUSE_ANIMATION(EntityData * entity);	The EntityData of which you want to pause its animation.	Pauses the animation.

void UNPAUSE_ANIMATION(EntityData * entity);	The EntityData of which you want to unpause its animation.	Unpauses the animation.
int IS_ANIMATION_PAUSED(EntityData * entity);	The EntityData of which you want to know if its animation is paused.	Returns 1 if the animation is paused. Returns 0 if not.

Behaviors

Behaviors are functions with which we tell the game entities how to perform their actions. Using behaviors we tell a vehicle how to steer depending on the user inputs, also we can tell a character how to automatically hide from danger, or tell a single rock how and when to fall.

Behaviors also offer a Finite State Machine style design pattern. Imagine a relatively big game entity, like the player's character. This entity can perform a lot of distinct tasks such as walking, climbing, swimming and more. Behavior functions make it easier.

Behaviors must detect when to stop working and deliver the control of the game entity to another behavior. For example, a behavior for **walking** must pass the control to the behavior **falling** if it detects there is no ground under the player. The same way the behavior **falling** must deliver the control to the behavior **die** if it detects that the player touches the ground again and the falling speed is large.

Behavior functions must have the following syntax:

```
void BehaviorName (EntityData * data)
```

Assign the initial behaviors from scenes, or change behaviors from another behaviors by using the following function.

FUNCTION	PARAMETERS	DESCRIPTION
void SET_BEHAVIOR_FUNCTION(EntityData* _EData, void(*ptrFN)(EntityData*));	1. The EntityData of which you want to assign a behavior. 2. The pointer to the behavior function.	Sets or changes a behavior.

Enabling and disabling entities.

Game entities that are not being used can be disabled. Disabling entities you can improve performance because these entities are ignored by most of the internal systems.

Disables entities are ignored by:

- The collision system.
- The behavior updater.
- The Render.

You can enable and disable entities by using the following functions.

FUNCTIONS	PARAMETERS	DESCRIPTIONS
void SET_ACTIVE(EntityData* ent, int mode);	1. The EntityData that is going to be enabled or disabled. 2. A value 1 or 0 for enabled and disabled.	Enables or disables a game entity.
int IS_ACTIVE(EntityData * ent);	The EntityData of which you want to know its active mode (Disabled or Enabled)	Tells if an entity is enabled or disabled.

SFX

Importing sound effects.

Sound effects must be **“.wav”** files. You should place them inside the SFX folder located on the root directory of the engine. Inside the SFX folder you are able to create your own folder hierarchy.

Implementing sound effects.

FUNCTIONS	PARAMETERS	DESCRIPTIONS
void PLAY_SFX(char * sound);	The name of the audio file **without** the **“.wav”** extension.	Plays a sound. If the sound is not loaded yet, the function automatically finds the audio file and loads it.
Void PRELOAD_SFX(char * sound);	The name of the audio file **without** the **“.wav”** extension.	Loads a sound without playing it. Useful for loading all the used sounds before the scene starts. This avoids lag on game time.

BGM

Importing music.

Music files must be **“.mp3”** files. You should place them inside the BGM folder located on the root directory of the engine. Inside the SFX folder, you are able to create your own folder hierarchy.

Implementing music.

FUNCTIONS	PARAMETERS	DESCRIPTIONS
void PLAY_BGM (char * name);	The name of the audio file **without** the “.**mp3**” extension.	Plays music. If the music file is not loaded yet, the function finds and loads it first and then plays it.
void STOP_BGM ();		Stop/Pauses the current music.
void RESUME_BGM();		Resumes the paused music.
void PRELOAD_BGM(char * name);	The name of the music you want to load, without the “.mp3” extension.	Loads a music file without playing it.

Cameras

Cameras are the way we can see what is happening on the game world. Without them we cannot see anything. Here is how to create a camera and how to configure its field of view, position and some other attributes.

There is a limit of how many cameras could exist on a scene. You can modify this value in the "**Config.h**" file located on the root/Core directory of the engine.

Reserving memory for a camera:

```
Camera * c = malloc (sizeof(Camera));
```

Functions to configure the created camera:

FUNCTIONS	PARAMETERS	DESCRIPTIONS
void CONFIG_CAM(Camera * _cam);	The camera you have just created.	It configures some internal values for the camera. You must call this function immediately after reserving the memory for the camera pointer.
void STORE_CAMERA(Camera * cam);	The camera you want to store	Stores a camera on the core, so the engine can manage it.
void RECORD_CLASS(Camera * _cam, char * _class);	1. The camera in context 2. The class name	This allows the camera to see or record entities of an specified class.
int CAM_HAS_CLASS_NAME(Camera * _cam, char * _name);	1. The camera in context 2. The nclass name	Returns 0 if the camera in context is allowed to record entities that match with the given class name.
int CAM_SEES_ENTITY(Camera * _cam, EntityData * _entity);	1. The camera in context 2. The entity in context	Returns 0 if a game entity is inside the camera's field of view.

void SET_CAM_SIZE(Camera * _cam, double w, double h);	1. The camera in context. 2. The width of the field of view 3. The height of the field of view	Sets the size of the camera's field of view.
double GET_CAM_WIDTH(Camera* _cam);	The camera in context	Returns the camera's horizontal size of its field of view.
double GET_CAM_HEIGHT(Camera * _cam);	The camera in context	Returns the camera's vertical size of its field of view.
void SET_CAM_POS(Camera * _cam, double x, double y);	1. The camera in context. 2. The X position 3. The Y position	Puts the camera on the given position using pixel units.
double GET_CAM_POS_X(Camera *_cam);	The camera in context	Gets the X position of the camera
double GET_CAM_POS_Y(Camera *_cam);	The camera in context	Gets the Y position of the camera
void SET_RENDER_PRIORITY(Camera * _cam, int priority);	1. The camera in context. 2. The level of priority	It gives a camera a priority for being rendered over the rest of cameras. Cameras with lower levels will be sent to the graphics back buffer first than cameras with larger levels.

Inputs

Keyboard

You can obtain which keys have been just pressed, which keys are still pressed, and which keys have been just released; using the following methods. These methods receive the engine's key codes that you can find at the end of this section.

FUNCTIONS	PARAMETERS	DESCRIPTION
short int GETBTN(short int _btncode);	The key code	Returns 1 if the given key is pressed. 0 if not.
short int GETBTNDOWN(short int _btncode);	The key code	Returns 1 if the given key has been just pressed. 0 if not
short int GETBTNUP(short int _btncode);	The key code	Returns 1 if the given key has been just released. 0 if not

BTN_0	number 0	BTN_q	q	BTN_a	a
BTN_1	number 1	BTN_w	w	BTN_s	s
BTN_2	number 2	BTN_e	e	BTN_d	d
BTN_3	number 3	BTN_r	r	BTN_f	f
BTN_4	number 4	BTN_t	t	BTN_g	g
BTN_5	number 5	BTN_y	y	BTN_h	h
BTN_6	number 6	BTN_u	u	BTN_j	j
BTN_7	number 7	BTN_i	i	BTN_k	k
BTN_8	number 8	BTN_o	o	BTN_l	l
BTN_9	number 9	BTN_p	p	BTN_z	z
BTN_x	x	BTN_right	right key	BTN_f1	f1
BTN_c	c	BTN_up	up key	BTN_f2	f2
BTN_v	v	BTN_down	down key	BTN_f3	f3
BTN_b	b	BTN_return	enter	BTN_f4	f4

BTN_n	n	BTN_escape	ESC	BTN_f5	f5
BTN_m	m	BTN_lshift	left shift	BTN_f6	f6
BTN_space	space	BTN_rshift	right shift	BTN_f7	f7
BTN_alt	left alt	BTN_lctrl	left control	BTN_f8	f8
BTN_altgr	right alt	BTN_rctrl	right control	BTN_f9	f9
BTN_left	left key			BTN_f10	f10
				BTN_f11	f11
				BTN_f12	f12

Time and Delta-Time

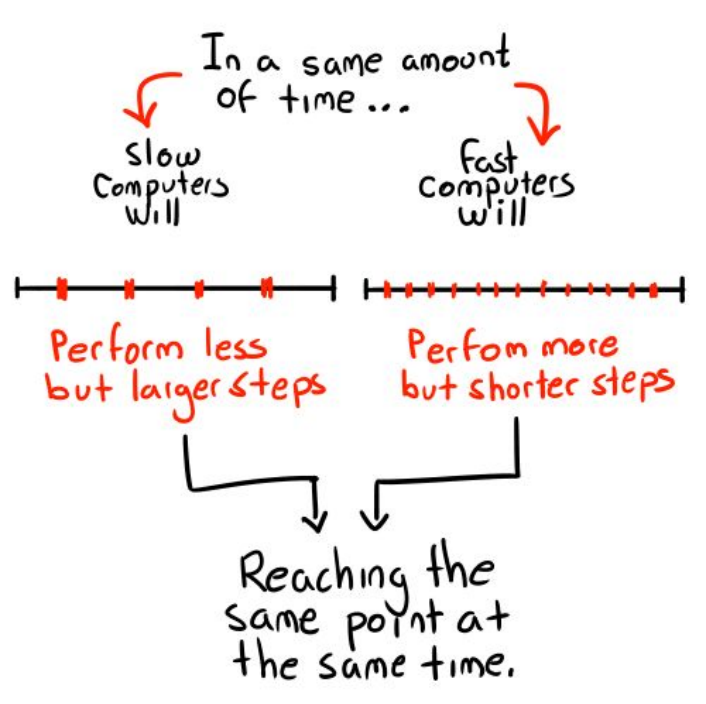
FUNCTIONS	PARAMETERS	DESCRIPTIONS
double GET_TIME();		Returns how many milliseconds have passed since the program started its execution.
double GET_DELTAT();		Returns how long the previous frame took to be completed.

Achieving a constant execution speed

Different computers run programs at different speeds, some of them are incredibly faster. This is a problem because we want our game to run at the same speed no matter the power of the computer. We achieve this with a concept called **DeltaTime.**

At the beginning of the frame, the current program's time (read time section) is gotten and stored as timeA. Then at the end of the frame the current program's time is gotten again and stored as timeB. If we apply the following formula, we obtain how long the frame did last.

DeltaTime = timeB - timeA



So it is logical to suppose that if DeltaTime is **large** it means the last frame did last a **long** time, probably because of a slow computer. And If it is **small**, it means the last frame was completed **fast**, because a fast computer.

If we multiply this **DeltaTime** with all increments like speeds or counters that depend of time, they will reach a desired point at the same time, no matter how fast the computer is.

Use functions shown on the time section >>here<< in order to get deltaTime.

Aborting execution

The engine's core is already configured to abort the execution when the window's exit button is pressed. But also you can abort the execution whenever you want by using the following function:

FUNCTION	PARAMETERS	DESCRIPTION
void KILL_CORELOOP();		Lets the engine to finnish its current core loop iteration, returning the control of the program to the section were engine was initialized and launched. All routines for releasing memory are triggered by this function.

Useful data structures

Vector2	**Rect**	**Circle**
A structure that represents a vector of two dimensions.	A structure that represents a rectangle, with its position, its height and its width.	A structure that represents a circle, with its position, and its radius.
Double x Double y	Double x Double y Double w Double h	Double x Double y Double r

File Browser

The file browser function lets you to find the file path where an specific file is located. This is useful when you are working with files that may change of directory during its development, or for other reasons.

FUNCTION	PARAMETERS	DESCRIPTION
void FINDFILEPATH(char * dest, int dest_size, char* filename)	1. The text buffer where the returned path will be stored. 2. The size of the text buffer 3. The name of the file you are finding. It must include extension (.txt, .doc, .png…)	Finds where is a file given its name and file extension, and stores the file path into a text buffer.

Compiling project

Compiling a project in VGME is easy! You do not need to merge the engine's source inside any complex IDE. Just execute '**Valles' Makefile Gen Tool**' located inside the root folder of the engine, named as **Make Project.exe**. This program will generate a **Makefile** for your project and then will trigger the compilation routines.

Requirements:

- You must install mingw32's C compiler (gcc). You can get it <<HERE>>.
- You must add the path to mingw32's compiler tools folder in the **%PATH%** environment variable of windows.

MinGW has a well explained guide for making these configuration process, read about it <<HERE>>.

Considerations:

- The current version of the makefile gen tool does **not** support paths containing special characters such as '**á,ñ,ö**,...' and so on. Keep the entire path from the operative system root directory (C:/ for example), to your project's directory clear of special chars. Use only characters that belongs to the english alphabet.