NEMA®|GUI-Builder

User Manual

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1 Overview

NEMA®|GUI-Builder is one of the main software tools available in NEMA® GPU's ecosystem. Its main purpose is to provide the end users a simple and flexible tool for rapid graphical user interfaces development, tailored for ultra-low power systems.

By taking advantage of the NEMA®|GUI-Builder , one can simply design high quality, seamless and interactive graphical interfaces within minutes instead of spending months on developing the corresponding code that produces equivalent graphical result. In addition, there is no need for the end users to know details about the underlying graphics API.

The procedure followed by this tool is simple and straightforward. The user performs drag-n-drop operations on the desired graphics items in a design area, selects the associated assets (images and fonts), sets the desired events and then the tool automatically generates the code that implements the designed graphical interface. The generated code can be afterwards compiled and deployed on a compatible system.

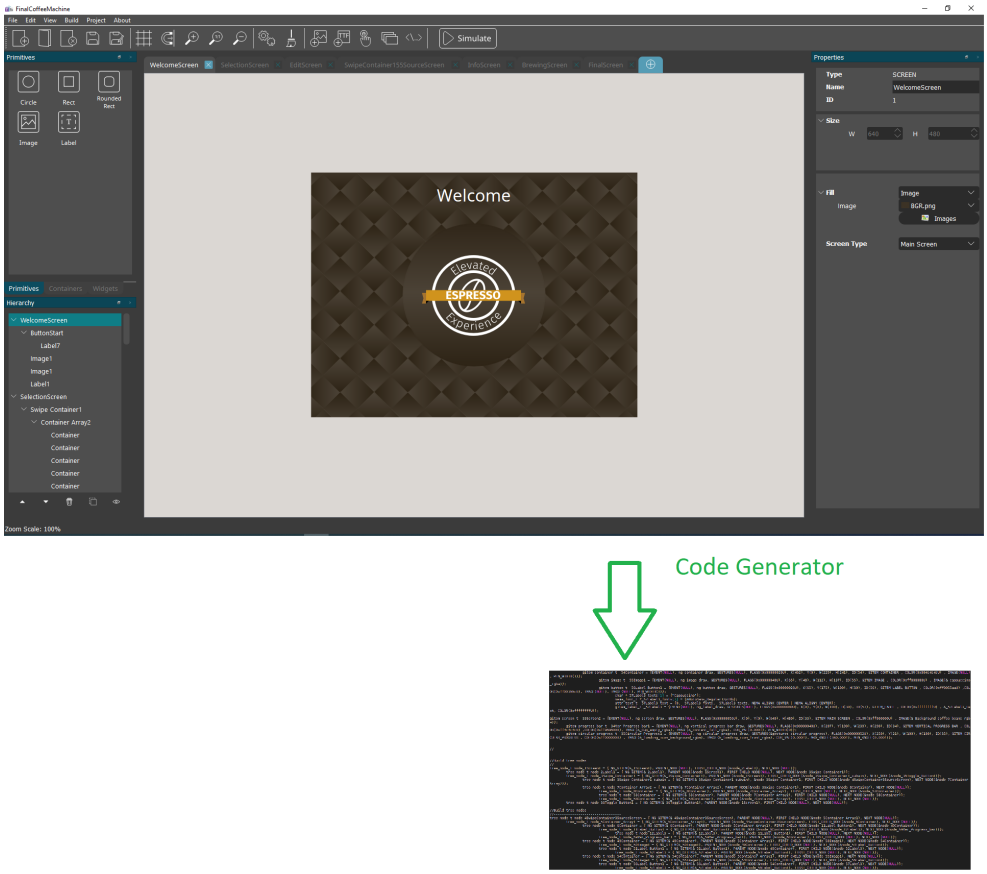


Figure 1: NEMA®|GUI-Builder

Think Silicon's proprietary NEMA®|GFX is utilized in the generated code which makes it compatible with a great variety of computing systems (multiple operating systems or bare metal systems). In resource constrained devices (such as embedded and wearable devices) it is imperative that the software executed

on the device will utilize the available resources in an optimal way. In practical terms, this means that metrics such as the CPU usage or the memory consumption need to be minimum. Keeping such metrics minimum will consequently be beneficial for the battery life of the target device.

This is achieved through the NEMA®|GFX , as its modular architecture is designed specifically for this kind of applications. Its small memory footprint, command lists features (allowing optimal CPU-GPU decoupling), low overhead features and lack of any external dependencies makes it an ideal API for developing vivid graphics on ultra-low power devices.

Moreover, NEMA®|GFX comes in two different flavors; NEMA® GPU or CPU based rendering. As a result, the generated code of NEMA®|GUI-Builder can run on CPU - NEMA® GPU systems (optimum performance, maximum energy efficiency) but also, on less sophisticated, CPU based embedded systems (where no GPU is available).

System Requirements
OS: Windows (10), Linux (Ubuntu 32/64-bit), Screen resolution: 800x600 or higher, RAM: at least 256MB, Hard Drive: 100MB available space.

2 User Interface

NEMA®|GUI-Builder layout is illustrated in Figure 2. As one can observe, the user interface consists of four windows (*Graphics Items*, *Screen Hierarchy*, *Design Area* and *Properties*), each of which (except the *Design Area*) can be independently displayed or hidden.

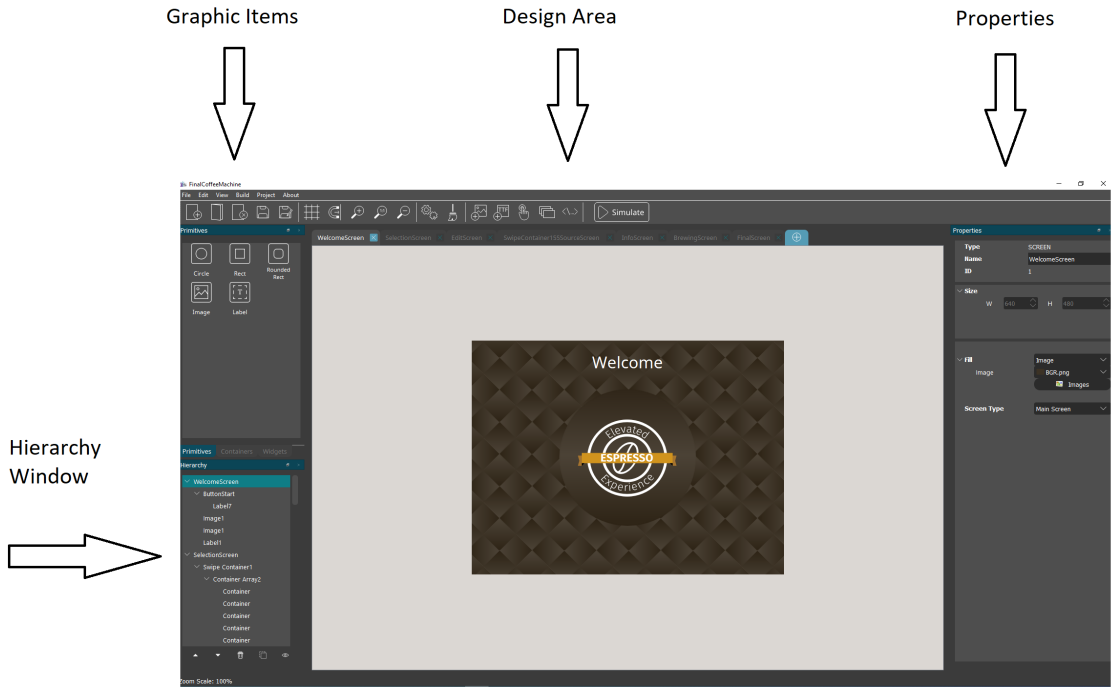


Figure 2: NEMA®|GUI-Builder user interface

The *Graphics Items* window (explained in more details in following section) contains the items that the user can drag-and-drop in the *Design Area*. When such operations take place (or when an item is deleted from the *Design Area*) the *Hierarchy* window updates its contents which summarize the contents of the designed GUI. Additionally, one can also drag-and-drop existing items in the *Hierarchy* window (this is a comfortable way of assigning items to different parent-items). Furthermore, the user is able to review or edit the properties of each graphics item in the *Properties* window at any time.

3 Graphics Items

Any GUI designed in the NEMA®|GUI-Builder consists of several graphics items which are the fundamental items of the GUI. The user can drag-and-drop such items in the *Design Area* and in this stepwise way a GUI can be designed within a minimum amount of time. Graphics items are divided into three categories: primitives, containers and widgets:

Primitives (circle, rectangle, rounded rectangle, image and label) are elementary items that perform basic drawing operations:

Circle	Circle of desired radius. Can be either filled with a specified color or not.
Rect	Rectangle of desired size (width/height). Filled or not.
Rounded Rect	Same as *Rect*, corners are rounded according to a desired radius value.
Image	Image item that must be associated to an image asset.
Label	Label for displaying text information. Must be associated to a font asset.

Table 1: Primitive Graphics Items

Containers (container, table, window, swipe window) are more complex items than primitives as they can be used in order to group together several other items. More specifically, items inside a container are grouped together so that they can move altogether along with their parent item (container). *Tables* are used to group together several containers for the creation of list-like tables.

Container	Containers act as parent items to the items they contain. They can be filled or not with a selected color or an image.
Table	Tables consist of several sub-items (containers) in a tabular layout. The user can configure the number of rows and columns, their dimensions and the distance between them. When adding new items, the last added item is copied to the new ones, so that uniform tables can be created in minimum time.
Window	The Window is a special item because of its property to display any screen except its parent within its area (this can be selected by its corresponding *Source Screen* property). The displayed content is scrollable at runtime and therefore Windows can be used to create scrollable items (i.e. scrolling tables).
Swipe Window	A special case of window (a graphics item that accepts a source screen). Its source screen contains an array of containers that act as swipe pages. The swipe window displays one of these swipe pages and the user can make swipe gestures in order to navigate from one to another.

Table 2: Containers Graphics Items

Widgets (label button, icon button, toggle button, radio button, horizontal slider, vertical slider, digital meter, icon, progress bar, gauge, circular progress, watch face, digital clock) are the graphics items that handle user interactions during application runtime. Widgets are able to send or receive events to/from other widgets. It must be noted that under certain circumstances, some primitives can also act as widgets (i.e. when an image graphics item needs to be displayed at the press of a button, the image receives an event). This functionality is achieved by setting the graphics item's *Interactive* property in the *Properties* window.

Label Button	Button containing text. The background of the text (image or color) can be configured when the button is pressed or released.
Icon Button	Button containing an icon. The background of the icon (image or color) can be configured when the button is pressed or released.
Toggle Button	Toggle button consists of many states each of which is visualy displayed by an image. In addition, when a toggle button is pressed (highlighted) it can scale its resolution.
Radio Button	Radio buttons must be placed inside a table for grouping multiple radio buttons. Checking a radio button will uncheck all the other radio buttons that belong to the same group (table).
Horizontal Slider	The slider consists of two rectangles (filled and empty) and a container as its indicator. The properties of each sub-item can be edited by selecting the respective item in the *Hierarchy* window.
Vertical Slider	Same as *Horizontal*.
Digital Meter	Widget for displaying digital values. The user can edit its background color, precision (number of decimal digits) and initial value.
Icon	Icon consists of an image and a label. Useful in cases whereas pressing it should activate a specific action.
Horizontal Progress Bar	Widget for displaying the progress attribute. Respective events about setting its value have to be manually configured.
Vertical Progress Bar	Same as *Horizontal*.
Gauge	A gauge with a needle that displays its current value.
Circular Progress	Widget used to display a circular progress by making use of two images (background and foreground).
Watch Face	Displays time as an analog watch. At runtime, the system's wall time is used by default.
Digital Clock	Displays the time in many different formats. At runtime, the system's wall time is used by default.

Table 3: Widgets Graphics Items

4 Basic Functionality

Once the user has opened the application, the GUI design can begin after completing a few steps. The first one is to create a new project (by selecting *New Project* under the *File* menu). At this point the project wizard is invoked (Figure 3) and asks the user to enter a project directory and a project name. The wizard will then allocate the entered directory for the needs of the project and all the project related files (assets, generated files etc.) will be saved within this location.

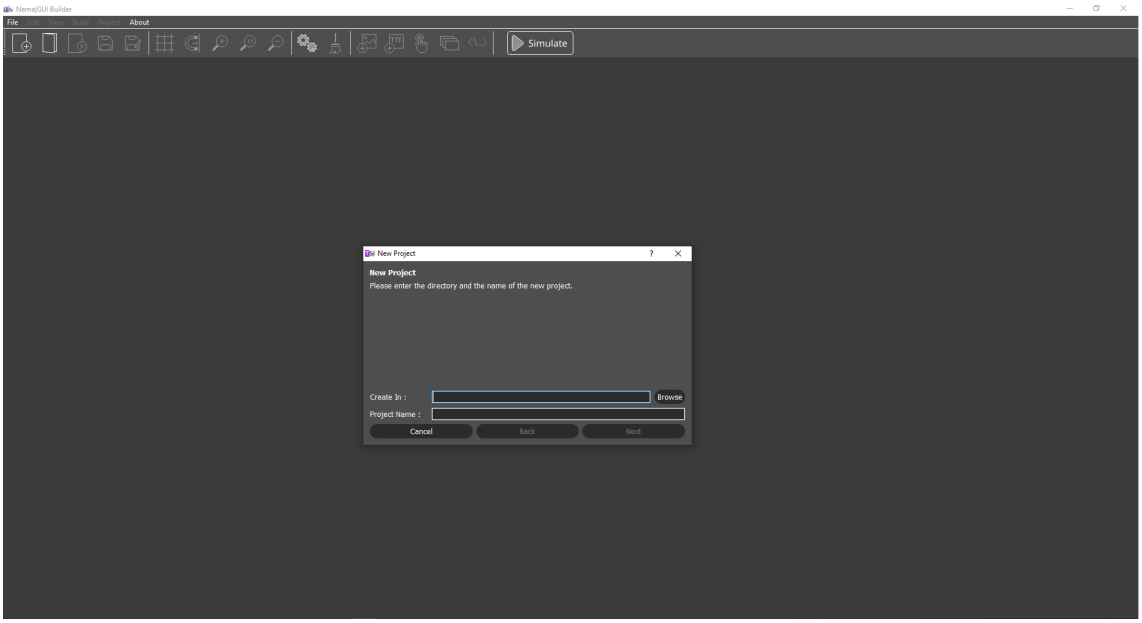


Figure 3: Creating a new Project

Subsequently to entering the project's directory the wizard asks the user to enter the projects resolution (resolution of the target screen). After completing these steps, the user can start designing the GUI in the *Design Area* (Figure 4).

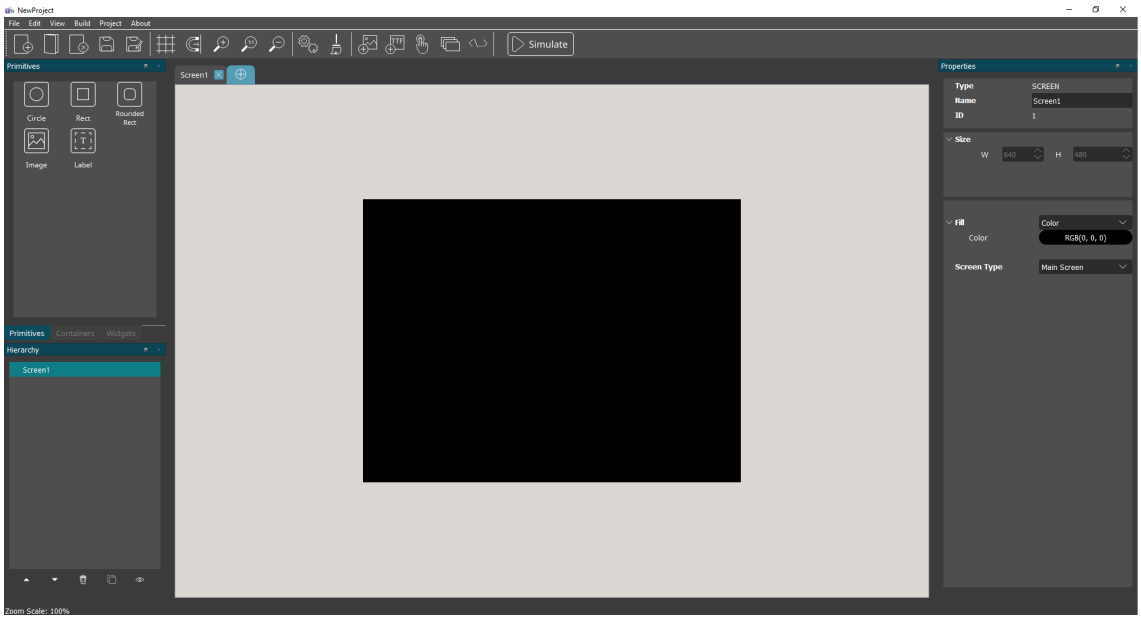


Figure 4: Creating a new Project from scratch

At this point, the user can see a blank screen as there are no items added in it. More screens can be added by selecting the icon in the design area. Screens can either be configured as Primary or Secondary screens. This affects the way they are displayed at application runtime.

Primary screens have fixed resolution and when they are displayed they occupy the whole area of the framebuffer. Secondary screens have variable resolution so that they can be used along with a *Window* item or they can be displayed as pop-up screens.

The background of the screen can be edited by the *Properties* window. This can either be a plain color or an image. Images must be added in project's assets before they can be used in the project. This is performed by clicking "Import" in the *Properties* window, or by selecting *Assets/Images* under the *Project* menu. This will pop-up a form that allows the user to inspect and modify the project's images (Figure 5).

In addition, the user can zoom in/out the design area. The zooming operation is performed by pressing the *'Ctrl'* key and scrolling the mouse wheel, while the mouse cursor is within the design area, or alternatively by using the keyboard hotkeys:

'Ctrl' + *'='* or *'Ctrl'* + *'+'* (zoom in),

'Ctrl' + *'-'* (zoom out)

'Ctrl' + *'0'* (reset zoom to 100%).

The zoom scale is displayed at the status bar (at the bottom of the designed area).

The imported images can now be used to customize image compatible graphics items (images, containers etc.). After setting the screen background and adding a container in the *Design Area*, the application should look as in Figure 6. Please note that in this figure the *Grid* is also visible.

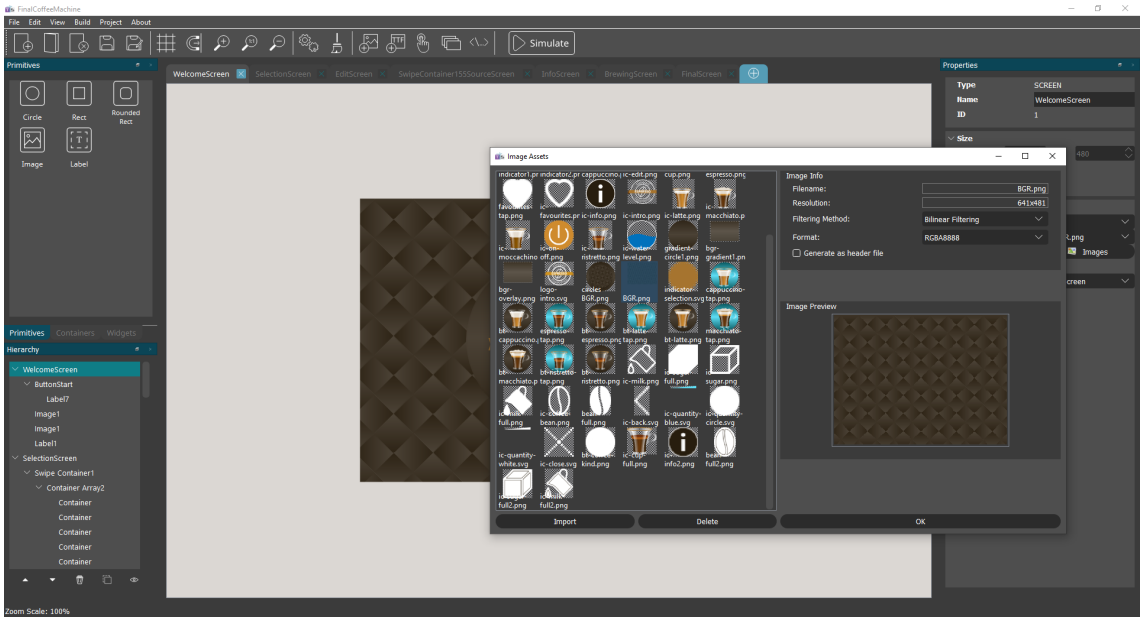


Figure 5: Importing images in a project

The *Grid* is a feature that eases the alignment of graphics items. It can be shown or hidden by checking the respective checkbox under the *View* menu. In addition, graphics items can be snapped to grid by selecting the corresponding option while the grid parameters (width, height, horizontal and vertical offset) can be modified under the same menu. This guarantees that the items will be aligned on the desired line of the grid, thus avoiding the manual alignment by setting each of the coordinates of every item. Please note that snapping is available only for the top-left corner of each item.

Graphics items support generic capabilities such as copy, paste, cut, delete, bring to front and send to back. Whenever such actions take place in *Containers*, the same action takes place for the contained graphics items. The default graphics items, that NEMA®|GUI-Builder offers, include some complex items.

These items consist of a set of basic items (i.e. sliders that are made of a progress bar and an indicator container). Manipulating the basic items can be performed by the *Hierarchy* window or by double clicking on them in the *Design Area*. The user can select these items in the *Hierarchy* window and edit their properties in the *Properties* window. In addition, supported drag-and-drop operations in such items can also be performed in the *Hierarchy* window (by dragging the name of the desired item and dropping it over the name of the desired parent item). Selecting also sub-items, can be achieved by double-clicking consecutively on them (until the get selected).

In this way the functionality of complex items is extended as they come with some default features (so that the user does not have to worry about them at first hand) and they can be customized to the demands of each application (i.e. dropping a circle inside a slider's container, changes the way the slider's indicator can look like).

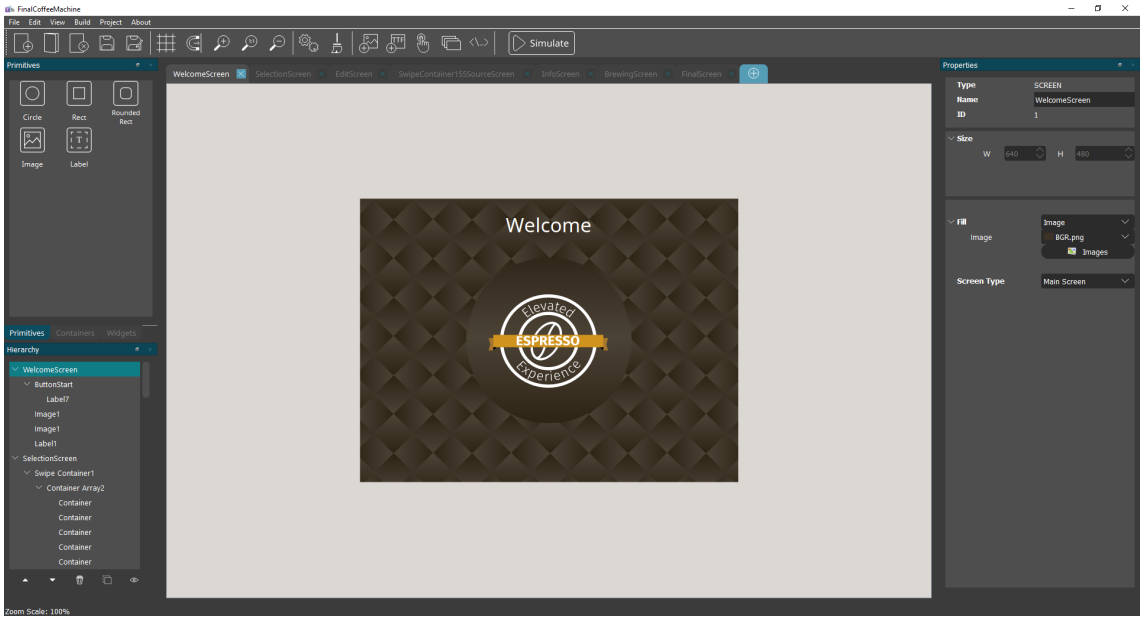


Figure 6: Design area after the addition of graphics items

Furthermore, a project can be saved in the designated location (project directory) as **.tsg* file. This will save:

- The project's structure (in *xml* format)
- The Assets (images and fonts)
- The Events (explained in more detail in following section)

A saved project with these features (structure, assets, and events) can then be opened by the application for further modifications. In addition, NEMA®|GUI-Builder is configured to auto-save the current project silently every 2 minutes. In this way, one can recover the projects content when this action is necessary (i.e. data loss or corrupted files). The backup files are located inside the project directory in the folder *"Backup"*. In order to recover the project from the *"Backup"* files, the user must copy the backup files to the project sources manually.

When a project has been saved, the user must be very cautious when modifying the saved files outside the NEMA®|GUI-Builder . This could break associations between these files by breaking the project's structure or even by making the project incompatible with NEMA®|GUI-Builder .

5 Project Assets

At the current state of the application, images and fonts compose the assets of the project. This is a very important feature as they allow the customization of graphics items that contain images or text (that are ubiquitous in GUI design).

5.1 Images

As explained in Section 4, images that are necessary for the GUI must be imported to it before becoming available for graphics item customization. Images can be imported by the corresponding menu under the *Project* menu. In addition, graphics items that support images have a respective button in their *Properties* window in order to ease the user when importing new images. Current supported formats are *png*, *jpg* and *svg* image formats.

After importing an image to the assets, the user can modify the target format that is going to be used during runtime. The imported images must be converted into a format suitable for low power devices. Such formats require direct pixel mapping in the memory subsystem of the device. NEMA®|GUI-Builder currently supports the following formats:

- RGBA8888 (32 bits-per-pixel)
- RGBA5650 (16 bpp)
- RGBA5551 (16 bpp)
- RGBA4444 (16 bpp)
- L8 (luminance-only 8bpp)
- A8 (transparency-only 8bpp)
- Think Silicon's proprietary and patented formats:
  - TSC™4 (4 bpp)
  - TSC™6 (6 bpp)
  - TSC™6a (6 bpp with alpha channel support).

The default format for newly imported images is set to RGBA8888 format.

Please note that the format of an associated image asset to an item with opacity (opacity value different than 255) must support opacity, otherwise these items will not be displayed properly during the application runtime. Think Silicon's formats (TSC™4 and TSC™6) as well as RGBA5650 do not support opacity. When an image asset's format is A8, the user can also select a default color, in order to colorize the displayed image.

Table 4 summarizes the memory requirements for each format.

Besides the target format that affects the application memory requirements, the user is also free to select the texture filtering method (the way that image pixels are rendered on the output screen pixels). This method can either be "point-sampling filtering" (also known as "nearest-neighbor filtering") or "bilinear

Format	Bytes/pixel
RGBA8888	4
RGBA5650	2
RGBA5551	2
RGBA4444	2
RGBA3320	1
TSC4	0.5
TSC6	0.75
TSC6A	0.75
L8	1
A8	1

Table 4: Memory bytes per pixel for various image formats.

filtering". The first one offers high performance versus poor rendering quality while the latter one trades-off performance to rendering quality.

Depending on the nature of each image (not all the images of a GUI contain high level of details) the users have the freedom to tune the application to their actual requirements. Figure 7 illustrates the difference between these two texture filtering methods.

(a) Point-Sampling filtering

(b) Bilinear filtering

Figure 7: Texture filtering method

At the runtime of a deployed project, the generated assets (images and fonts) are usually stored in a file system (eg. an SD card). These stored files are then loaded to the main memory of the system so that the application can start executing. Nevertheless there exist systems that are not equipped with a file system. In this case, the images can be generated as header file so that they can be included in the source code of the generated project. For instance, the image *mostlysunny.svg* of Figure 8 will be generated as header file.

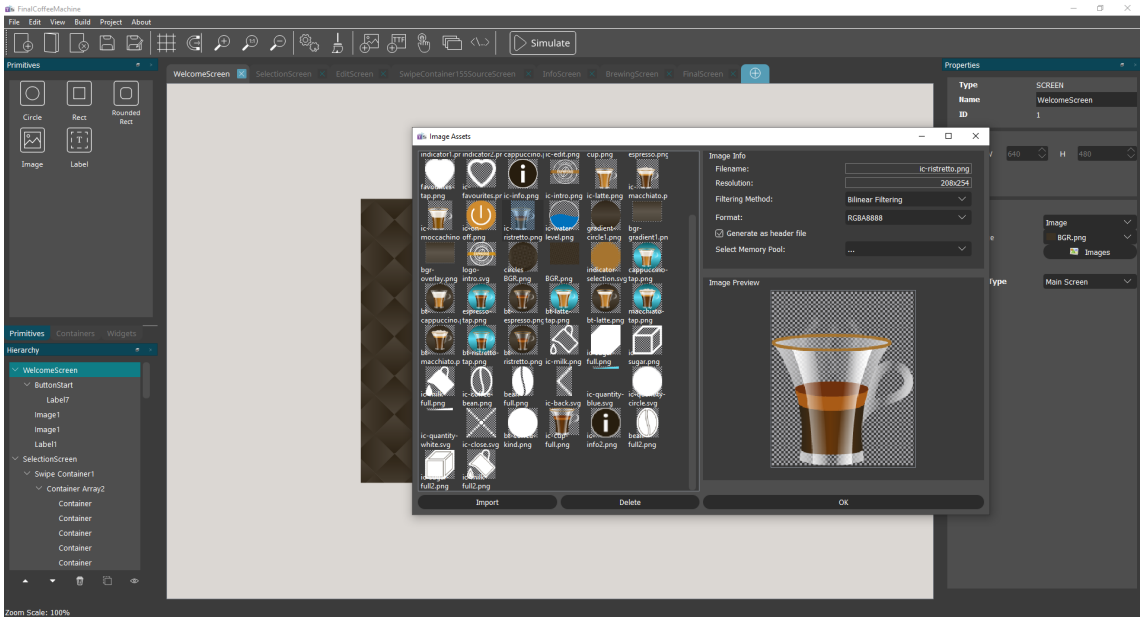


Figure 8: Option of generating image assets as header files

5.2 Fonts

Fonts are necessary for customizing any graphics items with text support such as labels, digital meters etc. NEMA®|GUI-Builder includes the NotoSans_Regular-12 (font family: NotoSans-Regular, font size: 12) as default font. Nevertheless, the end user can import at any time new fonts from the respective *Asset* menu. Only true-type-fonts are currently supported and consequently the user can only import such files (*.ttf* files). Figure 9 shows the form used for this purpose.

When importing a font, its *size*, *bits-per-pixel*, *range count* as well as the *start* and *end* values for each range need to be set. By using the default values, the imported font will have size 12, 8 bits-per-pixel and one range that spans from value 32 to 127; this is the range for the ASCII character set. In order to include characters beyond this range, the *start* and *end* values can be modified. However, is must be noted that the more characters are included the bigger the memory footprint will be. Therefore, the user is advised to make use of multiple ranges that contain exactly the number of character needed by the application. Each range can contain characters that belong to the Unicode character set: 0 up to 10FFFF (hexadecimal value). In addition, the size and bits-per-pixel parameters affect directly the memory size of the generated fonts as well. Please ensure that these parameters are fine tuned before generating the project code, so that their impact in memory consumption will be as small as possible.

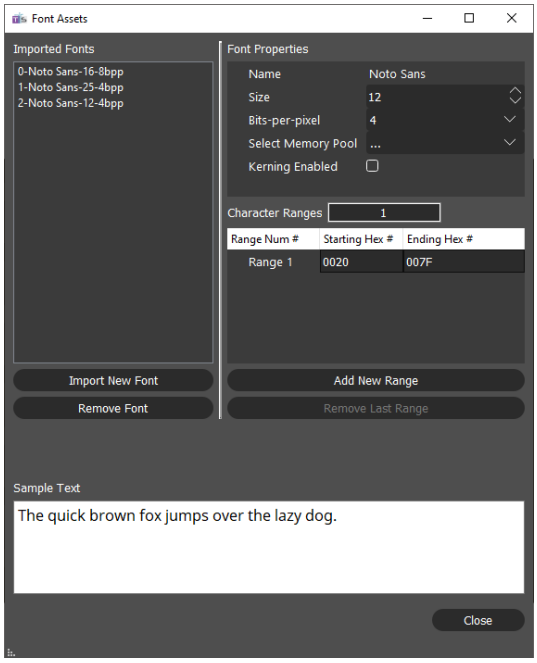


Figure 9: Form used for adding a new font

6 Project Properties

Each project created in NEMA®|GUI-Builder has some specific properties, that affect the code generation process as well as the generated code. These are:

- How many framebuffers will be used (single, double or triple buffering)
- The frame-buffer format (RGBA8888, RGBA5650, TSC™4 , TSC™6)
- How many back buffers will be used (up to two). Two back buffers are necessary when performing animations such as screen transitions using a non *linear* animation effect. If the animation buffers are less than two, screen transitions will be performed using *linear* effect and show/hide animations will be performed instantly, without animation effect.
- The back-buffers format (RGBA8888, RGBA5650, TSC™4 , TSC™6) To keep the memory usage to minimum, the default format of these buffers is TSC™4 .
- The memory pool that will be used for the framebuffers and the back buffers.
- The animations frame rate (this sets the animation timer period used in the generated code)
- The project's resolution and the code generator options (whether the code generator will generate the fonts, images and if the generated images will be scaled to the minimum possible resolution as identified by NEMA®|GUI-Builder).

In addition, the user can see the current project path and navigate to it by pressing the respective button (*Open Directory*).

Last but not least, the users can also adapt some settings relative to the code generation. These concern the generation of images and fonts and whether the images should be scaled or not. Image scaling aims to minimize the memory that the generated images will consume. In order to achieve this, a large image can be scaled down to the resolution of the graphic item that it is assigned. If the resolution of the imported image is smaller than the resolution of the respective graphics item, the original resolution is kept. The resolution of the generated images, can be inspected in the code generation report (generated along with a project).

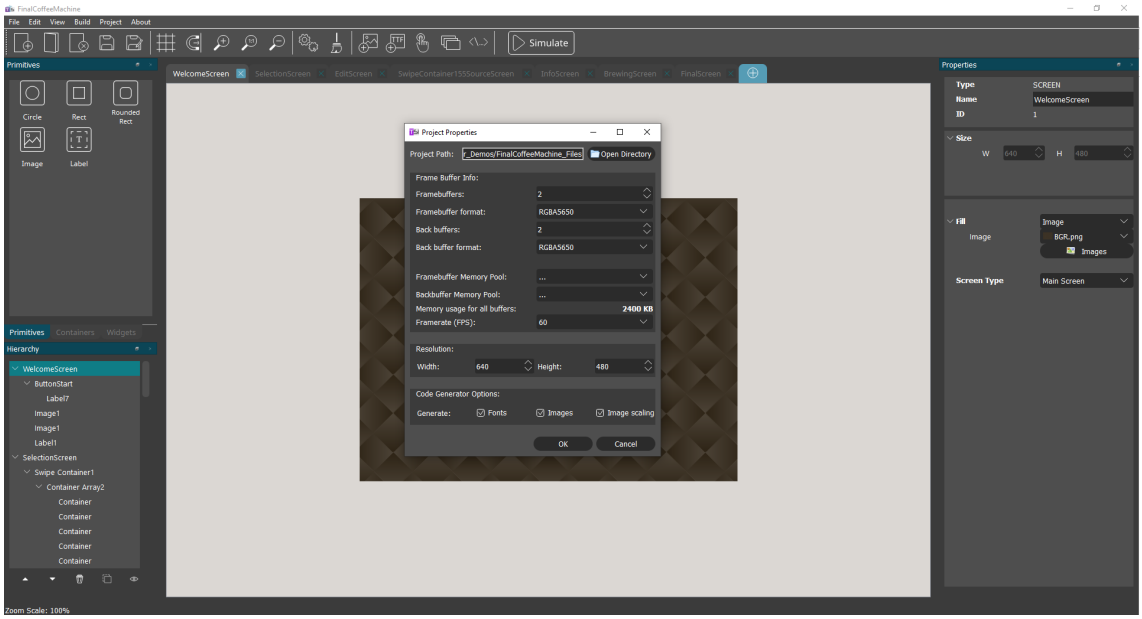


Figure 10: Project properties

7 Screen Groups

Modern applications usually consist of several sub-applications with similar but different user interfaces. For instance, complete smart-watch UI, can include graphical interfaces for sub-apps such as weather forecast, music player, make a call via a connected smart-phone and many more.

Having this in mind, NEMA®|GUI-Builder organizes the designed screens of a project into one or several groups. By adopting this technique, screens are organized in an efficient way that makes the design of complex applications easier.

Each group has its own transition effect; effect during scene rendering while swiping from one screen to another. Swiping operations are allowed only for screens of the same group. In addition, screen groups have a layout. The layout can be either *horizontal* or *vertical* and it defines the orientation of swiping operations. For instance, when swiping a screen that belongs to a screen group with horizontal layout, the respective screen transition will be controlled by the cursor movement (mouse, touch point etc.) *dx* on the horizontal axis.

Changing the current screen group can be achieved by displaying a screen of a different group (eg. by pressing a button). In this case the applications' current group will be set according to the target screen.

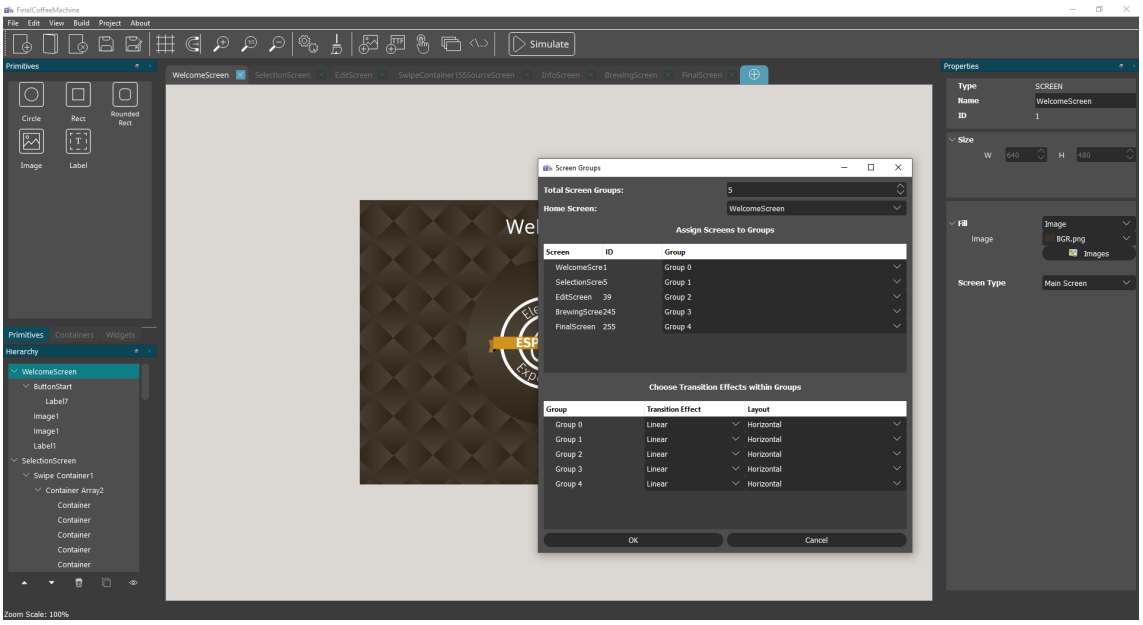


Figure 11: Screen Groups

8 Event Manager

NEMA®|GUI-Builder utilizes the *Event Manager* for managing the events associated to a project. It can be found under the *Project* menu. This maximizes the user's interaction during runtime and allows them to inspect, add or remove events according to the needs of the project in a user-friendly way. Through the *Event Manager*, the user can add events by setting following parameters:

- The *Trigger* (eg. a button is released)
- The *Source item* (if applicable)
- The *Action*: what should happen when the event is triggered

Depending on the *Action* that should be executed, the user can add more data to an event. For instance a *Screen Transition* action needs to know the duration and animation effect, while a *Set Value* action should know the value (absolute value or percentage) that will be set. These attributes are displayed when the user creates an event or inspects an existing one.

Many actions are predefined, nevertheless, the user can also create custom events and tailor their functionality to the project requirements. This can be performed by selecting a *Custom action* when creating a new event (or attaching a new action to an existing event). In the generated code, *Actions* are handled as callback functions. Therefore the user needs to complete these callback functions with the desired code. These functions can be found in the *custom_callbacks.c* file among the generated files.

For ease of use, custom actions are divided in four categories:

- One-Shot
- Periodic
- Transition
- Periodic Transition

The *One-Shot* The callback function is executed instantly when the event is triggered.

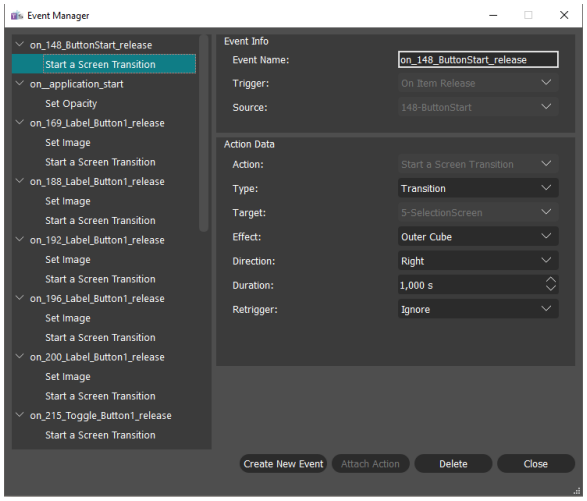
The *Periodic* actions are performed in a periodic basis. For example, the callback function is executed periodically according to the defined period (i.e. a *Digital Meter* that needs to set its value every 10 seconds).

The *Transition* is a special case of custom action. This action can be used to change an attribute of the target item (eg. opacity) in a continuous way. The *Transition* has a specific duration, defined by the user and during runtime, it keeps track of its progress (discussed in more detail in the next section).

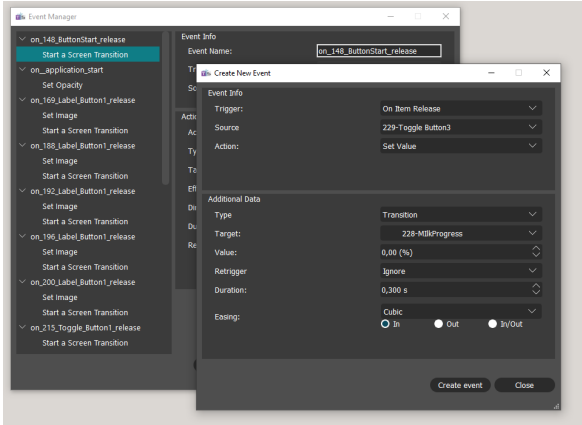
The *Periodic Transitions* are essentially *Transitions* that are performed periodically. The user must define both the duration and the period of this action.

After a custom action has been created, this can be afterwards edited by changing its corresponding attributes (*Type*, *Duration* and *Period*) in the *Event Manager*.

Figure 12 depicts how the user can manage events in the *Event Manager*.



(a) The *Event Manager* Form



(b) Adding a new event

Figure 12: Manage events in the *Event Manager*

9 Simulation Window

The current project can be simulated by selecting the *Simulate* option under the *Build* menu. This will invoke the simulation window (Figure 13) in which the user can simulate the project at its current status and observe whether its behavior is the desired one or not. The simulator supports all user interactions except the custom ones (custom events). Screen transitions, show/hide animation effects, scrollable graphics items and the rest of the visual features can be inspected at no time in the simulation window.

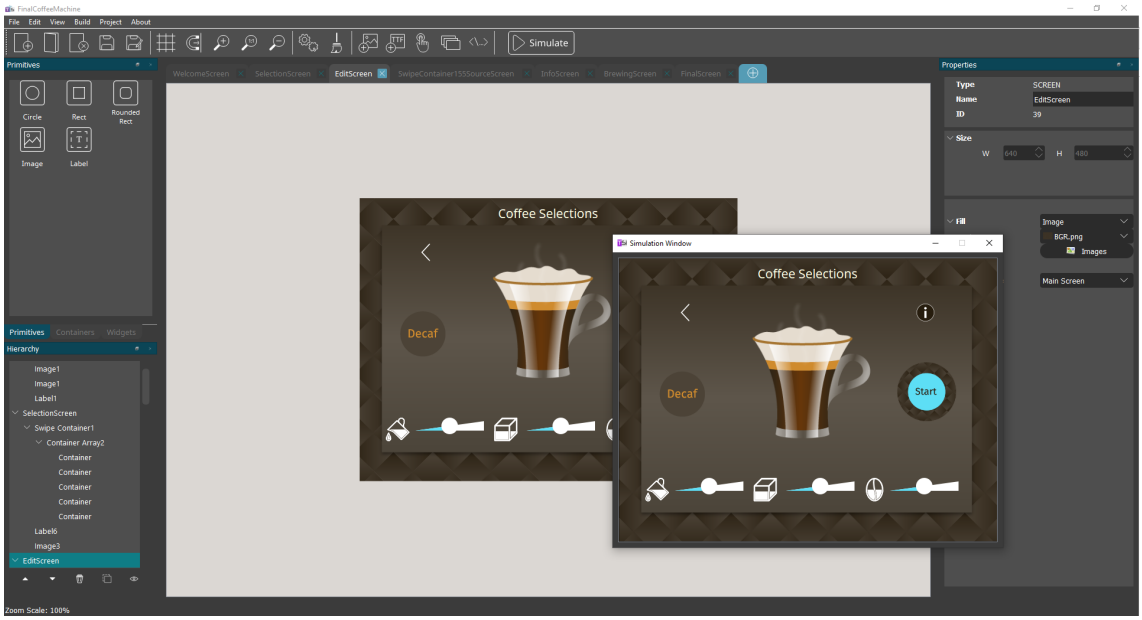


Figure 13: Simulation Window

The *Simulate* option has some limitations, but the generated code is not affected by them. These limitations are:

- The simulation window is always rendered in RBGA8888 color format, and thus the differences when using different image or framebuffer format cannot be observed there.

10 Generated Code and Custom Callbacks

At code generation, a folder *generated* will be created inside the project's file directory. The generated files (C language) are located inside the *generated* folder. In this folder, one can find the generated assets (images and fonts) the *NemaGUI* folder that contains the API responsible for the runtime of the generated application. More specifically, it contains the header files of the necessary modules (e.g. main loop, gestures, screen transitions etc.) and data structs (graphics items data structs, events data structs etc.) that are necessary for an application in order to run on an embedded device. Besides the header files that expose the interface to the end user, *NemaGUI API* is provided as a library and the generated code is linked against the library, as indicated inside the generated Makefile (link against *libNemaGUI*). More details regarding *NemaGUI API* can be found in Sections 13 and Section 14 that contain its documentation. In addition, project specific files are also generated inside the *generated* folder, as depicted in Figure 14.

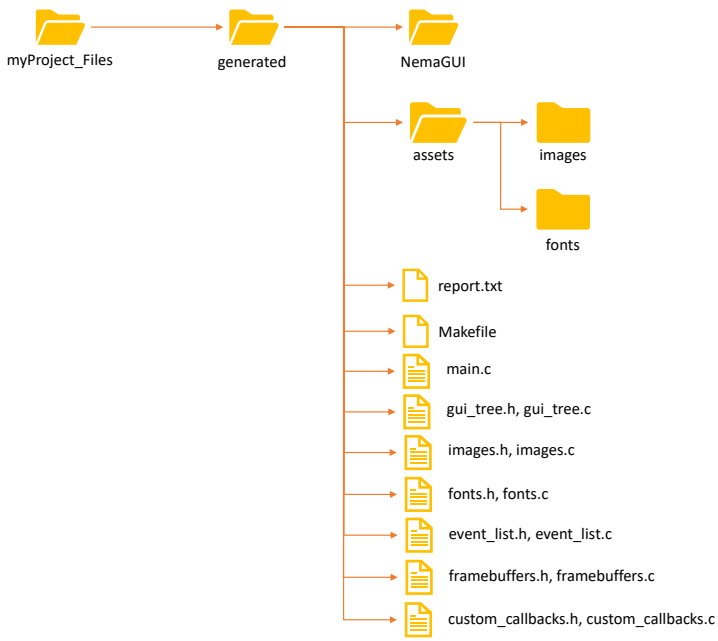


Figure 14: Generated code directory structure

Such files are:

- report.txt, contains information regarding the memory consumtion of the generated images, fonts and framebuffers.
- Makefile, a default Makefile for building the generated code.
- main.c, the application't entry point (initializes *NemaGUI API*, NEMA®|GFX library and enters the application's main loop).
- gui_tree.h and gui_tree.c, contain the generated graphics items.
- fonts.h and fonts.c, contain the code that loads the generated fonts.
- images.h and images.c, contain the code that loads the generated images.

- event_list.h and event_list.c, contain the generated event list.
- framebuffers.h and framebuffers.c, contain the code that creates the framebuffer(s), back buffers (if available) memory objects along with the display layers.
- custom_callbacks.h and custom_callbacks.c, are the files that the user needs to fill in with custom code.

event_list.c and *custom_callbacks.c* are the files related to the events the an application contains. More specifically, *event_list.c* contains the events that the *Event Manager's* contains, translated in C code.

The *custom_callbacks.c* is the file that the user needs to edit, in order to define the custom functionality. When the tool generates this file, it defines the respective callback function for each event that is associated to a *custom* Action.

These functions are named according to the name given by the user (when a custom action was created).

The user should fill the body of these functions and must not edit their names (as these names are used in the respective header file and the *event_list.c*)

By default, these functions contain a pointer to the related event *ng_event_base_t *event* and a void pointer *void *data*.

An example of a generated function is the following:

```
void my_custom_callback(ng_event_base_t* event, void *data){
        ng_transition_t *transition = NG_TRANSITION(event);


}
```

In the above snippet, one can observe that the event pointer is casted to a *ng_transition_t* type. This is due to the fact that the callback is assigned to a transition event (the code generator casts the base event type to the desired type automatically). In this way, the user can now access the attributes of the *ng_transition_t* inside the function body. For instance the opacity of an object can be set based on the progress (transition attribute) of the event. The second argument is currently not used. For more information about the data strcuts used in the event mechanism, see Section 13.

Events can be triggered using various triggers such as when the application starts-up, when a button is pressed, when a screen is entered and more. A special case of an event trigger is the *custom trigger*. When a custom trigger is used, it means that the event will be triggered manually by the user. To trigger an event, one needs to run its *start function*. The following snippet shows how an event can be manually triggered.

```
#include "ng_globals.h" //access the event list

void my_custom_trigger(){
        ng_event_base_t *my_event = NG_EVENT_LIST[8];
        my_event->start();
}
```

In the previous snippet, one can observe that the *ng_globals.h* must be included in the file that the custom trigger (*start* function) will be called. Including this file gives access to the necessary *NG_EVENT_LIST* array that contains the generated events. The developer needs to identify the index of the the event that will be manually triggered by inspecting the generated *event_list.c* file. Once the index of the desired event is identified, the respective element of the event list can then be retrieved (the index in this example is 8) and its *start* function can then run.

11 Examples

NEMA®|GUI-Builder comes along with four example projects that aim to work as "hello world" applications. They can be found inside the installation directory, in the *examples* folder. The goal of these examples is to familiarize the userswith the NEMA®|GUI-Builder environment and the way it handles the GUI development process. They can be instantly simulated in order to evaluate their behavior at runtime. The examples are:

- Animated screens: Contains six screens that are divided into two screen groups. It depicts the functionality of swiping inside a screen group, along with how a transition from one group to another is performed (button-triggered transition).
- Gauge: This example contains a button that is connected to a *gauge* and a *digital meter*. Clicking the button will set the value of the *gauge* and the *digital meter* using a transition event.
- Mixer: The functionality and custom style (modified compared to the default one) of *sliders* is illustrated in this example. In addition, interactive (swipable) *gauges* are used in order to create rotating objects.
- Coffee Machine: A demo application that depicts how a coffee machine UI is designed in NEMA®|GUI-Builder .

In all the examples, the events used to perform their functionality can be inspected in the Event Manager. It is recommended not to modify these examples as their goal is to act as guides for GUI development projects that should be available at any time. Modifying these examples and saving the changes will overwrite them and their initial structure cannot be recovered.

12 Project deployment

The source code of a project created in NEMA®|GUI-Builder can be generated simply by pressing the "*Generate*" button. This will create the "*generated*" folder inside the project's directory and the source code will be placed there. The user can then modify the generated code, by completing the code of the custom callbacks (if applicable). The next step is to compile the project's source code for the target platform.

12.1 Project deployment on Linux PC

In order to compile and run the project on a Linux PC, the generated source code must be compiled and linked to the NEMA®|GFX libraries. All the necessary files (libraries, header files) have been placed inside *<PATH_TO_Nema_GUI_Builder>/NemaGFX_SDK/*.

Inside the generated code's directory, there exists a Makefile that is going to be used for the creation of the executable file. Prior to running "*make*", the following environment parameters (shell variables) have to be configured.

- PLATFORM
- NEMAGFX_SDK_PATH
- LD_LIBRARY_PATH

They can be set by exporting them inside the shell terminal from which the make command will be executed, as follows:

```
export PLATFORM=sw_linux_sdl
export NEMAGFX_SDK_PATH=<PATH_TO_Nema_GUI_Builder>/NemaGFX_SDK
export LD_LIBRARY_PATH=<PATH_TO_Nema_GUI_Builder>/NemaGFX_SDK/lib
```

For instance, assuming that NEMA®|GUI-Builder is located inside the "*home*" directory on a Linux PC, these parameters can be set as:

```
export PLATFORM=sw_linux_sdl
export NEMAGFX_SDK_PATH=/home/Nema_GUI_Builder/NemaGFX_SDK
export LD_LIBRARY_PATH=/home/Nema_GUI_Builder/NemaGFX_SDK/lib/
```

The following figures, illustrate how the Gauge example (that comes along with NEMA®|GUI-Builder) is compiled and linked to *libNemaGFX.so*.

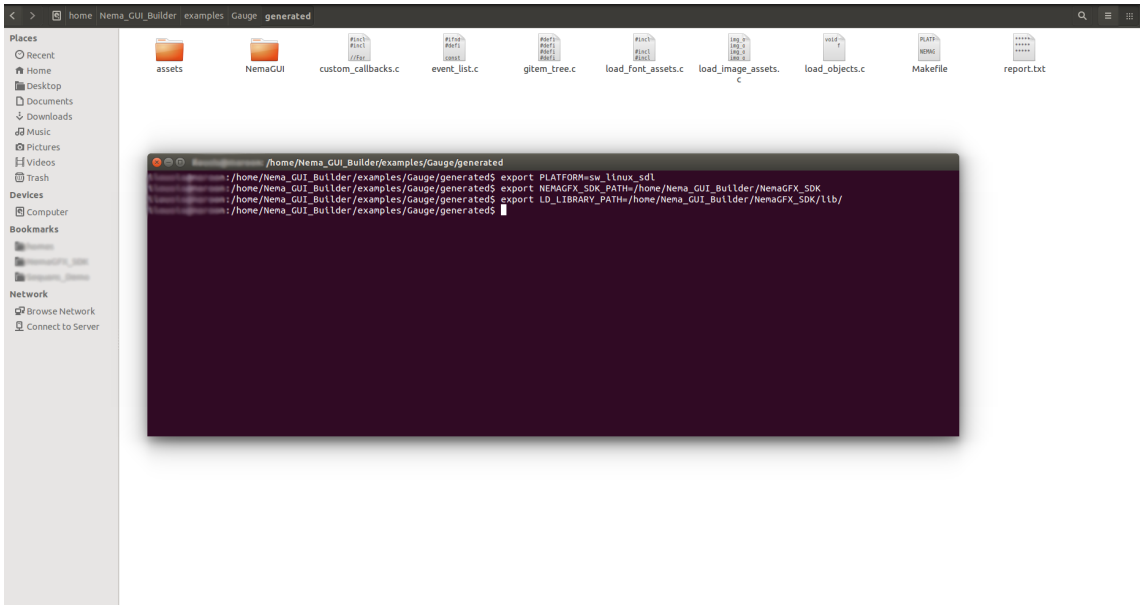


Figure 15: Setting environment variables

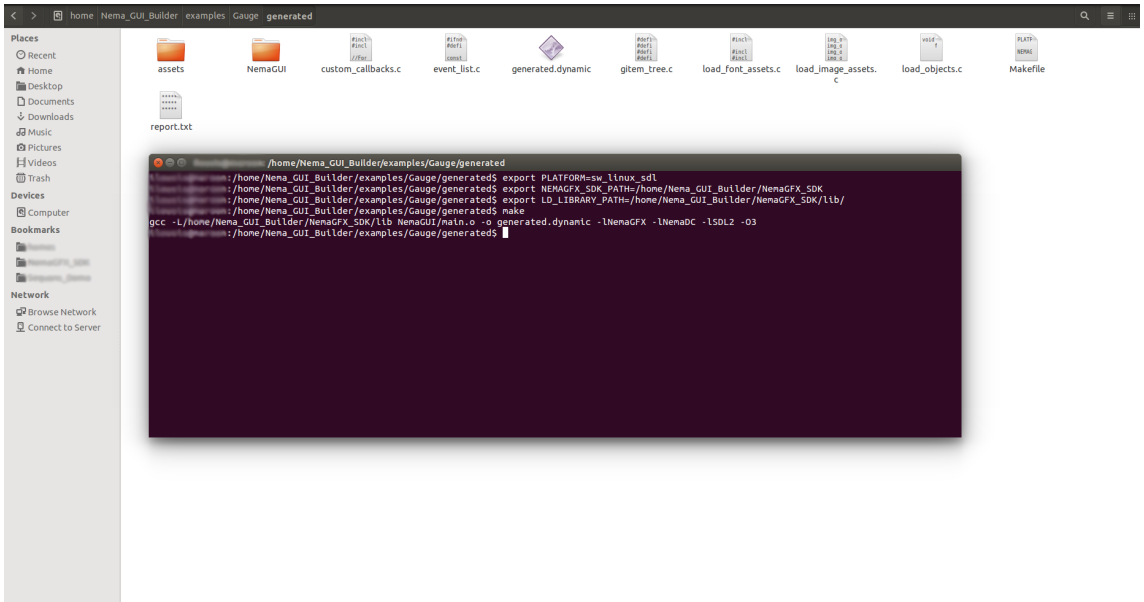


Figure 16: Running "*make*". The executable file is created

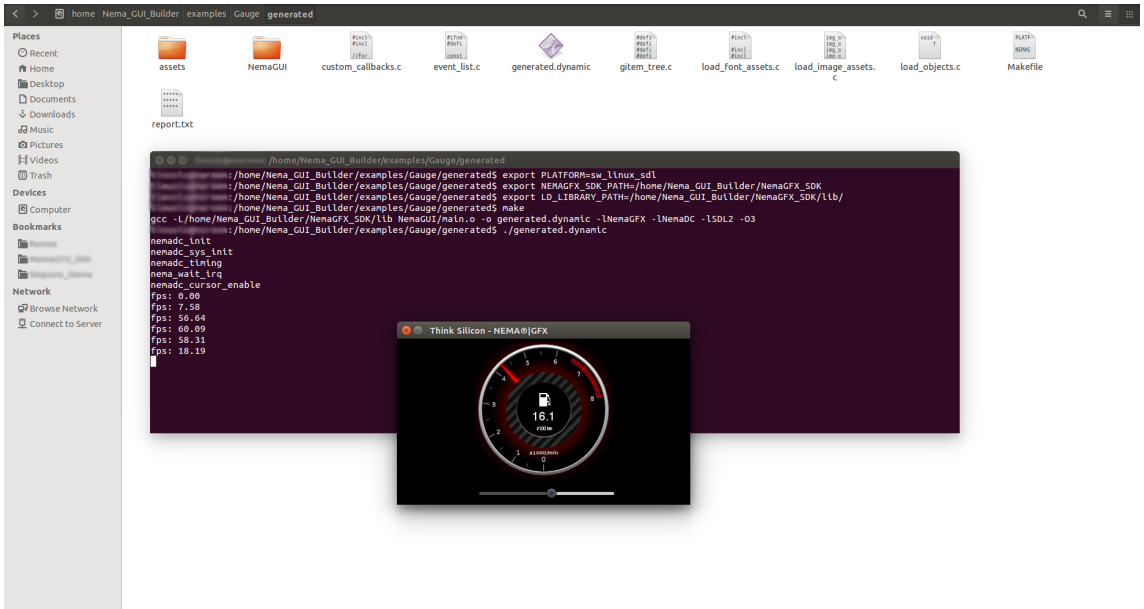


Figure 17: Running the executable file

As it can be seen in Figure 17, running the executable file (*generated.dynamic*) will display the application window. The frames per second (fps) are displayed in the terminal window.

12.2 Dependencies

The application window utilizes the Simple DirectMedia Layer 2 library (SDL2) (https://www.libsdl.org/), and therefore it is necessary that this library is installed on the host machine.

On an Ubuntu machine, the SDL2 library can be installed by executing the following command:

```
sudo apt-get install libsdl2-dev
```

12.3 Limitations

The software implementation of the NEMA®|GFX API is designed for use in embedded systems. This indicates that, in its current version, a few features are not implemented, mainly for performance reasons. The following limitations apply to running NEMA®|GUI-Builder generated applications without hardware acceleration (NEMA® GPU):

- TSC™4 , TSC™6 and TSC™6a formats are not supported. Framebuffers, back-buffers and imported images should be configured in a different format, otherwise they will not be displayed at all.
- Bilinear filtering in textures is not supported. Generated textures that contain the bilinear filtering attribute are rendered using the point-sampling method.

13 Nema GUI API Reference

This section provides an overview of the Nema GUI API which is the API for handling the runtime of a generated project. It contains the software modules and data structs that enable an application to run on an embedded device. Nema GUI consists of the graphics item's (widgets) data structs (described in the next section) along with the modules that handle their behavior and interactions. Nema GUI consumes approximately 25KB of memory with all its features included (all widgets, event types, animations etc.) By narrowing down the feature set used in an application, this amount can be further reduced.

13.1 ng_animation.h File Reference

Animations.

Data Structures

- struct ng_animation_data_t

Macros

- #define NG_DIRECTION_LEFT
- #define NG_DIRECTION_RIGHT
- #define NG_DIRECTION_TOP
- #define NG_DIRECTION_BOTTOM
- #define NG_SHOW
- #define NG_HIDE
- #define NG_ANIMATION_DATA(object)

Functions

- void ng_animation_callback (ng_event_base_t *event, void *data)

  Callback function executed continuously to update an animation.
- void ng_animation_draw (tree_node_t *node, int x_min, int y_min, int x_max, int y_max)

  Draws the animations back buffer (if available) in the framebuffer.
- bool ng_animation_init (ng_animation_data_t *data)

  Draws an animated tree node (along with its children) inside a back buffer (if available)
- void ng_animation_fade (ng_animation_data_t *data)

  Fade animation function.
- void ng_animation_fly (ng_animation_data_t *data)

Fly animation function.

- void ng_animation_fade_zoom (ng_animation_data_t *data)

  Fade-zoom animation function.

- void ng_animation_cube_face (ng_animation_data_t *data)

  Cube face animation function.

- void ng_animation_flip (ng_animation_data_t *data)

  Flip animation functioon.

13.1.1 Detailed Description

Animations.

This files includes the data needed for the implementation of animations (show/hide). Such animations are performed using back buffers. If there are no back buffers available, show and hide effects will be applied instantly.

13.1.2 Data Structure Documentation

13.1.2.1 struct ng_animation_data_t

Data struct that contains the animation data

Data Fields

tree_node_t *	node	Pointer to the animated tree node
easing_f	ez_func	Pointer to easing function
int	back_buffer_index	Index to the back buffer used (if available)
void *	ext_data	Pointer to extra data (ng_point_t is currently supported)
int	action	Action to be performed (show or hide)

13.1.3 Macro Definition Documentation

13.1.3.1 #define NG_DIRECTION_LEFT

Animation moves to the left

13.1.3.2 #define NG_DIRECTION_RIGHT

Animation moves to the right

13.1.3.3 #define NG_DIRECTION_TOP

Animation moves to the top

13.1.3.4 #define NG_DIRECTION_BOTTOM

Animation moves to the bottom

13.1.3.5 #define NG_SHOW

Animation should perform a "show"

13.1.3.6 #define NG_HIDE

Animation should perform a "hide"

13.1.3.7 #define NG_ANIMATION_DATA(*object*)

Type caster for casting a void pointer to ng_animation_data_t pointer struct

13.1.4 Function Documentation

13.1.4.1 void ng_animation_callback (ng_event_base_t * *event*, void * *data*)

Callback function executed continuously to update an animation.

Parameters

**data*	Pointer to *ng_animation_data_t* data struct tuple (type casting from *void* is perfomed internally)

Returns

void

13.1.4.2 void ng_animation_draw (tree_node_t * *node*, int *x_min*, int *y_min*, int *x_max*, int *y_max*)

Draws the animations back buffer (if available) in the framebuffer.

Parameters

*node	Pointer to the animated tree node
x_min	minimum x position
y_min	minimum y position
x_max	maximum x position
y_max	maximum y position

Returns

void

13.1.4.3 bool ng_animation_init (ng_animation_data_t * *data*)

Draws an animated tree node (along with its children) inside a back buffer (if available)

Parameters

*data	Pointer to the animation data

Returns

true if the drawing was performed inside the back buffer, otherwise false

13.1.4.4 void ng_animation_fade (ng_animation_data_t * *data*)

Fade animation function.

Parameters

*data	Pointer to the animation data

Returns

void

13.1.4.5 void ng_animation_fly (ng_animation_data_t * *data*)

Fly animation function.

Parameters

*data	Pointer to the animation data

Returns

void

13.1.4.6 void ng_animation_fade_zoom (ng_animation_data_t * *data*)

Fade-zoom animation function.

Parameters

**data*	Pointer to the animation data

Returns

void

13.1.4.7 void ng_animation_cube_face (ng_animation_data_t * *data*)

Cube face animation function.

Parameters

**data*	Pointer to the animation data

Returns

void

13.1.4.8 void ng_animation_flip (ng_animation_data_t * *data*)

Flip animation functioon.

Parameters

**data*	Pointer to the animation data

Returns

void

13.2 ng_callbacks.h File Reference

Callback functions.

Functions

- void ng_animate_uint32 (ng_event_base_t *event, void *data)

  Animates a uint32_t variable from an initial value to a final value using an easing function.
- void ng_animate_float (ng_event_base_t *event, void *data)

  Animates a float variable from an initial value to a final value using an easing function.
- void ng_set_uint32 (ng_event_base_t *event, void *data)

  Sets uint32_t variable.
- void ng_set_float (ng_event_base_t *event, void *data)

  Sets float variable.
- void ng_set_ptr (ng_event_base_t *event, void *data)

  Sets void pointer.
- void ng_update_gitem (ng_event_base_t *event, void *data)

  Utility callback for updating a gitem.
- void ng_set_int_int (ng_event_base_t *event, void *data)

  Sets two integer variables e.g. (w, h)
- void ng_animate_int_int_pair (ng_event_base_t *event, void *data)

  Animates two integer variables e.g. (w, h) from an initial value to a final value using an easing function.
- void ng_animate_int_int (ng_event_base_t *event, void *data)

  Animates an integer variable from an initial value to a final value using an easing function.
- void ng_set_tree_node (ng_event_base_t *event, void *data)

  Sets a tree_node_t pointer.
- void ng_set_node_to_node (ng_event_base_t *event, void *data)

  Sets a tree_node_t pointer to another tree node.
- void ng_set_percent (ng_event_base_t *event, void *data)

  Sets a percentage value [0.f, 1.f].

13.2.1 Detailed Description

Callback functions.

Generic callback functions are used by the event mechanism, for setting or animating various parameters (e.g. position, color, numerical value etc.) Any callback function must have the signature *void function_name*(ng_event_base_t **event*, *void **data*). The *void **data* argument should then be casted inside the callback function body to an appropriate data type

13.2.2 Function Documentation

13.2.2.1 void ng_animate_uint32 (ng_event_base_t * *event*, void * *data*)

Animates a *uint32_t* variable from an initial value to a final value using an easing function.

Parameters

**data*	Pointer to *ng_git_uint32_uint32_ez_t* data struct tuple (type casting from *void* is perfomed internally)

Returns

void

13.2.2.2 void ng_animate_float (ng_event_base_t * *event*, void * *data*)

Animates a *float* variable from an initial value to a final value using an easing function.

Parameters

**data*	Pointer to *ng_git_float_float_ez_t* data struct tuple (type casting from *void* is perfomed internally)

Returns

void

13.2.2.3 void ng_set_uint32 (ng_event_base_t * *event*, void * *data*)

Sets *uint32_t* variable.

Parameters

**data*	Pointer to *ng_git_uint32_t* tuple (type casting from *void* is perfomed internally)

Returns

void

13.2.2.4 void ng_set_float (ng_event_base_t * *event*, void * *data*)

Sets *float* variable.

Parameters

**data*	Pointer to *ng_git_float_t* tuple (type casting from *void* is perfomed internally)

Returns

void

13.2.2.5 void ng_set_ptr (ng_event_base_t * *event*, void * *data*)

Sets *void* pointer.

Parameters

**data*	Pointer to *ng_git_ptr_t* tuple (type casting from *void* is perfomed internally)

Returns

void

13.2.2.6 void ng_update_gitem (ng_event_base_t * *event*, void * *data*)

Utility callback for updating a gitem.

Parameters

**data*	Pointer to *ng_gitptr_t* tuple (type casting from *void* is perfomed internally)

Returns

void

13.2.2.7 void ng_set_int_int (ng_event_base_t * *event*, void * *data*)

Sets two integer variables e.g. (w, h)

Parameters

**data*	Pointer to *ng_git_int_int_t* tuple (type casting from *void* is perfomed internally)

Returns

void

13.2.2.8 void ng_animate_int_int_pair (ng_event_base_t * *event*, void * *data*)

Animates two integer variables e.g. (w, h) from an initial value to a final value using an easing function.

Parameters

**data*	Pointer to *ng_git_int_int_pair_ez_t* tuple (type casting from *void* is perfomed internally)

Returns

void

13.2.2.9 void ng_animate_int_int (ng_event_base_t * *event*, void * *data*)

Animates an integer variable from an initial value to a final value using an easing function.

Parameters

**data*	Pointer to *ng_git_int_int_ez_t* tuple (type casting from *void* is perfomed internally)

Returns

void

13.2.2.10 void ng_set_tree_node (ng_event_base_t * *event*, void * *data*)

Sets a *tree_node_t* pointer.

Parameters

**data*	Pointer to *ng_tree_node_ptr_t* tuple (type casting from *void* is perfomed internally)

Returns

void

13.2.2.11 void ng_set_node_to_node (ng_event_base_t * *event*, void * *data*)

Sets a *tree_node_t* pointer to another tree node.

Parameters

**data*	Pointer to *ng_node_node_t* tuple (type casting from *void* is perfomed internally)

Returns

void

13.2.2.12 void ng_set_percent (ng_event_base_t * *event*, void * *data*)

Sets a percentage value [0.f, 1.f].

Parameters

**data*	Pointer to *ng_git_float_t* tuple (type casting from *void* is perfomed internally)

Returns

void

13.3 ng_display.h File Reference

Display.

Macros

- #define DISPLAY_SCREEN
- #define DISPLAY_SCREEN_TRANSITION
- #define DISPLAY_POPUP

Functions

- void ng_display_screen_node_to_fb (img_obj_t *fb_img, tree_node_t *screen_node, int x_off, int y_off)

  Draws a screen tree node (screen gitem along with its children) to a designated buffer.
- void ng_display_screen_clear (int wait)

  Clears the current framebuffer.
- void ng_display_bind_transition_buffers (void)

  Binds the transition buffers (if available) to the GPU.
- void ng_display (void)

Updates the display (redraws current screen)

- void ng_display_init (void)

  Initializes the display module (framebuffer(s), command lists)

- void ng_display_set_event (ng_event_base_t *event)

  Sets the event used for performing a screen transition.

- void ng_display_set_mode (int mode)

  Sets the mode of the display.

- int ng_display_get_mode ()

  Gets the current display mode.

- void ng_display_set_popup (tree_node_t *node)

  Sets the pop-up tree node to be diplayed along with the display mode (DISPLAY_POPUP)

- void ng_display_set_clear (bool clear)

  Controlls if the display should perform a "clear screen" before updating it.

- bool ng_back_buffer_is_locked (int index)

  Checks if the buckbuffer "index" is locked (currently not available)

- void ng_back_buffer_lock (int index)

  Locks the back buffer "index".

- void ng_back_buffer_unlock (int index)

  Unlocks the back buffer "index".

Variables

- EXTERN nema_transition_t global_screen_trans_effect

  Screen transition effect.

- EXTERN nema_cmdlist_t cl_screen

  Command lists used for updating the background of the current screen.

- EXTERN nema_cmdlist_t cl

  Command lists used for updating the children of the current screen.

13.3.1 Detailed Description

Display.

The display module, provides functions for updating the framebuffer according to the current context. This can either be displaying a simple screen, a screen transition or a pop-up window on top of a main screen.

13.3.2 Macro Definition Documentation

13.3.2.1 #define DISPLAY_SCREEN

Display mode for displaying a screen (default mode)

13.3.2.2 #define DISPLAY_SCREEN_TRANSITION

Display mode when performing a screen transition

13.3.2.3 #define DISPLAY_POPUP

Display mode for a pop-up

13.3.3 Function Documentation

13.3.3.1 void ng_display_screen_node_to_fb (img_obj_t * *fb_img*, tree_node_t * *screen_node*, int *x_off*, int *y_off*)

Draws a screen tree node (screen gitem along with its children) to a designated buffer.

Parameters

**fb_img*	Pointer to the designated buffer
**screen_node*	Pointer of the screen tree node that needs to be drawn
x_off	x offset
y_off	y offset

13.3.3.2 void ng_display_screen_clear (int *wait*)

Clears the current framebuffer.

Parameters

wait	if this is equal to zero, the command list is submitted whithout waiting for an interrupt

13.3.3.3 void ng_display_bind_transition_buffers (void)

Binds the transition buffers (if available) to the GPU.

13.3.3.4 void ng_display (void)

Updates the display (redraws current screen)

13.3.3.5 void ng_display_init (void)

Initializes the display module (framebuffer(s), command lists)

13.3.3.6 void ng_display_set_event (ng_event_base_t * *event*)

Sets the event used for performing a screen transition.

Parameters

event	Pointer to the screen transition event data struct (casted to ng_transition_t struct internally)

13.3.3.7 void ng_display_set_mode (int *mode*)

Sets the mode of the display.

Parameters

mode	This can either be DISPLAY_SCREEN, DISPLAY_SCREEN_TRANSITION or DISPLAY_POPUP

13.3.3.8 int ng_display_get_mode ( )

Gets the current display mode.

Returns

int This should be DISPLAY_SCREEN, DISPLAY_SCREEN_TRANSITION or DISPLAY_POPUP

13.3.3.9 void ng_display_set_popup (tree_node_t * *node*)

Sets the pop-up tree node to be diplayed along with the display mode (DISPLAY_POPUP)

Parameters

node	pop-up node to be siplayed

13.3.3.10 void ng_display_set_clear (bool *clear*)

Controlls if the display should perform a "clear screen" before updating it.

Parameters

clear	If true, the display will clear its current content before updating it. Otherwise it will draw the new content on top of the old one

13.3.3.11 bool ng_back_buffer_is_locked (int *index*)

Checks if the buckbuffer "index" is locked (currently not available)

Parameters

index	Index of the back buffer to check

Returns

bool True if the back buffer is locked, otherwise false

13.3.3.12 void ng_back_buffer_lock (int *index*)

Locks the back buffer "index".

Parameters

index	Index of the back buffer to lock

13.3.3.13 void ng_back_buffer_unlock (int *index*)

Unlocks the back buffer "index".

Parameters

index	Index of the buck buffer to unlock

13.3.4 Variable Documentation

13.3.4.1 EXTERN nema_transition_t global_screen_trans_effect

Screen transition effect.

13.3.4.2 EXTERN nema_cmdlist_t cl_screen

Command lists used for updating the background of the current screen.

This is the first of the two command lists that are currently used for rendering a complete frame.

13.3.4.3 EXTERN nema_cmdlist_t cl

Command lists used for updating the children of the current screen.

This is the second command list, used for rendering a complete frame.

13.4 ng_draw.h File Reference

High level drawing functions for performing hierarchical drawing of tree nodes (along with their children)

Functions

- void ng_draw_tree_node (tree_node_t *node, int x_off, int y_off, int x_min, int y_min, int x_max, int y_max)

  Draws a specific tree node (its graphics item) in the framebuffer.
- void ng_draw_tree (tree_node_t *node, int x_off, int y_off, int x_min, int y_min, int x_max, int y_max)

  Reccursive function, similar to ng_draw_tree_node but draws recursively every child tree node of the initial node.
- void ng_draw_to_buffer (tree_node_t *node, int x_off, int y_off, int x_min, int y_min, int x_max, int y_max)

  Draws a tree node and its children nodes inside the bound framebuffer (used by the animations module)

13.4.1 Detailed Description

High level drawing functions for performing hierarchical drawing of tree nodes (along with their children)

13.4.2 Function Documentation

13.4.2.1 void ng_draw_tree_node (tree_node_t * *node*, int *x_off*, int *y_off*, int *x_min*, int *y_min*, int *x_max*, int *y_max*)

Draws a specific tree node (its graphics item) in the framebuffer.

Parameters

node	The tree node whose graphics item needs to be drawn
x_off	Horizontal offset whithin the framebuffer (absolute coordinate)
y_off	Vertical offset whithin the framebuffer (absolute coordinate)
x_min	Minimum x coordinate (needed for clipping)
y_min	Minimum y coordinate (needed for clipping)
x_max	Maximum x coordinate (needed for clipping)
y_max	Maximum y coordinate (needed for clipping)

13.4.2.2 void ng_draw_tree (tree_node_t * *node*, int *x_off*, int *y_off*, int *x_min*, int *y_min*, int *x_max*, int *y_max*)

Reccursive function, similar to ng_draw_tree_node but draws recursively every child tree node of the initial *node*.

Parameters

node	The initial tree node whose graphics item needs to be drawn (usually a tree node that contains a screen)
x_off	Horizontal offset whithin the framebuffer (absolute coordinate)
y_off	Vertical offset whithin the framebuffer (absolute coordinate)
x_min	Minimum x coordinate (needed for clipping)
y_min	Minimum y coordinate (needed for clipping)
x_max	Maximum x coordinate (needed for clipping)
y_max	Maximum y coordinate (needed for clipping)

13.4.2.3 void ng_draw_to_buffer (tree_node_t * *node*, int *x_off*, int *y_off*, int *x_min*, int *y_min*, int *x_max*, int *y_max*)

Draws a tree node and its children nodes inside the bound framebuffer (used by the animations module)

Parameters

node	The initial tree node whose graphics item needs to be drawn
x_off	Horizontal offset whithin the framebuffer (absolute coordinate)
y_off	Vertical offset whithin the framebuffer (absolute coordinate)
x_min	Minimum x coordinate (needed for clipping)
y_min	Minimum y coordinate (needed for clipping)
x_max	Maximum x coordinate (needed for clipping)
y_max	Maximum y coordinate (needed for clipping)

13.5 ng_draw_prim.h File Reference

Primitive drawing (rectangle, circle, rounded rectanle, quadrilateral and image)

Functions

- void ng_fill_rect (int x, int y, int w, int h, uint32_t color, int override_blend)

  Fills a rectangular area with a color (that can contain opacity)
- void ng_draw_primitive_rect (int x, int y, int w, int h, uint32_t color, int pen_width, int override_blend)

  Draws a rectangle (outline) with a certain color (that can contain opacity) and pen width.
- void ng_draw_primitive_rounded_rect (int x, int y, int w, int h, uint32_t color, int radius, int override_blend)

  Draws a rounded rectangle with a certain color (that can contain opacity) and radius.
- void ng_fill_primitive_rounded_rect (int x, int y, int w, int h, uint32_t color, int radius, int override_blend)

  Fills a rounded rectangle with a certain color (that can contain opacity) and radius.
- void ng_draw_primitive_circle (int x, int y, int r, uint32_t color, int override_blend)

  Draws a circle with a specific color (that contains the opacity) and radius.
- void ng_fill_primitive_circle (int x, int y, int r, uint32_t color, int override_blend)

  Fills a circle with a specific color (that can contain opacity) and radius.

- void ng_blit_rect_fit (img_obj_t *img, int x, int y, int w, int h, int override_blend, uint8_t opacity)

  Blits a source image by fitting it into a rectangular area.

- void ng_blit_quad_fit (img_obj_t *img, float x0, float y0, float x1, float y1, float x2, float y2, float x3, float y3, int override_blend, uint8_t opacity)

  Blits a source image by fitting it into a quadrilateral area.

- void ng_fill_quad (float x0, float y0, float x1, float y1, float x2, float y2, float x3, float y3, int override_blend, uint32_t color)

  Fills a quadrilateral area with a cirtain color (that can contain opacity)

13.5.1 Detailed Description

Primitive drawing (rectangle, circle, rounded rectanle, quadrilateral and image)

Drawing functions used commonly used accross several graphics items (by their drawing functions)

13.5.2 Function Documentation

13.5.2.1 void ng_fill_rect (int *x*, int *y*, int *w*, int *h*, uint32_t *color*, int *override_blend*)

Fills a rectangular area with a color (that can contain opacity)

Parameters

x	Aboslute x position inside the framebuffer
y	Aboslute y position inside the framebuffer
w	Rectangle's width
h	Rectangle's height
color	Rectangle's color
override_blend	If zero, the parameters needed for blending (blending mode, const color, texture color) are implicitly calculated whithin this function, otherwise they need to be configured manually before calling this function

13.5.2.2 void ng_draw_primitive_rect (int *x*, int *y*, int *w*, int *h*, uint32_t *color*, int *pen_width*, int *override_blend*)

Draws a rectangle (outline) with a certain color (that can contain opacity) and pen width.

Parameters

Parameters

x	Aboslute x position inside the framebuffer
y	Aboslute y position inside the framebuffer
w	Rectangle's width
h	Rectangle's height
color	Rectangle's color
pen_width	Pen width
override_blend	If zero, the parameters needed for blending (blending mode, const color, texture color) are implicitly calculated whithin this function, otherwise they need to be configured manually before calling this function

13.5.2.3 void ng_draw_primitive_rounded_rect (int *x*, int *y*, int *w*, int *h*, uint32_t *color*, int *radius*, int *override_blend*)

Draws a rounded rectangle with a certain color (that can contain opacity) and radius.

Parameters

x	Aboslute x position inside the framebuffer
y	Aboslute y position inside the framebuffer
w	Rectangle's width
h	Rectangle's height
color	Rectangle's color
radius	Radius
override_blend	If zero, the parameters needed for blending (blending mode, const color, texture color) are implicitly calculated whithin this function, otherwise they need to be configured manually before calling this function

13.5.2.4 void ng_fill_primitive_rounded_rect (int *x*, int *y*, int *w*, int *h*, uint32_t *color*, int *radius*, int *override_blend*)

Fills a rounded rectangle with a certain color (that can contain opacity) and radius.

Parameters

x	Aboslute x position inside the framebuffer

Parameters

y	Aboslute y position inside the framebuffer
w	Rectangle's width
h	Rectangle's height
color	Rectangle's color
radius	Radius
override_blend	If zero, the parameters needed for blending (blending mode, const color, texture color) are implicitly calculated whithin this function, otherwise they need to be configured manually before calling this function

13.5.2.5 void ng_draw_primitive_circle (int *x*, int *y*, int *r*, uint32_t *color*, int *override_blend*)

Draws a circle with a specific color (that contains the opacity) and radius.

Parameters

x	Aboslute x position inside the framebuffer
y	Aboslute y position inside the framebuffer
r	Radius
color	Circle's color
override_blend	If zero, the parameters needed for blending (blending mode, const color, texture color) are implicitly calculated whithin this function, otherwise they need to be configured manually before calling this function

13.5.2.6 void ng_fill_primitive_circle (int *x*, int *y*, int *r*, uint32_t *color*, int *override_blend*)

Fills a circle with a specific color (that can contain opacity) and radius.

Parameters

x	Aboslute x position inside the framebuffer
y	Aboslute y position inside the framebuffer
r	Radius
color	Circle's color
override_blend	If zero, the parameters needed for blending (blending mode, const color, texture color) are implicitly calculated whithin this function, otherwise they need to be configured manually before calling this function

13.5.2.7 void ng_blit_rect_fit (img_obj_t * *img*, int *x*, int *y*, int *w*, int *h*, int *override_blend*, uint8_t *opacity*)

Blits a source image by fitting it into a rectangular area.

Parameters

img	Pointer to the source image
x	Aboslute x position inside the framebuffer
y	Aboslute y position inside the framebuffer
w	Rectangle's width
h	Rectangle's height
override_blend	If zero, the parameters needed for blending (blending mode, const color, texture color) are implicitly calculated whithin this function, otherwise they need to be configured manually before calling this function
opacity	Opacity [0, 255]

13.5.2.8 void ng_blit_quad_fit (img_obj_t * *img*, float *x0*, float *y0*, float *x1*, float *y1*, float *x2*, float *y2*, float *x3*, float *y3*, int *override_blend*, uint8_t *opacity*)

Blits a source image by fitting it into a quadrilateral area.

Parameters

img	Pointer to the source image
x0	x position of the first vertex of the quaqrilateral
y0	y position of the first vertex of the quaqrilateral
x1	x position of the second vertex of the quaqrilateral
y1	y position of the second vertex of the quaqrilateral
x2	x position of the third vertex of the quaqrilateral
y2	y position of the third vertex of the quaqrilateral
x3	x position of the fourth vertex of the quaqrilateral
y3	y position of the fourth vertex of the quaqrilateral
override_blend	If zero, the parameters needed for blending (blending mode, const color, texture color) are implicitly calculated whithin this function, otherwise they need to be configured manually before calling this function
opacity	Opacity [0, 255]

13.5.2.9 void ng_fill_quad (float *x0*, float *y0*, float *x1*, float *y1*, float *x2*, float *y2*, float *x3*, float *y3*, int *override_blend*, uint32_t *color*)

Fills a quadrilateral area with a cirtain color (that can contain opacity)

Parameters

x0	x position of the first vertex of the quaqrilateral
y0	y position of the first vertex of the quaqrilateral
x1	x position of the second vertex of the quaqrilateral
y1	y position of the second vertex of the quaqrilateral
x2	x position of the third vertex of the quaqrilateral
y2	y position of the third vertex of the quaqrilateral
x3	x position of the fourth vertex of the quaqrilateral
y3	y position of the fourth vertex of the quaqrilateral
override_blend	If zero, the parameters needed for blending (blending mode, const color, texture color) are implicitly calculated whithin this function, otherwise they need to be configured manually before calling this function
color	Color (contains opacity information)

13.6 ng_event.h File Reference

Data Structures

- union ng_act_ptr

  Union that groups together pointers to all possible actions that are supported in the event mechanism. More...

- struct __ng_event_base_t

  Event base struct definition. More...

Macros

- #define EV_TRIGGER_NULL
- #define EV_TRIGGER_PRESS
- #define EV_TRIGGER_RELEASE
- #define EV_TRIGGER_HOLD
- #define EV_TRIGGER_DRAG
- #define EV_TRIGGER_VALUE_CHANGED

- #define EV_TRIGGER_STATE_CHANGED
- #define EV_TRIGGER_SCREEN_ENTERED
- #define EV_TRIGGER_APP_START
- #define EV_TRIGGER_CUSTOM
- #define EV_TRIGGER_TIMER
- #define EV_RETRIGGER_IGNORE
- #define EV_RETRIGGER_PAUSE
- #define EV_RETRIGGER_RESUME
- #define EV_RETRIGGER_PAUSE_TOGGLE
- #define EV_RETRIGGER_REVERSE
- #define EV_RETRIGGER_RESET
- #define EV_RETRIGGER_FINISH
- #define EV_RETRIGGER_RESTART
- #define EV_RETRIGGER_STOP
- #define EV_STATUS_STOPPED
- #define EV_STATUS_RUNNING
- #define EV_STATUS_PAUSED
- #define EV_STATUS_MASK
- #define EV_STATUS_REVERSED
- #define EV_STATUS_FIRST_RUN
- #define EV_STATUS_LAST_RUN
- #define EVENT_BASE_STRUCT

  Define that contains all the ng_event_base_t data struct attributes that are common among all different event types (oneshot, periodic, transition, periodic transition)
- #define ng_event_is_stopped(ev_ptr)
- #define ng_event_is_running(ev_ptr)
- #define ng_event_is_paused(ev_ptr)
- #define NG_EVENT(object)
- #define PROGRESS(t)
- #define DURATION(t)
- #define PERIOD(t)
- #define START_TIME(t)
- #define NG_CALLBACK_DATA(data)

Typedefs

- typedef void(∗ act_gitptr_float_f) (struct _gitem_base_t ∗gitem, float value)
- typedef void(∗ act_gitptr_ptr_f) (struct _gitem_base_t ∗gitem, void ∗ptr)
- typedef void(∗ act_gitptr_int_f) (struct _gitem_base_t ∗gitem, int value)
- typedef void(∗ act_gitptr_uint_f) (struct _gitem_base_t ∗gitem, uint32_t value)
- typedef void(∗ act_gitptr_f) (struct _gitem_base_t ∗gitem)
- typedef void(∗ act_gitptr_int_int_f) (struct _gitem_base_t ∗gitem, int a, int b)
- typedef void(∗ act_nodeptr_f) (struct _tree_node_t ∗node)
- typedef void(∗ act_nodeptr_nodeptr_f) (struct _tree_node_t ∗node0, struct _tree_node_t ∗node1)
- typedef void(∗ act_animptr_f) (ng_animation_data_t ∗data)
- typedef void(∗ act_void_f) (void)
- typedef void(∗ handler_f) (struct _ng_event_base_t ∗event, uint32_t trigger)
- typedef void(∗ start_f) (struct _ng_event_base_t ∗event)
- typedef void(∗ stop_f) (struct _ng_event_base_t ∗event, bool force_finish)
- typedef void(∗ pause_toggle_f) (struct _ng_event_base_t ∗event, bool pause)

Functions

- void ng_event_init (void)

  Assignes events to graphics items (as generated) and creates the application's timer.
- void ng_event_handle (ng_event_base_t ∗event, uint32_t trigger_event)

  Handles an event according to the trigger that triggered it.
- void ng_event_run_callback (ng_event_base_t ∗event, int status_flags)

  Runs the callback function of the event.
- void ng_event_set_status (ng_event_base_t ∗event, uint32_t status)

  Set the status (stopped, running, paused) of an event.
- bool ng_event_check_retrigger_flag (ng_event_base_t ∗event, int flag)

  Checks if a retrigger flag of an event is set or not.
- bool ng_event_check_status_flag (ng_event_base_t ∗event, int flag)

  Checks the status of an event.
- void ng_event_set_status_flag (ng_event_base_t ∗event, int flag)

  Sets a status flag of an event.
- void ng_event_unset_status_flag (ng_event_base_t ∗event, int flag)

  Unets a status flag of an event.
- void ng_event_flip_status_flag (ng_event_base_t ∗event, int flag)

Flips (inverts) a status flag of an event.

13.6.1 Data Structure Documentation

13.6.1.1 union ng_act_ptr

Union that groups together pointers to all possible actions that are supported in the event mechanism.

Data Fields

act_gitptr_float_f	act_gitptr_float	Function pointer to a act_gitptr_float_f function
act_gitptr_ptr_f	act_gitptr_ptr	Function pointer to a act_gitptr_ptr_f function
act_gitptr_int_f	act_gitptr_int	Function pointer to a act_gitptr_int_f function
act_gitptr_uint_f	act_gitptr_uint	Function pointer to a act_gitptr_uint_f function
act_gitptr_f	act_gitptr	Function pointer to a act_gitptr_f function
act_gitptr_int_int_f	act_gitptr_int_int	Function pointer to a act_gitptr_int_int_f function
act_nodeptr_f	act_nodeptr	Function pointer to a act_nodeptr_f function
act_nodeptr_nodeptr_f	act_nodeptr_nodeptr	Function pointer to a act_nodeptr_nodeptr_f function
act_animptr_f	act_animptr	Function pointer to a act_animptr_f function
act_void_f	act_void	Function pointer to a act_void_f function

13.6.1.2 struct __ng_event_base_t

Event base struct definition.

Data Fields

	EVENT_BASE_STRUCT	Atributes as defined in the description of EVENT_BASE_STRUCT

13.6.2 Macro Definition Documentation

13.6.2.1 #define EV_TRIGGER_NULL

Reserved

13.6.2.2 #define EV_TRIGGER_PRESS

Press trigger

13.6.2.3 #define EV_TRIGGER_RELEASE

Release trigger

13.6.2.4 #define EV_TRIGGER_HOLD

Hold trigger (reserved for future use)

13.6.2.5 #define EV_TRIGGER_DRAG

Drag (swipe) trigger

13.6.2.6 #define EV_TRIGGER_VALUE_CHANGED

Value changed trigger

13.6.2.7 #define EV_TRIGGER_STATE_CHANGED

State changed trigger

13.6.2.8 #define EV_TRIGGER_SCREEN_ENTERED

Screen enetered trigger

13.6.2.9 #define EV_TRIGGER_APP_START

Application start-up trigger

13.6.2.10 #define EV_TRIGGER_CUSTOM

Custom trigger

13.6.2.11 #define EV_TRIGGER_TIMER

Timmer trigger

13.6.2.12 #define EV_RETRIGGER_IGNORE

Ignore the retriger (continue execution normally)

13.6.2.13 #define EV_RETRIGGER_PAUSE

Pause a running event

13.6.2.14 #define EV_RETRIGGER_RESUME

Resume a paused event

13.6.2.15 #define EV_RETRIGGER_PAUSE_TOGGLE

Ignore the retriiger (continue execution normally)

13.6.2.16 #define EV_RETRIGGER_REVERSE

Return to the initial state by running the event in reverse order (cur_progress to 0.f)

13.6.2.17 #define EV_RETRIGGER_RESET

Reset the event to its initial state

13.6.2.18 #define EV_RETRIGGER_FINISH

Go to final state (transition)

13.6.2.19 #define EV_RETRIGGER_RESTART

On retrigger, restart periodic/transitional event

13.6.2.20 #define EV_RETRIGGER_STOP

Go to final state and stop (periodic transition)

13.6.2.21 #define EV_STATUS_STOPPED

The event is stopped

13.6.2.22 #define EV_STATUS_RUNNING

The event is ruiing

13.6.2.23 #define EV_STATUS_PAUSED

The event is paused

13.6.2.24 #define EV_STATUS_MASK

Helper mask

13.6.2.25 #define EV_STATUS_REVERSED

The event is performing a backwards transition (from progress: p1 to 0)

13.6.2.26 #define EV_STATUS_FIRST_RUN

Indicates the first run of the event

13.6.2.27 #define EV_STATUS_LAST_RUN

Indicates the last run of the event

13.6.2.28 #define EVENT_BASE_STRUCT

Define that contains all the *ng_event_base_t* data struct attributes that are common among all different event types (oneshot, periodic, transition, periodic transition)

These attributes are:
uint32_t trigger: Pointer to an event assigned to the graphics item
uint32_t retrigger: Pointer to the draw function
gitem_base_t ∗src_gitem: Pointer to the source graphics item
callback_f callback: Function pointer to callback function
union ng_act_ptr (∗action): Function pointer to action function
void ∗action_data: Pointer to the action's data
int affected_screen_id: ID of the screen that is affected by the event
uint32_t status: Event status
handler_f handler: Function pointer the event handler function
start_f start: Function pointer to the event start function
stop_f stop: Function pointer to the evetn stop function

pause_toggle_f pause_toggle: Function pointer to the event pause-toggle function
ng_event_base_t ∗next: Pointer to the next event (used by graphics items that accept multiple events)

13.6.2.29 #define ng_event_is_stopped(*ev_ptr*)

Checks if a screen transition is stopped (returns true/false)

13.6.2.30 #define ng_event_is_running(*ev_ptr*)

Checks if a screen transition is running (returns true/false)

13.6.2.31 #define ng_event_is_paused(*ev_ptr*)

Checks if an event is paused (returns true/false)

13.6.2.32 #define NG_EVENT(*object*)

Type caster from a derived event data structs (transition, periodic etc.) to the base ng_event_base_t data struct

13.6.2.33 #define PROGRESS(*t*)

Redability helper

13.6.2.34 #define DURATION(*t*)

Redability helper

13.6.2.35 #define PERIOD(*t*)

Redability helper

13.6.2.36 #define START_TIME(*t*)

Redability helper

13.6.2.37 #define NG_CALLBACK_DATA(*data*)

Redability helper

13.6.3 Typedef Documentation

13.6.3.1 typedef void(∗ act_gitptr_float_f) (struct _gitem_base_t ∗gitem, float value)

Typedef function pointer that takes a pointer to a gitem_base_t and a float as arguments

13.6.3.2 typedef void(∗ act_gitptr_ptr_f) (struct _gitem_base_t ∗gitem, void ∗ptr)

Typedef function pointer that takes a pointer to a gitem_base_t and a void pointer as arguments

13.6.3.3 typedef void(∗ act_gitptr_int_f) (struct _gitem_base_t ∗gitem, int value)

Typedef function pointer that takes a pointer to a gitem_base_t and a int as arguments

13.6.3.4 typedef void(∗ act_gitptr_uint_f) (struct _gitem_base_t ∗gitem, uint32_t value)

Typedef function pointer that takes a pointer to a gitem_base_t and a uint32_t as arguments

13.6.3.5 typedef void(∗ act_gitptr_f) (struct _gitem_base_t ∗gitem)

Typedef function pointer that takes a pointer to a gitem_base_t as argument

13.6.3.6 typedef void(∗ act_gitptr_int_int_f) (struct _gitem_base_t ∗gitem, int a, int b)

Typedef function pointer that takes a pointer to a gitem_base_t and two int as arguments

13.6.3.7 typedef void(∗ act_nodeptr_f) (struct _tree_node_t ∗node)

Typedef function pointer that takes a tree_node_t pointer as argument

13.6.3.8 typedef void(∗ act_nodeptr_nodeptr_f) (struct _tree_node_t ∗node0, struct _tree_node_t ∗node1)

Typedef function pointer that takes two tree_node_t pointers as arguments

13.6.3.9 typedef void(∗ act_animptr_f) (ng_animation_data_t ∗data)

Typedef function pointer that takes a pointer to ng_animation_data_t as argument

13.6.3.10 typedef void(∗ act_void_f) (void)

Typedef function pointer that takes no arguments

13.6.3.11 typedef void(∗ handler_f) (struct _ng_event_base_t ∗event, uint32_t trigger)

Function pointer to an event handler

13.6.3.12 typedef void(∗ start_f) (struct _ng_event_base_t ∗event)

Function pointer to an event start function

13.6.3.13 typedef void(∗ stop_f) (struct _ng_event_base_t ∗event, bool force_finish)

Function pointer to an event stop function

13.6.3.14 typedef void(∗ pause_toggle_f) (struct _ng_event_base_t ∗event, bool pause)

Function pointer to an event pause-toggle function

13.6.4 Function Documentation

13.6.4.1 void ng_event_init (void)

Assignes events to graphics items (as generated) and creates the application's timer.

13.6.4.2 void ng_event_handle (ng_event_base_t ∗ *event*, uint32_t *trigger_event*)

Handles an *event* according to the *trigger* that triggered it.

Parameters

∗*event*	Pointer to the event that needs to be handled
trigger_event	Triggers that caused the the event

13.6.4.3 void ng_event_run_callback (ng_event_base_t * *event*, int *status_flags*)

Runs the callback function of the event.

Parameters

*event	Pointer to the event whose callback needs to run
status_flags	Allows the callback to run with specific flags

13.6.4.4 void ng_event_set_status (ng_event_base_t * *event*, uint32_t *status*)

Set the status (stopped, running, paused) of an event.

Parameters

*event	Pointer to the event
status	Status to be set

13.6.4.5 bool ng_event_check_retrigger_flag (ng_event_base_t * *event*, int *flag*)

Checks if a retrigger flag of an event is set or not.

Parameters

*event	Pointer to the event
flag	Flag to be checked

Returns

bool True is the flag is set, otherwize false

13.6.4.6 bool ng_event_check_status_flag (ng_event_base_t * *event*, int *flag*)

Checks the status of an event.

Parameters

*event	Pointer to the event
flag	Flag to be checked

Returns

bool True is the flag is set, otherwize false

13.6.4.7 void ng_event_set_status_flag (ng_event_base_t * *event*, int *flag*)

Sets a status flag of an event.

Parameters

*event	Pointer to the event
flag	Flag to be set

13.6.4.8 void ng_event_unset_status_flag (ng_event_base_t * *event*, int *flag*)

Unets a status flag of an event.

Parameters

*event	Pointer to the event
flag	Flag to be unset

13.6.4.9 void ng_event_flip_status_flag (ng_event_base_t * *event*, int *flag*)

Flips (inverts) a status flag of an event.

Parameters

*event	Pointer to the event
flag	Flag to be flipped

13.7 ng_event_oneshot.h File Reference

This file contains the event handler of a one-shot event.

Functions

- void ng_oneshot_handler (ng_event_base_t *event, uint32_t trigger)

  Fuction for handling the execution of a one-shot event.

13.7.1 Detailed Description

This file contains the event handler of a one-shot event.

13.7.2 Function Documentation

13.7.2.1 void ng_oneshot_handler (ng_event_base_t * *event*, uint32_t *trigger*)

Fuction for handling the execution of a one-shot event.

Parameters

*event	Pointer to the event that needs to be handled
trigger	The trigger that iniated the execution of the event

13.8 ng_event_periodic.h File Reference

Periodic event type.

Data Structures

- struct ng_periodic_t

Macros

- #define NG_PERIODIC(object)

Functions

- void ng_periodic_handler (ng_event_base_t *event, uint32_t trigger)

  Handler function of a periodic event.
- void ng_periodic_start (ng_event_base_t *event)

  Start function for starting a periodic event.
- void ng_periodic_stop (ng_event_base_t *event, bool force_finish)

  Stop function for stopping a periodic transition.
- void ng_periodic_pause_toggle (ng_event_base_t *event, bool pause)

  Function for pausing or resuming a periodic event.

13.8.1 Detailed Description

Periodic event type.

Periodic is derived from the base event type *ng_event_base_t* and contains additional attributes regarding its timing as well as specific functions for controlling it (*handler start stop pause_toggle*).

13.8.2 Data Structure Documentation

13.8.2.1 struct ng_periodic_t

Data struct that contains a periodic event's data

Data Fields

	EVENT_BASE_STRUCT	Inherited attributes from ng_event_base_t data struct
float	start_time	Start time of the periodic transition
float	period	Period in seconds

13.8.3 Macro Definition Documentation

13.8.3.1 #define NG_PERIODIC(*object*)

Type caster from base ng_event_base_t struct to derived ng_periodic_t struct

13.8.4 Function Documentation

13.8.4.1 void ng_periodic_handler (ng_event_base_t * *event*, uint32_t *trigger*)

Handler function of a periodic event.

Parameters

*event	Pointer to the base struct *ng_event_base_t* of the event that needs to be handled (casted internally to *ng_periodic_t*)
trigger	The trigger that iniated the execution of the event

13.8.4.2 void ng_periodic_start (ng_event_base_t * *event*)

Start function for starting a periodic event.

Parameters

*event	Pointer to the base struct *ng_event_base_t* of the event that needs to be started (casted internally to *ng_periodic_t*)

13.8.4.3 void ng_periodic_stop (ng_event_base_t * *event*, bool *force_finish*)

Stop function for stopping a periodic transition.

Parameters

*event	Pointer to the base struct *ng_event_base_t* of the event that needs to be stopped (casted internally to *ng_periodic_t*)
force_finish	unused (needed for function's signature)

13.8.4.4 void ng_periodic_pause_toggle (ng_event_base_t * *event*, bool *pause*)

Function for pausing or resuming a periodic event.

Parameters

*event	Pointer to the base struct *ng_event_base_t* of the event that needs to be paused/resumed (casted internally to *ng_periodic_t*)
pause	if true, the periodic event will explicitly pause, otherwise if the periodic event is paused, it will resume its execution

13.9 ng_event_periodic_transition.h File Reference

Periodic transition event type.

Data Structures

- struct ng_periodic_transition_t

Macros

- #define NG_PERIODIC_TRANSITION(object)

Functions

- void ng_periodic_transition_handler (ng_event_base_t *event, uint32_t trigger)

  Handler function of a periodic transition.
- void ng_periodic_transition_start (ng_event_base_t *event)

  Start function for starting a periodic transition.
- void ng_periodic_transition_stop (ng_event_base_t *event, bool force_finish)

  Stop function for stopping a periodic transition.
- void ng_periodic_transition_pause_toggle (ng_event_base_t *event, bool pause)

  Function for pausing or resuming a periodic transition.

13.9.1 Detailed Description

Periodic transition event type.

Periodic transition is derived from the base event type *ng_event_base_t* and contains additional attributes regarding its timing as well as specific functions for controlling it (*handler start stop pause_toggle*).

13.9.2 Data Structure Documentation

13.9.2.1 struct ng_periodic_transition_t

Data struct that contains a periodic transition's data

Data Fields

	EVENT_BASE_STRUCT	Inherited attributes from ng_event_base_t data struct
float	start_time	Start time of the periodic transition
float	duration	Duration in seconds (must be less or equal to period)
float	progress	Progress [0.f, 1.f]
float	period	Period in seconds

13.9.3 Macro Definition Documentation

13.9.3.1 #define NG_PERIODIC_TRANSITION(*object*)

Type caster from base ng_event_base_t struct to derived ng_periodic_transition_t struct

13.9.4 Function Documentation

13.9.4.1 void ng_periodic_transition_handler (ng_event_base_t * *event*, uint32_t *trigger*)

Handler function of a periodic transition.

Parameters

*event	Pointer to the base struct *ng_event_base_t* of the event that needs to be handled (casted internally to *ng_periodic_transition_t*)
trigger	The trigger that iniated the execution of the event

13.9.4.2 void ng_periodic_transition_start (ng_event_base_t * *event*)

Start function for starting a periodic transition.

Parameters

*event	Pointer to the base struct *ng_event_base_t* of the event that needs to be started (casted internally to *ng_periodic_transition_t*)

13.9.4.3 void ng_periodic_transition_stop (ng_event_base_t * *event*, bool *force_finish*)

Stop function for stopping a periodic transition.

Parameters

*event	Pointer to the base struct *ng_event_base_t* of the event that needs to be stopped (casted internally to *ng_periodic_transition_t*)
force_finish	if this is true, the periodic trasnition will go to its final state (progress = 1.f) and stop, otherwise it will reset to its initial state (progress = 0.f) and stop

13.9.4.4 void ng_periodic_transition_pause_toggle (ng_event_base_t * *event*, bool *pause*)

Function for pausing or resuming a periodic transition.

Parameters

*event	Pointer to the base struct *ng_event_base_t* of the event that needs to be paused/resumed (casted internally to *ng_periodic_transition_t*)
pause	if true, the periodic tranitions will explicitly pause, otherwise if the periodic transition is paused, it will resume its execution

13.10 ng_event_transition.h File Reference

Transition event type.

Data Structures

- struct ng_transition_t

Macros

- #define NG_TRANSITION(object)

Functions

- void ng_transition_handler (ng_event_base_t *event, uint32_t trigger)

  Handler function of a transition.
- void ng_transition_start (ng_event_base_t *event)

  Start function for starting a periodic transition.
- void ng_transition_stop (ng_event_base_t *event, bool force_finish)

  Stop function for stopping a transition.
- void ng_transition_pause_toggle (ng_event_base_t *event, bool pause)

  Function for pausing or resuming a transition.
- void ng_transition_revert (ng_event_base_t *event)

  Reverts the transition progress once (do not use this function to re-revert a transition)
- void ng_transition_revert_force (ng_event_base_t *event, int set)

  Reverts the transition progress.

13.10.1 Detailed Description

Transition event type.

Transition is derived from the base event type *ng_event_base_t* and contains additional attributes regarding its timing as well as specific functions for controlling it (*handler start stop pause_toggle*).

13.10.2 Data Structure Documentation

13.10.2.1 struct ng_transition_t

Data struct that contains a transition's data

Data Fields

	EVENT_BASE_STRUCT	Inherited attributes from ng_event_base_t data struct
float	start_time	Start time of the periodic transition
float	duration	Duration in seconds
float	progress	Progress [0.f, 1.f]

13.10.3 Macro Definition Documentation

13.10.3.1 #define NG_TRANSITION(*object*)

Type caster from base ng_event_base_t struct to derived ng_transition_t struct

13.10.4 Function Documentation

13.10.4.1 void ng_transition_handler (ng_event_base_t * *event*, uint32_t *trigger*)

Handler function of a transition.

Parameters

*event	Pointer to the base struct *ng_event_base_t* of the event that needs to be handled (casted internally to *ng_transition_t*)
trigger	The trigger that iniated the execution of the event

13.10.4.2 void ng_transition_start (ng_event_base_t * *event*)

Start function for starting a periodic transition.

Parameters

*event	Pointer to the base struct *ng_event_base_t* of the event that needs to be started (casted internally to *ng_transition_t*)

13.10.4.3 void ng_transition_stop (ng_event_base_t * *event*, bool *force_finish*)

Stop function for stopping a transition.

Parameters

*event	Pointer to the base struct *ng_event_base_t* of the event that needs to be stopped (casted internally to *ng_transition_t*)
force_finish	if this is true, the periodic trasnition will go to its final state (progress = 1.f) and stop, otherwise it will reset to its initial state (progress = 0.f) and stop

13.10.4.4 void ng_transition_pause_toggle (ng_event_base_t * *event*, bool *pause*)

Function for pausing or resuming a transition.

Parameters

*event	Pointer to the base struct *ng_event_base_t* of the event that needs to be paused/resumed (casted internally to *ng_transition_t*)
pause	if true, the tranitions will explicitly pause, otherwise if the transition is paused, it will resume its execution

13.10.4.5 void ng_transition_revert (ng_event_base_t * *event*)

Reverts the transition progress once (do not use this function to re-revert a transition)

Parameters

*event	Pointer to the base struct *ng_event_base_t* of the transition that needs to be reverted (casted internally to *ng_transition_t*)

13.10.4.6 void ng_transition_revert_force (ng_event_base_t * *event*, int *set*)

Reverts the transition progress.

Parameters

**event*	Pointer to the base struct *ng_event_base_t* of the transition that needs to be reverted (casted internally to *ng_transition_t*)
set	if this is equal to zero, the transition's final progress is 1.f, otherwise the final progress is 0.f

13.11 ng_gestures.h File Reference

Data Structures

- struct gitem_gestures_t

Macros

- #define GESTURE_FUNC_ABORT_PRESS(NAME)

  Gesture's abort function signature.
- #define GESTURE_FUNC_RELEASE(NAME)

  Gesture's release function signature.
- #define GESTURE_FUNC_PRESS(NAME)

  Gesture's press function signature.
- #define GESTURE_FUNC_SWIPE(NAME)

  Gesture's swipe function signature.

Functions

- typedef GESTURE_FUNC_RELEASE (release_gesture_func_t)

  Gesture's release function definition.
- typedef GESTURE_FUNC_PRESS (press_gesture_func_t)

  Gesture's press function definition.
- typedef GESTURE_FUNC_SWIPE (swipe_gesture_func_t)

  Gesture's swipe function definition.
- typedef GESTURE_FUNC_ABORT_PRESS (abort_gesture_func_t)

  Gesture's abort function definition.

- tree_node_t * ng_gestures_press (nema_event_t *event, int event_press_x, int event_press_y)

  Function executed on mouse/finger press.
- void ng_gestures_release (nema_event_t *event)

  Function executed on mouse/finger release.
- void ng_gestures_swipe (nema_event_t *event, int mouse_dx, int mouse_dy)

  Function executed on mouse/finger swipe/drag.
- bool ng_gestures_is_inside_popup (int x, int y)

13.11.1 Data Structure Documentation

13.11.1.1 struct gitem_gestures_t

Data struct that contains function pointers to gestures

Data Fields

press_gesture_func_t *	press	Function pointer to press function
release_gesture_func_t *	release	Function pointer to release function
swipe_gesture_func_t *	swipe	Function pointer to swipe function
abort_gesture_func_t *	abort	Function pointer to abort function

13.11.2 Macro Definition Documentation

13.11.2.1 #define GESTURE_FUNC_ABORT_PRESS(*NAME*)

Gesture's abort function signature.

13.11.2.2 #define GESTURE_FUNC_RELEASE(*NAME*)

Gesture's release function signature.

13.11.2.3 #define GESTURE_FUNC_PRESS(*NAME*)

Gesture's press function signature.

13.11.2.4 #define GESTURE_FUNC_SWIPE(*NAME*)

Gesture's swipe function signature.

13.11.3 Function Documentation

13.11.3.1 typedef GESTURE_FUNC_RELEASE (release_gesture_func_t)

Gesture's release function definition.

13.11.3.2 typedef GESTURE_FUNC_PRESS (press_gesture_func_t)

Gesture's press function definition.

13.11.3.3 typedef GESTURE_FUNC_SWIPE (swipe_gesture_func_t)

Gesture's swipe function definition.

13.11.3.4 typedef GESTURE_FUNC_ABORT_PRESS (abort_gesture_func_t)

Gesture's abort function definition.

13.11.3.5 tree_node_t* ng_gestures_press (nema_event_t * *event*, int *event_press_x*, int *event_press_y*)

Function executed on mouse/finger press.

Parameters

*event	Pointer to the press event as forwarded by the main loop
event_press_x	The x position (absolute coordinate) of the press event
event_press_y	The y position (absolute coordinate) of the press event

Returns

tree_node_t* The tree node that accepted the "press" if its graphics item supports press, otherwise NULL

13.11.3.6 void ng_gestures_release (nema_event_t * *event*)

Function executed on mouse/finger release.

Parameters

*event	Pointer to the release event as forwarded by the main loop

13.11.3.7 void ng_gestures_swipe (nema_event_t * *event*, int *mouse_dx*, int *mouse_dy*)

Function executed on mouse/finger swipe/drag.

Parameters

*event	Pointer to the release event as forwarded by the main loop
mouse_dx	Horizontal difference in pixels to the previously captured event
mouse_dy	Vertical difference in pixels to the previously captured event

13.11.3.8 bool ng_gestures_is_inside_popup (int *x*, int *y*)

Parameters

x	Gesture's horizontal position
y	Gesture's vertical position

Returns

bool True if the gesture was performed inside a pop-up, otherwise false

13.12 ng_gitem.h File Reference

Data Structures

- struct __gitem_base_t

  Graphics item base struct definition. More...
- struct attr_text_t

  Text attributes data struct. More...

Macros

- #define GITEMF_ALWAYS
- #define GITEMF_PRESS
- #define GITEMF_RELEASE
- #define GITEMF_HOLD
- #define GITEMF_DRAG
- #define GITEMF_FILL_COLOR

- #define GITEMF_FILL_IMAGE
- #define GITEMF_FILL_OUTLINE
- #define GITEMF_HIGHLIGHTED
- #define GITEMF_CHECKED
- #define GITEMF_STOP_RECUR
- #define GITEMF_HIDDEN
- #define GITEMF_ANIMATED
- #define GITEMF_PRESS_SCALE
- #define GITEMF_CONTAINS_WINDOW
- #define BASE_STRUCT

  Define that contains all the gitem_base_t data struct attributes that are common among all different graphics items (widgets)
- #define NG_GITEM(object)
- #define DRAW_FUNC(NAME)
- #define ID(v)
- #define X(v)
- #define Y(v)
- #define W(v)
- #define H(v)
- #define COLOR(v)
- #define EVENT(v)
- #define IMAGE(v)
- #define CUR_VAL(v)
- #define MAX_VAL(v)
- #define MIN_VAL(v)
- #define FLAGS(v)
- #define GESTURES(v)
- #define PEN_WIDTH(v)
- #define TEXT_COLOR(v)
- #define SEC_COLOR(v)
- #define SEC_IMAGE(v)
- #define ANGLE(v)
- #define MAX_ANGLE(v)
- #define MIN_ANGLE(v)
- #define STEP(v)
- #define X_ROT(v)

- #define Y_ROT(v)
- #define NEEDLE(v)
- #define HOUR(v)
- #define MINUTE(v)
- #define SECOND(v)
- #define RADIUS(v)
- #define SUFFIX(v)
- #define PAGE_COUNT(v)
- #define SPACING(v)
- #define CUR_STATE(v)
- #define STATE_COUNT(v)
- #define CUR_PAGE(v)
- #define INT_PRECISION(v)
- #define DEC_PRECISION(v)
- #define TIME_FORMAT(v)

Enumerations

- enum gitem_type_e {
  GITEM_MAIN_SCREEN,
  GITEM_CONTAINER,
  GITEM_CIRCLE,
  GITEM_RECT,
  GITEM_ROUNDED_RECT,
  GITEM_IMAGE,
  GITEM_LABEL,
  GITEM_LABEL_BUTTON,
  GITEM_CHECKBOX,
  GITEM_RADIO_BUTTON,
  GITEM_HORIZONTAL_SLIDER,
  GITEM_VERTICAL_SLIDER,
  GITEM_DIGITAL_METER,
  GITEM_WINDOW_SCREEN,
  GITEM_ICON,
  GITEM_TABLE,
  GITEM_HORIZONTAL_PROGRESS_BAR,
  GITEM_GAUGE,
  GITEM_NEEDLE,
  GITEM_ICON_BUTTON,
  GITEM_WINDOW,
  GITEM_CIRCULAR_PROGRESS,
  GITEM_WATCH_FACE,
  GITEM_DIGITAL_CLOCK,
  GITEM_VERTICAL_PROGRESS_BAR,
  GITEM_SWIPE_WINDOW,
  GITEM_TOGGLE_BUTTON,
  GITEM_TYPE_COUNT }

  Enumerator that contains the various graphics items types. Each type is documented in the next section (widgets)

Functions

- float ng_gitem_get_value (gitem_base_t *git)

  Gets the current value of the graphics item (if supported)
- void ng_gitem_set_flag (gitem_base_t *git, uint32_t flag)

  Sets a flag of a graphics item.
- void ng_gitem_unset_flag (gitem_base_t *git, uint32_t flag)

  Unsets a graphics item's flag.

- void ng_gitem_set_visible (gitem_base_t *git)

  Makes a graphics item visible (if was previously hidden)
- void ng_gitem_set_hidden (gitem_base_t *git)

  Hides a graphics item.
- void ng_gitem_set_alpha (gitem_base_t *git, uint32_t alpha)

  Set the opacity (alpha channel) of a graphics item.
- void ng_gitem_set_color (gitem_base_t *git, uint32_t rgba)

  Sets the color of a graphics item.
- void ng_gitem_set_position (gitem_base_t *git, int x, int y)

  Sets the position of a graphics item.
- void ng_gitem_set_x (gitem_base_t *git, int x)

  Sets the x-position of a graphics item.
- void ng_gitem_set_y (gitem_base_t *git, int y)

  Sets the y-position of a graphics item.
- void ng_gitem_set_size (gitem_base_t *git, int w, int h)

  Sets the size of a graphics item.

13.12.1 Data Structure Documentation

13.12.1.1 struct __gitem_base_t

Graphics item base struct definition.

Data Fields

	BASE_STRUCT	Atribbutes as defined in the description of BASE_STRUCT (event pointer, draw function pointer, gestures pointer, flags, x, y, w, h, id, type, color)

13.12.1.2 struct attr_text_t

Text attributes data struct.

Data Fields

uint8_t	index	Current index that helps identifying the graphics item's current text and font
nema_font_t **	fonts	Pointer to an array of font pointer
char **	texts	Pointer to an array of strings

Data Fields

uint32_t	alignment	Text alignment (bitwise operator)

13.12.2 Macro Definition Documentation

13.12.2.1 #define GITEMF_ALWAYS

Reserved

13.12.2.2 #define GITEMF_PRESS

The graphics item accepts mouse press events

13.12.2.3 #define GITEMF_RELEASE

The graphics item accepts mouse release events

13.12.2.4 #define GITEMF_HOLD

The graphics item accepts mouse hold events (reserved for future use)

13.12.2.5 #define GITEMF_DRAG

The graphics item accepts mouse drag (swipe) events

13.12.2.6 #define GITEMF_FILL_COLOR

The graphics item draw function fills a color in the item's geometry

13.12.2.7 #define GITEMF_FILL_IMAGE

The graphics item draw function blits a texture in the item's geometry

13.12.2.8 #define GITEMF_FILL_OUTLINE

The graphics item draw function draw's the outline of the item

13.12.2.9 #define GITEMF_HIGHLIGHTED

The graphics item is highlighted

13.12.2.10 #define GITEMF_CHECKED

The graphics item is checked

13.12.2.11 #define GITEMF_STOP_RECUR

Stop a recursion flag

13.12.2.12 #define GITEMF_HIDDEN

The graphics item is hidden

13.12.2.13 #define GITEMF_ANIMATED

The graphics item is animated (displayed using a back buffer)

13.12.2.14 #define GITEMF_PRESS_SCALE

The graphics item scales itself (size) when pressed

13.12.2.15 #define GITEMF_CONTAINS_WINDOW

Apllicable to "Screen", indicates whether the screen contains a window or not

13.12.2.16 #define BASE_STRUCT

Define that contains all the *gitem_base_t* data struct attributes that are common among all different graphics items (widgets)

These attributes are:
ng_event_base_t ∗event: Pointer to an event assigned to the graphics item
draw_f ∗draw: Pointer to the draw function
uint32_t flags: Graphics item's flags (as defined earlier)
int x: Horizontal (x) offset (with respect to its parent)
int y: Vertical (y) offset (with respect to its parent)
uint16_t w: Width
uint16_t h: Height

int id: Unique identification number
gitem_type_e type: Enumerator that indicates the type of the graphics items
uint32_t color: Base color (contains the item's opacity)

13.12.2.17 #define NG_GITEM(*object*)

Type caster from a derived gitem data struct to the base gitem_base_t

13.12.2.18 #define DRAW_FUNC(*NAME*)

Draw function definition

13.12.2.19 #define ID(*v*)

Redability helper

13.12.2.20 #define X(*v*)

Redability helper

13.12.2.21 #define Y(*v*)

Redability helper

13.12.2.22 #define W(*v*)

Redability helper

13.12.2.23 #define H(*v*)

Redability helper

13.12.2.24 #define COLOR(*v*)

Redability helper

13.12.2.25 #define EVENT(*v*)

Redability helper

13.12.2.26 #define IMAGE(*v*)

Redability helper

13.12.2.27 #define CUR_VAL(*v*)

Redability helper

13.12.2.28 #define MAX_VAL(*v*)

Redability helper

13.12.2.29 #define MIN_VAL(*v*)

Redability helper

13.12.2.30 #define FLAGS(*v*)

Redability helper

13.12.2.31 #define GESTURES(*v*)

Redability helper

13.12.2.32 #define PEN_WIDTH(*v*)

Redability helper

13.12.2.33 #define TEXT_COLOR(*v*)

Redability helper

13.12.2.34 #define SEC_COLOR(*v*)

Redability helper

13.12.2.35 #define SEC_IMAGE(*v*)

Redability helper

13.12.2.36 #define ANGLE(*v*)

Redability helper

13.12.2.37 #define MAX_ANGLE(*v*)

Redability helper

13.12.2.38 #define MIN_ANGLE(*v*)

Redability helper

13.12.2.39 #define STEP(*v*)

Redability helper

13.12.2.40 #define X_ROT(*v*)

Redability helper

13.12.2.41 #define Y_ROT(*v*)

Redability helper

13.12.2.42 #define NEEDLE(*v*)

Redability helper

13.12.2.43 #define HOUR(*v*)

Redability helper

13.12.2.44 #define MINUTE(*v*)

Redability helper

13.12.2.45 #define SECOND(*v*)

Redability helper

13.12.2.46 #define RADIUS(*v*)

Redability helper

13.12.2.47 #define SUFFIX(*v*)

Redability helper

13.12.2.48 #define PAGE_COUNT(*v*)

Redability helper

13.12.2.49 #define SPACING(*v*)

Redability helper

13.12.2.50 #define CUR_STATE(*v*)

Redability helper

13.12.2.51 #define STATE_COUNT(*v*)

Redability helper

13.12.2.52 #define CUR_PAGE(*v*)

Redability helper

13.12.2.53 #define INT_PRECISION(*v*)

Redability helper

13.12.2.54 #define DEC_PRECISION(*v*)

Redability helper

13.12.2.55 #define TIME_FORMAT(*v*)

Redability helper

13.12.3 Enumeration Type Documentation

13.12.3.1 enum gitem_type_e

Enumerator that contains the various graphics items types. Each type is documented in the next section (widgets)

Enumerator

GITEM_MAIN_SCREEN Main screen
GITEM_CONTAINER Container
GITEM_CIRCLE Circle
GITEM_RECT Rectangle
GITEM_ROUNDED_RECT Rounded rectangle
GITEM_IMAGE Image
GITEM_LABEL Label
GITEM_LABEL_BUTTON Label button
GITEM_CHECKBOX Checkbox
GITEM_RADIO_BUTTON Radio button
GITEM_HORIZONTAL_SLIDER Horizontal slider
GITEM_VERTICAL_SLIDER Vertical slider
GITEM_DIGITAL_METER Digital meter
GITEM_WINDOW_SCREEN Window (secondary) screen
GITEM_ICON Icon
GITEM_TABLE Table
GITEM_HORIZONTAL_PROGRESS_BAR Horizontal progress bar
GITEM_GAUGE Gauge
GITEM_NEEDLE Needle
GITEM_ICON_BUTTON Icon button
GITEM_WINDOW Window
GITEM_CIRCULAR_PROGRESS Circular progress
GITEM_WATCH_FACE Watch-face
GITEM_DIGITAL_CLOCK Digital clock
GITEM_VERTICAL_PROGRESS_BAR Vertical progress bar
GITEM_SWIPE_WINDOW Swipe window
GITEM_TOGGLE_BUTTON Toggle button
GITEM_TYPE_COUNT Reserved

13.12.4 Function Documentation

13.12.4.1 float ng_gitem_get_value (gitem_base_t * *git*)

Gets the current value of the graphics item (if supported)

Parameters

git	Pointer to the graphics item that its value should be returned

Returns

float Value of the graphics item. If the item does not support "value", returns 0.f

13.12.4.2 void ng_gitem_set_flag (gitem_base_t * *git*, uint32_t *flag*)

Sets a flag of a graphics item.

Parameters

git	Pointer to the graphics item
flag	Flag to be set

13.12.4.3 void ng_gitem_unset_flag (gitem_base_t * *git*, uint32_t *flag*)

Unsets a graphics item's flag.

Parameters

git	Pointer to the graphics item
flag	Flag to be unset

13.12.4.4 void ng_gitem_set_visible (gitem_base_t * *git*)

Makes a graphics item visible (if was previously hidden)

Parameters

git	Pointer to the graphics item

13.12.4.5 void ng_gitem_set_hidden (gitem_base_t * *git*)

Hides a graphics item.

Parameters

git	Pointer to the graphics item

13.12.4.6 void ng_gitem_set_alpha (gitem_base_t * *git*, uint32_t *alpha*)

Set the opacity (alpha channel) of a graphics item.

Parameters

git	Pointer to the graphics item
alpha	Opacity value

13.12.4.7 void ng_gitem_set_color (gitem_base_t * *git*, uint32_t *rgba*)

Sets the color of a graphics item.

Parameters

git	Pointer to the graphics item
rgba	Color value

13.12.4.8 void ng_gitem_set_position (gitem_base_t * *git*, int *x*, int *y*)

Sets the position of a graphics item.

Parameters

git	Pointer to the graphics item
x	Horizontal offset
y	Vertical offset

13.12.4.9 void ng_gitem_set_x (gitem_base_t * *git*, int *x*)

Sets the x-position of a graphics item.

Parameters

git	Pointer to the graphics item
x	Horizontal offset

13.12.4.10 void ng_gitem_set_y (gitem_base_t * *git*, int *y*)

Sets the y-position of a graphics item.

Parameters

git	Pointer to the graphics item
y	Vertical position

13.12.4.11 void ng_gitem_set_size (gitem_base_t * *git*, int *w*, int *h*)

Sets the size of a graphics item.

Parameters

git	Pointer to the graphics item
w	Width
h	Height

13.13 ng_globals.h File Reference

Macros

- #define NG_LAYOUT_HOR
- #define NG_LAYOUT_VER
- #define SCREEN_TRANSITION_PAUSED
- #define SCREEN_TRANSITION_RUNNING
- #define SCREEN_TRANSITION_STOPPED
- #define DOING_SCREEN_TRANSITION

Functions

- void ng_globals_set_resolution (int resx, int resy)

  Sets the resolution of the applciation (NG_RESX and NG_RESY variables)

- void ng_globals_register_screen_transition_event (ng_event_base_t *event)

  Registers the screen transition event to the API. By default, this event is the first event of the generated event list.

- void ng_globals_register_event_list (ng_event_base_t **event_list, int list_size, int temp_animations)

  Registers the generated event list to the API.

- void ng_globals_register_screen_groups (int group_count, int popup_count, int *screens_per_group, tree_node_t ***nodes_per_group, nema_transition_t *effect_per_group, uint8_t *layout_per_group, tree_node_t **popup_nodes, int cur_group, int cur_screen, tree_node_t **cur_group_nodes)

  Registers the generated screen groups to the API.

- void ng_globals_register_framebuffers (int frame_buffer_count, img_obj_t *frame_buffers, int back_buffer_cou img_obj_t *back_buffers, nemadc_layer_t *layers)

  Registers the framebuffers to the API.

- int ng_globals_sanity_check ()

  Performs a sanity check, that the generated project's parameters have been properly registered to the API.

Variables

- EXTERN int NG_RESX
- EXTERN int NG_RESY
- EXTERN tree_node_t * popup_node
- EXTERN int popup_off_x
- EXTERN int popup_off_y
- EXTERN bool NG_DISPLAY_UPDATE
- EXTERN ng_event_base_t * NG_SCREEN_TRANSITION_EVENT
- EXTERN int NG_EVENT_LIST_SIZE
- EXTERN int NG_TEMP_ANIMATIONS_COUNT
- EXTERN ng_event_base_t ** NG_EVENT_LIST
- EXTERN float NG_WALL_TIME
- EXTERN int NG_SCREEN_GROUPS_COUNT
- EXTERN int NG_POPUP_COUNT
- EXTERN int * NG_SCREENS_PER_GROUP
- EXTERN tree_node_t *** NG_NODES_PER_GROUP
- EXTERN nema_transition_t * NG_EFFECT_PER_GROUP

- EXTERN uint8_t * NG_LAYOUT_PER_GROUP
- EXTERN tree_node_t ** NG_POPUP_NODES
- EXTERN int NG_CUR_SCREEN_GROUP_INDEX
- EXTERN int NG_CUR_SCREEN_NODE_INDEX
- EXTERN tree_node_t ** NG_CUR_SCREEN_GROUP_NODES
- EXTERN int NG_FRAMEBUFFER_COUNT
- EXTERN int NG_BACKBUFFER_COUNT
- EXTERN img_obj_t * NG_FRAMEBUFFER
- EXTERN img_obj_t * NG_BACKBUFFER
- EXTERN nemadc_layer_t * NG_DC_LAYER

13.13.1 Macro Definition Documentation

13.13.1.1 #define NG_LAYOUT_HOR

Horizontal Layout

13.13.1.2 #define NG_LAYOUT_VER

Vertical Layout

13.13.1.3 #define SCREEN_TRANSITION_PAUSED

Checks if the screen transition event is paused (returns true/false)

13.13.1.4 #define SCREEN_TRANSITION_RUNNING

Checks if the screen transition event is running (returns true/false)

13.13.1.5 #define SCREEN_TRANSITION_STOPPED

Checks if the screen transition event is stopped (returns true/false)

13.13.1.6 #define DOING_SCREEN_TRANSITION

Checks if a screen transition is stopped (returns true/false)

13.13.2 Function Documentation

13.13.2.1 void ng_globals_set_resolution (int *resx*, int *resy*)

Sets the resolution of the applciation (NG_RESX and NG_RESY variables)

Parameters

resx	Horizontal resolution
resy	Vertical resolution

13.13.2.2 void ng_globals_register_screen_transition_event (ng_event_base_t * *event*)

Registers the screen transition event to the API. By default, this event is the first event of the generated event list.

Parameters

event	Pointer to the event that will be used for the screen transitions

13.13.2.3 void ng_globals_register_event_list (ng_event_base_t ** *event_list*, int *list_size*, int *temp_animations*)

Registers the generated event list to the API.

Parameters

***event_list*	List (array) with pointers to the generated events
list_size	Size of the event list
temp_animations	Maximum count of temporary animations (eg. swipe window animation)

13.13.2.4 void ng_globals_register_screen_groups (int *group_count*, int *popup_count*, int * *screens_per_group*, tree_node_t *** *nodes_per_group*, nema_transition_t * *effect_per_group*, uint8_t * *layout_per_group*, tree_node_t ** *popup_nodes*, int *cur_group*, int *cur_screen*, tree_node_t ** *cur_group_nodes*)

Registers the generated screen groups to the API.

Parameters

group_count	Total count of the screen groups
popup_count	Total count the pop-ups
∗*screens_per_group*	Array that contains how many screens belong to each screen group
∗∗∗*nodes_per_group*	Array that contains pointers to arrays that contain the tree nodes of each screen group
∗*effect_per_group*	Transition effect per screen goup
∗*layout_per_group*	Layout (horizontal-vertical) per screen group (application specific)
∗∗*popup_nodes*	Array that contains the pointers of all the pop-up tree nodes
cur_group	Index of the current screen group
cur_screen	Index of the current screen
∗∗*cur_group_nodes*	Array with pointers to the tree nodes of the current screen group

13.13.2.5 void ng_globals_register_framebuffers (int *frame_buffer_count*, img_obj_t ∗ *frame_buffers*, int *back_buffer_count*, img_obj_t ∗ *back_buffers*, nemadc_layer_t ∗ *layers*)

Registers the framebuffers to the API.

Parameters

frame_buffer_count	Count of the (front) framebuffers
frame_buffers	Array that contains the framebuffers
back_buffer_count	Count of the backbuffers
back_buffers	Array that contains the backbuffers
layers	Array that contains the display controller layers

13.13.2.6 int ng_globals_sanity_check ( )

Performs a sanity check, that the generated project's parameters have been properly registered to the API.

Returns

int Zero if everything has been registred corectly, otherwize a positive number that indicates the error

13.13.3 Variable Documentation

13.13.3.1 EXTERN int NG_RESX

Application's horizontal resolution

13.13.3.2 EXTERN int NG_RESY

Application's vertical resolution

13.13.3.3 EXTERN tree_node_t* popup_node

Pointer to the pop-up tree node (valid when displaying a pop-up)

13.13.3.4 EXTERN int popup_off_x

Pop-up's horizontal offset

13.13.3.5 EXTERN int popup_off_y

Pop-up's vertical offset

13.13.3.6 EXTERN bool NG_DISPLAY_UPDATE

Initialized as false in the beggining of every iteration of the main loop and updated afterwards. When true the GPU will update the framebuffer at the end of the main loop

13.13.3.7 EXTERN ng_event_base_t* NG_SCREEN_TRANSITION_EVENT

Pointer to the event used for performing screen transitions

13.13.3.8 EXTERN int NG_EVENT_LIST_SIZE

Size of the generated event list

13.13.3.9 EXTERN int NG_TEMP_ANIMATIONS_COUNT

Maximum count of temporary animations (eg. swipe window animation)

13.13.3.10 EXTERN ng_event_base_t** NG_EVENT_LIST

Pointer to the generated event list

13.13.3.11 EXTERN float NG_WALL_TIME

System's wall time (updated by the API, the user should use it as read-only)

13.13.3.12 EXTERN int NG_SCREEN_GROUPS_COUNT

Count of the screen groups (application specific)

13.13.3.13 EXTERN int NG_POPUP_COUNT

Count of the pop-ups (application specific)

13.13.3.14 EXTERN int* NG_SCREENS_PER_GROUP

Array that contains how many screens belong to each screen group (application specific)

13.13.3.15 EXTERN tree_node_t*** NG_NODES_PER_GROUP

Array that contains pointers to arrays that contain the tree nodes of each screen group

13.13.3.16 EXTERN nema_transition_t* NG_EFFECT_PER_GROUP

Transition effect per screen goup (application specific)

13.13.3.17 EXTERN uint8_t* NG_LAYOUT_PER_GROUP

Layout (horizontal-vertical) per screen group (application specific)

13.13.3.18 EXTERN tree_node_t** NG_POPUP_NODES

Array that contains the pointers of all the pop-up tree nodes (application specific)

13.13.3.19 EXTERN int NG_CUR_SCREEN_GROUP_INDEX

Index of the current screen group

13.13.3.20 EXTERN int NG_CUR_SCREEN_NODE_INDEX

Index of the current screen

13.13.3.21 EXTERN tree_node_t** NG_CUR_SCREEN_GROUP_NODES

Array with pointers to the tree nodes of the current screen group

13.13.3.22 EXTERN int NG_FRAMEBUFFER_COUNT

Count of the (front) framebuffers (application specific)

13.13.3.23 EXTERN int NG_BACKBUFFER_COUNT

Count of the backbuffers (application specific)

13.13.3.24 EXTERN img_obj_t* NG_FRAMEBUFFER

Array that contains the framebuffers

13.13.3.25 EXTERN img_obj_t* NG_BACKBUFFER

Array that contains the backbuffers

13.13.3.26 EXTERN nemadc_layer_t* NG_DC_LAYER

Array that contains the display controller layers

13.14 ng_main_loop.h File Reference

NemaGUI main loop function.

Functions

- void ng_main_loop (const int run_once)

  The applications main loop function.

13.14.1 Detailed Description

NemaGUI main loop function.

This file must be included inside the main function's file. It contains the main loop function of a NemaGUI application.

13.14.2 Function Documentation

13.14.2.1 void ng_main_loop (const int *run_once*)

The applications main loop function.

Parameters

run_once	if this is zero, the application will enter an endless loop, otherwise the main loop will run for one iteration.

13.15 ng_screen_trans.h File Reference

Macros

- #define SCREEN_TRANSITION_DURATION_SECS

Functions

- void ng_screen_trans_initialize (ng_event_base_t *event, tree_node_t *to_screen, tree_node_t *from_screen, nema_transition_t effect, int go_right, float initial_progress)

  Initializes a screen transition.
- void ng_screen_trans_swipe (float progress_diff)

  Function executed when swiping during a screen transition.
- void ng_screen_trans_resume (ng_event_base_t *event, float duration, int abort)

  Rusumes an active screen transition after mouse/finger release (uses the timer)
- void ng_screen_trans_pause (ng_event_base_t *event)

Pauses the screen transition's event.

- void ng_screen_trans_swipable (ng_event_base_t *event, void *data)

  Callback function assigned to the screen transition event.

- void ng_callback_show_screen (ng_event_base_t *event, void *data)

  Callback function executed when the screen transition's event is triggered by the timer.

- void ng_callback_set_screen (ng_event_base_t *event, void *data)

  Callback function for setting instantly the current screen.

13.15.1 Macro Definition Documentation

13.15.1.1 #define SCREEN_TRANSITION_DURATION_SECS

Defines the maximum duration of the screen transition's event

13.15.2 Function Documentation

13.15.2.1 void ng_screen_trans_initialize (ng_event_base_t * *event*, tree_node_t * *to_screen*, tree_node_t * *from_screen*, nema_transition_t *effect*, int *go_right*, float *initial_progress*)

Initializes a screen transition.

Parameters

*event	Pointer to the event struct that controls the transition
*to_screen	Pointer to the final screen's tree node
*from_screen	Pointer to the initial screen's tree node
effect	Transition effect
go_right	Parameter for the direction of the transition
initial_progress	Screen transition's event initial progress

13.15.2.2 void ng_screen_trans_swipe (float *progress_diff*)

Function executed when swiping during a screen transition.

Parameters

progress_diff	Progress difference of the screen transition's event

13.15.2.3 void ng_screen_trans_resume (ng_event_base_t * *event*, float *duration*, int *abort*)

Rusumes an active screen transition after mouse/finger release (uses the timer)

Parameters

**event*	Pointer to the event of the screen transition
duration	Remaining duration
abort	If this different than zero, the screen transition will return to its initial screen

13.15.2.4 void ng_screen_trans_pause (ng_event_base_t * *event*)

Pauses the screen transition's event.

Parameters

**event*	Pointer to the screen transition's event

13.15.2.5 void ng_screen_trans_swipable (ng_event_base_t * *event*, void * *data*)

Callback function assigned to the screen transition event.

Parameters

**event*	Pointer to the screen transition event
data	Screen transition data (casted to ng_node_effect_direction_t type internaly)

13.15.2.6 void ng_callback_show_screen (ng_event_base_t * *event*, void * *data*)

Callback function executed when the screen transition's event is triggered by the timer.

Parameters

**event*	Pointer to the screen transition's event
**data*	Transition data (casted to *ng_node_effect_direction_t* data struct internally)

13.15.2.7 void ng_callback_set_screen (ng_event_base_t * *event*, void * *data*)

Callback function for setting instantly the current screen.

Parameters

*event	Pointer to the event with this action
*data	Pointer to the screen's tree node that needs to be set as current screen (casted to *ng_tree_node_ptr_t* internally)

13.16 ng_timer.h File Reference

Timer module.

Functions

- int ng_timer_create ()

  Creates the periodic timer needed by the application.
- void ng_timer_set_period (int ms)

  Sets the period of the timer.
- void ng_timer_start ()

  Starts the timer.
- void ng_timer_stop ()

  Stops the timer.
- void ng_timer_handler ()

  Function executed each time the timer ticks. Runs all the running events.
- int ng_timer_get ()

  Gets the timer ID.
- bool ng_timer_is_running ()

  Checks if the timer is currently running.
- int ng_timer_get_period ()

  Gets the period of the timer.
- float ng_timer_get_frequency ()

  Gets the timer frequency in Hz.

13.16.1 Detailed Description

Timer module.

Provides the functions needed to create a control the application timer. An NemaGUI application requires one periodic timer.

13.16.2 Function Documentation

13.16.2.1 int ng_timer_create ( )

Creates the periodic timer needed by the application.

Returns

int The timer's ID

13.16.2.2 void ng_timer_set_period (int *ms*)

Sets the period of the timer.

Parameters

ms	Period in ms

13.16.2.3 void ng_timer_start ( )

Starts the timer.

13.16.2.4 void ng_timer_stop ( )

Stops the timer.

13.16.2.5 void ng_timer_handler ( )

Function executed each time the timer ticks. Runs all the *running* events.

13.16.2.6 int ng_timer_get ( )

Gets the timer ID.

Returns

int Timer ID

13.16.2.7 bool ng_timer_is_running ( )

Checks if the timer is currently running.

Returns

bool true if the timer is running, otherwise false

13.16.2.8 int ng_timer_get_period ( )

Gets the period of the timer.

Returns

int Timer period in ms

13.16.2.9 float ng_timer_get_frequency ( )

Gets the timer frequency in Hz.

Returns

float Timer frequency in Hz

13.17 ng_tree.h File Reference

This file contains the necessary data and functions for controlling a project's tree struct.

Data Structures

- struct tree_node_t

Macros

- #define NG_TREE_NODE(object)
- #define PARENT_NODE(v)
- #define FIRST_CHILD_NODE(v)
- #define NEXT_NODE(v)

Functions

- void ng_tree_set_current_screen (tree_node_t *node)

  Sets the current screen.
- void ng_tree_set_current_popup (tree_node_t *node)

  Sets the current pop-up to be displayed.
- tree_node_t * ng_tree_get_current_screen ()

  Returns the tree node of the current screen.
- tree_node_t * ng_tree_get_node_under_cursor (tree_node_t *node, uint32_t gesture, int x, int y, int x_off, int y_off, int *click_x, int *click_y)

  Recursive function, gets the tree node under the cursor (mouse, finger etc)

13.17.1 Detailed Description

This file contains the necessary data and functions for controlling a project's tree struct.

13.17.2 Data Structure Documentation

13.17.2.1 struct tree_node_t

Data struct that defines a tree node

Data Fields

gitem_base_t *	this_	Pointer to the graphics item that the node contains
struct _tree_node_t *	parent	Pointer to the parent node
struct _tree_node_t *	first_child	Pointer to the first child of the node
struct _tree_node_t *	next	Pointer to the next node (in the same hierarchy level)

13.17.3 Macro Definition Documentation

13.17.3.1 #define NG_TREE_NODE(*object*)

Type caster for casting a void pointer to tree_node_t pointer struct

13.17.3.2 #define PARENT_NODE(*v*)

Redability helper

13.17.3.3 #define FIRST_CHILD_NODE(*v*)

Redability helper

13.17.3.4 #define NEXT_NODE(*v*)

Redability helper

13.17.4 Function Documentation

13.17.4.1 void ng_tree_set_current_screen (tree_node_t * *node*)

Sets the current screen.

Parameters

*node	Pointer to the node that contains the new screen

13.17.4.2 void ng_tree_set_current_popup (tree_node_t * *node*)

Sets the current pop-up to be displayed.

Parameters

*node	Pointer to a tree node that contains the pop-up

13.17.4.3 tree_node_t* ng_tree_get_current_screen ( )

Returns the tree node of the current screen.
Returns

tree_node_t* Node of the current screen

13.17.4.4 tree_node_t* ng_tree_get_node_under_cursor (tree_node_t * *node*, uint32_t *gesture*, int *x*, int *y*, int *x_off*, int *y_off*, int * *click_x*, int * *click_y*)

Recursive function, gets the tree node under the cursor (mouse, finger etc)

Parameters

node	Node to be checked in the current iteration (recursion)

Parameters

gesture	Gesture that was initiated by the cursor
x	Cursor x
y	Cursor y
x_off	Horizontal offset with respect to the parent node
y_off	Vertical offset with respect to the parent node
click_x	Node's absolute x position
click_y	Node's absolute y position

Returns

tree_node_t∗ Returns the tree node that supports the specific gesture

13.18 ng_tuples.h File Reference

Tuples are core data structs used by NemaGUI API.

Data Structures

- struct ng_point_t
- struct ng_git_uint32_t
- struct ng_git_uint32_uint32_ez_t
- struct ng_git_ptr_t
- struct ng_git_float_t
- struct ng_git_float_float_ez_t
- struct ng_git_int_int_t
- struct ng_git_int_int_ez_t
- struct ng_git_int_int_pair_ez_t
- struct ng_node_effect_direction_t
- struct ng_node_node_t
- struct ng_gitptr_t
- struct ng_tree_node_ptr_t

13.18.1 Detailed Description

Tuples are core data structs used by NemaGUI API.

A major use of these data structs is in the event handling mechanism. Callback functions accept a void pointer in their arguments (signature contraint). Depending on the specific action that should take place during an event this void pointer is casted inside the implementation of each callback to specific data structs, most of which are defined here.

13.18.2 Data Structure Documentation

13.18.2.1 struct ng_point_t

Data struct that contains point (x,y coordinates)

Data Fields

int	x	x coordinate
int	y	y coordinate

13.18.2.2 struct ng_git_uint32_t

Data struct that contains a pointer to a *gitem_base_t* and a *uint32_t* value

Data Fields

gitem_base_t *	git	Pointer to a graphics item
uint32_t	val	uint32_t value

13.18.2.3 struct ng_git_uint32_uint32_ez_t

Data struct that contains a pointer to a *gitem_base_t*, two *uint32_t* values and a pointer to an easing function

Data Fields

gitem_base_t *	git	Pointer to a graphics item
uint32_t	val_0	First uint32_t value
uint32_t	val_1	Second uint32_t value
easing_f	easing	Pointer to easing function

13.18.2.4 struct ng_git_ptr_t

Data struct that contains a pointer to a *gitem_base_t* and a *void* pointer

Data Fields

gitem_base_t *	git	Pointer to a graphics item
void *	ptr	Void to a graphics item

13.18.2.5 struct ng_git_float_t

Data struct that contains a pointer to a *gitem_base_t* and a *float* value

Data Fields

gitem_base_t *	git	Pointer to a graphics item
float	val	Floating point value

13.18.2.6 struct ng_git_float_float_ez_t

Data struct that contains a pointer to a *gitem_base_t*, two *float* values and a pointer to an easing function

Data Fields

gitem_base_t *	git	Pointer to a graphics item
float	val_0	First float value
float	val_1	Second float value
easing_f	easing	Pointer to easing function

13.18.2.7 struct ng_git_int_int_t

Data struct that contains a pointer to a *gitem_base_t* and two *int* values

Data Fields

gitem_base_t *	git	Pointer to a graphics item
int	a	First int value
int	b	Second int value

13.18.2.8 struct ng_git_int_int_ez_t

Data struct that contains a pointer to a *gitem_base_t*, two *int* values and a pointer to an easing function

Data Fields

gitem_base_t *	git	Pointer to a graphics item
int	a	First int value
int	b	First int value
easing_f	easing	Pointer to an easing function

13.18.2.9 struct ng_git_int_int_pair_ez_t

Data struct that contains a pointer to a *gitem_base_t*, two pairs of *int* values and a pointer to an easing function

Data Fields

gitem_base_t *	git	Pointer to a graphics item
int	a0	First value of the first pair
int	a1	Second value of the first pair
int	b0	First value of the second pair
int	b1	Second value of the second pair
easing_f	easing	Pointer to an easing function

13.18.2.10 struct ng_node_effect_direction_t

Data struct that contains a pointer to a *tree_node_t*, a transition effect and a direction value (according to the defines in ng_animation.h)

Data Fields

tree_node_t *	node	Pointer to a tree node
nema_transition_t	effect	Transition effect
int	direction	Direction (see the defines in ng_animation.h)

13.18.2.11 struct ng_node_node_t

Data struct that contains two pointers to a *tree_node_t* data structs

Data Fields

tree_node_t *	node0	Pointer to the first tree node
tree_node_t *	node1	Pointer to the second tree node

13.18.2.12 struct ng_gitptr_t

Utility data struct that contains a *gitem_base_t* pointer

Data Fields

gitem_base_t *	git	Pointer to a graphics item

13.18.2.13 struct ng_tree_node_ptr_t

Utility data struct that contains a *tree_node_t* pointer

Data Fields

tree_node_t *	node	Pointer to a tree node

13.19 ng_typedefs.h File Reference

Typedefs

- typedef struct _gitem_base_t gitem_base_t
- typedef struct _tree_node_t tree_node_t
- typedef struct _gitem_gestures_t gitem_gestures_t
- typedef struct _ng_event_base_t ng_event_base_t
- typedef float(* easing_f) (float val)
- typedef void(* draw_f) (struct _gitem_base_t *gitem, int x_off, int y_off)
- typedef void(* callback_f) (struct _ng_event_base_t *event, void *data)

13.19.1 Typedef Documentation

13.19.1.1 typedef struct _gitem_base_t gitem_base_t

13.19.1.2 typedef struct _tree_node_t tree_node_t

13.19.1.3 typedef struct _gitem_gestures_t gitem_gestures_t

13.19.1.4 typedef struct _ng_event_base_t ng_event_base_t

13.19.1.5 typedef float(∗ easing_f) (float val)

Typedef to easing function pointer

13.19.1.6 typedef void(∗ draw_f) (struct _gitem_base_t ∗gitem, int x_off, int y_off)

Typedef to draw function pointer (used by the gitem_base_t struct)

13.19.1.7 typedef void(∗ callback_f) (struct _ng_event_base_t ∗event, void ∗data)

Typedef to callback function pointer (used by the g_event_base_t struct)

13.20 ng_utils.h File Reference

Macros

- #define SAFE_CAST(x, srcType, dstType)
- #define CLAMP(x, low, high)
- #define NG_LOAD_ARRAY(array)

Functions

- void float2str (char ∗str, int size, float f, int precision)
- void int2str (char ∗str, int size, int val)
- void concatenate_strings (char ∗str1, char ∗str2)
- int round_up (int numToRound, int multiple)
- void append_trailing_zeros (char ∗str, int len, int zeros_count)
- static nema_buffer_t create_bo_from_pointer (const void ∗ptr, size_t size)

13.20.1 Macro Definition Documentation

13.20.1.1 #define SAFE_CAST(*x*, *srcType*, *dstType*)

13.20.1.2 #define CLAMP(*x*, *low*, *high*)

13.20.1.3 #define NG_LOAD_ARRAY(*array*)

13.20.2 Function Documentation

13.20.2.1 void float2str (char * *str*, int *size*, float *f*, int *precision*)

13.20.2.2 void int2str (char * *str*, int *size*, int *val*)

13.20.2.3 void concatenate_strings (char * *str1*, char * *str2*)

13.20.2.4 int round_up (int *numToRound*, int *multiple*)

13.20.2.5 void append_trailing_zeros (char * *str*, int *len*, int *zeros_count*)

13.20.2.6 static nema_buffer_t create_bo_from_pointer (const void * *ptr*, size_t *size*) [static]

14 Widgets Reference

This section provides interface of each widgets supported by NemaGUI API. The more widgets are used in an application, the more memory is required in order to store them. The following table summarizes the memory needed for each instance of a widget (graphics item).

Widget	Bytes/Widget
Screen	60
Circle	56
Rectangle	60
Rounded Rectangle	60
Image	60
Label	84
Container	64
Table	56
Container Array	56
Window	56
Swipe Window	84
Label Button	72
Toggle Button	64
Icon Button	72
Radio Button	72
Checkbox	72
Horizontal Slider	68
Vertical Slider	68
Digital Meter	92
Icon	56
Horizontal Progress bar	76
Vertical Progress Bar	76
Gauge	100
Circular Progress	76
Watch-face	76
Digital Clock	72

14.1 ng_button.h File Reference

Data Structures

- struct gitem_button_t

Macros

- #define NG_BUTTON(object)

Functions

- DRAW_FUNC (ng_button_draw)

Draw function.

- void ng_button_set_primary_image (gitem_base_t *git, void *asset_ptr)

  Sets the primary image asset.

- void ng_button_set_secondary_image (gitem_base_t *git, void *asset_ptr)

  Sets the secondary image asset.

- void ng_button_set_secondary_color (gitem_base_t *git, uint32_t rgba)

  Sets the secondary color.

14.1.1 Data Structure Documentation

14.1.1.1 struct gitem_button_t

Button widget data struct. Acts as parent widget for label button and icon button

Data Fields

	BASE_STRUCT	Inherited attributes from gitem_base_t data struct
uint32_t	secondary_color	Secondary color (color when button is pressed)
img_obj_t *	primary_image	Pointer to primary image asset (image displayed when button is released)
img_obj_t *	secondary_image	Pointer to secondary image asset (image displayed when button is pressed)
uint16_t	pen_width	Pen width (when button is outlined)

14.1.2 Macro Definition Documentation

14.1.2.1 #define NG_BUTTON(*object*)

Type caster from base gitem_base_t struct to derived gitem_button_t struct

14.1.3 Function Documentation

14.1.3.1 DRAW_FUNC (ng_button_draw)

Draw function.

Parameters

*git	Pointer to image's base gitem (gitem_base_t data struct)

Parameters

x_off	Horizontal offset from its parent item
y_off	Vertical offset from its parent item

Returns

void

14.1.3.2 void ng_button_set_primary_image (gitem_base_t * *git*, void * *asset_ptr*)

Sets the primary image asset.

Parameters

**git*	Pointer to target gitem (gitem_base_t data struct)
**asset_ptr*	Pointer to image asset (casted to img_obj_t internally)

Returns

void

14.1.3.3 void ng_button_set_secondary_image (gitem_base_t * *git*, void * *asset_ptr*)

Sets the secondary image asset.

Parameters

**git*	Pointer to target gitem (gitem_base_t data struct)
**asset_ptr*	Pointer to image asset (casted to img_obj_t internally)

Returns

void

14.1.3.4 void ng_button_set_secondary_color (gitem_base_t * *git*, uint32_t *rgba*)

Sets the secondary color.

Parameters

**git*	Pointer to target gitem (gitem_base_t data struct)
rgba	Color value

Returns

void

14.2 ng_checkbox.h File Reference

Data Structures

- struct gitem_checkbox_t

Macros

- #define NG_CHECKBOX(object)

Functions

- DRAW_FUNC (ng_checkbox_draw)

  Draw function.
- void ng_checkbox_set_image (gitem_base_t *git, void *asset_ptr)

  Sets the foreground image asset.
- void ng_checkbox_set_secondary_color (gitem_base_t *git, uint32_t rgba)

  Sets the secondary color.

Variables

- gitem_gestures_t gestures_checkbox

14.2.1 Data Structure Documentation

14.2.1.1 struct gitem_checkbox_t

Checkbox widget data struct

Data Fields

	BASE_STRUCT	Inherited attributes from gitem_base_t data struct
uint32_t	secondary_color	Secondary color (color when checkbox is pressed)
img_obj_t *	background_image	Pointer to background image asset
img_obj_t *	foreground_image	Pointer to foreground image asset (eg. a checkmark)
uint16_t	pen_width	Pen width (for painting the checkbox outline)

14.2.2 Macro Definition Documentation

14.2.2.1 #define NG_CHECKBOX(*object*)

Type caster from base gitem_base_t struct to derived gitem_checkbox_t struct

14.2.3 Function Documentation

14.2.3.1 DRAW_FUNC (ng_checkbox_draw)

Draw function.

Parameters

*git	Pointer to checkbox's base gitem (gitem_base_t data struct)
x_off	Horizontal offset from its parent item
y_off	Vertical offset from its parent item

Returns

void

14.2.3.2 void ng_checkbox_set_image (gitem_base_t * *git*, void * *asset_ptr*)

Sets the foreground image asset.

Parameters

*git	Pointer to target gitem (gitem_base_t data struct)
*asset_ptr	Pointer to image asset (casted to img_obj_t internally)

Returns

void

14.2.3.3 void ng_checkbox_set_secondary_color (gitem_base_t * *git*, uint32_t *rgba*)

Sets the secondary color.

Parameters

*git	Pointer to target gitem (gitem_base_t data struct)
rgba	Color value

Returns

void

14.2.4 Variable Documentation

14.2.4.1 gitem_gestures_t gestures_checkbox

Checkbox gestures data struct

14.3 ng_circle.h File Reference

Data Structures

- struct gitem_circle_t

Functions

- DRAW_FUNC (ng_circle_draw)

  Draw function.

14.3.1 Data Structure Documentation

14.3.1.1 struct gitem_circle_t

Circle widget data struct

Data Fields

	BASE_STRUCT	Inherited attributes from gitem_base_t data struct

14.3.2 Function Documentation

14.3.2.1 DRAW_FUNC (ng_circle_draw)

Draw function.

Parameters

**git*	Pointer to checkbox's base gitem (gitem_base_t data struct)
x_off	Horizontal offset from its parent item

Parameters

y_off	Vertical offset from its parent item

Returns

void

14.4 ng_circular_progress.h File Reference

Data Structures

- struct gitem_circular_progress_t

Macros

- #define NG_CIRCULAR_PROGRESS(object)

Functions

- DRAW_FUNC (ng_circular_progress_draw)

  Draw function.
- void ng_circular_progress_set_percent (gitem_base_t *git, float percent)

  Sets the current value (percent) of the progress bar.
- void ng_circular_progress_set_background_image (gitem_base_t *git, void *asset_ptr)

  Sets the background image asset.
- void ng_circular_progress_set_foreground_image (gitem_base_t *git, void *asset_ptr)

  Sets the foreground image asset.

Variables

- gitem_gestures_t gestures_circular_progress

14.4.1 Data Structure Documentation

14.4.1.1 struct gitem_circular_progress_t

Circular progress widget data struct

Data Fields

	BASE_STRUCT	Inherited attributes from gitem_base_t data struct
img_obj_t *	background_image	Pointer to background image asset
img_obj_t *	foreground_image	Pointer to foreground image asset (displayed on top of the background)
float	value	Current value (0.f up to 1.f)
float	max_angle	Maximum angle (span starts from min_angle up to max_angle)
float	min_angle	Minimum angle (span starts from min_angle up to max_angle)

14.4.2 Macro Definition Documentation

14.4.2.1 #define NG_CIRCULAR_PROGRESS(*object*)

Type caster from base gitem_base_t struct to derived gitem_circular_progress_t struct

14.4.3 Function Documentation

14.4.3.1 DRAW_FUNC (ng_circular_progress_draw)

Draw function.

Parameters

*git	Pointer to circular progress's base gitem (gitem_base_t data struct)
x_off	Horizontal offset from its parent item
y_off	Vertical offset from its parent item

Returns

void

14.4.3.2 void ng_circular_progress_set_percent (gitem_base_t * *git*, float *percent*)

Sets the current value (percent) of the progress bar.

Parameters

*git	Pointer to target gitem (gitem_base_t data struct)
percent	Percent value in range [0.f , 1.f]. If it is beyond the acceptable range, it is automatically clamped

Returns

void

14.4.3.3 void ng_circular_progress_set_background_image (gitem_base_t * *git*, void * *asset_ptr*)

Sets the background image asset.

Parameters

*git	Pointer to target gitem (gitem_base_t data struct)
*asset_ptr	Pointer to image asset (casted to img_obj_t internally)

Returns

void

14.4.3.4 void ng_circular_progress_set_foreground_image (gitem_base_t * *git*, void * *asset_ptr*)

Sets the foreground image asset.

Parameters

*git	Pointer to target gitem (gitem_base_t data struct)
*asset_ptr	Pointer to image asset (casted to img_obj_t internally)

Returns

void

14.4.4 Variable Documentation

14.4.4.1 gitem_gestures_t gestures_circular_progress

Circular progress gestures data struct

14.5 ng_container.h File Reference

Data Structures

- struct gitem_container_t

Macros

- #define NG_CONTAINER(object)

Functions

- DRAW_FUNC (ng_container_draw)

  Draw function.
- void ng_container_set_image (gitem_base_t *git, void *asset_ptr)

  Sets the foreground image asset.

14.5.1 Data Structure Documentation

14.5.1.1 struct gitem_container_t

Container widget data struct

Data Fields

	BASE_STRUCT	Inherited attributes from gitem_base_t data struct
img_obj_t *	image	Pointer to image asset
uint16_t	pen_width	Pen width (when container is outlined)

14.5.2 Macro Definition Documentation

14.5.2.1 #define NG_CONTAINER(*object*)

Type caster from base gitem_base_t struct to derived gitem_container_t struct

14.5.3 Function Documentation

14.5.3.1 DRAW_FUNC (ng_container_draw)

Draw function.

Parameters

*git	Pointer to circular progress's base gitem (gitem_base_t data struct)
x_off	Horizontal offset from its parent item
y_off	Vertical offset from its parent item

Returns

void

14.5.3.2 void ng_container_set_image (gitem_base_t * *git*, void * *asset_ptr*)

Sets the foreground image asset.

Parameters

*git	Pointer to target gitem (gitem_base_t data struct)
*asset_ptr	Pointer to image asset (casted to img_obj_t internally)

Returns

void

14.6 ng_digimeter.h File Reference

Data Structures

- struct gitem_digimeter_t

Macros

- #define NG_DIGIMETER(object)

Functions

- DRAW_FUNC (ng_digimeter_draw)

  Draw function.
- void ng_digimeter_set_value (gitem_base_t *git, float value)

  Sets the current value of the digital meter.
- void ng_digimeter_set_percent (gitem_base_t *git, float percent)

  Sets the current value of the digital meter by percent (value = percent(max_val-min_val) + min_val). Percent must be within [0.f, 1.f].*
- void ng_digimeter_count_up (gitem_base_t *git)

  Count up, increase the digital meter's value by its step.
- void ng_digimeter_count_down (gitem_base_t *git)

  Count down, decrease the digital meter's value by its step.

- void ng_digimeter_set_text_color (gitem_base_t *git, uint32_t rgba)

  Sets the digital meter's text color.

14.6.1 Data Structure Documentation

14.6.1.1 struct gitem_digimeter_t

Digital meter widget data struct

Data Fields

	BASE_STRUCT	Inherited attributes from gitem_base_t data struct
uint32_t	text_color	Text color
float	value	Current value
float	max_value	Maximum value
float	min_value	Minimum value
float	step	Step (increase/decrease by)
nema_font_t *	font	Pointer to font asset
uint32_t	alignment	Horizontal/Vertical alignment (bitfields)
uint8_t	dec_precision	Decimal digits
uint8_t	int_precision	Integer digits. If this is bigger than zero, padding with zeros takes place on empty digits)
char *	suffix	Suffix string

14.6.2 Macro Definition Documentation

14.6.2.1 #define NG_DIGIMETER(*object*)

Type caster from base gitem_base_t struct to derived gitem_digimeter_t struct

14.6.3 Function Documentation

14.6.3.1 DRAW_FUNC (ng_digimeter_draw)

Draw function.

Parameters

*git	Pointer to digimeter's base gitem (gitem_base_t data struct)
x_off	Horizontal offset from its parent item

Parameters

y_off	Vertical offset from its parent item

Returns

void

14.6.3.2 void ng_digimeter_set_value (gitem_base_t * *git*, float *value*)

Sets the current value of the digital meter.

Parameters

*git	Pointer to target gitem (gitem_base_t data struct)
value	Value in range [min_value , max_value]. If it is beyond the acceptable range, it is automatically clamped

Returns

void

14.6.3.3 void ng_digimeter_set_percent (gitem_base_t * *git*, float *percent*)

Sets the current value of the digital meter by percent (value = percent*(max_val-min_val) + min_val). Percent must be within [0.f, 1.f].

Parameters

*git	Pointer to target gitem (gitem_base_t data struct)
percent	Percentage in range [0.f, 1.f]. If it is beyond the acceptable range, it is automatically clamped

Returns

void

14.6.3.4 void ng_digimeter_count_up (gitem_base_t * *git*)

Count up, increase the digital meter's value by its step.

Parameters

*git	Pointer to target gitem (gitem_base_t data struct)

Returns

void

14.6.3.5 void ng_digimeter_count_down (gitem_base_t * *git*)

Count down, decrease the digital meter's value by its step.

Parameters

*git	Pointer to target gitem (gitem_base_t data struct)

Returns

void

14.6.3.6 void ng_digimeter_set_text_color (gitem_base_t * *git*, uint32_t *rgba*)

Sets the digital meter's text color.

Parameters

*git	Pointer to target gitem (gitem_base_t data struct)
rgba	Color value

Returns

void

14.7 ng_digital_clock.h File Reference

Data Structures

- struct gitem_digital_clock_t

Macros

- #define NG_TIME_HH_MM_SS
- #define NG_TIME_HH_MM
- #define NG_TIME_H_MM
- #define NG_TIME_HH
- #define NG_TIME_H

- #define NG_TIME_MM
- #define NG_TIME_SS
- #define NG_DIGITAL_CLOCK(object)

Functions

- DRAW_FUNC (ng_digital_clock_draw)

  Draw function.
- void ng_digital_clock_update (gitem_base_t *git)

  Updates the clock's text according to the current time. System's wall time is used by default.

14.7.1 Data Structure Documentation

14.7.1.1 struct gitem_digital_clock_t

Digital clock data struct

Data Fields

	BASE_STRUCT	Inherited attributes from gitem_base_t data struct
uint32_t	text_color	Text color
nema_font_t *	font	Pointer to font asset
uint32_t	alignment	Horizontal/Vertical alignment (bitfields)
uint32_t	time_format	Time format

14.7.2 Macro Definition Documentation

14.7.2.1 #define NG_TIME_HH_MM_SS

Time format eg. "09:45:18"

14.7.2.2 #define NG_TIME_HH_MM

Time format eg. "09:45"

14.7.2.3 #define NG_TIME_H_MM

Time format eg. "9:45"

14.7.2.4 #define NG_TIME_HH

Time format eg. "09"

14.7.2.5 #define NG_TIME_H

Time format eg. "9"

14.7.2.6 #define NG_TIME_MM

Time format eg. "45"

14.7.2.7 #define NG_TIME_SS

Time format eg. "18"

14.7.2.8 #define NG_DIGITAL_CLOCK(*object*)

Type caster from base gitem_base_t struct to derived gitem_digital_clock_t struct

14.7.3 Function Documentation

14.7.3.1 DRAW_FUNC (ng_digital_clock_draw)

Draw function.

Parameters

*git	Pointer to digital clocks's base gitem (gitem_base_t data struct)
x_off	Horizontal offset from its parent item
y_off	Vertical offset from its parent item

Returns

void

14.7.3.2 void ng_digital_clock_update (gitem_base_t * *git*)

Updates the clock's text according to the current time. System's wall time is used by default.

In order to use a different time update method (not the system's wall time), the define WALL_TIME_CLOCKS (defined in the compiler flags of the generated Makefile) needs to be undefined and the time needs to be updated inside the #else segment of this function.

Parameters

*git	Pointer to target gitem (gitem_base_t data struct)

Returns

void

14.8 ng_gauge.h File Reference

Data Structures

- struct gitem_gauge_t

Macros

- #define NG_GAUGE(object)

Functions

- DRAW_FUNC (ng_gauge_draw)

  Draw function.
- void ng_gauge_set_value (gitem_base_t *git, float value)

  Sets the current value of thegauge.
- void ng_gauge_set_percent (gitem_base_t *git, float percent)

  Sets the current value of the gauge by percent (value = percent(max_val-min_val) + min_val). Percent must be within [0.f, 1.f].*
- void ng_gauge_set_image (gitem_base_t *git, void *asset_ptr)

  Sets the image asset.

Variables

- gitem_gestures_t gestures_gauge

14.8.1 Data Structure Documentation

14.8.1.1 struct gitem_gauge_t

Gauge widget data struct

Data Fields

	BASE_STRUCT	Inherited attributes from gitem_base_t data struct
img_obj_t *	image	Pointer to image asset
gitem_base_t *	needle	Pointer to its "needle child item"
float	value	Current value
float	max_value	Maximum value
float	min_value	Minimum value
float	angle	Needle's current angle
float	max_angle	Maximum angle
float	min_angle	Minimum angle
int	x_rot	Rotation x relative coordinate
int	y_rot	Rotation y relative coordinate
uint16_t	pen_width	Pen width (used when gauge is outlined)

14.8.2 Macro Definition Documentation

14.8.2.1 #define NG_GAUGE(*object*)

Type caster from base gitem_base_t struct to derived gitem_gauge_t struct

14.8.3 Function Documentation

14.8.3.1 DRAW_FUNC (ng_gauge_draw)

Draw function.

Parameters

**git*	Pointer to gauge's base gitem (gitem_base_t data struct)
x_off	Horizontal offset from its parent item
y_off	Vertical offset from its parent item

Returns

void

14.8.3.2 void ng_gauge_set_value (gitem_base_t * *git*, float *value*)

Sets the current value of thegauge.

Parameters

*git	Pointer to target gitem (gitem_base_t data struct)
value	Value

Returns

void

14.8.3.3 void ng_gauge_set_percent (gitem_base_t * *git*, float *percent*)

Sets the current value of the gauge by percent (value = percent*(max_val-min_val) + min_val). Percent must be within [0.f, 1.f].

Parameters

*git	Pointer to target gitem (gitem_base_t data struct)
percent	Percentage value

Returns

void

14.8.3.4 void ng_gauge_set_image (gitem_base_t * *git*, void * *asset_ptr*)

Sets the image asset.

Parameters

*git	Pointer to target gitem (gitem_base_t data struct)
*asset_ptr	Pointer to image asset (casted to img_obj_t internally)

Returns

void

14.8.4 Variable Documentation

14.8.4.1 gitem_gestures_t gestures_gauge

Gauge gestures data struct

14.9 ng_icon.h File Reference

Data Structures

- struct gitem_icon_t

14.9.1 Data Structure Documentation

14.9.1.1 struct gitem_icon_t

Icon widget data struct (placeholder struct)

Data Fields

	BASE_STRUCT	Inherited attributes from gitem_base_t data struct

14.10 ng_image.h File Reference

Data Structures

- struct gitem_image_t

Macros

- #define NG_IMAGE(object)

Functions

- DRAW_FUNC (ng_image_draw)

  Draw function.

- void ng_image_set_asset (gitem_base_t *git, void *asset_ptr)

  Set image asset.

14.10.1 Data Structure Documentation

14.10.1.1 struct gitem_image_t

Image widget data struct

Data Fields

	BASE_STRUCT	Inherited attributes from gitem_base_t data struct
img_obj_t *	image	Pointer to image asset

14.10.2 Macro Definition Documentation

14.10.2.1 #define NG_IMAGE(*object*)

Type caster from base gitem_base_t struct to derived gitem_image_t struct

14.10.3 Function Documentation

14.10.3.1 DRAW_FUNC (ng_image_draw)

Draw function.

Parameters

*git	Pointer to image's base gitem (gitem_base_t data struct)
x_off	Horizontal offset from its parent item
y_off	Vertical offset from its parent item

Returns

void

14.10.3.2 void ng_image_set_asset (gitem_base_t * *git*, void * *asset_ptr*)

Set image asset.

Parameters

*git	Pointer to target gitem (gitem_base_t data struct)
*asset_ptr	Pointer to image asset (casted to img_obj_t internally)

Returns

void

14.11 ng_label.h File Reference

Data Structures

- struct gitem_label_t

Macros

- #define NG_LABEL(object)

Functions

- DRAW_FUNC (ng_label_draw)

  Draw function.
- void ng_label_set_text_color (gitem_base_t *git, uint32_t rgba)

  Sets the label's text color.

14.11.1 Data Structure Documentation

14.11.1.1 struct gitem_label_t

Label widget data struct

Data Fields

	BASE_STRUCT	Inherited attributes from gitem_base_t data struct
attr_text_t *	text	Pointer to its text attributes (string, font, index)
uint32_t	text_color	Text color

14.11.2 Macro Definition Documentation

14.11.2.1 #define NG_LABEL(*object*)

Type caster from base gitem_base_t struct to derived gitem_label_t struct

14.11.3 Function Documentation

14.11.3.1 DRAW_FUNC (ng_label_draw)

Draw function.

Parameters

**git*	Pointer to label's base gitem (gitem_base_t data struct)
x_off	Horizontal offset from its parent item
y_off	Vertical offset from its parent item

Returns

void

14.11.3.2 void ng_label_set_text_color (gitem_base_t * *git*, uint32_t *rgba*)

Sets the label's text color.

Parameters

**git*	Pointer to target gitem (gitem_base_t data struct)
rgba	Color value

Returns

void

14.12 ng_needle.h File Reference

Data Structures

- struct gitem_needle_t

Macros

- #define NG_NEEDLE(object)

Functions

- DRAW_FUNC (ng_needle_draw)

  Draw function.
- void ng_needle_set_image (gitem_base_t *git, void *asset_ptr)

  Sets the image asset.

14.12.1 Data Structure Documentation

14.12.1.1 struct gitem_needle_t

Needle widget data struct

Data Fields

	BASE_STRUCT	Inherited attributes from gitem_base_t data struct
img_obj_t *	image	Pointer to image asset
float	angle	Current angle
int	x_rot	Pivot x relative coordinate
int	y_rot	Pivot y relative coordinate
uint16_t	pen_width	Pen width

14.12.2 Macro Definition Documentation

14.12.2.1 #define NG_NEEDLE(*object*)

Type caster from base gitem_base_t struct to derived gitem_needle_t struct

14.12.3 Function Documentation

14.12.3.1 DRAW_FUNC (ng_needle_draw)

Draw function.

Parameters

*git	Pointer to needle's base gitem (gitem_base_t data struct)
x_off	Horizontal offset from its parent item
y_off	Vertical offset from its parent item

Returns

void

14.12.3.2 void ng_needle_set_image (gitem_base_t * *git*, void * *asset_ptr*)

Sets the image asset.

Parameters

*git	Pointer to target gitem (gitem_base_t data struct)
*asset_ptr	Pointer to image asset (casted to img_obj_t internally)

Returns

void

14.13 ng_progress_bar.h File Reference

Data Structures

- struct gitem_progress_bar_t

Macros

- #define NG_PROGRESS_BAR(object)

Functions

- DRAW_FUNC (ng_horizontal_progress_bar_draw)

  Draw function (horizontal progress bar)
- DRAW_FUNC (ng_vertical_progress_bar_draw)

  Draw function (vertical progress bar)
- void ng_progress_bar_set_percent (gitem_base_t *git, float percent)

Sets the current value (percent) of the progress bar.

- void ng_progress_bar_set_background_image (gitem_base_t *git, void *asset_ptr)

  Sets the background image asset.

- void ng_progress_bar_set_foreground_image (gitem_base_t *git, void *asset_ptr)

  Sets the foreground image asset.

- void ng_progress_bar_set_foreground_color (gitem_base_t *git, uint32_t rgba)

  Sets the foreground color.

14.13.1 Data Structure Documentation

14.13.1.1 struct gitem_progress_bar_t

Progress bar widget data struct

Data Fields

	BASE_STRUCT	Inherited attributes from gitem_base_t data struct
uint32_t	foreground_color	Foreground color
img_obj_t *	background_image	Pointer to background image asset
img_obj_t *	foreground_image	Pointer to foreground image asset
float	value	Current value [0.f, 1.f]
uint16_t	pen_width	Pen width

14.13.2 Macro Definition Documentation

14.13.2.1 #define NG_PROGRESS_BAR(*object*)

Type caster from base gitem_base_t struct to derived gitem_progress_bar_t struct

14.13.3 Function Documentation

14.13.3.1 DRAW_FUNC (ng_horizontal_progress_bar_draw)

Draw function (horizontal progress bar)

Parameters

*git	Pointer to needle's base gitem (gitem_base_t data struct)
x_off	Horizontal offset from its parent item

Parameters

y_off	Vertical offset from its parent item

Returns

void

14.13.3.2 DRAW_FUNC (ng_vertical_progress_bar_draw)

Draw function (vertical progress bar)

Parameters

*git	Pointer to progress bar's base gitem (gitem_base_t data struct)
x_off	Horizontal offset from its parent item
y_off	Vertical offset from its parent item

Returns

void

14.13.3.3 void ng_progress_bar_set_percent (gitem_base_t * *git*, float *percent*)

Sets the current value (percent) of the progress bar.

Parameters

*git	Pointer to target gitem (gitem_base_t data struct)
percent	Value in range [0.f , 1.f]. If it is beyond the acceptable range, it is automatically clamped

Returns

void

14.13.3.4 void ng_progress_bar_set_background_image (gitem_base_t * *git*, void * *asset_ptr*)

Sets the background image asset.

Parameters

*git	Pointer to target gitem (gitem_base_t data struct)

Parameters

*asset_ptr	Pointer to background image asset (casted to img_obj_t internally)

Returns

void

14.13.3.5 void ng_progress_bar_set_foreground_image (gitem_base_t * *git*, void * *asset_ptr*)

Sets the foreground image asset.

Parameters

*git	Pointer to target gitem (gitem_base_t data struct)
*asset_ptr	Pointer to foreground image asset (casted to img_obj_t internally)

Returns

void

14.13.3.6 void ng_progress_bar_set_foreground_color (gitem_base_t * *git*, uint32_t *rgba*)

Sets the foreground color.

Parameters

*git	Pointer to target gitem (gitem_base_t data struct)
rgba	Foreground color value

Returns

void

14.14 ng_radio_button.h File Reference

Data Structures

- struct gitem_radio_button_t

Macros

- #define NG_RADIO_BUTTON(object)

Functions

- DRAW_FUNC (ng_radio_button_draw)

  Draw function.
- void ng_radio_button_toggle (tree_node_t *node)

  Toggles all radio buttons inside a table.
- void ng_radio_button_set_secondary_color (gitem_base_t *git, uint32_t rgba)

  Sets the secondary color.

Variables

- gitem_gestures_t gestures_radio_button

14.14.1 Data Structure Documentation

14.14.1.1 struct gitem_radio_button_t

Radio button widget data struct

Data Fields

	BASE_STRUCT	Inherited attributes from gitem_base_t data struct
uint32_t	secondary_color	Secondary (pressed) color
img_obj_t *	background_image	Pointer to background (not selected) image asset
img_obj_t *	foreground_image	Pointer to foreground (selected) image asset
uint16_t	radius	Inner circle (if applicable) radius

14.14.2 Macro Definition Documentation

14.14.2.1 #define NG_RADIO_BUTTON(*object*)

Type caster from base gitem_base_t struct to derived gitem_radio_button_t struct

14.14.3 Function Documentation

14.14.3.1 DRAW_FUNC (ng_radio_button_draw)

Draw function.

Parameters

*git	Pointer to radio button's base gitem (gitem_base_t data struct)
x_off	Horizontal offset from its parent item
y_off	Vertical offset from its parent item

Returns

void

14.14.3.2 void ng_radio_button_toggle (tree_node_t * *node*)

Toggles all radio buttons inside a table.

Parameters

*node	Pointer to the radio button's parent tree node

Returns

void

14.14.3.3 void ng_radio_button_set_secondary_color (gitem_base_t * *git*, uint32_t *rgba*)

Sets the secondary color.

Parameters

*git	Pointer to target gitem (gitem_base_t data struct)
rgba	Secondary (pressed) color value

Returns

void

14.14.4 Variable Documentation

14.14.4.1 gitem_gestures_t gestures_radio_button

Radio button gestures data struct

14.15 ng_rect.h File Reference

Data Structures

- struct gitem_rect_t

Macros

- #define NG_RECT(object)

Functions

- DRAW_FUNC (ng_rect_draw)

  Draw function.

14.15.1 Data Structure Documentation

14.15.1.1 struct gitem_rect_t

Rectangle widget data struct

Data Fields

	BASE_STRUCT	Inherited attributes from gitem_base_t data struct
uint16_t	pen_width	Pen width

14.15.2 Macro Definition Documentation

14.15.2.1 #define NG_RECT(*object*)

Type caster from base gitem_base_t struct to derived gitem_rect_t struct

14.15.3 Function Documentation

14.15.3.1 DRAW_FUNC (ng_rect_draw)

Draw function.

Parameters

*git	Pointer to needle's base gitem (gitem_base_t data struct)
x_off	Horizontal offset from its parent item
y_off	Vertical offset from its parent item

Returns

void

14.16 ng_rounded_rect.h File Reference

Data Structures

- struct gitem_rounded_rect_t

Macros

- #define NG_ROUNDED_RECT(object)

Functions

- DRAW_FUNC (ng_rounded_rect_draw)

  Draw function.

14.16.1 Data Structure Documentation

14.16.1.1 struct gitem_rounded_rect_t

Rounded rectangle widget data struct

Data Fields

	BASE_STRUCT	Inherited attributes from gitem_base_t data struct
uint16_t	radius	Radius

14.16.2 Macro Definition Documentation

14.16.2.1 #define NG_ROUNDED_RECT(*object*)

Type caster from base gitem_base_t struct to derived gitem_rect_t struct

14.16.3 Function Documentation

14.16.3.1 DRAW_FUNC (ng_rounded_rect_draw)

Draw function.

Parameters

*git	Pointer to needle's base gitem (gitem_base_t data struct)
x_off	Horizontal offset from its parent item
y_off	Vertical offset from its parent item

Returns

void

14.17 ng_screen.h File Reference

Data Structures

- struct gitem_screen_t

Macros

- #define NG_SCREEN(object)

Functions

- DRAW_FUNC (ng_screen_draw)

Draw function.

- void ng_screen_set_image (gitem_base_t *git, void *asset_ptr)

  Set image asset.

14.17.1 Data Structure Documentation

14.17.1.1 struct gitem_screen_t

Screen widget data struct. Each project must contain at least one screen

Data Fields

	BASE_STRUCT	Inherited attributes from gitem_base_t data struct
img_obj_t *	image	Pointer to image asset

14.17.2 Macro Definition Documentation

14.17.2.1 #define NG_SCREEN(*object*)

Type caster from base gitem_base_t struct to derived gitem_screen_t struct

14.17.3 Function Documentation

14.17.3.1 DRAW_FUNC (ng_screen_draw)

Draw function.

Parameters

*git	Pointer to screen's base gitem (gitem_base_t data struct)
x_off	Horizontal offset from its parent item
y_off	Vertical offset from its parent item

Returns

void

14.17.3.2 void ng_screen_set_image (gitem_base_t * *git*, void * *asset_ptr*)

Set image asset.

Parameters

**git*	Pointer to gitem_base_t struct
**asset_ptr*	Pointer to image asset (casted to img_obj_t internally)

Returns

void

14.18 ng_slider.h File Reference

Data Structures

- struct gitem_slider_t

Macros

- #define NG_SLIDER(object)

Functions

- void ng_slider_set_percent (gitem_base_t **git, float percent)

  Sets the current value (percent) of the slider.
- void ng_slider_horizontal_set_indicator_x (gitem_base_t **git, int x)

  Sets the horizontal slider's indicator horizontal position.
- void ng_slider_vertical_set_indicator_y (gitem_base_t **git, int y)

  Sets the vertical slider's indicator vertical position.

14.18.1 Data Structure Documentation

14.18.1.1 struct gitem_slider_t

Slider widget data struct

Data Fields

	BASE_STRUCT	Inherited attributes from gitem_base_t data struct
float	value	Current value [0.f, 1.f]
gitem_base_t *	progress	Pointer to its "progress" child item
gitem_base_t *	indicator	Pointer to its "indicator" child item

14.18.2 Macro Definition Documentation

14.18.2.1 #define NG_SLIDER(*object*)

Type caster from base gitem_base_t struct to derived gitem_slider_t struct

14.18.3 Function Documentation

14.18.3.1 void ng_slider_set_percent (gitem_base_t * *git*, float *percent*)

Sets the current value (percent) of the slider.

Parameters

*git	Pointer to target gitem (gitem_base_t data struct)
percent	Value in range [0.f , 1.f]. If it is beyond the acceptable range, it is automatically clamped

Returns

void

14.18.3.2 void ng_slider_horizontal_set_indicator_x (gitem_base_t * *git*, int *x*)

Sets the horizontal slider's indicator horizontal position.

Parameters

*git	Pointer to target gitem (gitem_base_t data struct)
x	Coordinate x (relative)

Returns

void

14.18.3.3 void ng_slider_vertical_set_indicator_y (gitem_base_t * *git*, int *y*)

Sets the vertical slider's indicator vertical position.

Parameters

*git	Pointer to target gitem (gitem_base_t data struct)
y	Coordinate y (relative)

Returns

void

14.19 ng_slider_hor.h File Reference

Variables

- gitem_gestures_t gestures_slider_hor

14.19.1 Variable Documentation

14.19.1.1 gitem_gestures_t gestures_slider_hor

Horizontal slider gestures data struct

14.20 ng_swipe_window.h File Reference

Data Structures

- struct gitem_swipe_window_t

Macros

- #define NG_SWIPE_WINDOW(object)

Variables

- gitem_gestures_t gestures_swipe_window

14.20.1 Data Structure Documentation

14.20.1.1 struct gitem_swipe_window_t

Swipe widnow widget data struct

Data Fields

	BASE_STRUCT	Inherited attributes from gitem_base_t data struct
tree_node_t *	indicators_parent	Pointer to the tree node placeholder of the indicators (if applicable)
uint16_t	cur_page_index	Curretn page index

Data Fields

uint16_t	page_count	Total page count
uint16_t	spacing	Spacing between pages
uint8_t	layout	Layout (horizontal or vertical)
ng_transition_t *	animation	Pointer to a transition event (used for animating the swipe window)
ng_git_int_int_ez_t	animation_data	Animation data (start point, end point and easing function)

14.20.2 Macro Definition Documentation

14.20.2.1 #define NG_SWIPE_WINDOW(*object*)

Type caster from base gitem_base_t struct to derived gitem_swipe_window_t struct

14.20.3 Variable Documentation

14.20.3.1 gitem_gestures_t gestures_swipe_window

Swipe window gestures data struct

14.21 ng_toggle_button.h File Reference

Toggle button widget interface.

Data Structures

- struct gitem_toggle_button_t

Macros

- #define NG_TOGGLE_BUTTON(object)

Functions

- DRAW_FUNC (ng_toggle_button_draw)

  Draw function.

Variables

- gitem_gestures_t gestures_toggle_button

14.21.1 Detailed Description

Toggle button widget interface.

14.21.2 Data Structure Documentation

14.21.2.1 struct gitem_toggle_button_t

Toggle button widget data struct

Data Fields

	BASE_STRUCT	Inherited attributes from gitem_base_t data struct
uint16_t	cur_state	Current state's index
uint16_t	max_state	State count
img_obj_t **	images	Array of pointers to image assets, each image corresponds to each state

14.21.3 Macro Definition Documentation

14.21.3.1 #define NG_TOGGLE_BUTTON(*object*)

Type caster from base gitem_base_t struct to derived gitem_toggle_button_t struct

14.21.4 Function Documentation

14.21.4.1 DRAW_FUNC (ng_toggle_button_draw)

Draw function.

Parameters

**git*	Pointer to toggle button's base gitem (gitem_base_t data struct)
x_off	Horizontal offset from its parent item
y_off	Vertical offset from its parent item

Returns

void

14.21.5 Variable Documentation

14.21.5.1 gitem_gestures_t gestures_toggle_button

Toggle button gestures data struct

14.22 ng_watchface.h File Reference

Data Structures

- struct gitem_watchface_t

Macros

- #define NG_WATCHFACE(object)

Functions

- DRAW_FUNC (ng_watchface_draw)

  Draw function.
- void ng_watchface_update (gitem_base_t *git)

  Updates the watchface's hand angles according to the current time. System's wall time is used by default.

Variables

- const gitem_gestures_t watchface_gestures

14.22.1 Data Structure Documentation

14.22.1.1 struct gitem_watchface_t

Watchface widget data struct

Data Fields

	BASE_STRUCT	Inherited attributes from gitem_base_t data struct
img_obj_t *	image	Pointer to image asset

Data Fields

gitem_base_t *	hour	Pointer to its hours hand child item (gitem_needle_t)
gitem_base_t *	minute	Pointer to its minutes hand child item (gitem_needle_t)
gitem_base_t *	sec	Pointer to its seconds hand child item (gitem_needle_t)
uint16_t	pen_width	

14.22.2 Macro Definition Documentation

14.22.2.1 #define NG_WATCHFACE(*object*)

Type caster from base gitem_base_t struct to derived gitem_watchface_t struct

14.22.3 Function Documentation

14.22.3.1 DRAW_FUNC (ng_watchface_draw)

Draw function.

Parameters

*git	Pointer to watchface's base gitem (gitem_base_t data struct)
x_off	Horizontal offset from its parent item
y_off	Vertical offset from its parent item

Returns

void

14.22.3.2 void ng_watchface_update (gitem_base_t * *git*)

Updates the watchface's hand angles according to the current time. System's wall time is used by default.

In order to use a different time update method (not the system's wall time), the define WALL_TIME_CLOCKS (defined in the compiler flags of the generated Makefile) needs to be undefined and the time needs to be updated inside the #else segment of this function.

Parameters

*git	Pointer to target gitem (gitem_base_t data struct)

Returns

void

14.22.4 Variable Documentation

14.22.4.1 const gitem_gestures_t watchface_gestures

Watchface gestures data struct (placeholder)

14.23 ng_window.h File Reference

Data Structures

- struct gitem_window_t

Macros

- #define NG_WINDOW(object)

Functions

- void ng_window_set_source (tree_node_t *window, tree_node_t *source)

  Sets the source screen that the window displays.

Variables

- gitem_gestures_t gestures_window

14.23.1 Data Structure Documentation

14.23.1.1 struct gitem_window_t

Window widget data struct

Data Fields

BASE_STRUCT

14.23.2 Macro Definition Documentation

14.23.2.1 #define NG_WINDOW(*object*)

Type caster from base gitem_base_t struct to derived gitem_window_t struct

14.23.3 Function Documentation

14.23.3.1 void ng_window_set_source (tree_node_t * *window*, tree_node_t * *source*)

Sets the source screen that the window displays.

Parameters

**window*	Pointer to the window's tree node
**source*	Pointer to the source screen's tree node

Returns

void

14.23.4 Variable Documentation

14.23.4.1 gitem_gestures_t gestures_window

Window gestures data struct