

kiss_sdl - Universal low level widget toolkit for SDL2

1. Overview

kiss_sdl is a universal low level widget toolkit for SDL2. Low level may not sound good, but this is exactly what some developers are looking for, as it provides freedom to do whatever one needs. And it is simple and easy to use. At the time of writing this, there were only 2285 lines of code in the whole toolkit, and only 1063 lines of code in `kiss_widgets.c` and `kiss_draw.c`, where all the functionality of the toolkit is implemented. At the time of writing this, there were knowingly no other widget toolkits that anyone could make to work with SDL2 (SDL2 is not compatible with SDL1), but even if there were others universal ones, then they are likely much more complex and not so easily changeable than this one. When one writes a graphical user interface for one's game or application, using this toolkit, then it may feel like writing one's own widgets directly in SDL. It is so thin layer, there is not much in between, and thus also not much that restricts one from doing whatever one may want to do. With that widget toolkit it thus is that, SDL is high level, and widget toolkit is low level. SDL though should also be properly called a low level directmedia layer, thus with SDL, this widget toolkit provides a low level framework for writing Graphical User Interfaces (GUI), for games and applications.

Kiss is a known saying that means "Keep it simple". Different from other widget toolkits where you are supposed to choose from the existing widgets the one that fits you the best, in this toolkit, when there is no widget that satisfies all your needs, modify an existing widget, or write your own. Most other toolkits enable to write your own widgets, but it is not simple to do that, and they are not intended for that. The toolkit was made as simple as possible, to solve the problem of an immense complexity of most of the existing toolkits, which makes it impossible for many people to even use them. At that it was made universal, many simpler toolkits don't enable you to do many things that you want, due to their restricted internal design. This toolkit implements an original innovative approach for a widget toolkit, this new approach enabled to make the widget toolkit simpler than widget toolkits previously written. The toolkit is written in C, but it can also be used in C++.

This widget toolkit is made as modifiable as possible, so that it will not stand on the way of doing what the user may want to do. The code of this widget toolkit is split into four files. The file `kiss_widgets.c` contains only the functions of the widgets, and none of the SDL functions or external library functions are directly used in that file. The three other files serve as abstraction layers, and rewriting the functions in some of these files, enables to redefine how the operations that use the external library functions, are implemented. These three files are `kiss_draw.c`, for general drawing functions, `kiss_general.c`, for general functions such as an implementation of the variable size array, and `kiss_posix.c`, for some of the most necessary POSIX functions. In case of an error, the functions of this toolkit return -1 or NULL, depending on the return type, and the event processing functions return 0.

Ten widgets are implemented as standard widgets, these are a window, multiline label, button, select button, vertical scrollbar, horizontal scrollbar, progress bar, entry box, textbox, and combo box. The two examples show how to use these widgets together. The first example implements a working file selection dialog with scrollable text boxes, the second example shows a use of a combo box. Likely most of the user interfaces can be made by using only these widgets, but the toolkit doesn't prevent adding any additional functionality.

There are four ways to create ones own custom widget, different from the standard widgets. First is to create a composite widget. The widgets have coordinates relative to the main window, but it is possible and not so difficult, to add the coordinates of a local window to a certain group of widgets. It is possible to create and free such group of widgets in one function, or process its events or draw it in one function. Combo box is an example of a composite widget. Second is a user added functionality. Write your own event function and call the standard function from that. Then functionality can be added in case when the standard function returns nonzero, but also new reactions to mouse and keyboard events can be added. This has to be done the same way it is done in the standard widget event functions though, like at least it should be first checked whether the widget is visible. Third, the functionality can also be added in case if the event is a NULL pointer. Like for games it may be important to add time dependent effects to widgets, like making them to continuously change shape, rather than being static. A progress bar is an example of this. And fourth is to write your own widget, by copying the structure and functions of a standard widget, and modifying them.

Is it possible to do the event processing in a separate function? Yes it is, by passing objects using a variable ize array, but because of simplicity this has not been done in the examples of this toolkit.

Can the images be compiled into the code, instead of being in separate files? Yes they can, images can be compiled into the C code, also Gimp enables to save them directly in that way. Then with a special function they can be retrieved from the data in the code. But again because of simplicity, this has not been done in the examples of this toolkit.

Can i use other colors, textures, etc? Yes. To use certain other fonts or textures, you may have to rewrite the init function. You can also draw anything you like on the widgets in the drawing function, this will be automatically redrawn every time after the window is exposed.

Can i do this or that other thing? You can do whatever you want, different from some other widget toolkits, this toolkit has not been made to restrict your freedom, or dictating to you how you should do things or what you can do. Just learn the basic things about how it works, the toolkit is simple and thus not difficult to learn, but it would be difficult to do what you want otherwise.

2. Install

To maintain simplicity, no library has been made. To use it, copy all files to your project's directory and compile them with your code. The `kiss_makefile` compiles the examples that show all the widgets in the toolkit. The makefile was made for Linux, to use it in Windows, edit the makefile, comment the `LD_FLAGS`, `C_FLAGS`, `EXE1` and `EXE2`, and uncomment the `LD_FLAGS`, `C_FLAGS`, `EXE1` and `EXE2` for Windows. Then change the paths to the directories under the folders where you installed your SDL development libraries. By default it is assumed that the libraries are installed under `C:`. The change may be simple, like only changing the version of the library from 2.0.4 to 2.0.6.

The common way in Windows is to copy all the dll-s from the proper bin directories (or library directories when using Visual Studio) of SDL, SDL_image and SDL_ttf, to your project's directory, this is how SDL programs are usually distributed. Or copy them to the Windows system directory, but then they may have to be replaced when using different versions of SDL.

In Windows, this toolkit was tested with MinGW64, MinGW32 should also work, and in the Visual Studio Community 2015. The project files for the Visual Studio are provided, but a similar changes to the library paths should be made, as described above, in the project -> properties -> configuration properties -> vc++ directories. For compiling in Visual Studio, run `kiss_example1.vcxproj` or `kiss_example2.vcxproj`, make sure that on toolbar x64 or x86 is selected, it was tested with x86, then build. Use one of the following commands to compile either in Linux, or in Windows using MinGW.

```
make -f kiss_makefile
```

```
mingw32-make -f kiss_makefile
```

3. Version

0.8.8

4. License

zlib license

5. Macros and enumerations

```
#define KISS_MAX_LENGTH 100
```

The maximum length of a line of text. This is the length of the buffer that includes the terminating `'\0'` character.

```
#define KISS_MIN_LENGTH 10
```

Only used internally for implementation of the variable size array, the initial size of the array, no need to use it in any code.

```
#define KISS_MAX_LABEL 500
```

The maximum length of a label. This is the length of the buffer that includes the terminating '\0' character.

```
enum {OTHER_TYPE, WINDOW_TYPE, RENDERER_TYPE, TEXTURE_TYPE,  
      SURFACE_TYPE, FONT_TYPE, STRING_TYPE, ARRAY_TYPE};
```

For the ID when storing a reference to an object to the variable size array, to determine the type of the object.

```
enum {TEXT_FONT, BUTTON_FONT};
```

Used for the ftype argument to identify the font. The functions kiss_maxlength(), kiss_textwidth() and kiss_rendertext() need to be rewritten when a custom widget uses a different font.

6. Structures

This toolkit is not object oriented, each widget has its own structure, it is not more complicated. There are no callbacks or signals and slots.

```
typedef struct stat kiss_stat;
```

The POSIX structure stat for file information, the implementation in the Visual Studio is not full POSIX.

```
typedef struct dirent kiss_dirent;
```

The POSIX structure dirent for directory entry, the implementation in the Visual Studio is not full POSIX.

```
typedef DIR kiss_dir;
```

The POSIX structure DIR for directory, the implementation in the Visual Studio is not full POSIX.

```
typedef struct kiss_array {
    void **data;
    int *id;
    int length;
    int size;
    int ref;
} kiss_array;
```

The structure for a variable size array, also called dynamically sized array, which is an array similar to the variable size array in glib, and a vector container in C++. It is an array with unlimited size. data is an array of void pointers and id is an array of integers, both are in the continuous memory space and thus can be indexed as ordinary C arrays. length is the number of elements in these C arrays that have been appended. The initial length is 0, only appending the elements increases the length. ref is the reference count, it should be increased when more references to the array are made, and is decreased by kiss_array_free(), when it reaches zero, the C arrays data and id shall be freed.

```
typedef struct kiss_window {
    SDL_Rect rect;
    int visible;
    int focus;
    int decorate;
    SDL_Color bg;
    struct kiss_window *wdw;
} kiss_window;
```

The structure for a window widget. This widget is only a rectangle rect, drawn with a color bg, and decorated with the function kiss_decorate() when the member decorate is nonzero. This is a simple widget and its structure contains members that appear in most of the other widget structures. visible and focus are to separately set the visibility and mouse focus for the widget. wdw is a pointer to another window widget that determines the visibility and focus of the widget. The window wdw is a dialog window, on which other widgets are drawn.

```
typedef struct kiss_label {
    SDL_Rect rect;
    int visible;
    char text[KISS_MAX_LABEL];
    SDL_Color textcolor;
    kiss_window *wdw;
} kiss_label;
```

The structure for a label widget. textcolor is the color of the text. The structure member text contains a string to be drawn. This string may contain '\n' characters for line feed, thus the label can be multiline. This structure does not contain the member focus, as label does not react to mouse events.

```
typedef struct kiss_button {
    SDL_Rect rect;
    int visible;
    int focus;
    int textx;
    int texty;
    char text[KISS_MAX_LENGTH];
    int active;
    int prelight;
    SDL_Color textcolor;
    kiss_window *wdw;
} kiss_button;
```

The structure for a button widget. The members textx and texty are the SDL window coordinates of the upper left corner of the text texture, these are calculated in kiss_button_new() and there is no need to use them in any code. text is the text drawn on the button. prelight is nonzero when the mouse pointer is on the button. active is nonzero when the button is pushed (held down). The combination of these provides three states of the button, normal (active 0, prelight 0), prelight (prelight nonzero) and active (active nonzero). A separate image corresponds to each of these states, like in Windows widgets these images have a 3D look.

```
typedef struct kiss_selectbutton {
    SDL_Rect rect;
    int visible;
    int focus;
    int selected;
    kiss_window *wdw;
} kiss_selectbutton;
```

The structure for a select button widget. The select button is a simple widget similar to button, that can be in two states. When selected is nonzero, then the select button is selected and drawn by default as a small filled rectangle, and when it is zero then the select button is not selected and is drawn by default as a small empty rectangle.

```
typedef struct kiss_vscrollbar {
    int visible;
    int focus;
    SDL_Rect uprect;
    SDL_Rect downrect;
    SDL_Rect sliderrect;
    int maxpos;
    double fraction;
    double step;
    unsigned int lasttick;
    int downclicked;
    int upclicked;
    int sliderclicked;
    kiss_window *wdw;
} kiss_vscrollbar;
```

The structure for a vertical scrollbar widget. Different from other widgets, vertical scrollbar has three rectangles, uprect, downrect and sliderrect, correspondingly for the up arrow, down arrow and slider. These rectangles are used in the same way as rect is

used for other widgets, both for drawing the images and to determine whether the mouse events happened inside these rectangles. The member `maxpos` is the maximum number of pixels by which the slider can go down. It is calculated in `kiss_vscrollbar_new()` and there is no need to use it in any code. The fraction is a floating point number in the range 0. to 1. and it is the fraction of the maximal position of the slider, by which the slider is currently down from its upper position. The step is the step by which the slider moves by one mouse click on the down arrow, it is a floating point number in the range 0. to 1. If the step is close to 0., the scrollbar does not react to mouse events.

The member `lasttick` in this and other widgets, is a number of time ticks before the number of ticks is read again, this is handled by `kiss_vscrollbar_event()` internally. The members `downclicked`, `upclicked` and `sliderclicked` indicate whether the mouse is currently clicked on the up arrow, down arrow or on the slider. In case of slider the mouse pointer may move away from the slider, `sliderclicked` remains nonzero until the left mouse button is released. These members are handled by `kiss_vscrollbar_event()` internally, and there is no need to use them in any code.

```
typedef struct kiss_hscrollbar {
    int visible;
    int focus;
    SDL_Rect leftrect;
    SDL_Rect rightrect;
    SDL_Rect sliderrect;
    int maxpos;
    double fraction;
    double step;
    unsigned int lasttick;
    int leftclicked;
    int rightclicked;
    int sliderclicked;
    kiss_window *wdw;
} kiss_hscrollbar;
```

The structure for a horizontal scrollbar widget. This widget is similar to the vertical scrollbar widget, with the only difference that the slider moves horizontally, and instead of up and down arrows, there are left and right arrows.

```
typedef struct kiss_progressbar {
    SDL_Rect rect;
    int visible;
    SDL_Rect barrect;
    int width;
    double fraction;
    double step;
    SDL_Color bg;
    unsigned int lasttick;
    int run;
    kiss_window *wdw;
} kiss_progressbar;
```

The structure for a progress bar widget. `barrect` is the current rectangle for the progress bar, this changes when the progress bar increases or decreases. `width` is the maximum

width of the progress bar, this is calculated by `kiss_progressbar_new()` and is used internally. `fraction` is the current fraction of the width of the progress bar, of `width`. `step` is a fraction of `width`, by which the progress bar moves during one `kiss_progress_interval`. `run` indicates whether the progress bar currently moves, this enables to make the progress bar to continuously move with the speed determined by `step`.

```
typedef struct kiss_entry {
    SDL_Rect rect;
    int visible;
    int focus;
    int decorate;
    int textx;
    int texty;
    char text[KISS_MAX_LENGTH];
    int active;
    int textwidth;
    int selection[4];
    int cursor[2];
    SDL_Color normalcolor;
    SDL_Color activecolor;
    SDL_Color bg;
    kiss_window *wdw;
} kiss_entry;
```

The structure for an entry box widget. `text` is the text in the entry box. `textwidth` is the width of the text area in pixels, this is calculated in `kiss_entry_new()`. The maximum number of characters in the entry box is calculated by `textwidth` and the width of the characters in the font, this enables to also use proportional fonts, by rewriting the functions `kiss_maxlength` and `kiss_textwidth` in `kiss_draw.c`. `active` indicates whether the entry box is open. When the entry box is open, the color of the text changes from `normalcolor` to `activecolor`, also the decoration color changes by default from blue to green, if the entry box is decorated. When active, the entry box is open to editing, until closed by pressing Enter. The `cursor` and `selection` are members for implementing additional editing and text processing, these are not currently used.


```
typedef struct kiss_textbox {
    SDL_Rect rect;
    int visible;
    int focus;
    int decorate;
    kiss_array *array;
    SDL_Rect textrect;
    int firstline;
    int maxlines;
    int textwidth;
    int highlightline;
    int selectedline;
    int selection[4];
    int cursor[2];
    SDL_Color textcolor;
    SDL_Color hlcolor;
    SDL_Color bg;
    kiss_window *wdw;
} kiss_textbox;
```

The structure for a text box widget. array is a kiss_array that contains text, one line of text in every element of it. This array has to be created by the user, and added to the text box as an argument of kiss_textbox_new(). The user is also responsible for freeing the array. textrect is the actual rectangle for the text, this is calculated in kiss_textbox_new() and used internally. firstline is the index of the line of the text in the array, that is first in the text box. maxlines is the maximum number of lines of text in the text box, this is calculated in kiss_textbox_new(). Highlightline is the number of the line in the text box on which the mouse cursor currently is, starting from 0, it is -1 when the mouse cursor is not on any line. hlcolor is the color of the background of that line, it is set to light blue in kiss_textbox_new(), but can be changed to another color by the user. selectedline is the number of the line in the text box that is selected by mouse click. Selecting a line causes the event function to return nonzero, and selectedline can be read when reacting to that, to determine what line was selected.

```
typedef struct kiss_combobox {
    int visible;
    char text[KISS_MAX_LENGTH];
    kiss_entry entry;
    kiss_window window;
    kiss_vscrollbar vscrollbar;
    kiss_textbox textbox;
    kiss_window *wdw;
} kiss_combobox;
```

The structure for a combo box widget. Combo box is a composite widget, and thus it contains entry, window, vscrollbar and textbox, that are all widget structures of the corresponding widgets. text is the initial text in the entry box, and it also contains the final text when the combo box closes either by selecting a line in the text box, or finishing editing the entry box by pressing Enter.

7. Global variables

The global variables are not declared as constant, to make the code more easily modifiable, but they should be used as constants, by changing them only during the initialization.

```
SDL_Color kiss_white, kiss_black, kiss_green, kiss_blue,  
          kiss_lightblue;
```

Standard colors, assigned in kiss_draw.c.

```
TTF_Font *kiss_textfont, *kiss_buttonfont;
```

Fonts loaded in kiss_init().

```
SDL_Texture *kiss_normal, *kiss_prelight, *kiss_active, *kiss_bar,  
             *kiss_up, *kiss_down, *kiss_left, *kiss_right, *kiss_vslider,  
             *kiss_hslider, *kiss_unselected, *kiss_selected;
```

Textures loaded in kiss_init().

```
double kiss_spacing;
```

Fraction of the line height for space between the text lines, a floating point value in the range 0. to 1., assigned in kiss_draw.c.

```
int kiss_textfont_size, kiss_buttonfont_size;
```

By default, only one ttf font is loaded, and the size of the font is different for text and buttons, these sizes are assigned in kiss_draw.c.

```
int kiss_click_interval, kiss_progress_interval;
```

The intervals of movement in scroll bars and progress bar, in milliseconds, assigned in kiss_draw.c.

```
int kiss_slider_padding;
```

The minimal space between the slider and the arrows in pixels, assigned in kiss_draw.c.

```
int kiss_border, kiss_edge;
```

Border is a free space around the edge of the widget in pixels, and edge is the distance from the edge of the widget to the beginning of the decoration, or where the decoration becomes dark enough. Assigned in kiss_draw.c.

```
int kiss_screen_width, kiss_screen_height;
```

The width and height of the SDL window, assigned in kiss_init().

```
int kiss_text_advance, kiss_text_fontheight, kiss_text_descent;
```

Attributes of the text font, assigned in `kiss_init()` by querying the font. Advance is the horizontal distance in pixels between the beginning of a character and the beginning of the next character, font height is the maximal height in pixels of the characters including descent, and descent is the number of pixels below the text's baseline. `kiss_text_descent` is used to align widgets to the baseline of the text.

```
int kiss_text_spacing, kiss_text_lineheight;
```

The vertical space between the lines in pixels, and the vertical distance between the beginning of a line and the beginning of the next line. Calculated in `kiss_init()` from `kiss_text_fontheight` and `kiss_spacing`.

```
int kiss_button_texty;
```

The distance between the text and the upper edge of the button, calculated in `kiss_init()`. It is used to calculate the SDL window coordinates of the upper left corner of the text texture in `kiss_button_new()`.

```
int kiss_button_advance;
```

The horizontal distance in pixels between the beginning of a character and the beginning of the next character for the button font. Assigned in `kiss_init()` by querying the font.

```
int kiss_button_width, kiss_button_height, kiss_selected_width,  
    kiss_selected_height, kiss_vslider_width, kiss_vslider_height,  
    kiss_up_height, kiss_down_height, kiss_hslider_width,  
    kiss_hslider_height, kiss_left_width, kiss_right_width,  
    kiss_bar_width, kiss_bar_height;
```

Attributes of the loaded images (height and width), assigned in `kiss_init()` by querying the textures.

8. POSIX functions

These are defined in `kiss_posix.c`.

```
char *kiss_getcwd(char *buf, int size);
```

An overwritten POSIX function to get the path of the current working directory.

```
int kiss_chdir(char *path);
```

An overwritten POSIX function to change directory.

```
int kiss_getstat(char *pathname, kiss_stat *buf);
```

An overwritten POSIX function to get information about a file or directory entry, and write it to the structure `kiss_stat` pointed to by `buf`.

```
kiss_dir *kiss_opendir(char *name);
```

An overwritten POSIX function to get information about a directory.

```
kiss_dirent *kiss_readdir(kiss_dir *dirp);
```

An overwritten POSIX function to get information about a directory entry.

```
int kiss_closedir(kiss_dir *dirp);
```

An overwritten POSIX function to close the directory opened to get information, and free all information returned about the directory and its entries.

```
int kiss_isdir(kiss_stat s);
```

An overwritten POSIX function that returns nonzero when the directory entry is a directory.

```
int kiss_isreg(kiss_stat s);
```

An overwritten POSIX function that returns nonzero when the directory entry is a regular file.

9. General functions

These are defined in `kiss_general.c`, these functions are not specific to the widget toolkit or any graphical processing.

The general variable size array implemented in this toolkit, enables to add the widget structures to it, and pass them together to an external function. The variable size array also has an ID number for every element, this enables to use unique numbers for every added widget, and by these numbers it is possible to identify these widgets in another function. Passing objects like that also makes a re-entrant or thread-safe code possible.

```
int kiss_makerect(SDL_Rect *rect, int x, int y, int h, int w);
```

A function to make an SDL rectangle from the arguments.

```
int kiss_pointinrect(int x, int y, SDL_Rect *rect);
```

A function that returns nonzero when a point with the coordinates `x` and `y`, is in the SDL rectangle.

```
char *kiss_string_copy(char *dest, size_t size, char *source1,  
    char *source2);
```

A general function that copies two strings to dest. The maximum number of characters copied is one less than size, and the terminating '/'0' character is always written. Both source1 and source2 can be NULL pointers. Returns NULL in case of error.

```
int kiss_string_compare(const void *a, const void *b);
```

A general function to compare two strings, that can be used as an argument of the functions for searching and sorting arrays.

```
char *kiss_backspace(char *str);
```

A general function that deletes the last character in the string.

```
int kiss_array_new(kiss_array *a);
```

Creates a new variable size array. The kiss_array structure for the array has to be created and provided by the user.

```
void *kiss_array_data(kiss_array *a, int index);
```

Returns the data element of the variable size array, at the index.

```
int kiss_array_id(kiss_array *a, int index);
```

Returns the ID element of the variable size array, at the index.

```
int kiss_array_assign(kiss_array *a, int index, int id,  
    void *data);
```

Assigns ID and data to an element of the variable size array, at the index.

```
int kiss_array_append(kiss_array *a, int id, void *data);
```

Appends ID and data elements to the end of the variable size array.

```
int kiss_array_appendstring(kiss_array *a, int id, char *text1,  
    char *text2);
```

Appends a string made by adding text1 and text2, to the variable size array. The length of the string is limited by KISS_MAX_LENGTH.

```
int kiss_array_insert(kiss_array *a, int index, int id,  
    void *data);
```

Inserts ID and data elements before the variable size array element, at the index.

```
int kiss_array_remove(kiss_array *a, int index);
```

Removes the variable size array element at the index.

```
int kiss_array_free(kiss_array *a);
```

Frees the variable size array. Does not free the kiss_array structure, freeing that structure is the responsibility of the user.

10. Draw functions

These are defined in kiss_draw.c.

```
int kiss_maxlength(int ftype, int width, char *str);
```

Returns the maximum number of characters that can be rendered from the string with the given font, including one character for the terminating '\0' in a buffer, without exceeding the length of width pixels. The string as an argument is not necessary for monotype fonts, but is provided to enable to rewrite the function for using proportional fonts or Unicode. The value of the ftype argument can by default be either TEXT_FONT or BUTTON_FONT.

```
int kiss_textwidth(int ftype, char *str1, char *str2);
```

Returns the width of the text rendered with the given font, in pixels. The value of the ftype argument can by default be either TEXT_FONT or BUTTON_FONT.

```
int kiss_rendertexture(SDL_Renderer *renderer, SDL_Texture *image,  
    int x, int y, SDL_Rect *clip);
```

Renders texture to the SDL window at the coordinates x and y with the width and height provided by the rectangle clip, or the whole texture when clip is a NULL pointer.

```
int kiss_rendertext(SDL_Renderer *renderer, char *text,  
    int x, int y, int ftype, SDL_Color color);
```

Renders text to the SDL window at the coordinates x and y with the color, the ftype argument can by default be either TEXT_FONT or BUTTON_FONT.

```
int kiss_fillrect(SDL_Renderer *renderer, SDL_Rect *rect,  
    SDL_Color color);
```

Renders a filled rectangle rect to the SDL window with color.

```
int kiss_decorate(SDL_Renderer *renderer, SDL_Rect *rect,  
    SDL_Color color, int edge);
```

A function for decorating the edge of a widget, by default renders a rectangle around the edge of the rectangle rect with color. edge is the distance from the edge of the

widget to the rendered rectangle, it is usually `kiss_edge`. All functions for creating the widgets that are decorated in that way, have an argument `decorate`, the edges of these widgets shall not be decorated when that argument is zero. The function can be overwritten for decorating the edge of the widget differently.

```
SDL_Renderer* kiss_init(char* title, kiss_array *a, int w, int h);
```

Creates a new SDL window with title, width w and height h, by default the window is centered on the screen, and returns renderer. It also initializes `kiss_sdl`, including loading all images and font. The array a has to be provided by the user, the created objects are appended to it, so that they can later be freed in `kiss_clean()`. This function can be overwritten for using different font or image libraries.

```
int kiss_clean(kiss_array *a);
```

Frees all objects added to the array a, and the array itself. This function is specific for `kiss_sdl`, and not general. Does not free the structure a, freeing that if it is created dynamically, is the responsibility of the user. When overwriting `kiss_init()`, this function may have to be overwritten also, to free different textures and fonts or other objects.

11. Widget functions

These are defined in `kiss_widgets.c`.

The functions for creating widgets have an argument `wdw` which, if provided, makes the widget to become visible when the window widget pointed by that argument becomes visible, and not visible when that window becomes not visible. That window is thus like a dialog window on which all the widgets in the dialog are drawn, the examples show how to do that. Some of these functions also have an additional argument named `decorate`, this determines whether the widget should be decorated by the standard function.

In addition to visibility, the widgets also may or may not have focus. Focus determines whether the widget processes mouse events. The focus of the widget is determined by the focus of the window `wdw`. If this window is provided and has no focus, the focus of a widget is determined by the focus member of the structure of that widget.

The event processing functions are called after each other in the event processing loop. The scrollbar, progressbar and combo box event functions are also called after the event processing loop with the event argument `NULL`. The standard function returns nonzero when an event happened in that widget which the user may want to additionally process. The event functions have an additional argument, a pointer to an integer that is assigned a nonzero value when the widgets have to be redrawn.

The drawing functions are called after each other in every cycle, after the event processing loop, when there is a need to redraw the widgets. The user may write one's own drawing functions and call the standard functions inside them, to do an additional drawing. The order of the drawing functions in the loop is important, the next functions

draw over the drawing done by the previous functions. Especially when combo boxes are used, as their popup textboxes draw over the widgets below the combo box.

```
int kiss_window_new(kiss_window *window, kiss_window *wdw,
    int decorate, int x, int y, int w, int h);
int kiss_window_event(kiss_window *window, SDL_Event *event,
    int *draw);
int kiss_window_draw(kiss_window *window, SDL_Renderer *renderer);
```

Standard functions for the window widget. The window widget is a simple widget which is only a filled rectangle with width *w* and height *h*, drawn on the SDL window at the coordinates *x* and *y*. The *wdw* argument in the new function, the same as with other widgets, may provide a dialog window on which this widget is drawn, or may be NULL. The draw function makes the widget visible, when its dialog window is visible.

```
int kiss_label_new(kiss_label *label, kiss_window *wdw,
    char *text, int x, int y);
int kiss_label_draw(kiss_label *label, SDL_Renderer *renderer);
```

Standard functions for the label widget. The label widget is a simple widget which is only a text drawn on the SDL window at the coordinates *x* and *y*. The text may contain '\n' characters, providing a multiline text. The label widget does not react to any events, thus it has no event function. A way to process events is to add a window widget beneath the label widget, and add event processing to that window widget.

```
int kiss_button_new(kiss_button *button, kiss_window *wdw,
    char *text, int x, int y);
int kiss_button_event(kiss_button *button, SDL_Event *event,
    int *draw);
int kiss_button_draw(kiss_button *button, SDL_Renderer *renderer);
```

Standard functions for the button widget, drawn at coordinates *x* and *y* on the SDL window, with text written on it. The new function for a button calculates its rectangle, copies the button's text and calculates its position, assigns the window argument to the member of its structure, and initializes other members of its structure to zero. The event function first writes one to the draw argument when the SDL window is exposed. Then it checks whether the button or the dialog window of the button has a mouse focus, and returns from the function if neither is true. Then it checks the mouse buttons and mouse motion, changes the state of the button based on these events, and returns nonzero when the button is released. The draw function makes the button visible, when its dialog window is visible. It then renders the image that corresponds to the current state of the button, and renders text to the button.


```
int kiss_selectbutton_new(kiss_selectbutton *selectbutton,
    kiss_window *wdw, int x, int y);
int kiss_selectbutton_event(kiss_selectbutton *selectbutton,
    SDL_Event *event, int *draw);
int kiss_selectbutton_draw(kiss_selectbutton *selectbutton,
    SDL_Renderer *renderer);
```

Standard functions for the select button widget, drawn at coordinates x and y on the SDL window. The select button is a simple widget similar to button, that can be in two states, toggled by clicking on the select button.

```
int kiss_vscrollbar_new(kiss_vscrollbar *vscrollbar,
    kiss_window *wdw, int x, int y, int h);
int kiss_vscrollbar_event(kiss_vscrollbar *vscrollbar,
    SDL_Event *event, int *draw);
int kiss_vscrollbar_draw(kiss_vscrollbar *vscrollbar,
    SDL_Renderer *renderer);
```

Standard functions for the vertical scrollbar widget, drawn at coordinates x and y on the SDL window, with height h. The event function returns nonzero when the slider moves, so that the user can do further processing, using the value of the fraction member of the widget's structure. The event function also has to be called in the main loop outside the event processing loop, with the event argument NULL. This is because when clicking on either of the arrows, and holding the left mouse button down, the slider moves after every certain number of time ticks, thus the event function has to be periodically called to read the time ticks.

```
int kiss_hscrollbar_new(kiss_hscrollbar *hscrollbar,
    kiss_window *wdw, int x, int y, int w);
int kiss_hscrollbar_event(kiss_hscrollbar *hscrollbar,
    SDL_Event *event, int *draw);
int kiss_hscrollbar_draw(kiss_hscrollbar *hscrollbar,
    SDL_Renderer *renderer);
```

Standard functions for the horizontal scrollbar widget, drawn at coordinates x and y on the SDL window, with width w. The event function returns nonzero when the slider moves, so that the user can do further processing, using the value of the fraction member of the widget's structure. The event function also has to be called in the main loop outside the event processing loop, with the event argument NULL. This is because when clicking on either of the arrows, and holding the left mouse button down, the slider moves after every certain number of time ticks, thus the event function has to be periodically called to read the time ticks.

```
int kiss_progressbar_new(kiss_progressbar *progressbar,
    kiss_window *wdw, int x, int y, int w);
int kiss_progressbar_event(kiss_progressbar *progressbar,
    SDL_Event *event, int *draw);
int kiss_pogressbar_draw(kiss_progressbar *progressbar,
    SDL_Renderer *renderer);
```

Standard functions for the progress bar widget, drawn at coordinates x and y on the SDL window, with width w. The progress bar widget is made to indicate the time passed while doing a long processing, by increasing the width of the progress bar. The event

function also has to be called in the main loop outside the event processing loop, with the event argument NULL. This is because when made to run, the width of the progress bar increases after every certain number of time ticks, thus the event function has to be periodically called to read the time ticks.

```
int kiss_entry_new(kiss_entry *entry, kiss_window *wdw,
    int decorate, char *text, int x, int y, int w);
int kiss_entry_event(kiss_entry *entry, SDL_Event *event,
    int *draw);
int kiss_entry_draw(kiss_entry *entry, SDL_Renderer *renderer);
```

Standard functions for the entry box widget, drawn at coordinates x and y on the SDL window, with width w, containing the initial text. By clicking in the entry box when it's not active, it becomes active. When active, the entry box is open to editing, until closed by pressing Enter. Thus the entry box, and also the entry box in the combo box, takes the keyboard focus when active. The editing provided is that of the early versions of Unix, backspace deletes the last character and ctrl-u deletes the entire text. An additional functionality can be added, such as clipboard, but what it may be depends on the particular needs.

```
int kiss_textbox_new(kiss_textbox *textbox, kiss_window *wdw,
    int decorate, kiss_array *a, int x, int y, int w, int h);
int kiss_textbox_event(kiss_textbox *textbox, SDL_Event *event,
    int *draw);
int kiss_textbox_draw(kiss_textbox *textbox,
    SDL_Renderer *renderer);
```

Standard functions for the text box widget, drawn at coordinates x and y on the SDL window, with width w and height h. The array a is a kiss_array that contains text, one line of text in every element of it, the array has to be provided by the user. By default the text box acts like a list box, with the event function returning nonzero when clicking on a line of text. But text box is not a list box, it is what it is called, a text box. The text editors such as vim have the text internally stored exactly in the same way as in the text box, as an array of pointers to strings. Thus everything can be done there, but this depends on what one may want to do, and there is a huge number of such things that can be done.

```
int kiss_combobox_new(kiss_combobox *combobox, kiss_window *wdw,
    char *text, kiss_array *a, int x, int y, int w, int h);
int kiss_combobox_event(kiss_combobox *combobox, SDL_Event *event,
    int *draw);
int kiss_combobox_draw(kiss_combobox *combobox,
    SDL_Renderer *renderer);
```

Standard functions for the combo box widget, drawn at coordinates x and y on the SDL window. The width w and height h at that, are not the width and height of the whole combo box, neither closed or opened, but the width and height of the text box of the combo box. Combo box is a composite widget, and thus it contains an entry box, a window, vertical scrollbar and text box. The text in the entry box can be edited, ending the editing by pressing Enter, closes the combo box and makes its event function to return nonzero. Selecting a line in the text box also closes the combo box and makes its

event function to return nonzero. The event function also has to be called in the main loop outside the event processing loop, with the event argument NULL. This is because the same applies to the vertical scrollbar of the combo box, as to the scrollbar widgets.