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# **LwSHELL**

**Tilen MAJERLE**

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Welcome to the documentation for version branch-45b1d75.

LwSHELL is lightweight dynamic memory manager optimized for embedded systems.

*[Download library](#) [Getting started](#) [Open Github](#) [Donate](#)*



## FEATURES

- Lightweight commands shell for embedded systems
- Platform independent and very easy to port
  - Development of library under Win32 platform
- Written in C language (C99)
- No dynamic allocation, maximum number of commands assigned at compile time
- Highly configurable
- Simple help-text with *cmd -v* option
- User friendly MIT license





## REQUIREMENTS

- C compiler
- Less than 5kB of non-volatile memory



## CONTRIBUTE

Fresh contributions are always welcome. Simple instructions to proceed:

1. Fork Github repository
2. Respect `C style & coding rules` used by the library
3. Create a pull request to `develop` branch with new features or bug fixes

Alternatively you may:

1. Report a bug
2. Ask for a feature request



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### 5.1 Getting started

Getting started may be the most challenging part of every new library. This guide is describing how to start with the library quickly and effectively

#### 5.1.1 Download library

Library is primarily hosted on [Github](#).

You can get it with:

- Downloading latest release from [releases area](#) on Github
- Cloning `master` branch for latest stable version
- Cloning `develop` branch for latest development

#### Download from releases

All releases are available on Github [releases area](#).

#### Clone from Github

##### First-time clone

This is used when you do not have yet local copy on your machine.

- Make sure `git` is installed.
- Open console and navigate to path in the system to clone repository to. Use command `cd your_path`
- Clone repository with one of available 3 options
  - Run `git clone --recurse-submodules https://github.com/MaJerle/lwshell` command to clone entire repository, including submodules
  - Run `git clone --recurse-submodules --branch develop https://github.com/MaJerle/lwshell` to clone *development* branch, including submodules
  - Run `git clone --recurse-submodules --branch master https://github.com/MaJerle/lwshell` to clone *latest stable* branch, including submodules
- Navigate to `examples` directory and run favourite example

## Update cloned to latest version

- Open console and navigate to path in the system where your resources repository is. Use command `cd your_path`
- Run `git pull origin master --recurse-submodules` command to pull latest changes and to fetch latest changes from submodules on master branch
- Run `git pull origin develop --recurse-submodules` command to pull latest changes and to fetch latest changes from submodules on develop branch
- Run `git submodule foreach git pull origin master` to update & merge all submodules

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**Note:** This is preferred option to use when you want to evaluate library and run prepared examples. Repository consists of multiple submodules which can be automatically downloaded when cloning and pulling changes from root repository.

---

### 5.1.2 Add library to project

At this point it is assumed that you have successfully download library, either cloned it or from releases page. Next step is to add the library to the project, by means of source files to compiler inputs and header files in search path

- Copy `lwshell` folder to your project, it contains library files
- Add `lwshell/src/include` folder to *include path* of your toolchain. This is where `C/C++` compiler can find the files during compilation process. Usually using `-I` flag
- Add source files from `lwshell/src/` folder to toolchain build. These files are built by `C/C++` compiler
- Copy `lwshell/src/include/lwshell/lwshell_opts_template.h` to project folder and rename it to `lwshell_opts.h`
- Build the project

### 5.1.3 Configuration file

Configuration file is used to overwrite default settings defined for the essential use case. Library comes with template config file, which can be modified according to needs. and it should be copied (or simply renamed in-place) and named `lwshell_opts.h`

---

**Note:** Default configuration template file location: `lwshell/src/include/lwshell/lwshell_opts_template.h`. File must be renamed to `lwshell_opts.h` first and then copied to the project directory where compiler include paths have access to it by using `#include "lwshell_opts.h"`.

---

List of configuration options are available in the [Configuration](#) section. If any option is about to be modified, it should be done in configuration file

Listing 1: Template configuration file

```
1 /**
2  * \file          lwshell_opts_template.h
3  * \brief         Template config file
4  */
```

(continues on next page)



(continued from previous page)

```

5
6  /*
7   * Copyright (c) 2020 Tilen MAJERLE
8   *
9   * Permission is hereby granted, free of charge, to any person
10  * obtaining a copy of this software and associated documentation
11  * files (the "Software"), to deal in the Software without restriction,
12  * including without limitation the rights to use, copy, modify, merge,
13  * publish, distribute, sublicense, and/or sell copies of the Software,
14  * and to permit persons to whom the Software is furnished to do so,
15  * subject to the following conditions:
16  *
17  * The above copyright notice and this permission notice shall be
18  * included in all copies or substantial portions of the Software.
19  *
20  * THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND,
21  * EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES
22  * OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE
23  * AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT
24  * HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY,
25  * WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING
26  * FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR
27  * OTHER DEALINGS IN THE SOFTWARE.
28  *
29  * This file is part of LwSHELL - Lightweight shell library.
30  *
31  * Author:          Tilen MAJERLE <tilen@majerle.eu>
32  * Version:         v0.1.0
33  */
34 #ifndef LWSHELL_HDR_OPTS_H
35 #define LWSHELL_HDR_OPTS_H
36
37 /* Rename this file to "lwshell_opts.h" for your application */
38
39 /*
40  * Open "include/lwshell/lwshell_opt.h" and
41  * copy & replace here settings you want to change values
42  */
43
44 #endif /* LWSHELL_HDR_OPTS_H */

```

---

**Note:** If you prefer to avoid using configuration file, application must define a global symbol `LWSHELL_IGNORE_USER_OPTS`, visible across entire application. This can be achieved with `-D` compiler option.

---

### 5.1.4 Minimal example code

To verify proper library setup, minimal example has been prepared. Run it in your main application file to verify its proper execution

Listing 2: Absolute minimum example

```
1  #include <string.h>
2  #include "lwshell/lwshell.h"
3
4  /* Command to get called */
5  int32_t
6  mycmd_fn(int32_t argc, char** argv) {
7      printf("mycmd_fn called. Number of argv: %d\r\n", (int)argc);
8      for (int32_t i = 0; i < argc; ++i) {
9          printf("ARG[%d]: %s\r\n", (int)argc, argv[i]);
10     }
11
12     /* Successful execution */
13     return 0;
14 }
15
16 /* Example code */
17 void
18 example_minimal(void) {
19     const char* input_str = "mycmd param1 \"param 2 with space\"";
20
21     /* Init library */
22     lwshell_init();
23
24     /* Define shell commands */
25     lwshell_register_cmd("mycmd", mycmd_fn, "Adds 2 integer numbers and prints them");
26
27     /* User input to process every character */
28
29     /* Now insert input */
30     lwshell_input(input_str, strlen(input_str));
31 }
```

## 5.2 User manual

### 5.2.1 How it works

This section describes how library works from the basic perspective.

LwSHELL is designed to accept *computer-command-like* input, in format of `cmdname param1 "param 2 with space"`, parse it properly and search for function callback that is assigned for specific `cmdname`.

Library starts processing input line on *line-feed* or *carriage-return* characters. It splits tokens by space character:

- Tokens must not include space character or it will be considered as multi-token input
- To use *space* character as token input, encapsulate character in *double-quotes*

## Command structure

Every command has assigned dedicated name and must start with it. Application must take care to input exact command name since commands are case-sensitive, `mycmd` is a different command than `Mycmd`.

Command structure looks like:

- It must start with command name and has at least one (1) parameter, eg. `mycommand`. Command name is counted as first parameter
- It may have additional parameters split with *space* character
- Every input is parsed as string, even if parameter is string

---

**Tip:** To use space as an input, encapsulate it with *double quotes*, eg. `mycmd param1 "param 1 has spaces"`

---

## Register command

Application must register command(s) to be used by the system. This can be done using `lwshell_register_cmd()` function which accepts *command name*, *command function* and optional *command description*

## Command description

Every command can have assigned its very simple description text, know as *help text*. Description is later accessible with special command input that has 2 parameters in total and second is `-h, cmdname -h`.

## Data output

To properly work with the library, application must input data to process by using `lwshell_input()` function. Thanks to the library implementation, it is possible to get data feedback and be able to implement OS-like console.

To enable data-output feature, define your output callback function and assign it with `lwshell_set_output_fn()` function.

Data outputs works on:

- Special characters for *carriage return* and *line-feed*
- Special character *backspace* that returns set of characters to implement backspace-like event on your output
- Actual input character printed back for user feedback
- `cmdname -h` feature works to print simple help text

## 5.3 API reference

List of all the modules:

### 5.3.1 LwSHELL

*group* **LWSHELL**  
Lightweight shell.

#### Defines

**LWSHELL\_ARRAYSIZE** (*x*)

Get size of statically allocated array.

#### Parameters

- **x** (*[in]*) – Object to get array size of

**Returns** Number of elements in array

**lwshell\_parse\_int** (*str*)

Parse input string as integer

#### Parameters

- **str** (*[in]*) – String to parse

**Returns** String parsed as integer

**lwshell\_parse\_double** (*str*)

Parse input string as double

#### Parameters

- **str** (*[in]*) – String to parse

**Returns** String parsed as double

**lwshell\_parse\_long** (*str*)

Parse input string as long

#### Parameters

- **str** (*[in]*) – String to parse

**Returns** String parsed as long

**lwshell\_parse\_long\_long** (*str*)

Parse input string as long long

#### Parameters

- **str** (*[in]*) – String to parse

**Returns** String parsed as long long

## Typedefs

**typedef** int32\_t (\*lwshell\_cmd\_fn) (int32\_t argc, char \*\*argv)  
Command function prototype.

### Parameters

- [in] **argc** – Number of arguments
- [in] **argv** – Pointer to arguments

**Returns** 0 on success, -1 otherwise

**typedef** void (\*lwshell\_output\_fn) (const char \*str, struct lwshell \*lw)  
Callback function for character output.

### Parameters

- [in] **str** – String to output
- [in] **lw** – LwSHELL instance

## Enums

**enum** lwshellr\_t  
LwSHELL result enumeration.

*Values:*

**enumerator** lwshellOK  
Everything OK

**enumerator** lwshellERRPAR  
Parameter error

**enumerator** lwshellERRMEM  
Memory error

## Functions

*lwshellr\_t* **lwshell\_init** (void)  
Initialize shell interface.

**Returns** *lwshellOK* on success, member of *lwshellr\_t* otherwise

*lwshellr\_t* **lwshell\_set\_output\_fn** (lwshell\_output\_fn out\_fn)  
Set output function to use to print data from library to user.

**Parameters** [in] **out\_fn** – Output function to print library data. Set to NULL to disable the feature

**Returns** *lwshellOK* on success, member of *lwshellr\_t* otherwise

*lwshellr\_t* **lwshell\_register\_cmd** (const char \*cmd\_name, lwshell\_cmd\_fn cmd\_fn, const char \*desc)

Register new command to shell.

### Parameters

- [in] **cmd\_name** – Command name. This one is used when entering shell command
- [in] **cmd\_fn** – Function to call on command match

- **[in] desc** – Custom command description

Returns *lwshellOK* on success, member of *lwshellr\_t* otherwise

*lwshellr\_t* **lwshell\_input** (**const** void \**in\_data*, size\_t *len*)

Input data to shell processing.

#### Parameters

- **[in] in\_data** – Input data to process
- **[in] len** – Length of data for input

Returns *lwshellOK* on success, member of *lwshellr\_t* otherwise

**struct lwshell\_t**

*#include <lwshell.h>* LwSHELL main structure.

#### Public Members

*lwshell\_output\_fn* **out\_fn**

Optional output function

char **buff**[LWSHELL\_CFG\_MAX\_INPUT\_LEN + 1]

Shell command input buffer

size\_t **buff\_ptr**

Buffer pointer for input

int32\_t **argc**

Number of arguments parsed in command

char \***argv**[LWSHELL\_CFG\_MAX\_CMD\_ARGS]

Array of all arguments

### 5.3.2 Configuration

This is the default configuration of the middleware. When any of the settings shall be modified, it shall be done in dedicated application config *lwshell\_opts.h* file.

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**Note:** Check *Getting started* for guidelines on how to create and use configuration file.

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*group* **LWSHELL\_OPT**

LwSHELL options.

#### Defines

**LWSHELL\_CFG\_MAX\_CMDS**

Maximum number of different commands to be registered.

**LWSHELL\_CFG\_MAX\_INPUT\_LEN**

Maximum characters for command line input.

This includes new line character and trailing zero. Commands longer than this are automatically discarded

**LWSHELL\_CFG\_MAX\_CMD\_NAME\_LEN**

Maximum characters for command name.

**LWSHELL\_CFG\_MAX\_CMD\_ARGS**

Maximum number of parameters accepted by command.

Number includes command name itself

**LWSHELL\_CFG\_USE\_OUTPUT**

Enables 1 or disables 0 output function to print data from library to application.

This is useful to give library feedback to user

## 5.4 Examples and demos

Various examples are provided for fast library evaluation on embedded systems. These are prepared and maintained for 2 platforms, but could be easily extended to more platforms:

- WIN32 examples, prepared as [Visual Studio Community](#) projects
- ARM Cortex-M examples for STM32, prepared as [STM32CubeIDE](#) GCC projects

**Warning:** Library is platform independent and can be used on any platform.

### 5.4.1 Example architectures

There are many platforms available today on a market, however supporting them all would be tough task for single person. Therefore it has been decided to support (for purpose of examples) 2 platforms only, *WIN32* and *STM32*.

#### WIN32

Examples for *WIN32* are prepared as [Visual Studio Community](#) projects. You can directly open project in the IDE, compile & debug.

#### STM32

Embedded market is supported by many vendors and STMicroelectronics is, with their [STM32](#) series of microcontrollers, one of the most important players. There are numerous amount of examples and topics related to this architecture.

Examples for *STM32* are natively supported with [STM32CubeIDE](#), an official development IDE from STMicroelectronics.

You can run examples on one of official development boards, available in repository examples.





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