EFSL

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1 Preface

1.1 Project aims

The EFSL project aims to create a library for filesystems, to be used on various

2 Getting started

2.1 On Linux (file)

Debugging efsl on embedded devices is a rather hard job, because you can't just printf debug strings or watch memory maps easily. Because of that, core development has been performed under the Linux operating system. Under Linux, efsl can be compiled as library and used as a userspace filesystem handler. On Unix- style operating system (like Linux), all devices (usb stick, disc, ...) can be seen as a file, and as such been opened by efsl.

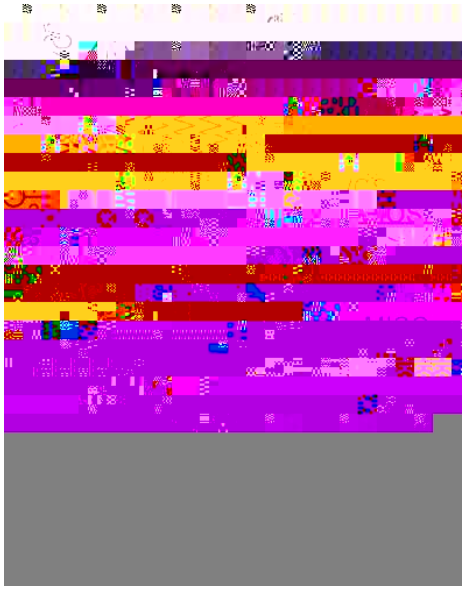
In the following section, we will explain how to get started using efsl as userspace

2.2 On AVR (SD-Card)

This section describes how to implement Efsl on a AVR μC connected to an SD-

Connect the following lines on the SD-card:

- Pin 9 (DAT2) - NC
  (or pull-up to 3.3V)
- Pin 1 (CD) - Any pin on the Atmega128
- Pin 2 (CMD) - MOSI
  (pin 12 on the Atmega128)
- Pin 3 (Vss) - GND
- Pin 4 (Vdd) - +3.3V
- Pin 5 (CLK) - SCK
  (pin 11 on the Atmega128)
- Pin 6 (Vss) - GND
- Pin 7 (DAT0) - MISO
  (pin 12 on the Atmega128)
- Pin 8 (DAT1) - NC
  (or pull-up to 3.3V)



Remark: this schematic includes pull-up's to 3.3V, which can be left o.

Remark 1: Mak0-11.95a-3eeat95a-3y7rk-ur4.54/F977.69-3145.2.435

First, create a new directory in which you put the compiled efsl-library (

- Line 7: The object efs is created, this object will contain information about the hardware layer, the partition table and the disc.
- Line 8: The objects `file_r` and `file_w` are created, these objects will contain information about the files that we will open on the efs-object.
- Line 9: A buffer of 512 bytes is allocated. This buffer will be used for reading and writing blocks of data.
- Line 12: Call of `efs_init()`, which will initialize the efs-object. To this function we pass:

  1. A pointer to the efs-object.
  2. A pointer to the file that contains the partition table / file system (in this example, we select a device as file).

  If this function returns 0, it means that a valid fat partition is found on the SD-card connected. If no valid fat-filesystem is found, or the file does not exist, the function returns a negative value. In this example we then go to an infinite loop to prevent the program to continue.

-

2.2.4 Testing

So now let's test the program:

1. Make sure that your directory contains both the example from above called avrtest.c and the library libefsl.a .
2. Compile the program:
   - On Linux (with avr-gcc): avr-gcc -I/home/user/efsl/inc/ -I/home/user/efsl/conf -reestanding -mmcu=atmega128 -Os -o avrtest.o avrtest.c -L./ -lefsl
   - On Windows (with WinAVR): avr-gcc -Ic:\efsl\inc -Ic:\efsl\conf -reestanding -mmcu=atmega128 -Os -o avrtest.o avrtest.c -L.\ -lefsl
3. Generate(-221(-I/homa-I/h3(hexest70(frohomvr-gcc)-4oefs55(jcop-gccy-I/homejfrohom.text-I/h3(ejfroh

2.3.2 McBSP configuration

McBSP Register Explanations			
SPCR			Serial Port Control Register
Name	Bit	Value	Value (0x00001800 | 0x00410001)
RRST	0	1b	The serial port receiver is enabled
XRST	16	1b	The serial port transmitter is enabled

2.4 On ARM7 (SD-Card)

This section describes how the ARM7 port of EFSL works. This documentation was written by Martin Thomas, as is the port to the ARM7 and the examples included with EFSL. The examples are pretty large, so we will not print them here, they have their own subdirectory in the examples sections and should be quite understandable.

2.4.1 License

1. Example lpc2138

3 Configuring EFSL

On architectures that do have the alignment problem, you should turn this flag o. Failure to do so will result in undefined behavior.

3.3 Cache configuration

This section is dedicated to configuring the cache memory for the library. Caching is performed by the IOMan object, see section 6.4.

IOMAN_NUMBUFFER

This number determines how much memory will be used for caching. Since this is sector based one `IOMAN_NUMBUFFER`

3.5 Endianness

The Microsoft FAT filesystem was originally created to be run on Intel compatible hardware. Therefore the Microsoft programmers decided to record all data on the disc in little endian format. Our library supports running on big endian devices. Here you can select whether your target CPU is little or big endian.

Running on big endian will cause some performance lose because (rather simple)

- On AVR debug will be sent over a selected UART
  Make sure youT

4.2 efs

4.4 file

```
25          fs_umount(&efs.myFs);
26      }
```

4.5 file_read

Purpose

Reads a file and puts it's content in a buffer.

Prototype

```
euint32 file_read (File *file, euint32 size, euint8 *buf);
```

Arguments

```
24          DBG((TXT("File opened for reading.\n")));
25
26          /* Write buffer to file */
27          if( file\n")));
/
```

4.7 mkdir

Purpose

Creates a new directory.

Prototype

```
esint8 mkdir(FileSystem *fs,eint8* dirname);
```

Arguments

Objects passed to `mkdir` :

- `fs` : pointer to the FileSystem object
- `dir` : pointer to the path + name of the new directory

Return value

Returns 0 if no errors are detected.

Returns non-zero if an error is detected:

- Returns -1 if the directory already exists.
-

```
18              mkdir(&efsl.myFs,"dir1/subdir2");
19              mkdir(&efsl.myFs,"dir1/subdir3");
20          }
21
22          /* Close filesystem */
23          fs_umount(&efsl.ms                    8
```

4.8 ls_openDir

Purpose

This function opens a directory for viewing, allowing you to iterate through it's contents.

Prototype

```
esint8 ls
```

21 list

4.10 rmfile

Purpose

Deletes a file.

Prototype

```
esint16 rmfile(FileSystem *fs,euint8* filename);
```

Arguments

Objects passed to `rmfile` :

- `fs` : pointer to the FileSystem object
- `filename` : pointer to the path + name of the file to be removed

Return value

Returns 0 if no errors are detected.

Returns non-zero if an error is detected, most likely that the file does not exist.

Note

If you have opened a file with `fopen()` , and you wish to delete it, first close

```
18
19          /* Close filesystem */
20          fs_umount(&efsl.myFs);
21      }
```

4.11 Getting the free space

To get the free space left on EFSL 0.2 is a bit tricky. This feature was implemented after it had gone into stable, so it couln't interfere with other library functions.

5 EFSL utilities

5.1 Notations

The utilities can be compiled and run on any POSIX compliant system. Al-

sourcefile on your local filesystem. The third argument (

6 Developer notes

6.1 Integer types

- Initialize the hardware
- Read sectors from disc
- Write sectors to disc

All requests are *sector*based, a sector is a 512 byte piece from the disc, that is

6. Add your object file to the Makefile Take the Makefile that works best on your platform (they should all work with GNU/Make), or create a new one, using the existing one's as a template. Make sure to include your new pigeon object to the library. If you have an 'ar' like utility you can create a static library, else you may have to create a new project containing all required source files.

The basic framework is now complete, now all that's left to do is to write the code that will perform the actual flying work.

6.3.1 hwInterface

This structure represents the underlying hardware. There are some field that

```
11
12      /  Initialize hardware  /
13      feed(hw->pigeon);
14      pet (hw->pigeon);
15
16      /  Get sectors count  /
17
```

6.4 I/O Manager

The IOManager that is the second lowest layer of the embedded filesystems library is responsible for coordinating disk input and output, as well as managing a caching system. This documentation describes the second implementation of IOMan, which includes features such as :

- Delayed write
- Buffer reference statistics
- Buffer exportable to users
- Support for cached direct I/O as well as indirect I/O
- Can allocate memory itself (on the stack), or you can do it yourself (heap)

3.

7 Legal notes

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