

# [PATCH 2.6.18 V7] drivers: add lcd display support

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*Source:* <http://linux.derkeiler.com/Mailing-Lists/Kernel/2006-10/msg00033.html>

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- *From:* Miguel Ojeda Sandonis <[maxextreme@xxxxxxxxx](mailto:maxextreme@xxxxxxxxx)>
  - *Date:* Sat, 30 Sep 2006 23:24:45 +0000
- 

miguelojeda-2.6.18-add-lcd-display-support.patch.v7

Brief

-----

- Adds a "lcddisplay" class for registering LCD devices.
- Adds support for the ks0108 LCD Controller as a device driver.  
(uses lcddisplay class and parport interface)
- Adds support for the cfag12864b LCD Display as a device driver.  
(uses ks0108 device driver)
- Adds a new ioctl() magic number/range (0xFF) in the list for the cfag12864b device.
- Adds the usual Documentation, ABI, includes, Makefiles, Kconfigs, MAINTAINERS, CREDITS...

Changelog (newer first)

-----

V7 - Fixed mistakes found by Randy Dunlap

- removed kmalloc/kfree calls, do it at init/exit
- added Documentation/ABI/testing/cfag12864b
- changed %i to %Zd at printk calls to avoid gcc warnings
- removed image startup
- coding style
- improved MODULE\_DESCRIPTIONs
- added parens to some macros
- changed KERN\_DEBUG to KERN\_INFO for "inited" and "exited" messages
- added single spaces around arithmetic operators
- added several spacebars
- fixed several spelling issues

V6 - Fixed mistakes found by Andrew Morton

- added locking
- removed "add const to class\_create" part, as it is already accepted in 2.6.18-git10
- removed PRINT\_PREFIX macro, use KERN\_... instead
- reverted bitops to standard |= and &=
- added const to fop's static struct
- added error code checking for class\_device\_create()
- removed "if(foo > maxfoo) foo=maxfoo;", use min(foo,maxfoo) instead

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- coding style:
- used #defined constants directly, not static constants = DEFINED\_CONSTANT
- removed blank lines
- changed pointers declarations to "T \*name"
- changed for's coding style
- added single spaces around arithmetic operators
- changed counter's nomenclature to i,j,k
- shorter function definitions
- removed newlines at some function calls
- udelay(2)

### V5 - Fixed mistakes found by Joe Perches

- coding style
- const, spelling mistake

### V4 - Fixed mistakes found by Pavel Machek

- no zero initialization
- GPL version
- use bitop generic functions

### V3 - Apply for 2.6.18

- added const to class\_create (2.6.18 hasn't add-const-to-class\_create.patch)

### V2 - Fixed mistakes found by Greg KH

- lots about coding style

### V1 - Fixed mistakes found by Alexey Dobriyan

- coding style
- init() and exit() error management

### V0 - Original patch

### Patched files Index

---

CREDITS | 8

Documentation/ABI/testing/cfag12864b | 50 ++

Documentation/ioctl-number.txt | 2

Documentation/lcddisplay/cfag12864b | 402 ++++++

Documentation/lcddisplay/lcddisplay | 37 +

MAINTAINERS | 6

drivers/Kconfig | 2

drivers/Makefile | 1

drivers/lcddisplay/Kconfig | 106 +++++

drivers/lcddisplay/Makefile | 7

drivers/lcddisplay/cfag12864b.c | 600 ++++++

drivers/lcddisplay/ks0108.c | 171 ++++++

drivers/lcddisplay/lcddisplay.c | 79 +++

include/linux/cfag12864b.h | 58 ++

include/linux/ks0108.h | 36 +

[PATCH 2.6.18 V7] drivers: add lcd display support

include/linux/lcddisplay.h | 34 +  
16 files changed, 1599 insertions(+)

Please review. (Roargh, I think this way I'm going to reach V123 :)

miguelojeda-2.6.18-add-lcd-display-support.patch.v7

Signed-off-by: Miguel Ojeda Sandonis <maxextreme@xxxxxxxx>

---

diff -uprN -X dontdiff linux-2.6.18-vanilla/CREDITS linux-2.6.18/CREDITS

--- linux-2.6.18-vanilla/CREDITS 2006-09-20 03:42:06.000000000 +0000

+++ linux-2.6.18/CREDITS 2006-09-27 19:15:13.000000000 +0000

@@ -2535,6 +2535,14 @@ S: Subiaco, 6008

S: Perth, Western Australia

S: Australia

+N: Miguel Ojeda Sandonis

+E: maxextreme@xxxxxxxx

+D: Author: LCD Display Drivers (ks0108, cfag12864b)

+D: Maintainer: LCD Display Drivers Tree (drivers/lcddisplay/\*)

+S: C/ Mieses 20, 9-B

+S: Valladolid 47009

+S: Spain

+

N: Greg Page

E: gpage@xxxxxxxxxxxxxx

D: IPX development and support

diff -uprN -X dontdiff linux-2.6.18-vanilla/Documentation/ABI/testing/cfag12864b

linux-2.6.18/Documentation/ABI/testing/cfag12864b

--- linux-2.6.18-vanilla/Documentation/ABI/testing/cfag12864b 1970-01-01 00:00:00.000000000 +0000

+++ linux-2.6.18/Documentation/ABI/testing/cfag12864b 2006-09-30 23:35:56.000000000 +0000

@@ -0,0 +1,50 @@

+What: drivers/lcddisplay/cfag12864b driver

+Date: 2006-09-30

+KernelVersion: 2.6.18.x

+Contact: Miguel Ojeda Sandonis <maxextreme@xxxxxxxx>

+Description:

+ The cfag12864b lcd driver defines two ways to communicate

+ with the lcd display.

+

+ 1. Use seek and write syscalls. Bytes written appear on  
+ the screen without any formatting on the position pointed  
+ by the file offset.

+

+ It is hardware dependent. It should be use to modify  
+ specific display's pixels to achieve higher refreshing  
+ rates.

+

+ 2. Use ioctl syscall. The magic number is 0xFF.

+ There are four ioctls:

+

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[PATCH 2.6.18 V7] drivers: add lcd display support

```
+ 2.0. off _IO(0xFF,0)
+
+ Power off display.
+
+ It doesn't clear the display.
+ It doesn't stop the controllers.
+
+ 2.1. on _IO(0xFF,1)
+
+ Power on display.
+
+ 2.2. clear _IO(0xFF,2)
+
+ Clear the display.
+
+ 2.3. format _IOW(0xFF,3,void *)
+
+ Read the given buffer, transform it to the hardware
+ dependent format and show it on the screen.
+
+ The argument must point to a userspace buffer of
+ size 128*64 bytes (the display's size).
+
+ Each buffer's byte (unsigned) represent a pixel:
+ 0 = pixel will turn off
+ >0 = pixel will turn on
+
+ For more information and examples, see
+ Documentation/lcddisplay/cfag12864b
+
+Users:
diff -uprN -X dontdiff linux-2.6.18-vanilla/Documentation/ioctl-number.txt
linux-2.6.18/Documentation/ioctl-number.txt
--- linux-2.6.18-vanilla/Documentation/ioctl-number.txt 2006-09-20 03:42:06.000000000 +0000
+++ linux-2.6.18/Documentation/ioctl-number.txt 2006-09-27 19:15:13.000000000 +0000
@@ -191,3 +191,5 @@ Code Seq# Include File Comments
<mailto:aherrman@xxxxxxxxxxx>
0xF3 00-3F video/sisfb.h sisfb (in development)
<mailto:thomas@xxxxxxxxxxxxxxxxxxx>
+0xFF 00-1F linux/cfag12864b.h cfag12864b LCD Display Driver
+ <mailto:maxextreme@xxxxxxxxxxx>
diff -uprN -X dontdiff linux-2.6.18-vanilla/Documentation/lcddisplay/cfag12864b
linux-2.6.18/Documentation/lcddisplay/cfag12864b
--- linux-2.6.18-vanilla/Documentation/lcddisplay/cfag12864b 1970-01-01 00:00:00.000000000 +0000
+++ linux-2.6.18/Documentation/lcddisplay/cfag12864b 2006-10-01 00:10:01.000000000 +0000
@@ -0,0 +1,402 @@
+ =====
+ cfag12864b Driver Documentation
+ =====
+
+License: GPL
```

[PATCH 2.6.18 V7] drivers: add lcd display support

+Author & Maintainer: Miguel Ojeda Sandonis <maxextreme@xxxxxxxxxx>

+Date: 2006-09-30

+

+

+

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+0. INDEX

+-----

+

+ 1. DRIVER INFORMATION

+ 2. DEVICE INFORMATION

+ 3. WIRING

+ 4. USER-SPACE PROGRAMMING

+ 4.1. ioctl and a 128\*64 boolean matrix

+ 4.2. Direct writing

+ 6. USEFUL FILES

+ 5.1. cfag12864b.h

+ 6.2. bmpwriter.h

+

+

+-----

+1. DRIVER INFORMATION

+-----

+

+This driver support one cfag12864b display at time.

+

+

+-----

+2. DEVICE INFORMATION

+-----

+

+Manufacturer: Crystalfontz

+Webpage: <http://www.crystalfontz.com>

+Device Webpage: <http://www.crystalfontz.com/products/12864b/>

+Type: LCD Display

+Width: 128

+Height: 64

+Colors: 2

+Controller: ks0108

+Controllers: 2

+Pages: 8 each controller

+Addresses: 64 each page

+

+

+

+-----

+3. WIRING

+-----

+

+The cfag12864b LCD Display Series don't have official wiring.

+

+The common wiring is done to the parallel port:

+

+[http://www.skippari.net/lcd/sekalaista/crystalfontz\\_cfag12864B-TMI-V.png](http://www.skippari.net/lcd/sekalaista/crystalfontz_cfag12864B-TMI-V.png)

+

+You can get help at Crystalfontz and LCDInfo forums.

+

+

+

+-----

#### +4. USERSPACE PROGRAMMING

+-----

+

+This interface is described briefly at Documentation/ABI/testing/cfag12864b

+

+Include a copy of the provided header:

+

+ #include "cfag12864b.h"

+

+Open the device for writing, /dev/cfag12864b0:

+

+ int fd = open("/dev/cfag12864b0",O\_WRONLY);

+

+Then use simple ioctl calls to control it:

+

+ ioctl(fdisplay,CFAG12864B\_IOCTLFF); /\* Turn off (don't clear) \*/

+ ioctl(fdisplay,CFAG12864B\_IOCTLON); /\* Turn on \*/

+ ioctl(fdisplay,CFAG12864B\_IOCTLCLR); /\* Clear the display \*/

+

+For writing to the display, you have two options:

+

+

##### +4.1. ioctl & 128\*64 boolean matrix

+-----

+

+This method is easier, but you have to update the entire display

+each time you want to change it.

+

+Just calling the ioctl:

+

+ ioctl(fdisplay, CFAG12864B\_IOCTLFORMAT, Buffer);

+

+Your drawing should appear on the display.

+

+Note:

+

+ CFAG12864B\_FORMATSIZE ==

+ CFAG12864B\_WIDTH \* CFAG12864B\_HEIGHT ==

+ 128 \* 64

+

+The buffer should be a 128\*64 unsigned char array:

+

## [PATCH 2.6.18 V7] drivers: add lcd display support

```
+ unsigned char Buffer[CFAG12864B_FORMATSIZE];
+
+To fill this buffer, you have several ways. Examples:
+
+a)
+ Fill a bidimensional 128x64 buffer (each byte representing a pixel
+ on the display), copy it to the first one and call the ioctl:
+
+ unsigned char Buffer[CFAG12864B_FORMATSIZE];
+ unsigned char MyDrawing[CFAG12864B_WIDTH][CFAG12864B_HEIGHT];
+
+ /* Create drawing ... */
+
+ for(i = 0; i < CFAG12864B_WIDTH; i++)
+ for(j = 0; j < CFAG12864B_HEIGHT; j++)
+ Buffer[i + j * CFAG12864B_WIDTH] = MyDrawing[i][j];
+
+ ioctl(fdisplay, CFAG12864B_IOCTLFORMAT, Buffer);
+
+b)
+ Create helper functions/macros to change a specific bit
+ in the final buffer. This way you don't need an extra buffer,
+ and it is faster. When you are ready, call the ioctl:
+
+ #define SET(x,y) Buffer[x + y * CFAG12864B_WIDTH] = 1;
+ #define UNSET(x,y) Buffer[x + y * CFAG12864B_WIDTH] = 0;
+
+ unsigned char Buffer[CFAG12864B_FORMATSIZE];
+
+ /* Create drawing ... */
+
+ ioctl(fdisplay, CFAG12864B_IOCTLFORMAT, Buffer);
+
+4.2. Direct writing
+-----
+
+This method allows you to change each byte of the device,
+so you can achieve a higher update rate updating only the pixels
+you are going to change.
+
+The device size is 1024 == CFAG12864B_SIZE.
+
+You can write and seek the device. The first 512 bytes write to
+the first k0108 controller (left display half) and the last 512 bytes
+write to the second ks0108 controller (right display half).
+
+Each controller is divided into 8 pages. Each page has 64 bytes.
+
+ Controller 0 Controller 1
+ _____
```

## [PATCH 2.6.18 V7] drivers: add lcd display support

```
+Page 0 |_____|_____|
+Page 1 |_____|_____|
+Page 2 |_____|_____|
+Page 3 |_____|_____|
+Page 4 |_____|_____|
+Page 5 |_____|_____|
+Page 6 |_____|_____|
+Page 7 |_____|_____|
```

```
+ <--- 64 --->
```

```
+
```

```
+You will understand how the device work executing some commands:
```

```
+
```

```
+ # echo -n A > /dev/cfag12864b0
```

```
+ # echo -n a > /dev/cfag12864b0
```

```
+ # echo AAAAAA > /dev/cfag12864b0
```

```
+ # echo 000000 > /dev/cfag12864b0
```

```
+ # echo Hello world! > /dev/cfag12864b0
```

```
+ # echo Hello world! Hello world! > /dev/cfag12864b0
```

```
+
```

```
+After you understand it, code your functions to change specific bytes.
```

```
+
```

```
+Use write() and lseek() system calls, like:
```

```
+
```

```
+ lseek(fdisplay, ipage * CFAG12864B_HEIGHT, SEEK_SET);
```

```
+ lseek(fdisplay, icontrroller * CFAG12864B_SIZE / 2, SEEK_SET);
```

```
+
```

```
+ write(fdisplay, bufpage, CFAG12864B_HEIGHT);
```

```
+ write(fdisplay, bufcontroller, CFAG12864B_SIZE / 2);
```

```
+ write(fdisplay, bufdisplay, CFAG12864B_SIZE);
```

```
+
```

```
+
```

```
+-----  
+5. USEFUL FILES
```

```
+-----
```

```
+
```

```
+
```

```
+5.1 cfag12864b.h
```

```
+-----
```

```
+
```

```
+You can use a copy of this header in your userspace programs.
```

```
+
```

```
+---
```

```
+/*
```

```
+ * Filename: cfag12864b.h
```

```
+ * Version: 0.1.0
```

```
+ * Description: cfag12864b LCD Display Driver Header for user-space apps
```

```
+ *
```

```
+ * Author: Miguel Ojeda Sandonis <maxextreme@xxxxxxxxxx>
```

```
+ * Date: 2006-09-30
```

```
+ */
```

```
+
```

[PATCH 2.6.18 V7] drivers: add lcd display support

```
+#ifndef _CFAG12864B_H_
+#define _CFAG12864B_H_
+
+#include <sys/ioctl.h>
+
+#define CFAG12864B_WIDTH (128)
+#define CFAG12864B_HEIGHT (64)
+#define CFAG12864B_FORMATSIZE ((CFAG12864B_WIDTH)*(CFAG12864B_HEIGHT))
+#define CFAG12864B_SIZE (1024)
+
+#define CFAG12864B_IOC_MAGIC (0xFF)
+
+#define CFAG12864B_IOC_OFF (_IO((CFAG12864B_IOC_MAGIC),0))
+#define CFAG12864B_IOC_ON (_IO((CFAG12864B_IOC_MAGIC),1))
+#define CFAG12864B_IOC_CLEAR (_IO((CFAG12864B_IOC_MAGIC),2))
+#define CFAG12864B_IOC_FORMAT (_IOW((CFAG12864B_IOC_MAGIC),3,void *))
+
+#endif // _CFAG12864B_H_
+
+
+
+
+5.2 Example BMP writer
+-----
+
+You can take ideas from this code and start programming. I think it is useful
+for understanding how the driver can be used. It just works, don't expect
+good BMP-related code. I chose such bitmap format because it is simple.
+
+The program reads a .bmp 128x64 2-colors file, converts it to a
+boolean [128*64] buffer and then uses ioctl to display it on the screen.
+
+
+/*
+ * Filename: bmpwriter.h
+ * Version: 0.1.0
+ * Description: BMP Writer sample app for cfag12864b LCD driver
+ *
+ * Author: Miguel Ojeda Sandonis <maxextreme@xxxxxxxx>
+ * Date: 2006-09-30
+ */
+
+#include <stdio.h>
+#include <stdlib.h>
+#include <string.h>
+
+#include <sys/types.h>
+#include <sys/stat.h>
+#include <fcntl.h>
+
+#include "cfag12864b.h"
```

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```
+
+#define BMP_SIZE 1024
+
+union dword
+{
+ unsigned int u32;
+ unsigned char u8[4];
+};
+
+#define Bit(n) ((unsigned char)(1<<(n)))
+
+void BMP2Format(
+ unsigned char _Src[BMP_SIZE],
+ unsigned char _Dest[CFAG12864B_FORMATSIZE])
+{
+ const unsigned int Width = CFAG12864B_WIDTH;
+ const unsigned int Height = CFAG12864B_HEIGHT;
+ const unsigned int Bits = 8;
+
+ unsigned int Y,X,Bit;
+
+ for(Y=0; Y<Height; ++Y)
+ for(X=0; X<Width/Bits; ++X)
+ for(Bit=0; Bit<Bits; ++Bit)
+ _Dest[X * Bits + Bit + (Height - Y - 1) * Width] =
+ _Src[Y * Width / Bits + X] & Bit(Bits - Bit - 1) ? 0 : 1;
+}
+
+int main(int argc, char * argv[])
+{
+ const unsigned int Width = CFAG12864B_WIDTH;
+ const unsigned int Height = CFAG12864B_HEIGHT;
+ const unsigned int Size = CFAG12864B_SIZE;
+ const unsigned int BPP = 1;
+ const unsigned int HeaderSize = 0x3E;
+ const unsigned int BMPSize = BMP_SIZE;
+
+ unsigned char c;
+ unsigned int i,j;
+ union dword n;
+
+ unsigned char Buffer_BMP[BMP_SIZE];
+ unsigned char Buffer_Matrix[CFAG12864B_FORMATSIZE];
+
+ int fdisplay;
+ FILE * fbmp;
+
+ // Check args
+ if(argc!=3) {
+ printf("%s: Bad number of arguments. Expected 3\n",
+ argv[0]);
```

```

+ return -1;
+ }
+
+ // Open file
+ fbmp = fopen(argv[2],"rb");
+ if(fbmp==NULL) {
+ printf("%s: Can't open %s\n",argv[0], argv[2]);
+ return -2;
+ }
+
+ // Check file size
+ fseek(fbmp,0,SEEK_END);
+ i=ftell(fbmp);
+ if(i!=HeaderSize+Size) {
+ printf("%s: Bad file size. %i instead of %i\n",
+ argv[0], i, HeaderSize+Size);
+ fclose(fbmp);
+ return -3;
+ }
+
+ // Check both magic BMP bytes
+ fseek(fbmp,0,SEEK_SET);
+ c = fgetc(fbmp);
+ if(c!='B') {
+ printf("%s: Bad first magic byte. '%c' instead of 'B'\n",
+ argv[0], c);
+ fclose(fbmp);
+ return -4;
+ }
+ c = fgetc(fbmp);
+ if(c!='M') {
+ printf("%s: Bad second magic byte. '%c' instead of 'M'\n",
+ argv[0], c);
+ fclose(fbmp);
+ return -5;
+ }
+
+ // Check this is a 128x64 1-bpp BMP file
+ fseek(fbmp,0x12,SEEK_SET);
+ for(i=0; i<4; ++i)
+ n.u8[i] = fgetc(fbmp);
+ if(n.u32!=Width) {
+ printf("%s: Bad width. %i instead of %i\n",
+ argv[0], n.u32, Width);
+ fclose(fbmp);
+ return -6;
+ }
+ for(i=0; i<4; ++i)
+ n.u8[i] = fgetc(fbmp);
+ if(n.u32!=Height) {
+ printf("%s: Bad width. %i instead of %i\n",

```

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```
+ argv[0], n.u32, Height);
+ fclose(fbmp);
+ return -7;
+ }
+ fseek(fbmp,0x1C,SEEK_SET);
+ c = fgetc(fbmp);
+ if(c!=BPP) {
+ printf("%s: Bad bpp. %i instead of %i\n",
+ argv[0], c, BPP);
+ fclose(fbmp);
+ return -8;
+ }
+
+ // Get bitmap data
+ fseek(fbmp,0x3E,SEEK_SET);
+ fread(Buffer_BMP,1,BMPSize,fbmp);
+ fclose(fbmp);
+
+ // Transform BMP data to 2D matrix
+ BMP2Format(Buffer_BMP,Buffer_Matrix);
+
+ // Open file
+ fdisplay = open(argv[1],O_WRONLY);
+ if(fdisplay < 0) {
+ printf("%s: Can't open %s\n", argv[0], argv[1]);
+ return -9;
+ }
+
+ // Send matrix
+ ioctl(fdisplay,CFAG12864B_IOCTLFORMAT,Buffer_Matrix);
+
+ // Close file
+ close(fdisplay);
+
+ return 0;
+}
+---
+
+
+EOF
diff -uprN -X dontdiff linux-2.6.18-vanilla/Documentation/lcddisplay/lcddisplay
linux-2.6.18/Documentation/lcddisplay/lcddisplay
--- linux-2.6.18-vanilla/Documentation/lcddisplay/lcddisplay 1970-01-01 00:00:00.000000000 +0000
+++ linux-2.6.18/Documentation/lcddisplay/lcddisplay 2006-09-30 12:07:59.000000000 +0000
@@ -0,0 +1,37 @@
+=====
+ LCD Display Drivers Documentation
+=====
+
+License: GPL
+Author & Maintainer: Miguel Ojeda Sandonis <maxextreme@xxxxxxxxxx>
```

[PATCH 2.6.18 V7] drivers: add lcd display support

+Date: 2006-09-30

+

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+0. INDEX

+-----

+

+ 1. NEW DISPLAY DRIVERS

+ 2. GENERAL TIPS

+

+

+

+-----

+1. NEW DISPLAY DRIVERS

+-----

+

+Feel free to send me new display drivers. I will try to do my best.

+

+If you don't get any answer, send your patch directly to the linux-kernel ml.

+

+

+

+-----

+2. GENERAL TIPS

+-----

+

+-- Divide your driver into the controller driver, like ks0108,  
+ and the specific LCD display series driver, like cfag12864b.

+

+-- Claim for your IO ports in the controller driver.

+

+EOF

diff -uprN -X dontdiff linux-2.6.18-vanilla/drivers/Kconfig linux-2.6.18/drivers/Kconfig

--- linux-2.6.18-vanilla/drivers/Kconfig 2006-09-20 03:42:06.000000000 +0000

+++ linux-2.6.18/drivers/Kconfig 2006-09-27 19:15:12.000000000 +0000

@@ -74,4 +74,6 @@ source "drivers rtc/Kconfig"

source "drivers/dma/Kconfig"

+source "drivers/lcddisplay/Kconfig"

+

endmenu

diff -uprN -X dontdiff linux-2.6.18-vanilla/drivers/lcddisplay/cfag12864b.c

linux-2.6.18/drivers/lcddisplay/cfag12864b.c

--- linux-2.6.18-vanilla/drivers/lcddisplay/cfag12864b.c 1970-01-01 00:00:00.000000000 +0000

+++ linux-2.6.18/drivers/lcddisplay/cfag12864b.c 2006-10-01 00:30:40.000000000 +0000

@@ -0,0 +1,600 @@

+/\*

+ \* Filename: cfag12864b.c

+ \* Version: 0.1.0

+ \* Description: cfag12864b LCD display driver

+ \* License: GPLv2 or later

[PATCH 2.6.18 V7] drivers: add lcd display support

[PATCH 2.6.18 V7] drivers: add lcd display support

```
+ * Depends: lcdisplay ks0108
+ *
+ * Author: Copyright (C) Miguel Ojeda Sandonis <maxextreme@xxxxxxxxxx>
+ * Date: 2006-09-30
+ *
+ * This program is free software; you can redistribute it and/or modify
+ * it under the terms of the GNU General Public License as published by
+ * the Free Software Foundation; either version 2 of the License, or
+ * (at your option) any later version.
+ *
+ * This program is distributed in the hope that it will be useful,
+ * but WITHOUT ANY WARRANTY; without even the implied warranty of
+ * MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE. See the
+ * GNU General Public License for more details.
+ *
+ * You should have received a copy of the GNU General Public License
+ * along with this program; if not, write to the Free Software
+ * Foundation, Inc., 59 Temple Place, Suite 330, Boston, MA 02111-1307 USA
+ *
+ */
+
+#include <linux/init.h>
+#include <linux/module.h>
+#include <linux/kernel.h>
+#include <linux/fs.h>
+#include <linux/cdev.h>
+#include <linux/device.h>
+#include <linux/lcdisplay.h>
+#include <linux/ks0108.h>
+#include <linux/cfag12864b.h>
+#include <asm/uaccess.h>
+
+#define CFAG12864B_NAME "cfag12864b"
+
+/*
+ * Device
+ */
+
+static const unsigned int cfag12864b_firstminor;
+static const unsigned int cfag12864b_ndevices = 1;
+static int cfag12864b_major;
+static int cfag12864b_minor;
+static dev_t cfag12864b_device;
+struct cdev cfag12864b_chardevice;
+static unsigned char * cfag12864b_buffer;
+static unsigned char * cfag12864b_formatbuffer;
+DECLARE_MUTEX(cfag12864b_mutex);
+
+/*
+ * cfag12864b Commands
+ */
```

[PATCH 2.6.18 V7] drivers: add lcd display support

```
+ * E = Enable signal
+ * Everytime E switch from low to high,
+ * cfag12864b/ks0108 reads the command/data.
+ *
+ * CS1 = First ks0108controller.
+ * If high, the first ks0108 receives commands/data.
+ *
+ * CS2 = Second ks0108 controller
+ * If high, the second ks0108 receives commands/data.
+ *
+ * DI = Data/Instruction
+ * If low, cfag12864b will expect commands.
+ * If high, cfag12864b will expect data.
+ *
+ */
+
+#define bit(n) (((unsigned char)1)<<(n))
+
+#define CFAG12864B_BIT_E (0)
+#define CFAG12864B_BIT_CS1 (2)
+#define CFAG12864B_BIT_CS2 (1)
+#define CFAG12864B_BIT_DI (3)
+
+static unsigned char cfag12864b_state;
+
+static void cfag12864b_set(void)
+{
+ ks0108_writecontrol(cfag12864b_state);
+}
+
+static void cfag12864b_setbit(unsigned char state, unsigned char n)
+{
+ if (state)
+ cfag12864b_state |= bit(n);
+ else
+ cfag12864b_state &= ~bit(n);
+ cfag12864b_set();
+}
+
+static void cfag12864b_e(unsigned char state)
+{
+ cfag12864b_setbit(state, CFAG12864B_BIT_E);
+}
+
+static void cfag12864b_cs1(unsigned char state)
+{
+ cfag12864b_setbit(state, CFAG12864B_BIT_CS1);
+}
+
+static void cfag12864b_cs2(unsigned char state)
+{
```

[PATCH 2.6.18 V7] drivers: add lcd display support

```
+ cfag12864b_setbit(state, CFAG12864B_BIT_CS2);
+}
+
+static void cfag12864b_di(unsigned char state)
+{
+ cfag12864b_setbit(state, CFAG12864B_BIT_DI);
+}
+
+static void cfag12864b_setcontrollers(unsigned char first, unsigned char second)
+{
+ if (first)
+ cfag12864b_cs1(0);
+ else
+ cfag12864b_cs1(1);
+
+ if (second)
+ cfag12864b_cs2(0);
+ else
+ cfag12864b_cs2(1);
+}
+
+static void cfag12864b_controller(unsigned char which)
+{
+ if (which == 0)
+ cfag12864b_setcontrollers(1, 0);
+ else if (which == 1)
+ cfag12864b_setcontrollers(0, 1);
+}
+
+static void cfag12864b_displaystate(unsigned char state)
+{
+ cfag12864b_di(0);
+ cfag12864b_e(1);
+ ks0108_displaystate(state);
+ cfag12864b_e(0);
+}
+
+static void cfag12864b_address(unsigned char address)
+{
+ cfag12864b_di(0);
+ cfag12864b_e(1);
+ ks0108_address(address);
+ cfag12864b_e(0);
+}
+
+static void cfag12864b_page(unsigned char page)
+{
+ cfag12864b_di(0);
+ cfag12864b_e(1);
+ ks0108_page(page);
+ cfag12864b_e(0);
```

[PATCH 2.6.18 V7] drivers: add lcd display support

```
+}
+
+static void cfag12864b_startline(unsigned char startline)
+{
+ cfag12864b_di(0);
+ cfag12864b_e(1);
+ ks0108_startline(startline);
+ cfag12864b_e(0);
+}
+
+static void cfag12864b_writebyte(unsigned char byte)
+{
+ cfag12864b_di(1);
+ cfag12864b_e(1);
+ ks0108_writedata(byte);
+ cfag12864b_e(0);
+}
+
+static void cfag12864b_nop(void)
+{
+ cfag12864b_startline(0);
+}
+
+/*
+ * Auxiliary
+ */
+
+static void normalizeoffset(unsigned int *offset)
+{
+ if (*offset >= CFAG12864B_PAGES * CFAG12864B_ADDRESSES)
+ *offset -= CFAG12864B_PAGES * CFAG12864B_ADDRESSES;
+}
+
+static unsigned char calcaddress(unsigned int offset)
+{
+ normalizeoffset(&offset);
+ return offset % CFAG12864B_ADDRESSES;
+}
+
+static unsigned char calcontroller(unsigned int offset)
+{
+ if (offset < CFAG12864B_PAGES * CFAG12864B_ADDRESSES)
+ return 0;
+ return 1;
+}
+
+static unsigned char calcpage(unsigned int offset)
+{
+ normalizeoffset(&offset);
+ return offset / CFAG12864B_ADDRESSES;
+}
```

[PATCH 2.6.18 V7] drivers: add lcd display support

```
+
+/*
+ * cfag12864b Internal Commands (don't lock)
+ */
+
+void cfag12864b_on_nolock(void)
+{
+ cfag12864b_setcontrollers(1, 1);
+ cfag12864b_displaystate(1);
+}
+
+void cfag12864b_off_nolock(void)
+{
+ cfag12864b_setcontrollers(1, 1);
+ cfag12864b_displaystate(0);
+}
+
+void cfag12864b_clear_nolock(void)
+{
+ unsigned char i,j;
+
+ cfag12864b_setcontrollers(1, 1);
+ for (i = 0; i < CFAG12864B_PAGES; i++) {
+ cfag12864b_page(i);
+ cfag12864b_address(0);
+ for (j = 0; j < CFAG12864B_ADDRESSES; j++)
+ cfag12864b_writebyte(0);
+ }
+}
+
+void cfag12864b_write_nolock(unsigned short offset, const unsigned char *buffer,
+ unsigned short count)
+{
+ unsigned short i;
+
+ /* Invalid values: They get updated at the first cycle */
+ unsigned char controller = 0xFF;
+ unsigned char page = 0xFF;
+ unsigned char address = 0xFF;
+
+ unsigned char tmpcontroller, tmppage, tmpaddress;
+
+ if (offset > CFAG12864B_SIZE)
+ return;
+ if (count + offset > CFAG12864B_SIZE)
+ count = CFAG12864B_SIZE - offset;
+
+ for (i = 0; i < count; i++, offset++, address++) {
+ tmpcontroller = calcontroller(offset);
+ tmppage = calcpage(offset);
+ tmpaddress = calcaddress(offset);
```

[PATCH 2.6.18 V7] drivers: add lcd display support

```
+
+ if (controller != tmpcontroller) {
+ controller = tmpcontroller;
+ cfag12864b_controller(controller);
+ cfag12864b_nop();
+ }
+ if (page != tmppage) {
+ page = tmppage;
+ cfag12864b_page(page);
+ cfag12864b_nop();
+ }
+
+ /* Safe method, still quick */
+ cfag12864b_address(tmpaddress);
+ cfag12864b_nop();
+
+ /* Dummy */
+ cfag12864b_nop();
+
+ cfag12864b_writebyte(buffer[i]);
+ }
+}
+
+void cfag12864b_format_nolock(unsigned char *src)
+{
+ unsigned short i, j, k, n;
+
+ for (i = 0; i < CFAG12864B_CONTROLLERS; i++)
+ for (j = 0; j < CFAG12864B_PAGES; j++)
+ for (k = 0; k < CFAG12864B_ADDRESSES; k++) {
+ cfag12864b_buffer[(i * CFAG12864B_PAGES + j) * CFAG12864B_ADDRESSES + k] = 0;
+ for (n = 0; n < 8; n++)
+ if (src[i * CFAG12864B_ADDRESSES + k + (j * 8 + n) * CFAG12864B_WIDTH])
+ cfag12864b_buffer[(i * CFAG12864B_PAGES + j) * CFAG12864B_ADDRESSES + k] |= bit(n);
+ }
+
+ cfag12864b_write_nolock(0, cfag12864b_buffer, CFAG12864B_SIZE);
+}
+
+/*
+ * cfag12864b Exported Commands (do lock)
+ */
+
+void cfag12864b_on(void)
+{
+ if (down_interruptible(&cfag12864b_mutex))
+ return;
+
+ cfag12864b_on_nolock();
+
+ up(&cfag12864b_mutex);
```

[PATCH 2.6.18 V7] drivers: add lcd display support

```
+}
+
+void cfag12864b_off(void)
+{
+ if (down_interruptible(&cfag12864b_mutex))
+ return;
+
+ cfag12864b_off_nolock();
+
+ up (&cfag12864b_mutex);
+}
+
+void cfag12864b_clear(void)
+{
+ if (down_interruptible(&cfag12864b_mutex))
+ return;
+
+ cfag12864b_clear_nolock();
+
+ up(&cfag12864b_mutex);
+}
+
+void cfag12864b_write(unsigned short offset, const unsigned char *buffer,
+ unsigned short count)
+{
+ if (down_interruptible(&cfag12864b_mutex))
+ return;
+
+ cfag12864b_write_nolock(offset, buffer, count);
+
+ up(&cfag12864b_mutex);
+}
+
+void cfag12864b_format(unsigned char *src)
+{
+ if (down_interruptible(&cfag12864b_mutex))
+ return;
+
+ cfag12864b_format_nolock(src);
+
+ up(&cfag12864b_mutex);
+}
+
+EXPORT_SYMBOL_GPL(cfag12864b_on);
+EXPORT_SYMBOL_GPL(cfag12864b_off);
+EXPORT_SYMBOL_GPL(cfag12864b_clear);
+EXPORT_SYMBOL_GPL(cfag12864b_write);
+EXPORT_SYMBOL_GPL(cfag12864b_format);
+
+/*
+ * cfag12864b ioctls (don't lock because ioctl fop do)
```

[PATCH 2.6.18 V7] drivers: add lcd display support

```
+ */
+
+static int cfag12864b_fopioctlformat(void __user *arg)
+{
+ int result;
+ int ret = -ENOTTY;
+
+ result = copy_from_user(cfag12864b_formatbuffer, arg,
+ sizeof(unsigned char) * CFAG12864B_MATRIXSIZE);
+ if (result != 0) {
+ printk(KERN_ERR CFAG12864B_NAME ": FOP ioctl: ERROR: "
+ "can't copy memory from user\n");
+ goto none;
+ }
+
+ cfag12864b_format_nolock(cfag12864b_formatbuffer);
+
+ ret = 0;
+
+none:
+ return ret;
+}
+
+/*
+ * cfag12864b_fops (do lock)
+ */
+
+static loff_t cfag12864b_fopseek(struct file *filp, loff_t offset, int whence)
+{
+ loff_t ret = -EINVAL;
+
+ if (down_interruptible(&cfag12864b_mutex))
+ return -ERESTARTSYS;
+
+ switch (whence) {
+ case SEEK_SET:
+ ret = offset;
+ break;
+ case SEEK_CUR:
+ ret = filp->f_pos + offset;
+ break;
+ case SEEK_END:
+ ret = CFAG12864B_SIZE + offset;
+ break;
+ }
+
+ if (ret < 0) {
+ ret = -EINVAL;
+ goto none;
+ }
+
+}
```

[PATCH 2.6.18 V7] drivers: add lcd display support

```
+ filp->f_pos = ret;
+
+none:
+ up(&cfag12864b_mutex);
+ return ret;
+}
+
+
+static ssize_t cfag12864b_fopwrite(struct file *filp,
+ const char __user *buffer, size_t count, loff_t *offset)
+{
+ int ret = -EINVAL;
+ int result;
+
+ if (down_interruptible(&cfag12864b_mutex))
+ return -ERESTARTSYS;
+
+ if (*offset > CFAG12864B_SIZE) {
+ ret = 0;
+ goto none;
+ }
+ if (*offset + count > CFAG12864B_SIZE)
+ count = CFAG12864B_SIZE - *offset;
+
+ result = copy_from_user(cfag12864b_buffer, buffer, count);
+ if (result != 0) {
+ printk(KERN_ERR CFAG12864B_NAME ": FOP write: ERROR: "
+ "can't copy memory from user\n");
+ ret = -EFAULT;
+ goto none;
+ }
+
+ cfag12864b_write_nolock(*offset, cfag12864b_buffer, count);
+
+ *offset += count;
+ ret = count;
+
+none:
+ up(&cfag12864b_mutex);
+ return ret;
+}
+
+
+static int cfag12864b_fopioctl(struct inode *inode, struct file *filp,
+ unsigned int cmd, unsigned long arg)
+{
+ int ret = -ENOTTY;
+
+ if (down_interruptible(&cfag12864b_mutex))
+ return -ERESTARTSYS;
+
+ if (_IOC_TYPE(cmd) != CFAG12864B_IOC_MAGIC)
```

[PATCH 2.6.18 V7] drivers: add lcd display support

```
+ goto none;
+ if (_IOC_NR(cmd) > CFAG12864B_IOC_MAXNR)
+ goto none;
+
+ switch (cmd) {
+ case CFAG12864B_IOCON:
+ cfag12864b_on_nolock();
+ ret = 0;
+ break;
+ case CFAG12864B_IOCOFF:
+ cfag12864b_off_nolock();
+ ret = 0;
+ break;
+ case CFAG12864B_IOCCLEAR:
+ cfag12864b_clear_nolock();
+ ret = 0;
+ break;
+ case CFAG12864B_IOCFORMAT:
+ ret = cfag12864b_fopiocformat((void __user *)arg);
+ }
+
+none:
+ up(&cfag12864b_mutex);
+ return ret;
+}
+
+static const struct file_operations cfag12864b_fops =
+{
+ .owner = THIS_MODULE,
+ .llseek = cfag12864b_fopseek,
+ .write = cfag12864b_fopwrite,
+ .ioctl = cfag12864b_fopioc,
+};
+
+/*
+ * Module Init & Exit
+ */
+
+static int __init cfag12864b_init(void)
+{
+ int result;
+ int ret = -EINVAL;
+
+ cfag12864b_buffer = kmalloc(sizeof(unsigned char) * CFAG12864B_SIZE,
+ GFP_KERNEL);
+ if (cfag12864b_buffer == NULL) {
+ printk(KERN_ERR CFAG12864B_NAME ": ERROR: "
+ "can't alloc buffer (%i bytes)\n", CFAG12864B_SIZE);
+ ret = -ENOMEM;
+ goto none;
+ }
+}
```

[PATCH 2.6.18 V7] drivers: add lcd display support

```
+
+ cfag12864b_formatbuffer = kmalloc(sizeof(unsigned char) * CFAG12864B_MATRIXSIZE,
+ GFP_KERNEL);
+ if (cfag12864b_formatbuffer == NULL) {
+ printk(KERN_ERR CFAG12864B_NAME ": ERROR: "
+ "can't alloc format buffer (%i bytes)\n", CFAG12864B_MATRIXSIZE);
+ ret = -ENOMEM;
+ goto bufferallocated;
+ }
+
+ result = alloc_chrdev_region(&cfag12864b_device, cfag12864b_firstminor,
+ cfag12864b_ndevices, CFAG12864B_NAME);
+ if (result < 0) {
+ printk(KERN_ERR CFAG12864B_NAME ": ERROR: "
+ "can't alloc the char device region\n");
+ ret = result;
+ goto formatbufferallocated;
+ }
+
+ cfag12864b_major = MAJOR(cfag12864b_device);
+ cfag12864b_minor = cfag12864b_firstminor;
+ cfag12864b_device = MKDEV(cfag12864b_major, cfag12864b_minor);
+
+ cfag12864b_clear_nolock();
+ cfag12864b_on_nolock();
+
+ cdev_init(&cfag12864b_chardevice, &cfag12864b_fops);
+ cfag12864b_chardevice.owner = THIS_MODULE;
+ cfag12864b_chardevice.ops = &cfag12864b_fops;
+ result = cdev_add(&cfag12864b_chardevice, cfag12864b_device,
+ cfag12864b_ndevices);
+ if (result < 0) {
+ printk(KERN_ERR CFAG12864B_NAME ": ERROR: "
+ "unable to add a new char device\n");
+ ret = result;
+ goto regionallocated;
+ }
+
+ if (class_device_create(lcddisplay_class, NULL, cfag12864b_device, NULL,
+ "cfag12864b%d", cfag12864b_minor) == NULL) {
+ printk(KERN_ERR CFAG12864B_NAME ": ERROR: "
+ "unable to create a device class\n");
+ ret = -EINVAL;
+ goto cdevadded;
+ }
+
+ printk(KERN_DEBUG CFAG12864B_NAME ": Initd\n");
+
+ return 0;
+
+cdevadded:
```

[PATCH 2.6.18 V7] drivers: add lcd display support

```
+ cdev_del(&cfag12864b_chardevice);
+
+regionallocated:
+ unregister_chrdev_region(cfag12864b_device, cfag12864b_ndevices);
+
+formatbufferallocated:
+ kfree(cfag12864b_formatbuffer);
+
+bufferallocated:
+ kfree(cfag12864b_buffer);
+
+none:
+ return ret;
+}
+
+static void __exit cfag12864b_exit(void)
+{
+ cfag12864b_off_nolock();
+
+ class_device_destroy(lcddisplay_class, cfag12864b_device);
+ cdev_del(&cfag12864b_chardevice);
+ unregister_chrdev_region(cfag12864b_device, cfag12864b_ndevices);
+ kfree(cfag12864b_formatbuffer);
+ kfree(cfag12864b_buffer);
+
+ printk(KERN_DEBUG CFAG12864B_NAME ": Exited\n");
+}
+
+module_init(cfag12864b_init);
+module_exit(cfag12864b_exit);
+
+MODULE_LICENSE("GPL");
+MODULE_AUTHOR("Miguel Ojeda Sandonis <maxextreme@xxxxxxxx>");
+MODULE_DESCRIPTION("cfag12864b LCD display driver");
diff -uprN -X dontdiff linux-2.6.18-vanilla/drivers/lcddisplay/Kconfig
linux-2.6.18/drivers/lcddisplay/Kconfig
--- linux-2.6.18-vanilla/drivers/lcddisplay/Kconfig 1970-01-01 00:00:00.000000000 +0000
+++ linux-2.6.18/drivers/lcddisplay/Kconfig 2006-10-01 00:35:27.000000000 +0000
@@ -0,0 +1,106 @@
+#
+# For a description of the syntax of this configuration file,
+# see Documentation/kbuild/kconfig-language.txt.
+#
+# LCD Display drivers configuration.
+#
+# Maintainer: Miguel Ojeda Sandonis <maxextreme@xxxxxxxx>
+#
+
+menu "LCD Display support"
+
+config LCDDISPLAY
```

## [PATCH 2.6.18 V7] drivers: add lcd display support

```
+ tristate "LCD Display support"
+ default n
+ ---help---
+ If you have a LCD display, say Y.
+
+ To compile this as a module, choose M here:
+ the module will be called lcddisplay.
+
+ Most LCD drivers use an I/O port (like the parallel port)
+ so you will need to say Y or M for them.
+
+ If unsure, say N.
+
+comment "Parallel port dependent:"
+
+config KS0108
+ tristate "KS0108 LCD Controller"
+ depends on LCDDISPLAY && PARPORT
+ default n
+ ---help---
+ If you have an LCD display controlled by one or more KS0108
+ controllers, say Y. You will need also another more specific
+ driver for your LCD.
+
+ Depends on Parallel Port support. If you say Y at
+ parport, you will be able to compile this as a module (M)
+ and built-in as well (Y).
+
+ To compile this as a module, choose M here:
+ the module will be called ks0108.
+
+ If unsure, say N.
+
+config KS0108_PORT
+ hex "Parallel port where the LCD is connected"
+ depends on KS0108
+ default 0x378
+ ---help---
+ The address of the parallel port where the LCD is connected.
+
+ The first standard parallel port address is 0x378.
+ The second standard parallel port address is 0x278.
+ The third standard parallel port address is 0x3BC.
+
+ You can specify a different address if you need.
+
+ If you don't know what I'm talking about, load the parport module,
+ and execute "dmesg" or "cat /proc/ioports". You can see there how
+ many parallel ports are present and which address each one has.
+
+ Usually you only need to use 0x378.
```

[PATCH 2.6.18 V7] drivers: add lcd display support

```
+
+ If you compile this as a module, you can still override this
+ using the module parameters.
+
+config KS0108_DELAY
+ int "Delay between each control writing (microseconds)"
+ depends on KS0108
+ default "2"
+ ---help---
+ Amount of time the ks0108 should wait between each control write
+ to the parallel port.
+
+ If your driver seems to miss random writings, increment this.
+
+ If you don't know what I'm talking about, ignore it.
+
+ If you compile this as a module, you can still override this
+ value using the module parameters.
+
+config CFAG12864B
+ tristate "CFAG12864B LCD Display"
+ depends on KS0108
+ default n
+ ---help---
+ If you have a Crystalfontz 128x64 2-color LCD display,
+ cfag12864b Series, say Y. You also need the ks0108 LCD
+ Controller driver.
+
+ For help about how to wire your LCD to the parallel port,
+ check this image:
+
+ http://www.skippari.net/lcd/sekalaista/crystalfontz\_cfag12864B-TMI-V.png
+
+ Also, you can find help in Crystalfontz and LCDStudio forums.
+ Check Documentation/lcddisplay/cfag12864b for more information.
+
+ To compile this as a module, choose M here:
+ the module will be called cfag12864b.
+
+ If unsure, say N.
+
+endmenu
+
diff -uprN -X dontdiff linux-2.6.18-vanilla/drivers/lcddisplay/ks0108.c
linux-2.6.18/drivers/lcddisplay/ks0108.c
--- linux-2.6.18-vanilla/drivers/lcddisplay/ks0108.c 1970-01-01 00:00:00.000000000 +0000
+++ linux-2.6.18/drivers/lcddisplay/ks0108.c 2006-10-01 00:02:51.000000000 +0000
@@ -0,0 +1,171 @@
+/*
+ * Filename: ks0108.c
+ * Version: 0.1.0
```

[PATCH 2.6.18 V7] drivers: add lcd display support

```
+ * Description: ks0108 LCD display controller driver
+ * License: GPLv2 or later
+ * Depends: parport
+ *
+ * Author: Copyright (C) Miguel Ojeda Sandonis <maxextreme@xxxxxxxxxx>
+ * Date: 2006-09-30
+ *
+ * This program is free software; you can redistribute it and/or modify
+ * it under the terms of the GNU General Public License as published by
+ * the Free Software Foundation; either version 2 of the License, or
+ * (at your option) any later version.
+ *
+ * This program is distributed in the hope that it will be useful,
+ * but WITHOUT ANY WARRANTY; without even the implied warranty of
+ * MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE. See the
+ * GNU General Public License for more details.
+ *
+ * You should have received a copy of the GNU General Public License
+ * along with this program; if not, write to the Free Software
+ * Foundation, Inc., 59 Temple Place, Suite 330, Boston, MA 02111-1307 USA
+ *
+ */
+
+#include <linux/init.h>
+#include <linux/module.h>
+#include <linux/kernel.h>
+#include <linux/fs.h>
+#include <linux/delay.h>
+#include <linux/parport.h>
+#include <linux/ks0108.h>
+#include <asm/io.h>
+#include <asm/uaccess.h>
+
+#define KS0108_NAME "ks0108"
+
+/*
+ * Module Parameters
+ */
+
+static unsigned int ks0108_port = CONFIG_KS0108_PORT;
+module_param(ks0108_port, uint, S_IRUGO);
+MODULE_PARM_DESC(ks0108_port, "Parallel port where the LCD is connected");
+
+static unsigned int ks0108_delay = CONFIG_KS0108_DELAY;
+module_param(ks0108_delay, uint, S_IRUGO);
+MODULE_PARM_DESC(ks0108_delay, "Delay between each control writing (microseconds)");
+
+/*
+ * Device
+ */
+
```

## [PATCH 2.6.18 V7] drivers: add lcd display support

```
+static struct parport *ks0108_parport;
+static struct pardevice *ks0108_pardevice;
+
+/*
+ * ks0108 Exported cmds (don't lock)
+ *
+ * You should lock in the top driver: This functions should not
+ * get race conditions in any way. Locking for each byte here would be
+ * so slow and useless.
+ *
+ * There are not bit definitions because they are not flags,
+ * just arbitrary combinations defined by the documentation for each
+ * function in the ks0108 LCD controller. If you want to know what means
+ * a specific combination, look at the function's name.
+ *
+ * The ks0108_writecontrol bits need to be reverted ^(0,1,3) because
+ * the parallel port also revert them with a "not" logic gate.
+ */
+
+#define bit(n) (((unsigned char)1)<<(n))
+
+void ks0108_writedata(unsigned char byte)
+{
+ parport_write_data(ks0108_parport, byte);
+}
+
+void ks0108_writecontrol(unsigned char byte)
+{
+ udelay(ks0108_delay);
+ parport_write_control(ks0108_parport, byte ^ (bit(0) | bit(1) | bit(3)));
+}
+
+void ks0108_displaystate(unsigned char state)
+{
+ ks0108_writedata((state ? bit(0) : 0) | bit(1) | bit(2) | bit(3) | bit(4) | bit(5));
+}
+
+void ks0108_startline(unsigned char startline)
+{
+ ks0108_writedata(min(startline,(unsigned char)63) | bit(6) | bit(7));
+}
+
+void ks0108_address(unsigned char address)
+{
+ ks0108_writedata(min(address,(unsigned char)63) | bit(6));
+}
+
+void ks0108_page(unsigned char page)
+{
+ ks0108_writedata(min(page,(unsigned char)7) | bit(3) | bit(4) | bit(5) | bit(7));
+}
```

[PATCH 2.6.18 V7] drivers: add lcd display support

```
+
+EXPORT_SYMBOL_GPL(ks0108_writedata);
+EXPORT_SYMBOL_GPL(ks0108_writecontrol);
+EXPORT_SYMBOL_GPL(ks0108_displaystate);
+EXPORT_SYMBOL_GPL(ks0108_startline);
+EXPORT_SYMBOL_GPL(ks0108_address);
+EXPORT_SYMBOL_GPL(ks0108_page);
+
+/*
+ * Module Init & Exit
+ */
+
+static int __init ks0108_init(void)
+{
+ int result;
+ int ret = -EINVAL;
+
+ ks0108_parport = parport_find_base(ks0108_port);
+ if (ks0108_parport == NULL) {
+ printk(KERN_ERR KS0108_NAME ": ERROR: "
+ "parport didn't find %i port\n", ks0108_port);
+ goto none;
+ }
+
+ ks0108_pardevice = parport_register_device(ks0108_parport, KS0108_NAME,
+ NULL, NULL, NULL, PARPORT_DEV_EXCL, NULL);
+ if (ks0108_pardevice == NULL) {
+ printk(KERN_ERR KS0108_NAME ": ERROR: "
+ "parport didn't register new device\n");
+ goto none;
+ }
+
+ result = parport_claim(ks0108_pardevice);
+ if (result != 0) {
+ printk(KERN_ERR KS0108_NAME ": ERROR: "
+ "can't claim %i parport, maybe in use\n", ks0108_port);
+ ret = result;
+ goto registered;
+ }
+
+ printk(KERN_DEBUG KS0108_NAME ": Initd - ks0108_port=0x%X ks0108_delay=%i\n",
+ ks0108_port, ks0108_delay);
+ return 0;
+
+ registered:
+ parport_unregister_device(ks0108_pardevice);
+
+ none:
+ return ret;
+ }
+
```

[PATCH 2.6.18 V7] drivers: add lcd display support

```
+static void __exit ks0108_exit(void)
+{
+ parport_release(ks0108_pardevice);
+ parport_unregister_device(ks0108_pardevice);
+
+ printk(KERN_DEBUG KS0108_NAME ": Exited\n");
+}
+
+module_init(ks0108_init);
+module_exit(ks0108_exit);
+
+MODULE_LICENSE("GPL");
+MODULE_AUTHOR("Miguel Ojeda Sandonis <maxextreme@xxxxxxxx>");
+MODULE_DESCRIPTION("ks0108 LCD controller driver");
+
diff -uprN -X dontdiff linux-2.6.18-vanilla/drivers/lcddisplay/lcddisplay.c
linux-2.6.18/drivers/lcddisplay/lcddisplay.c
--- linux-2.6.18-vanilla/drivers/lcddisplay/lcddisplay.c 1970-01-01 00:00:00.000000000 +0000
+++ linux-2.6.18/drivers/lcddisplay/lcddisplay.c 2006-10-01 00:02:40.000000000 +0000
@@ -0,0 +1,79 @@
+/*
+ * Filename: lcddisplay.c
+ * Version: 0.1.0
+ * Description: LCD display class
+ * License: GPLv2 or later
+ * Depends: -
+ *
+ * Author: Copyright (C) Miguel Ojeda Sandonis <maxextreme@xxxxxxxx>
+ * Date: 2006-09-28
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+ * along with this program; if not, write to the Free Software
+ * Foundation, Inc., 59 Temple Place, Suite 330, Boston, MA 02111-1307 USA
+ */
+
+#include <linux/init.h>
+#include <linux/module.h>
+#include <linux/kernel.h>
+#include <linux/fs.h>
+#include <linux/device.h>
```

[PATCH 2.6.18 V7] drivers: add lcd display support

```
+#include <linux/lcddisplay.h>
+
+#define LCDDISPLAY_NAME "lcddisplay"
+
+/*
+ * Exported Display Data
+ */
+
+struct class *lcddisplay_class;
+EXPORT_SYMBOL_GPL(lcddisplay_class);
+
+/*
+ * Module Init & Exit
+ */
+
+static int __init lcddisplay_init(void)
+{
+ int ret = -EINVAL;
+
+ lcddisplay_class = class_create(THIS_MODULE, LCDDISPLAY_NAME);
+ if (IS_ERR(lcddisplay_class)) {
+ printk(KERN_ERR LCDDISPLAY_NAME ": ERROR: "
+ "can't create %s class\n", LCDDISPLAY_NAME);
+ goto none;
+ }
+
+ printk(KERN_DEBUG LCDDISPLAY_NAME ": Inited\n");
+
+ return 0;
+
+none:
+ return ret;
+}
+
+static void __exit lcddisplay_exit(void)
+{
+ class_destroy(lcddisplay_class);
+
+ printk(KERN_DEBUG LCDDISPLAY_NAME ": Exited\n");
+}
+
+module_init(lcddisplay_init);
+module_exit(lcddisplay_exit);
+
+MODULE_LICENSE("GPL");
+MODULE_AUTHOR("Miguel Ojeda Sandonis <maxextreme@xxxxxxxx>");
+MODULE_DESCRIPTION("lcddisplay class");
+
diff -uprN -X dontdiff linux-2.6.18-vanilla/drivers/lcddisplay/Makefile
linux-2.6.18/drivers/lcddisplay/Makefile
--- linux-2.6.18-vanilla/drivers/lcddisplay/Makefile 1970-01-01 00:00:00.000000000 +0000
```

## [PATCH 2.6.18 V7] drivers: add lcd display support

```
+++ linux-2.6.18/drivers/lcddisplay/Makefile 2006-09-27 19:15:13.000000000 +0000
@@ -0,0 +1,7 @@
+#
+# Makefile for the kernel LCD Display device drivers.
+#
+
+obj-$(CONFIG_LCDDISPLAY) += lcddisplay.o
+obj-$(CONFIG_KS0108) += ks0108.o
+obj-$(CONFIG_CFAG12864B) += cfag12864b.o
diff -uprN -X dontdiff linux-2.6.18-vanilla/drivers/Makefile linux-2.6.18/drivers/Makefile
--- linux-2.6.18-vanilla/drivers/Makefile 2006-09-20 03:42:06.000000000 +0000
+++ linux-2.6.18/drivers/Makefile 2006-09-27 19:15:13.000000000 +0000
@@ -76,3 +76,4 @@ obj-$(CONFIG_CRYPT0) += crypto/
obj-$(CONFIG_SUPERH) += sh/
obj-$(CONFIG_GENERIC_TIME) += clocksource/
obj-$(CONFIG_DMA_ENGINE) += dma/
+obj-$(CONFIG_LCDDISPLAY) += lcddisplay/
diff -uprN -X dontdiff linux-2.6.18-vanilla/include/linux/cfag12864b.h
linux-2.6.18/include/linux/cfag12864b.h
--- linux-2.6.18-vanilla/include/linux/cfag12864b.h 1970-01-01 00:00:00.000000000 +0000
+++ linux-2.6.18/include/linux/cfag12864b.h 2006-09-30 23:18:44.000000000 +0000
@@ -0,0 +1,58 @@
+/*
+ * Filename: cfag12864b.h
+ * Version: 0.1.0
+ * Description: cfag12864b LCD Display Driver Header
+ * License: GPLv2 or later
+ *
+ * Author: Copyright (C) Miguel Ojeda Sandonis <maxextreme@xxxxxxxxxx>
+ * Date: 2006-09-28
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+ * along with this program; if not, write to the Free Software
+ * Foundation, Inc., 59 Temple Place, Suite 330, Boston, MA 02111-1307 USA
+ */
+
+#ifndef _CFAG12864B_H_
+#define _CFAG12864B_H_
+
+#include <linux/ioctl.h>
```

[PATCH 2.6.18 V7] drivers: add lcd display support

```
+
+#define CFAG12864B_WIDTH (128)
+#define CFAG12864B_HEIGHT (64)
+#define CFAG12864B_MATRIXSIZE ((CFAG12864B_WIDTH) * (CFAG12864B_HEIGHT))
+
+#define CFAG12864B_CONTROLLERS (2)
+#define CFAG12864B_PAGES (8)
+#define CFAG12864B_ADDRESSES (64)
+#define CFAG12864B_SIZE ((CFAG12864B_CONTROLLERS) * \
+ (CFAG12864B_PAGES) * \
+ (CFAG12864B_ADDRESSES))
+
+#define CFAG12864B_IOC_MAGIC (0xFF)
+#define CFAG12864B_IOC_MAXNR (0x03)
+
+#define CFAG12864B_IOCOFF (_IO((CFAG12864B_IOC_MAGIC),0))
+#define CFAG12864B_IOCON (_IO((CFAG12864B_IOC_MAGIC),1))
+#define CFAG12864B_IOCLEAR (_IO((CFAG12864B_IOC_MAGIC),2))
+#define CFAG12864B_IOCFORMAT (_IOW((CFAG12864B_IOC_MAGIC),3,void *))
+
+extern void cfag12864b_on(void);
+extern void cfag12864b_off(void);
+extern void cfag12864b_clear(void);
+extern void cfag12864b_write(unsigned short offset,
+ const unsigned char *buffer, unsigned short count);
+extern void cfag12864b_format(unsigned char *src);
+
+#endif /* _CFAG12864B_H_ */
+
diff -uprN -X dontdiff linux-2.6.18-vanilla/include/linux/ks0108.h linux-2.6.18/include/linux/ks0108.h
--- linux-2.6.18-vanilla/include/linux/ks0108.h 1970-01-01 00:00:00.000000000 +0000
+++ linux-2.6.18/include/linux/ks0108.h 2006-09-28 19:59:51.000000000 +0000
@@ -0,0 +1,36 @@
+/*
+ * Filename: ks0108.h
+ * Version: 0.1.0
+ * Description: ks0108 LCD Display Controller Driver Header
+ * License: GPLv2 or later
+ *
+ * Author: Copyright (C) Miguel Ojeda Sandonis <maxextreme@xxxxxxxx>
+ * Date: 2006-09-28
+ *
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```

[PATCH 2.6.18 V7] drivers: add lcd display support

```
+ *
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+ * along with this program; if not, write to the Free Software
+ * Foundation, Inc., 59 Temple Place, Suite 330, Boston, MA 02111-1307 USA
+ *
+ */
+
+#ifndef _KS0108_H_
+#define _KS0108_H_
+
+extern void ks0108_writedata(unsigned char byte);
+extern void ks0108_writecontrol(unsigned char byte);
+extern void ks0108_displaystate(unsigned char state);
+extern void ks0108_startline(unsigned char startline);
+extern void ks0108_address(unsigned char address);
+extern void ks0108_page(unsigned char page);
+
+#endif /* _KS0108_H_ */
diff -uprN -X dontdiff linux-2.6.18-vanilla/include/linux/lcddisplay.h
linux-2.6.18/include/linux/lcddisplay.h
--- linux-2.6.18-vanilla/include/linux/lcddisplay.h 1970-01-01 00:00:00.000000000 +0000
+++ linux-2.6.18/include/linux/lcddisplay.h 2006-09-28 19:59:44.000000000 +0000
@@ -0,0 +1,34 @@
+/*
+ * Filename: lcddisplay.h
+ * Version: 0.1.0
+ * Description: Display Class Header
+ * License: GPLv2 or later
+ *
+ * Author: Copyright (C) Miguel Ojeda Sandonis <maxextreme@xxxxxxxxxx>
+ * Date: 2006-09-28
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+ * along with this program; if not, write to the Free Software
+ * Foundation, Inc., 59 Temple Place, Suite 330, Boston, MA 02111-1307 USA
+ *
+ */
+
+#ifndef _LCDDISPLAY_H_
+#define _LCDDISPLAY_H_
+
```

[PATCH 2.6.18 V7] drivers: add lcd display support

```
+#include <linux/device.h>
+
+extern struct class *lccdisplay_class;
+
+#endif /* _LCDDISPLAY_H_ */
+
diff -uprN -X dontdiff linux-2.6.18-vanilla/MAINTAINERS linux-2.6.18/MAINTAINERS
--- linux-2.6.18-vanilla/MAINTAINERS 2006-09-20 03:42:06.000000000 +0000
+++ linux-2.6.18/MAINTAINERS 2006-09-30 23:36:48.000000000 +0000
@@ -1707,6 +1707,12 @@ M: James.Bottomley@xxxxxxxxxxxxxxxxxxxxxxxxx
L: linux-scsi@xxxxxxxxxxxxxxxxxxxxx
S: Maintained
```

```
+LCD DISPLAY DRIVERS
+P: Miguel Ojeda Sandonis
+M: maxextreme@xxxxxxxxxx
+L: linux-kernel@xxxxxxxxxxxxxxxxxxxxx
+S: Maintained
```

```
+
LED SUBSYSTEM
P: Richard Purdie
M: rpurdie@xxxxxxxxxx
-
```

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