An Introduction to GPIO Programming

NUC980/NUC970 with Linux 5.10

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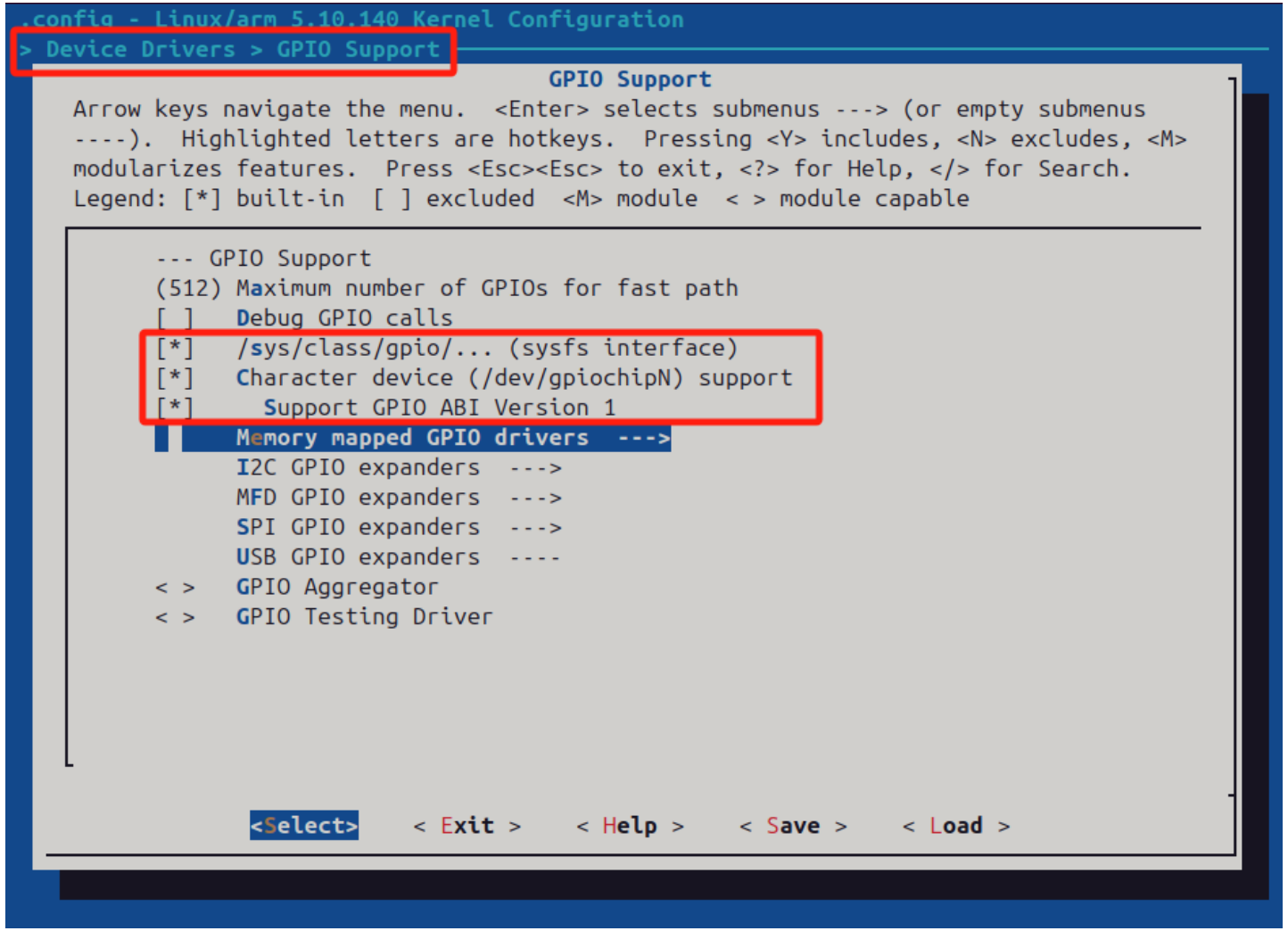
Configuring the Linux

- To access GPIO from user space, configure Linux to enable sysfs interface and support character device.

- Configure Linux within Buildroot
  $ make linux-menuconfig



Modifying the Device Tree

- Modify the Device Tree Source file
  <linux/arch/arm/boot/dts/nuc980.dtsi>
- In the device node entry apb:gpio:pinctrl_gpio:gpio-eint, configure 3 custom GPIO pins: PB8, PB13 and PG15

  1 0x08 0x0 0 /* PB8 */
  1 0x0D 0x0 0 /* PB13 */
  6 0x0F 0x0 0 /* PG15 */

- The GPIO pin number is defined in file
  <linux/arch/arm/mach-nuc980/include/mach/gpio.h>

```
gpio {
        pinctrl_gpio: gpio-eint {
                nuvoton,pins =
                        <
                         //0 0x0 0x5 0   /* eint0_A0 */
                         //0 0xD 0x8 0   /* eint0_A13 */

                         //0 0x1 0x5 0   /* eint1_A1 */
                         //0 0xE 0x6 0   /* eint1_A14 */

                         //3 0x0 0x4 0   /* eint2_D0 */
                         //4 0xA 0x5 0   /* eint2_E10 */
                         //1 0x3 0x3 0   /* eint2_B3 */
                         //1 0xD 0x2 0   /* eint2_B13 */

                         //3 0x1 0x4 0   /* eint3_D1 */
                         //4 0xC 0x5 0   /* eint3_E12 */
                         //6 0xF 0x4 0   /* eint3_G15 */

                         1 0x08 0x0 0      /* PB8  */
                         1 0x0D 0x0 0      /* PB13 */
                         6 0x0F 0x0 0      /* PG15 */
                        >;
        };
};

ccap0 {
        pinctrl_ccap0: ccap0 {
                nuvoton,pins =
```

Accessing GPIO from User Space

- Use GPIO from Linux shell

```
# echo 40 > /sys/class/gpio/export
# echo out > /sys/class/gpio/gpio40/direction
# echo 1 > /sys/class/gpio/gpio40/value
# echo 0 > /sys/class/gpio/gpio40/value
```

Accessing GPIO from Kernel Space

- Edit the device tree header file
  <linux/arch/arm/boot/dts/nuc980.dtsi>
- In the device node entry **apb:gpio:gpio@b0004000**, configure GPIO pins PB8, PB13 and PG15

```
gpios = <
   &gpio 0x28 GPIO_ACTIVE_LOW
   &gpio 0x2D GPIO_ACTIVE_LOW
   &gpio 0xCF GPIO_ACTIVE_LOW
>;
```

```
                /* 2nd: 0(PA1)/1(PA14) */
                /* 3rd: 0(both)/1(rasing)/2(falling)/3(heigh level)/4(low level) */
                eint1-config = <0 0 0>;

                /* 1st: 0(Disable)/1(Enable) */
                /* 2nd: 0(PD0)/1(PE10)/2(PB3)/3(PB13) */
                /* 3rd: 0(both)/1(rasing)/2(falling)/3(heigh level)/4(low level) */
                eint2-config = <0 3 0>;

                /* 1st: 0(Disable)/1(Enable) */
                /* 2nd: 0(PD1)/1(PE12)/2(PG15) */
                /* 3rd: 0(both)/1(rasing)/2(falling)/3(heigh level)/4(low level) */
                eint3-config = <0 2 0>;

                gpios = <
                    &gpio 0x28 GPIO_ACTIVE_LOW /* PB8  */
                    &gpio 0x2D GPIO_ACTIVE_LOW /* PB13 */
                    &gpio 0xCF GPIO_ACTIVE_LOW /* PG15 */
                >;

                status = "okay";
        };

        nadc: nadc@b0043000 {
                compatible = "nuvoton,nuc980-nadc";
                reg = <0xb0043000 0x100>;
                interrupts = <18 4 1>;
                map-addr = <0xf0043000>;
                pinctrl-names = "default";
                pinctrl-0 = <&pinctrl_nadc>;
```

Accessing GPIO from Kernel Space

- Edit the Linux GPIO driver source file **<linux/drivers/gpio/gpio-nuc980.c>**
- In probe function **nuc980_gpio_probe()**, add the code showed on the right side.

linux/drivers/gpio/gpio-nuc980.c

```
static int nuc980_gpio_probe(struct platform_device *pdev)
{
   int err, i, gpio_pin_count, gpio_pin_num;
   ...
   #ifdef CONFIG_GPIO_NUC980_EINT_WKUP
      nuc980_enable_eint(1, pdev);
   #else
      nuc980_enable_eint(0, pdev);
   #endif

   gpio_pin_count = of_gpio_count(pdev->dev.of_node);
   for (i = 0; i < gpio_pin_count; i++) {
      gpio_pin_num = of_get_gpio(pdev->dev.of_node, i);

      if (gpio_is_valid(gpio_pin_num)) {
         if (gpio_pin_num == NUC980_PG15) {
            gpio_direction_output(gpio_pin_num, 1);
         }

         if (gpio_pin_num == NUC980_PB13) {
            gpio_direction_input(gpio_pin_num);
         }
      }
   }
}
```

Joy of innovation

NUVOTON

谢谢

謝謝

Děkuji

Bedankt

Thank you

Kiitos

Merci

Danke

Grazie

ありがとう

감사합니다

Dziękujemy

Obrigado

Спасибо

Gracias

Teşekkür ederim

Cảm ơn