

# 03\_bringup



Moatasem Elsayed

# Content

1-Bringup Led

2-Bringup Mlx90614

3-update kernel

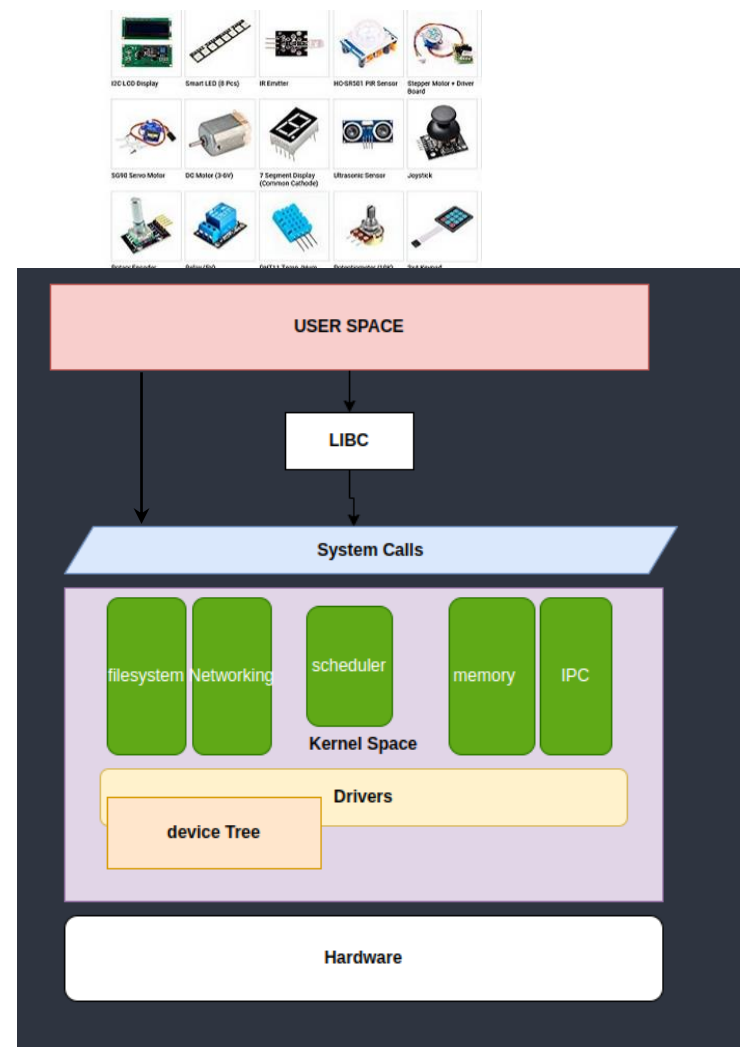
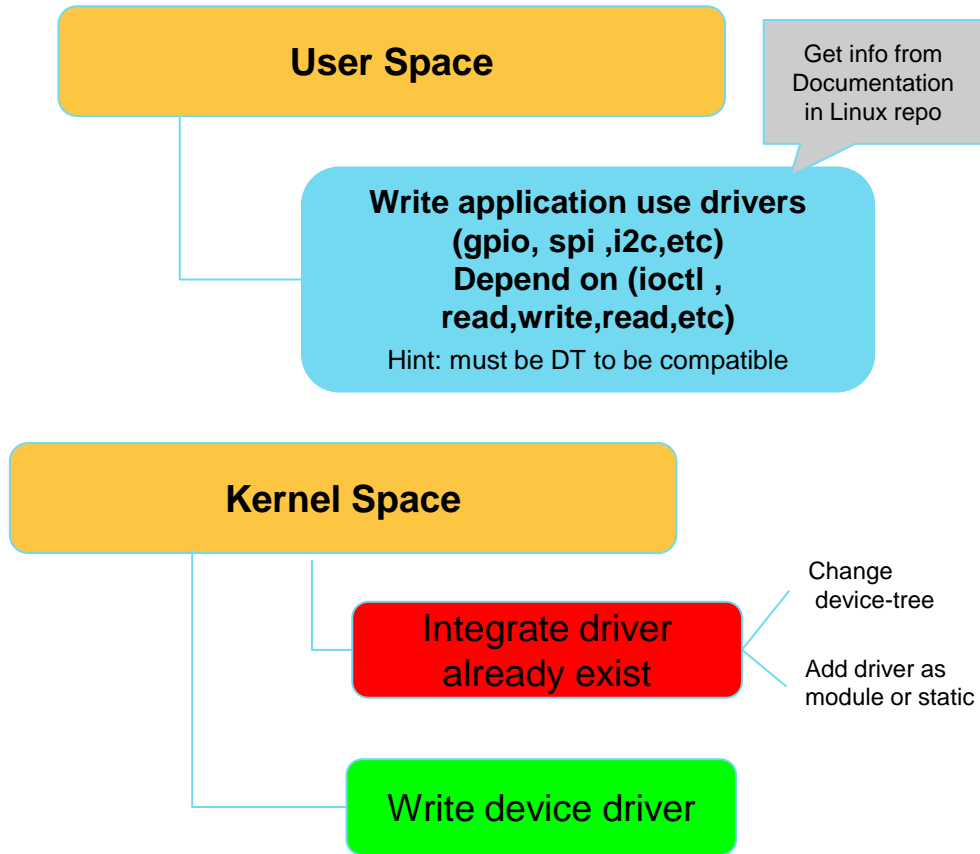
4-bluetoothctl

5-tasks

6-project

**Bringup LED  
Driver is Exist**

# Three options to integrate Hardware to ECU



# Update DTS

normally you already know which device tree binary you are used , but now in raspberry pi , you already have a lot of dtbs in system so how can I know which device tree I am using ?

```
pi@raspberrypi:~ $ ls /proc/device-tree -l
lrwxrwxrwx 1 root root 29 Nov 28 21:17 /proc/device-tree -> /sys/firmware/devicetree/base
pi@raspberrypi:~ $ cd /proc/device-tree
pi@raspberrypi:/proc/device-tree $ ls
'#address-cells'  __symbols__  axi          cam1_clk      chosen        cpus          interrupt-parent  memreserve    phy           reserved-memory  soc           timer
'#size-cells'    aliases      cam0_clk     cam1_regulator  clocks        fixedregulator_3v3  leds           model         reserved-memory  serial-number  system
__overrides__    arn-pmu      cam0_regulator  can_dummy_reg  compatible    fixedregulator_5v0  memory@0       name          serial-number    thermal-zones

pi@raspberrypi:/proc/device-tree $ cd ^C
pi@raspberrypi:/proc/device-tree $ cat model
Raspberry Pi 3 Model B Plus Rev 1.3pi@raspberrypi:/proc/device-tree $
pi@raspberrypi:/proc/device-tree $ ls /boot/
COPYING.linux          bcm2708-rpi-zero-w.dtb  bcm2710-rpi-3-b.dtb      bcm2711-rpi-cm4-to.dtb  fixup.dat      fixup_db.dat  kernel8.img  start4x.elf
LICENCE.broadcom       bcm2708-rpi-zero.dtb   bcm2710-rpi-cm3.dtb      bcm2711-rpi-cm4.dtb    fixup4.dat     fixup_x.dat  overlays    start_cd.elf
bcm2708-rpi-b-plus.dtb  bcm2709-rpi-2-b.dtb   bcm2710-rpi-zero-2-w.dtb  bcm2711-rpi-cm4s.dtb  fixup4cd.dat   issue.txt    start.elf   start_db.elf
bcm2708-rpi-b-rev1.dtb  bcm2709-rpi-cm2.dtb   bcm2710-rpi-zero-2.dtb   bootcode.bin          fixup4db.dat   kernel.img   start4.elf  start_x.elf
bcm2708-rpi-b.dtb       bcm2710-rpi-2-b.dtb   bcm2711-rpi-4-b.dtb      cmdline.txt            fixup4x.dat    kernel7.img  start4cd.elf
bcm2708-rpi-cm.dtb      bcm2710-rpi-3-b-plus.dtb  bcm2711-rpi-400.dtb     config.txt              fixup_cd.dat   kernel7l.img  start4db.elf
pi@raspberrypi:/proc/device-tree $ ls /boot/ | grep 3
bcm2710-rpi-3-b-plus.dtb
bcm2710-rpi-3-b.dtb
bcm2710-rpi-cm3.dtb
pi@raspberrypi:/proc/device-tree $
```

# Reverse source code

sudo apt-get install device-tree-compiler

```
Booksshelf Desktop Documents Downloads Music Pictures Public Templates Videos apps
pi@raspberrypi:~$ cp /boot/bcm2710-rpi-3-b-plus.dtb .
pi@raspberrypi:~$ dtc -I dtb -O dts -o file.dts bcm2710-rpi-3-b-plus.dtb
file.dts: Warning (unit_address_vs_reg): /soc: node has a reg or ranges property, but no unit name
file.dts: Warning (unit_address_vs_reg): /soc/axiperf: node has a reg or ranges property, but no unit name
file.dts: Warning (unit_address_vs_reg): /soc/gpiomem: node has a reg or ranges property, but no unit name
file.dts: Warning (simple_bus_reg): /soc/gpu: missing or empty reg/ranges property
file.dts: Warning (simple_bus_reg): /soc/axiperf: simple-bus unit address format error, expected "7e009800"
file.dts: Warning (simple_bus_reg): /soc/i2c0mux: missing or empty reg/ranges property
file.dts: Warning (simple_bus_reg): /soc/firmware: missing or empty reg/ranges property
file.dts: Warning (simple_bus_reg): /soc/power: missing or empty reg/ranges property
file.dts: Warning (simple_bus_reg): /soc/gpiomem: simple-bus unit address format error, expected "7e200000"
file.dts: Warning (simple_bus_reg): /soc/fb: missing or empty reg/ranges property
file.dts: Warning (simple_bus_reg): /soc/sound: missing or empty reg/ranges property
file.dts: Warning (avoid_unnecessary_addr_size): /soc/firmware: unnecessary #address-cells/#size-cells without "ranges" or child "reg" property
file.dts: Warning (unique_unit_address): /soc/mmc@7e300000: duplicate unit-address (also used in node /soc/mmcnr@7e300000)
file.dts: Warning (unique_unit_address): /soc/firmwarekms@7e600000: duplicate unit-address (also used in node /soc/smi@7e600000)
file.dts: Warning (clocks_property): /__symbols__:clocks: property size (21) is invalid, expected multiple of 4
file.dts: Warning (gpios_property): /aliases:gpio: property size (19) is invalid, expected multiple of 4
file.dts: Warning (gpios_property): /__symbols__:gpio: property size (19) is invalid, expected multiple of 4
pi@raspberrypi:~$ head file.dts
/dts-v1/;

/memreserve/ 0x0000000000000000 0x0000000000001000;
/ {
    compatible = "raspberrypi,3-model-b-plus\0bcm,bcm2837";
    model = "Raspberry Pi 3 Model B+";
    #address-cells = <0x01>;
    #size-cells = <0x01>;
    interrupt-parent = <0x01>;

pi@raspberrypi:~$
```

```
pi@raspberrypi:~$ ls /sys/class/leds/
ACT PWR default-on mmc0
pi@raspberrypi:~$
```

```
leds {
    compatible = "gpio-leds";
    phandle = <0x93>;

    led-act {
        label = "ACT";
        default-state = "off";
        linux,default-trigger = "mmc0";
        gpios = <0x07 0x1d 0x00>;
        phandle = <0x35>;
    };

    led-pwr {
        label = "PWR";
        default-state = "off";
        linux,default-trigger = "default-on";
        gpios = <0x0b 0x02 0x01>;
        phandle = <0x36>;
    };
}
```

# Change into DTS

```
FATAL ERROR: Unable to parse input tree
pi@raspberrypi:~ $ vim file.dts
pi@raspberrypi:~ $ dtc -I dts -O dtb file.dts -o bcm2710-rpi-3-b-plus.dtb
file.dts:90.6-1121.4: Warning (unit_address_vs_reg): /soc: node has a reg or range property
file.dts:1026.11-1032.5: Warning (unit_address_vs_reg): /soc/axiperf: node has a range property
file.dts:1105.11-1108.5: Warning (unit_address_vs_reg): /soc/gpiomem: node has a range property
```

```
--
    phandle = <0x34>;

    leds {
        compatible = "gpio-leds";
        phandle = <0x93>;

        led-act {
            label = "Moatasem";
            default-state = "off";
            linux,default-trigger = "mmc0";
            gpios = <0x07 0x1d 0x00>;
            phandle = <0x35>;
        };
    };
};
```

```
Last login: Thu Nov 30 22:39:00 2023
-bash: warning: setlocale: LC_ALL: cannot be null
pi@raspberrypi:~ $ ls /sys/class/leds
Moatasem PWR default-on mmc0
pi@raspberrypi:~ $
```

```
pi@raspberrypi:~ $ sudo cp bcm2710-rpi-3-b-plus.dtb /boot/
pi@raspberrypi:~ $
```

# Let's bring up LED device [ mapping ]

```
~/customize/linux/arch$ vim arm/boot/dts/broadcom/bcm2837-rpi-3-b-plus.dts
~/customize/linux/arch$
```

```
&leds {
    led-pwr {
        label = "PWR";
        gpios = <&expgpio 2 GPIO_ACTIVE_LOW>;
        default-state = "keep";
        linux,default-trigger = "default-on";
    };
};
```

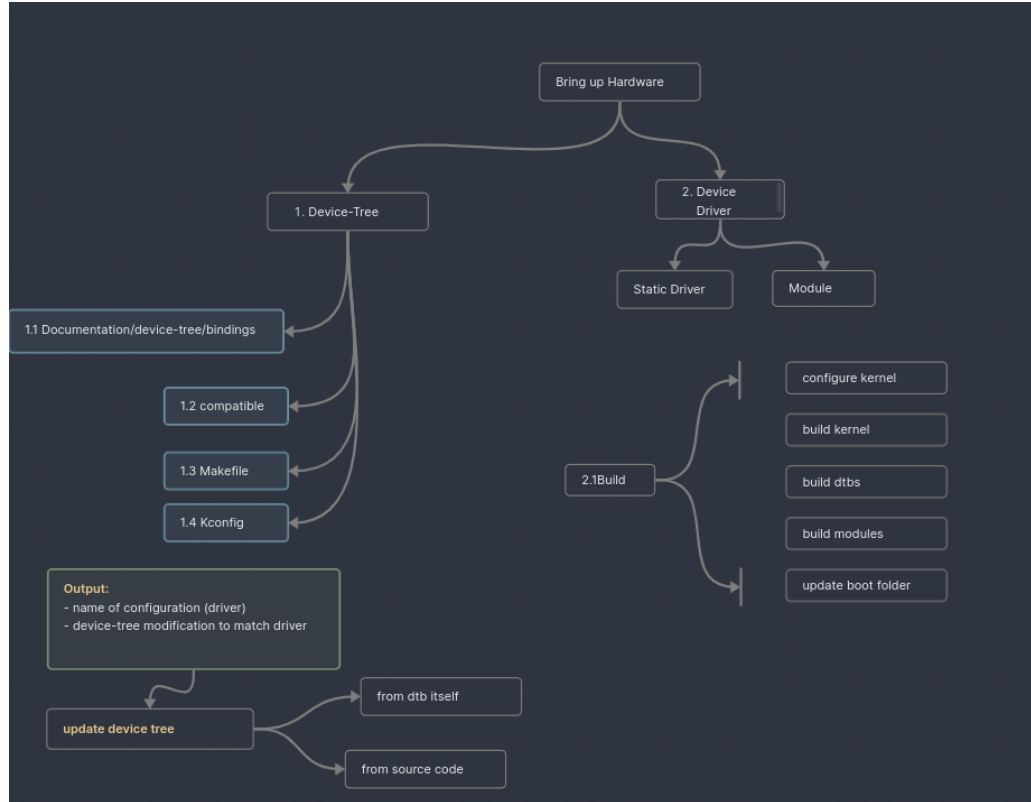
In source

```
led-pwr {
    label = "PWR";
    default-state = "off";
    linux,default-trigger = "default-on";
    gpios = <0x0b 0x02 0x01>;
    phandle = <0x36>;
};
```

```
bcm2837-rpi-3-b-plus.dts  F bcm2837.dts  F bcm283x.dtsi  X
F bcm283x.dtsi
Stefan Wahren, 6 months ago | 15 authors (Eric Anholt and others)
1 #include <dt-bindings/pinctrl/bcm2835.h>
2 #include <dt-bindings/clock/bcm2835.h>
3 #include <dt-bindings/clock/bcm2835-aux.h>
4 #include <dt-bindings/gpio/gpio.h> Eric Anholt, 9 years ago
5 #include <dt-bindings/interrupt-controller/irq.h>
6 #include <dt-bindings/soc/bcm2835-pm.h>
7
8 /* firmware-provided startup stubs live here, where the secondary
9  * spinning.
10  */
11
12 /memreserve/ 0x00000000 0x0001000;
13
14 /* This include file covers the common peripherals and configurat
15  * bcm2835 and bcm2836 implementations. Following the rpi configurat
16
17 bcm2837-rpi-3-b-plus.dts  F bcm2837.dts  F bcm283x.dtsi  C gpio.h  X
none > moattem > customize > linux > include > dt-bindings > gpio > C gpio.h
1 /* SPDX-License-Identifier: GPL-2.0 OR BSD-2-Clause */ ETI
2 /*
3  * This header provides constants for most GPIO bindings.
4  *
5  * Most GPIO bindings include a flags cell as part of the GPIO spe
6  * In most cases, the format of the flags cell uses the standard
7  * defined in this header.
8  */
9
10 #ifndef DT_BINDINGS_GPIO_GPIO_H
11 #define DT_BINDINGS_GPIO_GPIO_H
12
13 /* Bit 0 express polarity */
14 #define GPIO_ACTIVE_HIGH 0
15 #define GPIO_ACTIVE_LOW 1
16
```



# Let's bring up Hardware Device (LED )



# Kernel Source

Normally , you are the one who create the image fo you already know which branch kernel you are using

`git clone https://github.com/raspberrypi/linux.git`

```
moatsen@moatsen-IdeaPad-Gaming-3-15IAH7:~/customize/rpi/linux$ git tag -l | head
1.20210727
1.20210805
1.20210831
1.20210928
1.20211007
1.20211029
1.20220118
1.20220120
1.20220308
1.20220308_buster
moatsen@moatsen-IdeaPad-Gaming-3-15IAH7:~/customize/rpi/linux$
```

```
Thunderbird Mail moatsen@moatsen-IdeaPad-Gaming-3-15IAH7:~/customize/rpi/linux$ git checkout 1.20230405
Updating files: 100% (5756/5756), done.
Note: switching to '1.20230405'.

You are in 'detached HEAD' state. You can look around, make experimental
changes and commit them, and you can discard any commits you make in this
state without impacting any branches by switching back to a branch.

If you want to create a new branch to retain commits you create, you may
do so (now or later) by using -c with the switch command. Example:

  git switch -c <new-branch-name>

Or undo this operation with:

moatsen@moatsen-IdeaPad-Gaming-3-15IAH7:~/customize/rpi/linux$ git describe --help
moatsen@moatsen-IdeaPad-Gaming-3-15IAH7:~/customize/rpi/linux$ git describe --tag
1.20230405
moatsen@moatsen-IdeaPad-Gaming-3-15IAH7:~/customize/rpi/linux$
```

```
pi@raspberrypi:~ $ apt-cache policy raspberrypi-kernel-headers
raspberrypi-kernel-headers:
  Installed: 1:1.20230405-1
  Candidate: 1:1.20230405-1
  Version table:
*** 1:1.20230405-1 500
    500 http://archive.raspberrypi.org/debian bullseye/main armhf Packa
    100 /var/lib/dpkg/status
pi@raspberrypi:~ $
```

# cross compiler tools

```
sudo apt install crossbuild-essential-armhf
```

```
sudo apt install git bc bison flex libssl-dev make libc6-dev libncurses5-dev
```

# Documentation

```
moatsem@moatsem-IdeaPad-Gaming-3-15IAH7:~/customize/rpi/linux/Documentation/devicetree/bindings$ ls
ABI.rst      counter      eeprom       graph.txt    interconnect  mips         opp          pwm          security      sram          staging       vendor-prefixes.yaml
arc          cpu          example-schema.yaml  hsi          interrupt-controller  misc         pci          regmap       serial        staging       submitting-patches.rst  virtio
arm          cpufreq     extcon       hwinfn      iommu         mmc          peci         regulator     serio         submitting-patches.rst  w1
ata          crypto      firmware     hwlock      ipmi          mtd          perf        remoteproc    sifive        thermal       timer         watchdog
auxdisplay  csky       fpga        hwmmon      jailhouse.txt mux          phy          reserved-memory  slox          timer         trivial-devices.yaml   writing-bindings.rst
board       devfreq     fsi          i2c         leds           mailbox      nios2       powerpc      soc           timestamp     trivial-devices.yaml   x86
bus         display     fuse         i3c         mailbox       Makefile     nvme        powerpc      riscv         rng
chrome      dma         gnss        fio         media         memory-controllers  nvme        pps          rtc
clock       dsp         goldfish    infiniband  mfd           mfd          openrisc    ptp          scsi
common-properties.txt  dvfs        gpio        input        leds/
connector    edac        gpu         leds-bcm63138.yaml  leds-lm3532.txt  leds-mt6323.txt
ams,as3645a.txt  leds-bcm6328.yaml  leds-lm3601x.txt  leds-mt6360.yaml
backlight/     leds-bcm6358.txt  leds-lm36274.txt  leds-netxbig.txt
common.txt      leds-class-multicolor.yaml  leds-lm3692x.txt  leds-ns2.txt
common.yaml     leds-cpcap.txt    leds-lm3697.txt  leds-pca9532.txt
cznic,turris-omnia-leds.yaml  leds-cr0014114.txt  leds-lp50xx.yaml  leds-pca955x.txt
irled/         leds-el15203000.txt  leds-lp55xx.yaml  leds-pn8058.txt
issi,is31fl319x.yaml  leds-ls31fl32xx.txt  leds-lp8860.txt  leds-powernv.txt
kinetic,ktd2692.yaml  leds-ls31fl32xx.txt  leds-lt3593.txt  leds-pwm-multicolor.yaml
leds-an30259a.txt  leds-aw2013.yaml   leds-max77650.yaml  leds-pwm.yaml
moatsem@moatsem-IdeaPad-Gaming-3-15IAH7:~/customize/rpi/linux/Documentation/devicetree/bindings$ ls leds/
leds-lm3532.txt  leds-lm3601x.txt  leds-lm36274.txt  leds-lm3692x.txt  leds-lm3697.txt  leds-lp50xx.yaml  leds-lp55xx.yaml  leds-lp8860.txt  leds-lt3593.txt  leds-max77650.yaml  leds-mt6323.txt  leds-mt6360.yaml  leds-netxbig.txt  leds-ns2.txt  leds-pca9532.txt  leds-pca955x.txt  leds-pn8058.txt  leds-powernv.txt  leds-pwm-multicolor.yaml  leds-pwm.yaml
moatsem@moatsem-IdeaPad-Gaming-3-15IAH7:~/customize/rpi/linux/Documentation/devicetree/bindings$ cat leds/leds-gpio.yaml
# SPDX-License-Identifier: GPL-2.0-only
%YAML 1.2
---
$id: http://devicetree.org/schemas/leds/leds-gpio.yaml#
$schema: http://devicetree.org/meta-schemas/core.yaml#

title: LEDs connected to GPIO lines

maintainers:
  - Jacek Anaszewski <jacek.anaszewski@gmail.com>
```

## 1. Device-Tree

### 1.1 Documentation/device-tree/bindings

### 1.2 compatible

### 1.3 Makefile

### 1.4 Kconfig

#### Output:

- name of configuration (driver)
- device-tree modification to match driver

# leds-gpio.yaml

```
properties:
  compatible: Rob Herring, 4 years ago • dt-bindings: leds: Convert gpio-leds
  const: gpio-leds

patternProperties:
  # The first form is preferred, but fall back to just 'led' anywhere in the
  # node name to at least catch some child nodes.
  "(^led-[0-9a-f]$|led)":
    type: object

  $ref: common.yaml#

properties:
  gpios:
    maxItems: 1

  retain-state-suspended:
    description:
      The suspend state can be retained. Such as charge-led gpio.
    type: boolean

  retain-state-shutdown:
    description:
      Retain the state of the LED on shutdown. Useful in BMC systems, for
      example when the BMC is rebooted while the host remains up.
    type: boolean

  required:
    - gpios

additionalProperties: false

examples:
  - |

    #include <dt-bindings/gpio/gpio.h>
    #include <dt-bindings/leds/common.h>

    leds {
      compatible = "gpio-leds";
      led-0 {
        gpios = <&mcu_pio 0 GPIO_ACTIVE_LOW>;
        linux,default-trigger = "disk-activity";
        function = LED_FUNCTION_DISK;
      };

      led-1 {
        gpios = <&mcu_pio 1 GPIO_ACTIVE_HIGH>;
        /* Keep LED on if BIOS detected hardware fault */
        default-state = "keep";
        function = LED_FUNCTION_FAULT;
      };
    };
  - |
```

```
type: boolean
required:
  - gpios
```

```
additionalProperties: false
```

```
examples:
```

```
- |
```

```
#include <dt-bindings/gpio/gpio.h>
#include <dt-bindings/leds/common.h>
```

```
leds {
  compatible = "gpio-leds";
  led-0 {
    gpios = <&mcu_pio 0 GPIO_ACTIVE_LOW>;
    linux,default-trigger = "disk-activity";
    function = LED_FUNCTION_DISK;
  };

  led-1 {
    gpios = <&mcu_pio 1 GPIO_ACTIVE_HIGH>;
    /* Keep LED on if BIOS detected hardware fault */
    default-state = "keep";
    function = LED_FUNCTION_FAULT;
  };
};
```

```
non.yaml  ! leds-gpio.yaml  gpio.txt  x
gpio.txt
and bit-banged data signals:

gpio: gpio {
  gpio-controller;
  #gpio-cells = <2>;
};
[...]

data-gpios = <&gpio1 12 0>,
             <&gpio1 13 0>,
             <&gpio1 14 0>,
             <&gpio1 15 0>;
```

In the above example, `&gpio1` uses 2 cells to specify a gpio a local offset to the GPIO line and the second cell represents such as if the consumer desire the line to be **active** low (if drain. This is the recommended practice.

The exact meaning of each specifier cell is controller specific documented in the device tree binding for the device, but it is recommended to use the two-cell approach.

Most controllers are specifying a generic flag bitfield in for these, use the macros defined in `include/dt-bindings/gpio/gpio.h` whenever possible:

Example of a node using GPIOs:

```
node {
  enable-gpios = <&qmc_pio_e 18 GPIO_ACTIVE_HIGH>;
};
```

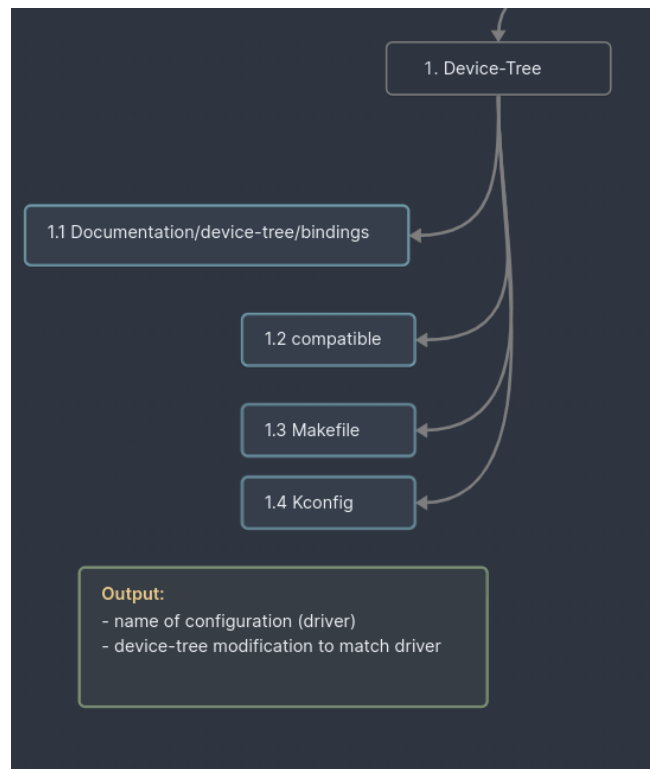
# Look for driver

1.1 device-tree [X]

1.2 compatible [X]

1.3 source & Makefile

```
moatsem@moatsem-IdeaPad-Gaming-3-15IAH7:~/customize/rpi/linux/drivers$ grep -nri "gpio-leds"  
leds/leds-gpio.c:203: { .compatible = "gpio-leds", },  
moatsem@moatsem-IdeaPad-Gaming-3-15IAH7:~/customize/rpi/linux/drivers$ ls leds/Makefile  
leds/Makefile  
moatsem@moatsem-IdeaPad-Gaming-3-15IAH7:~/customize/rpi/linux/drivers$ ls leds/Kconfig  
leds/Kconfig  
moatsem@moatsem-IdeaPad-Gaming-3-15IAH7:~/customize/rpi/linux/drivers$
```



# Configuration Name for Led Driver

```
grep: leds-gpio: invalid context length argument
moatsem@moatsem-IdeaPad-Gaming-3-15IAH7:~/customize/rpi/linux/drivers$ cat leds/Makefile | grep -A 5 leds-gpio
obj-$(CONFIG_LEDS_GPIO) += leds-gpio.o
obj-$(CONFIG_LEDS_GPIO_REGISTER) += leds-gpio-register.o
obj-$(CONFIG_LEDS_HP6XX) += leds-hp6xx.o
obj-$(CONFIG_LEDS_INTEL_SS4200) += leds-ss4200.o
obj-$(CONFIG_LEDS_IP30) += leds-ip30.o
obj-$(CONFIG_LEDS_IPAQ_MICRO) += leds-ipaq-micro.o
obj-$(CONFIG_LEDS_IS31FL319X) += leds-is31fl319x.o
moatsem@moatsem-IdeaPad-Gaming-3-15IAH7:~/customize/rpi/linux/drivers$ cat leds/Kconfig | grep -A 5 LEDS_GPIO
config LEDS_GPIO_REGISTER
    bool
    help
        This option provides the function gpio_led_register_device.
        As this function is used by arch code it must not be compiled as a
        module.
--
config LEDS_GPIO
    tristate "LED Support for GPIO connected LEDs"
    depends on LEDS_CLASS
    depends on GPIOLIB || COMPILE_TEST
    help
        This option enables support for the LEDs connected to GPIO
moatsem@moatsem-IdeaPad-Gaming-3-15IAH7:~/customize/rpi/linux/drivers$
```

# Good News this time ? nightmare later 😄

```
pi@raspberrypi:/usr/lib/modules/6.1.21-v7+/build $ cat .config | grep CONFIG_LEDS_GPIO
pi@raspberrypi:/usr/lib/modules/6.1.21-v7+/build $ cat .config | grep CONFIG_LEDS_GPIO
CONFIG_LEDS_GPIO=y
pi@raspberrypi:/usr/lib/modules/6.1.21-v7+/build $
```

How to make sure that the driver is exist statically ?

```
pi@raspberrypi:/sys $ cd
pi@raspberrypi:~ $ ls /sys/class/leds/
Moatasem PWR default-on mmc0 test
pi@raspberrypi:~ $
```

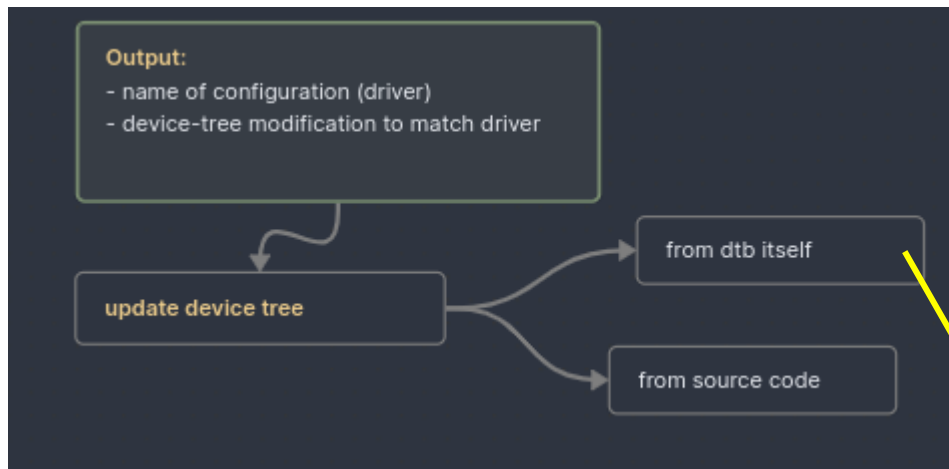
So Driver is already exist no need to build device drivers

- 1- /sys
- 2- dmesg





# So driver is already exist just need to update DTS



```
pi@raspberrypi:~ $ dtc -I dtb -O dts -o file.dts bcm2710-rpi-3-b-plus.dtb
```

# Update dts and replace /boot

```
pi@raspberrypi:~ $ vim file.dts
pi@raspberrypi:~ $ gpioinfo
gpiochip0 - 54 lines:
line 0: "ID_SDA" unused input active-high
line 1: "ID_SCL" unused input active-high
line 2: "SDA1" unused input active-high
line 3: "SCL1" unused input active-high
line 4: "GPIO_GCLK" unused input active-high
line 5: "GPIO5" unused input active-high
line 6: "GPIO6" unused input active-high
line 7: "SPI_CE1_N" "spi0 CS1" output active-low [used]
line 8: "SPI_CE0_N" "spi0 CS0" output active-low [used]
line 9: "SPI_MISO" unused input active-high
line 10: "SPI_MOSI" unused input active-high
line 11: "SPI_SCLK" unused input active-high
line 12: "GPIO12" unused input active-high
line 13: "GPIO13" unused input active-high
line 14: "TXD1" unused input active-high
line 15: "RXD1" unused input active-high
line 16: "GPIO16" unused input active-high
line 17: "GPIO17" unused input active-high
line 18: "GPIO18" unused input active-high
line 19: "GPIO19" unused input active-high
line 20: "GPIO20" unused input active-high
line 21: "GPIO21" "test" output active-low [used]
line 22: "GPIO22" unused input active-high
line 23: "GPIO23" unused input active-high
```

```
leds {
    compatible = "gpio-leds";
    phandle = <0x93>;

    led-act {
        label = "Moatasem";
        default-state = "off";
        linux,default-trigger = "mmc0";
        gpios = <0x07 0x1d 0x00>;
        phandle = <0x35>;
    };

    led-test {
        label = "test";
        default-state = "off";
        linux,default-trigger = "default-on";
        gpios = <0x07 0x15 0x01>;
    };

    led-pwr {
        label = "PWR";
        default-state = "off";
        linux,default-trigger = "default-on";
        gpios = <0x0b 0x02 0x01>;
        phandle = <0x36>;
    };
};
```

```
pi@raspberrypi:~ $ dtc -I dts -O dtb file.dts -o bcm2710-rpi-3-b-plus.dtb
pi@raspberrypi:~ $
```

## Bringup LED is Done

```
brightness - device - max_brightness - power - subsystem - trigger  
root@raspberrypi:/sys/class/leds/test# echo 1 > brightness  
root@raspberrypi:/sys/class/leds/test# echo 0 > brightness  
root@raspberrypi:/sys/class/leds/test# echo 1 > brightness  
root@raspberrypi:/sys/class/leds/test#
```

**Bringup Mlx90614  
Driver is not Exist**

## Lets bring up device not exist by default

```
crypto include      Kconfig mm          samples      tools
614tasem@raspberrypi:/lib/modules/6.1.21-v7+/build$ cat .config | grep -i mlx90
# CONFIG_MLX90614 is not set
moatasem@raspberrypi:/lib/modules/6.1.21-v7+/build$ 
CTRL-A Z for help | 115200 8N1 | NOR | Minicom 2.8 | VT102 | Offline | ttyUSB1
```



```
moatasem@raspberrypi:~$ i2cdetect -y 1
      0  1  2  3  4  5  6  7  8  9  a  b  c  d  e  f
00:                                     -- -- -- -- --
10: -- -- -- -- -- -- -- -- -- -- -- -- --
20: -- -- -- -- -- -- -- -- -- -- -- -- --
30: -- -- -- -- -- -- -- -- -- -- -- -- --
40: -- -- -- -- -- -- -- -- -- -- -- -- --
50: -- -- -- -- -- -- -- -- 5a -- -- -- -- --
60: -- -- -- -- -- -- -- -- -- -- -- -- --
70: -- -- -- -- -- -- -- -- -- -- -- -- --
moatasem@raspberrypi:~$
```

# Apply default configuration

## Output:

- name of configuration (driver)
- device-tree modification to match driver

update device tree

from dtb itself

from source code

[https://www.raspberrypi.com/documentation/computers/linux\\_kernel.html](https://www.raspberrypi.com/documentation/computers/linux_kernel.html)

wiki gmail yocto device driver github jetsonnano presentation LAN useful\_link dts datasheet c++ linux raspberry android vsomeip rust AI

### Computers

#### Getting started

Raspberry Pi 5

Raspberry Pi OS

Configuration

The config.txt file

Legacy config.txt options

The Linux kernel

Kernel

Updating your Kernel

Getting your Code into the Kernel

Building the Kernel

Building the Kernel Locally

Cross-Compiling the Kernel

Configuring the Kernel

Preparing to Configure

Using menuconfig

Saving your Changes

Patching the Kernel

Version Identification

Applying Patches

Kernel Headers

Remote access

Camera software

Raspberry Pi hardware

Compute Module hardware

Processors

### Kernel Configuration

Configure the kernel, as well as the default configuration, you may wish to *configure your kernel in more detail* or *apply patches from another source*, to add or remove required functionality.

#### Apply the Default Configuration

First, prepare the default configuration by running the following commands, depending on your Raspberry Pi model:

For Raspberry Pi 1, Zero and Zero W, and Raspberry Pi Compute Module 1 default (32-bit only) build configuration

```
cd /linux
KERNEL=kernel
make bcm2709_defconfig
```

For Raspberry Pi 2, 3, 3+ and Zero 2 W, and Raspberry Pi Compute Modules 3 and 3+ default 32-bit build configuration

```
cd /linux
KERNEL=kernel7
make bcm2709_defconfig
```

For Raspberry Pi 4 and 400, and Raspberry Pi Compute Module 4 default 32-bit build configuration

```
cd /linux
KERNEL=kernel7l
make bcm2711_defconfig
```

For Raspberry Pi 3, 3+, 4, 400 and Zero 2 W, and Raspberry Pi Compute Modules 3, 3+ and 4 default 64-bit build configuration

```
cd /linux
KERNEL=kernel8
make bcm2711_defconfig
```

For Raspberry Pi 5 default 64-bit build configuration

```
cd /linux
KERNEL=kernel_2712
make bcm2712_defconfig
```

Customising the Kernel Version Using LOCALVERSION

```
linux$ make ARCH=arm CROSS_COMPILE=arm-linux-gnueabihf- bcm2709_defconfig
```

moatsem@moatsem-IdeaPad-Gaming-3-15IAH7: ~/customize/rpi/linux 203x18

image from scratch

# Check Documentation

```
moatsem@moatsem-IdeaPad-Gaming-3-15IAH7:~/customize/rpi/linux/Documentation$ cd devicetree/
moatsem@moatsem-IdeaPad-Gaming-3-15IAH7:~/customize/rpi/linux/Documentation/devicetree$ grep -nri "mlx90614*"
bindings/iio/temperature/melexis,mlx90614.yaml:4:$id: http://devicetree.org/schemas/iio/temperature/melexis,mlx90614.yaml#
bindings/iio/temperature/melexis,mlx90614.yaml:7:title: Melexis MLX90614 contactless IR temperature sensor
bindings/iio/temperature/melexis,mlx90614.yaml:14: http://melexis.com/Infrared-Thermometer-Sensors/Infrared-Thermometer-Sensors/MLX90614-615.aspx
bindings/iio/temperature/melexis,mlx90614.yaml:18: const: melexis,mlx90614
bindings/iio/temperature/melexis,mlx90614.yaml:45: compatible = "melexis,mlx90614";
moatsem@moatsem-IdeaPad-Gaming-3-15IAH7:~/customize/rpi/linux/Documentation/devicetree$ grep -nri "melexis,mlx90614" ../../drivers/
../../drivers/iio/temperature/mlx90614.c:615: { .compatible = "melexis,mlx90614" },
grep: ../../drivers/iio/temperature/mlx90614.ko: binary file matches
grep: ../../drivers/iio/temperature/mlx90614.mod.o: binary file matches
../../drivers/iio/temperature/mlx90614.mod.c:70:MODULE_ALIAS("of:N*T*Cmelexis,mlx90614");
../../drivers/iio/temperature/mlx90614.mod.c:71:MODULE_ALIAS("of:N*T*Cmelexis,mlx90614C*");
grep: ../../drivers/iio/temperature/mlx90614.o: binary file matches
moatsem@moatsem-IdeaPad-Gaming-3-15IAH7:~/customize/rpi/linux/Documentation/devicetree$ grep "mlx90614*" ../../drivers/iio/temperature/Makefile
obj-$(CONFIG_MLX90614) += mlx90614.o
moatsem@moatsem-IdeaPad-Gaming-3-15IAH7:~/customize/rpi/linux/Documentation/devicetree$
```

```
examples:
- |
  #include <dt-bindings/gpio/gpio.h>
  i2c {
    #address-cells = <1>;
    #size-cells = <0>;

    temp-sensor@5a {
      compatible = "melexis,mlx90614";
      reg = <0x5a>;
      wakeup-gpios = <&gpio0 2 GPIO_ACTIVE_HIGH>;
    };
  };
...
```

```
maxItems: 1
required:
- compatible
- reg
```

Output : CONFIG\_MLX90614

Used for driver

Used for dts

# menuconfig

```
make menuconfig ARCH=arm CROSS_COMPILE=arm-linux-gnueabi- -j 20
```

```
|| General setup --->
[*] Patch physical to virtual translations at runtime
  System Type --->
  Bus support --->
  Kernel Features --->
  Boot options --->
  CPU Power Management --->
  Floating point emulation --->
  Power management options --->
  General architecture-dependent options --->
[*] Enable loadable module support --->
[*] Enable the block layer --->
  Executable file formats --->
  Memory Management options --->
[*] Networking support --->
  Device Drivers --->
  File systems --->
  Security options --->
v(+)

<Select>  < Exit >  < Help >  < Save >  < Load >
```

```
Symbol: MLX90614 [=n]
Type : tristate
Defined at drivers/iio/temperature/Kconfig:57
Prompt: MLX90614 contact-less infrared sensor
Depends on: IIO [=m] && I2C [=y]
Location:
-> Device Drivers
  -> Industrial I/O support (IIO [=m])
    -> Temperature sensors
      (1) -> MLX90614 contact-less infrared sensor (MLX90614 [=n])
```

```
<M> MLX90614 contact-less infrared sensor
```



# Build module and install

```
moatsem@moatsem-IdeaPad-Gaming-3-15IAH7:~/customize/rpi/linux$ ^C
moatsem@moatsem-IdeaPad-Gaming-3-15IAH7:~/customize/rpi/linux$ make modules ARCH=arm CROSS_COMPILE=arm-linux-gnueabihf- -j 20
  SYNC      include/config/auto.conf.cmd
  CALL      scripts/checksyscalls.sh
  UPD       kernel/config_data
  GZIP      kernel/config_data.gz
  CC [M]    kernel/configs.o
  CC [M]    drivers/iio/temperature/mlx90614.o
  MODPOST   Module.symvers
  LD [M]    kernel/configs.ko
```

```
XZ      /home/moatsem/customize/rpi/linux/out_library/lib/modules/6.1.21-v7+/kernel/sound/usb/ctne0/snd-usb-ctne0.ko.xz
XZ      /home/moatsem/customize/rpi/linux/out_library/lib/modules/6.1.21-v7+/kernel/sound/usb/misc/snd-ua101.ko.xz
XZ      /home/moatsem/customize/rpi/linux/out_library/lib/modules/6.1.21-v7+/kernel/sound/usb/snd-usb-audio.ko.xz
XZ      /home/moatsem/customize/rpi/linux/out_library/lib/modules/6.1.21-v7+/kernel/sound/usb/snd-usbmidi-lib.ko.xz
DEPMOD   /home/moatsem/customize/rpi/linux/out_library/lib/modules/6.1.21-v7+
```

```
moatsem@moatsem-IdeaPad-Gaming-3-15IAH7:~/customize/rpi/linux$ export INSTALL_MOD_PATH=/home/moatsem/customize/rpi/linux/out_library
moatsem@moatsem-IdeaPad-Gaming-3-15IAH7:~/customize/rpi/linux$ make modules_install ARCH=arm CROSS_COMPILE=arm-linux-gnueabihf- -j 20
```

```
~/customize/rpi/linux# sudo cp -r out_library/* /media/moatsem/rootfs/usr/
~/customize/rpi/linux#
```

moatsem@moatsem-IdeaPad-Gaming-3-15IAH7:~/customize/rpi/linux

# Test

```
modules.builtins.atlas.bin modules.order
moatasem@raspberrypi:/usr/lib/modules/6.1.21-v7+$ find kernel/ -iname "mlx90*"
kernel/drivers/iio/temperature/mlx90614.ko.xz
perature/mlx90614.ko.xzsr/lib/modules/6.1.21-v7+$ modinfo kernel/drivers/iio/tem
filename:      /usr/lib/modules/6.1.21-v7+/kernel/drivers/iio/temperature/mlx90614.ko.xz
license:      GPL
description:   Melexis MLX90614 contactless IR temperature sensor driver
author:       Crt Mori <cmo@melexis.com>
author:       Vianney le Clément de Saint-Marcq <vianney.leclement@essensium.com>
author:       Peter Meerwald <pmeerw@pmeerw.net>
srcversion:   41F08457915BFA19A1B32D6
alias:        i2c:mlx90614
alias:        of:N*T*Cmelexis,mlx90614C*
alias:        of:N*T*Cmelexis,mlx90614
depends:       industrialio
intree:       Y
name:         mlx90614
vermagic:     6.1.21-v7+ SMP mod_unload modversions ARMv7 p2v8
moatasem@raspberrypi:/usr/lib/modules/6.1.21-v7+$
```

. Register the module `sudo depmod`

Driver is exist but still device tree need to be updated

# device-tree

## Cross

```
211 spi-max-frequency = <12500000>;
212 };
213 };
214 };
215 i2c0if {
216     clock-frequency = <1000000>;
217 };
218 };
219 i2c1 {
220     pinctrl-names = "default";
221     pinctrl-0 = <6i2c1_pins>;
222     clock-frequency = <1000000>;
223     temp-sensor@5a {
224         status = "okay";
225         compatible = "melexis,mlx90614";
226         reg = <0x5a>;
227     };
228 };
229 };
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```

```
(failed reverse-i-search) dtbv: sudo cp arch/arm/boot/dts/*.^cb /media/maatsen/bootfs/
maatsen@maatsen-IdeaPad-Gaming-3-15IAH7:~/customize/rpi/linux$ make ARCH=arm CROSS_COMPILE=arm-linux-gnueabihf- dtbs -j 20
DTC arch/arm/boot/dts/bcm2710-rpi-3-b-plus.dtb
maatsen@maatsen-IdeaPad-Gaming-3-15IAH7:~/customize/rpi/linux$
```

## Native

```
i2c@7e804000 {
    compatible = "brcm,bcm2835-i2c";
    clocks = <0x08 0x14>;
    status = "okay";
    #address-cells = <0x01>;
    interrupts = <0x02 0x15>;
    #size-cells = <0x00>;
    phandle = <0x2b>;
    reg = <0x7e804000 0x1000>;
    clock-frequency = <0x186a0>;
    pinctrl-0 = <0x15>;
    pinctrl-names = "default";
};
```

```
temp-sensor@5a{
    status = "okay";
    compatible = "melexis,mlx90614";
    reg = <0x5a>;
};
```

```
file.dts:1350.3-31: Warning (gpios_property): /aliases:gpio: property size (19) is 1
file.dts:1436.3-27: Warning (gpios_property): /cam1_regulator:gpio: cell 0 is not a
file.dts:1339.10-1375.4: Warning (alias_paths): /aliases: aliases property name must
file.dts:1339.10-1375.4: Warning (alias_paths): /aliases: aliases property name must
maatsen@raspberrypi:~ $ dtc -I dts -O dtb -o bcm2710-rpi-3-b-plus.dtb file.dts
```

```
~ $ sudo cp bcm2710-rpi-3-b-plus.dtb /boot/
```

# It works

```
client_loop: send disconnect: Broken pipe
moatsem@moatsem-IdeaPad-Gaming-3-15IAH7:~/sigtest/philp_workspace/sig-distro$ ssh moa
Linux raspberrypi 6.1.21-v7+ #6 SMP Thu Dec  7 00:10:16 EET 2023 armv7l
```

The programs included with the Debian GNU/Linux system are free software;  
the exact distribution terms for each program are described in the  
individual files in /usr/share/doc/\*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent  
permitted by applicable law.

Last login: Thu Dec 7 01:06:14 2023

```
moatsem@raspberrypi:~$ sudo reboot^C
```

```
moatsem@raspberrypi:~$ ^C
```

```
moatsem@raspberrypi:~$ i2cdetect -y 1
```

	0	1	2	3	4	5	6	7	8	9	a	b	c	d	e	f
00:									--	--	--	--	--	--	--	--
10:	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
20:	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
30:	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
40:	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
50:	--	--	--	--	--	--	--	--	--	UU	--	--	--	--	--	--
60:	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
70:	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

```
moatsem@raspberrypi:~$ lsmod | head
```

Module	Size	Used by
hci_uart	40960	1
btbcm	20480	1 hci_uart
bluetooth	540672	3 hci_uart,btbcm
ecdh_generic	16384	1 bluetooth
ecc	40960	1 ecdh_generic
8021q	32768	0
garp	16384	1 8021q
stp	16384	1 garp
llc	16384	2 garp,stp

```
moatsem@raspberrypi:~$ lsmod | grep -i mlx
```

mlx90614	16384	0
industrialio	90112	1 mlx90614

```
moatsem@raspberrypi:~$
```

# sysfs

```
moatasem@raspberrypi:~ $ ls /sys/class/i2c-dev/i2c-1/device/ -l
total 0
-rwxr-xr-x 4 root root    0 Dec  7 01:06 1-005a
-rw-r--r-- 1 root root 4096 Dec  7 01:08 delete_device
-rwxrwxrwx 1 root root    0 Dec  7 01:08 device -> ../../3f804000.i2c
-rwxr-xr-x 3 root root    0 Dec  7 01:06 i2c-dev
-r--r--r-- 1 root root 4096 Dec  7 01:06 name
-rw-r--r-- 1 root root 4096 Dec  7 01:08 new_device
-rwxrwxrwx 1 root root    0 Dec  7 01:08 of_node -> ../../../../../../firmware/devicetree/base/soc/i2c@7e804000
-rwxr-xr-x 2 root root    0 Dec  7 01:08 power
-rwxrwxrwx 1 root root    0 Dec  7 01:06 subsystem -> ../../../../../../bus/i2c
-rw-r--r-- 1 root root 4096 Dec  7 01:06 uevent
moatasem@raspberrypi:~ $ ls /sys/class/i2c-dev/i2c-1/device/1-005a/ -l
total 0
-rwxrwxrwx 1 root root    0 Dec  7 01:06 driver -> ../../../../../../bus/i2c/drivers/mlx90614
-rwxr-xr-x 3 root root    0 Dec  7 01:06 iio:device0
-r--r--r-- 1 root root 4096 Dec  7 01:06 modalias
-r--r--r-- 1 root root 4096 Dec  7 01:06 name
-rwxrwxrwx 1 root root    0 Dec  7 01:08 of_node -> ../../../../../../firmware/devicetree/base/soc/i2c@7e804000/temp-sensor@5a
-rwxr-xr-x 2 root root    0 Dec  7 01:08 power
-rwxrwxrwx 1 root root    0 Dec  7 01:06 subsystem -> ../../../../../../bus/i2c
-rw-r--r-- 1 root root 4096 Dec  7 01:06 uevent
```

moatasem@raspberrypi: /sys/class/i2c-dev/i2c-1/device/1-005a/iio:device0 203x53

```
moatasem@raspberrypi:/sys/class/i2c-dev/i2c-1/device/1-005a/iio:device0 $ ls
in_temp_ambient_raw      in_temp_object_filter_low_pass_3db_frequency  in_temp_object_raw  in_temp_scale  of_node  subsystem  waiting_for_supplier
in_temp_object_calibemissivity  in_temp_object_filter_low_pass_3db_frequency_available  in_temp_offset      name           power    uevent
moatasem@raspberrypi:/sys/class/i2c-dev/i2c-1/device/1-005a/iio:device0 $
```

# Check Documentation of driver

linux / drivers / iio / temperature / mlx90614.c

```
Code Blame 787 lines (673 loc) · 21.6 KB Code 55% faster with GitHub Copilot

47 #define MLX90614_CONFIG_IIR_MASK (0x7 << MLX90614_CONFIG_IIR_SHIFT)
48 #define MLX90614_CONFIG_DUAL_SHIFT 6 /* single (0) or dual (1) IR sensor */
49 #define MLX90614_CONFIG_DUAL_MASK (1 << MLX90614_CONFIG_DUAL_SHIFT)
50 #define MLX90614_CONFIG_FIR_SHIFT 8 /* FIR coefficient */
51 #define MLX90614_CONFIG_FIR_MASK (0x7 << MLX90614_CONFIG_FIR_SHIFT)
52
53 #define MLX90615_CONFIG_IIR_SHIFT 12 /* IIR coefficient */
54 #define MLX90615_CONFIG_IIR_MASK (0x7 << MLX90615_CONFIG_IIR_SHIFT)
55
56 /* Timings (in ms) */
57 #define MLX90614_TIMING_EEPROM 20 /* time for EEPROM write/erase to complete */
58 #define MLX90614_TIMING_WAKEUP 34 /* time to hold SDA low for wake-up */
59 #define MLX90614_TIMING_STARTUP 250 /* time before first data after wake-up */
60
61 #define MLX90615_TIMING_WAKEUP 22 /* time to hold SCL low for wake-up */
62
63 #define MLX90614_AUTOSLEEP_DELAY 5000 /* default autosleep delay */
64
65 /* Magic constants */
66 #define MLX90614_CONST_OFFSET_DEC -13657 /* decimal part of the Kelvin offset */
67 #define MLX90614_CONST_OFFSET_REM 500000 /* remainder of offset (273.15*50) */
68 #define MLX90614_CONST_SCALE 20 /* Scale in milliKelvin (0.02 * 1000) */
69 #define MLX90614_CONST_FIR 0x7 /* Fixed value for FIR part of low pass filter */
70
71 /* Non-constant mask variant of FIELD_GET() and FIELD_PREP() */
```

```
n_temp_object_calibemissivity in_temp_object_filter_low_pass_3db_frequency_available in_temp_offset
oatase@raspberrypi:/sys/class/i2c-dev/i2c-1/device/1-005a/iio:device0 $ ls -l
total 0
-rw-r--r-- 1 root root 4096 Dec 7 01:22 in_temp_ambient_raw
-rw-r--r-- 1 root root 4096 Dec 7 01:22 in_temp_object_calibemissivity
-rw-r--r-- 1 root root 4096 Dec 7 01:22 in_temp_object_filter_low_pass_3db_frequency
-r--r--r-- 1 root root 4096 Dec 7 01:22 in_temp_object_filter_low_pass_3db_frequency_available
-rw-r--r-- 1 root root 4096 Dec 7 01:22 in_temp_object_raw
-rw-r--r-- 1 root root 4096 Dec 7 01:22 in_temp_offset
-rw-r--r-- 1 root root 4096 Dec 7 01:22 in_temp_scale
-r--r--r-- 1 root root 4096 Dec 7 01:22 name
-rwxrwxrwx 1 root root 0 Dec 7 01:22 of_node -> ../../../../firmware/devicetree/base/soc/i2c@7e
-rwxr-xr-x 2 root root 0 Dec 7 01:22 power
-rwxrwxrwx 1 root root 0 Dec 7 01:22 subsystem -> ../../../../bus/iio
-rw-r--r-- 1 root root 4096 Dec 7 01:17 uevent
-r--r--r-- 1 root root 4096 Dec 7 01:22 waiting_for_supplier
oatase@raspberrypi:/sys/class/i2c-dev/i2c-1/device/1-005a/iio:device0 $ cat in_temp_scale
0
oatase@raspberrypi:/sys/class/i2c-dev/i2c-1/device/1-005a/iio:device0 $ cat in_temp_object_raw
14781
oatase@raspberrypi:/sys/class/i2c-dev/i2c-1/device/1-005a/iio:device0 $ echo "14781 *0.02 -273.15" | bc
2.47
oatase@raspberrypi:/sys/class/i2c-dev/i2c-1/device/1-005a/iio:device0 $
```

```
232 What: /sys/bus/iio/devices/iio:deviceX/in_temp_y_raw
233 What: /sys/bus/iio/devices/iio:deviceX/in_temp_ambient_raw
234 What: /sys/bus/iio/devices/iio:deviceX/in_temp_object_raw
235 KernelVersion: 2.6.35
236 Contact: linux-iio@vger.kernel.org
237 Description:
238 Raw (unscaled no bias removal etc.) temperature measurement. Peter Meerwald
239 If an axis is specified it generally means that the temperature
240 sensor is associated with one part of a compound device (e.g.
241 a gyroscope axis). The ambient and object modifiers distinguish
242 between ambient (reference) and distant temperature for contact-
243 less measurements. Units after application of scale and offset
244 are milli degrees Celsius.
245
246 What: /sys/bus/iio/devices/iio:deviceX/in_tempX_input
247 KernelVersion: 2.6.38
248 Contact: linux-iio@vger.kernel.org
249 Description:
250 Scaled temperature measurement in milli degrees Celsius.
```

PROBLEMS 3 OUTPUT DEBUG CONSOLE TERMINAL PORTS GITLENS

```
moatsem@moatsem-IdeaPad-Gaming-3-15IAH7:~/customize/rpi/linux$ git grep "in_temp_object_raw"
Documentation/ABI/testing/sysfs-bus-iio:What: /sys/bus/iio/devices/iio:deviceX/in_temp_object_raw
moatsem@moatsem-IdeaPad-Gaming-3-15IAH7:~/customize/rpi/linux$
```

**update kernel**

# Kernel versions

## current

```
moatsen@moatsen-IdeaPad-Gaming-3-15IAH7:~/customize/rpi/linux$ gl
commit 0afb5e98488aed7017b9bf321b575d0177feb7ed (HEAD, tag: 1.20230405)
Author: Phil Elwell <phil@raspberrypi.com>
Date: Sat Apr 1 11:50:07 2023 +0100

    fixup! gpio-fsm: Avoid truncation of delay jiffies

    The kernel's time unit of jiffies should be stored as an unsigned long
    value. Storing it as an unsigned int, as gpio-fsm did, leads to
    truncation and malfunction when the kernel is built for a 64-bit
    platform.

    Signed-off-by: Phil Elwell <phil@raspberrypi.com>

commit a2bdda06d9189c30d607aa15c0784349a35b2404
```

```
moatsen@raspberrypi:~$
moatsen@raspberrypi:~$
moatsen@raspberrypi:~$ uname -a
Linux raspberrypi 6.1.21-v7+ #6 SMP Thu Dec 7 00:10:16 EET 2023 armv7l GNU/Linux
moatsen@raspberrypi:~$
```

```
moatsen@moatsen-IdeaPad-Gaming-3-15IAH7:~/customize/rpi/linux$ q^C
moatsen@moatsen-IdeaPad-Gaming-3-15IAH7:~/customize/rpi/linux$ git checkout origin
error: Your local changes to the following files would be overwritten by checkout:
    arch/arm/boot/dts/bcm2710-rpi-3-b-plus.dts
Please commit your changes or stash them before you switch branches.
Aborting
moatsen@moatsen-IdeaPad-Gaming-3-15IAH7:~/customize/rpi/linux$ git stash
Saved working directory and index state WIP on (no branch): 0afb5e98488a fixup! gpio-fsm: Avoid truncation of delay jiffies
moatsen@moatsen-IdeaPad-Gaming-3-15IAH7:~/customize/rpi/linux$ git checkout origin
Updating files: 100% (6227/6227), done.
Previous HEAD position was 0afb5e98488a fixup! gpio-fsm: Avoid truncation of delay jiffies
HEAD is now at 66e9997edf62 configs: rpi: Compile OV64A40 and BU64754 as modules
moatsen@moatsen-IdeaPad-Gaming-3-15IAH7:~/customize/rpi/linux$ git pull origin
You are not currently on a branch.
Please specify which branch you want to merge with.
See git-pull(1) for details.

    git pull <remote> <branch>

moatsen@moatsen-IdeaPad-Gaming-3-15IAH7:~/customize/rpi/linux$ git pull origin HEAD
From https://github.com/raspberrypi/linux
 * branch                HEAD          -> FETCH_HEAD
Already up to date.
moatsen@moatsen-IdeaPad-Gaming-3-15IAH7:~/customize/rpi/linux$
```

origin/HEAD

origin/rpi-6.1.y

configs: rpi: Compile OV64A40 and BU64754 as modules

Commit: 66e9997edf62cf5eeb1f86681c7c30a64e32e76a

Parents: 7f67a45ee7c008c308e45fd46f89c4287f3bc9e

Author: Jacopo Mondì <jacopo.mondi@edisonboard.com>

Author Date: Tue Oct 17 2023 15:41:56 GMT+0300 (Eastern European Summer Time)

Committer: Phil Elwell <99114092nelwell@users.noreply.github.com>

Committer Date: Wed Dec 06 2023 17:04:41 GMT+0200 (Eastern European Standard Time)

configs: rpi: Compile OV64A40 and BU64754 as modules

Compile both the OV64A40 and the BU64754 drivers used by the Arducam 64MP camera module based as modules in the defconfig files for

arch

arm / configs

- bcm2709\_defconfig (+2|-0)
- bcm2711\_defconfig (+2|-0)
- bcm2712\_defconfig (+2|-0)
- bcmrpi\_defconfig (+2|-0)

arm64 / configs

- bcm2711\_defconfig (+2|-0)
- bcm2712\_defconfig (+2|-0)
- bcmrpi3\_defconfig (+2|-0)

17 Oct 2023 15:41 Jacopo Mondì



# Build

```
moatsem@moatsem-IdeaPad-Gaming-3-15IAH7:~/customize/rpi/linux$ make bcm2709_defconfig ARCH=arm CROSS_COMPILE=arm-linux-gnueabihf-  
#  
# configuration written to .config  
#  
moatsem@moatsem-IdeaPad-Gaming-3-15IAH7:~/customize/rpi/linux$ ^C  
moatsem@moatsem-IdeaPad-Gaming-3-15IAH7:~/customize/rpi/linux$ make -j30 zImage modules dtbs ARCH=arm CROSS_COMPILE=arm-linux-gnueabihf-
```

It will take sometime

```
CC arch/arm/mm/proc-v7-bugs.o  
CC drivers/regulator/fixed-helper.o  
CC [M] sound/core/timer.o  
CC crypto/testmgr.o  
CC fs/attr.o  
CC crypto/hmac.o  
AR net/802/built-in.a  
CC [M] net/802/p8022.o  
CC drivers/dma/bcm2835-dma.o  
CC security/inode.o  
CC arch/arm/kernel/module-plts.o
```

```
0[|||||]100.0% 4[|||||]100.0% 8[|||||]100.0% 12[|||||]100.0%  
1[|||||]100.0% 5[|||||]100.0% 9[|||||]100.0% 13[|||||]100.0%  
2[|||||]100.0% 6[|||||]100.0% 10[|||||]100.0% 14[|||||]100.0%  
3[|||||]100.0% 7[|||||]100.0% 11[|||||]100.0% 15[|||||]100.0%  
Mem[|||||]11.0G/15.3G Tasks: 339, 1628 thr, 212 kthr; 16 running  
Swp[|]6.00M/8.00G Load average: 11.40 3.34 1.47  
Uptime: 03:19:35
```

PID	USER	PRI	NI	VIRT	RES	SHR	S	CPU%	MEMK%	TIME+	Command (merged)
138887	moatsem	20	0	2693M	1791M	708M	R	38.2	11.4	0:11.54	/usr/bin/git -c log.showSignatures

```
i/linux$ cp arch/arm/boot/zImage /media/moatsem/bootfs/  
i/linux$ cp arch/arm/boot/dts/*.dtb /media/moatsem/bootfs/  
i/linux$ cp arch/arm/boot/  
          .Image.cmd                  Makefile                  .zImage.cmd  
          install.sh                  zImage  
i/linux$ cp arch/arm/boot/^C  
i/linux$ cp arch/arm/boot/dts/overlays/*.dtbo /media/moatsem/bootfs/overlays/  
i/linux$ cp arch/arm/boot/dts/overlays/*.dtbo /media/moatsem/bootfs/overlays/
```

## modules

```
moatsem@moatsem-IdeaPad-Gaming-3-15IAH7:~/customize/rpi/linux$ readlink -f out_library/  
/home/moatsem/customize/rpi/linux/out_library  
moatsem@moatsem-IdeaPad-Gaming-3-15IAH7:~/customize/rpi/linux$ export INSTALL_MOD_PATH=/home/moatsem/customize/rpi/linux/out_library  
moatsem@moatsem-IdeaPad-Gaming-3-15IAH7:~/customize/rpi/linux$ make modules_install ARCH=arm CROSS_COMPILE=arm-linux-gnueabihf- -j 20
```



moatsem@moatsem-IdeaPad-Gaming-3-15IAH7: ~/customize/rpi/linux 203x25

## Send

```
$ sudo cp -r out_library/lib/ /media/moatsem/rootfs/usr/lib  
$
```

# Test

## Before

```
moatasem@raspberrypi:~$  
moatasem@raspberrypi:~$  
moatasem@raspberrypi:~$ uname -a  
Linux raspberrypi 6.1.21-v7+ #6 SMP Thu Dec 7 00:10:16 EET 2023 armv7l GNU/Linux  
moatasem@raspberrypi:~$
```

## After

```
6.1.65-v7+  
moatasem@raspberrypi:~$ uname -a  
Linux raspberrypi 6.1.65-v7+ #8 SMP Thu Dec 7 16:47:12 EET 2023 armv7l GNU/Linux  
moatasem@raspberrypi:~$  
CTRL-A Z for help | 115200 8N1 | NOR | Minicom 2.8 | VT102 | Offline | ttyUSB1
```

**Bluetooth**

# bluetoothctl

```
[bluetooth]#  
pi@raspberrypi:~ $ systemctl status bluetooth  
● bluetooth.service - Bluetooth service  
   Loaded: loaded (/lib/systemd/system/bluetooth.service; enabled; vendor preset: enabled)  
   Active: active (running) since Mon 2023-12-04 22:45:45 GMT; 3 days ago  
     Docs: man:bluetoothd(8)  
  Main PID: 632 (bluetoothd)  
   Status: "Running"  
    Tasks: 1 (limit: 1595)  
     CPU: 203ms  
    CGroup: /system.slice/bluetooth.service  
            └─632 /usr/libexec/bluetooth/bluetoothd
```

```
pi@raspberrypi: ~/apps/sound 85x48  
#!/bin/bash  
set -x  
echo -e 'power on \nconnect 9D:7E:25:23:AA:16 \n quit' | bluetoothctl  
while true; do  
  
    out=$(echo -e 'info' | bluetoothctl)  
    if [[ "${out}" =~ *"Connected: yes"* ]]  
  
        then  
            break  
        fi  
        sleep 1  
done  
mpg123 ~/036.mp3 &  
~
```

Make Sure that wifi is disabled  
Sudo ifconfig wlan0 down

```
pi@raspberrypi:~ $ bluetoothctl  
Agent registered  
[bluetooth]# power on  
Changing power on succeeded  
[bluetooth]# scan on  
Discovery started  
[CHG] Controller B8:27:EB:9C:E8:61 Discovering: yes  
[NEW] Device 6B:D2:3B:44:81:4D 6B-D2-3B-44-81-4D  
[NEW] Device 8C:79:F5:B8:29:33 [TV] Samsung 7 Series (55)  
[NEW] Device 79:98:67:D3:9B:AF 79-98-67-D3-9B-AF  
[NEW] Device 9D:7E:25:23:AA:16 XC-042  
[bluetooth]# scan off  
[CHG] Device 9D:7E:25:23:AA:16 RSSI is nil  
[CHG] Device 79:98:67:D3:9B:AF TxPower is nil  
[CHG] Device 79:98:67:D3:9B:AF RSSI is nil  
[CHG] Device 8C:79:F5:B8:29:33 RSSI is nil  
[CHG] Device 6B:D2:3B:44:81:4D TxPower is nil  
[CHG] Device 6B:D2:3B:44:81:4D RSSI is nil  
[CHG] Controller B8:27:EB:9C:E8:61 Discovering: no  
Discovery stopped  
[bluetooth]# connect 9D:7E:25:23:AA:16  
Attempting to connect to 9D:7E:25:23:AA:16  
[CHG] Device 9D:7E:25:23:AA:16 Connected: yes  
[CHG] Device 9D:7E:25:23:AA:16 UUIDs: 0000110b-0000-1000-8000-00805f9b34fb  
[CHG] Device 9D:7E:25:23:AA:16 UUIDs: 0000110e-0000-1000-8000-00805f9b34fb  
[CHG] Device 9D:7E:25:23:AA:16 ServicesResolved: yes  
[CHG] Device 9D:7E:25:23:AA:16 Paired: yes  
Connection successful  
[XC-042]#
```

# Start Mp3 on startup

```
pi@raspberrypi:/etc/systemd/system $ ls
bluetooth.target.wants      dhcpcd.service.d          printer.target.wants
dbus-fi.w1.wpa_supplicant1.service  display-manager.service  rc-local.service.d
dbus-org.bluez.service       getty.target.wants        reboot.target.wants
dbus-org.freedesktop.Avahi.service  getty@tty1.service.d     remote-fs.target.wants
dbus-org.freedesktop.ModemManager1.service  graphical.target.wants  sockets.target.wants
dbus-org.freedesktop.timesync1.service  halt.target.wants        sshd.service
default.target               multi-user.target.wants  sysinit.target.wants
default.target.wants         network-online.target.wants  syslog.service
dev-serial1.device.wants     poweroff.target.wants    timers.target.wants
pi@raspberrypi:/etc/systemd/system $ cat bluetooth.target.wants/bluetooth.service
[Unit]
Description=Bluetooth service
Documentation=man:bluetoothd(8)
ConditionPathIsDirectory=/sys/class/bluetooth

[Service]
Type=dbus
BusName=org.bluez
ExecStart=/usr/libexec/bluetooth/bluetoothd
NotifyAccess=main
#WatchdogSec=10
#Restart=on-failure
CapabilityBoundingSet=CAP_NET_ADMIN CAP_NET_BIND_SERVICE
LimitNPROC=1
ProtectHome=true
ProtectSystem=full

[Install]
WantedBy=bluetooth.target
Alias=dbus-org.bluez.service
pi@raspberrypi:/etc/systemd/system $ systemctl list-dependencies | head -n 15
default.target
├─e2scrub_reap.service
├─gui_hello.service
├─lightdm.service
├─raspi-config.service
├─rng-tools-debian.service
├─systemd-update-utmp-runlevel.service
├─udisks2.service
├─multi-user.target
├─auto_start_yasin.service
├─avahi-daemon.service
├─console-setup.service
├─cron.service
├─cups-browsed.service
├─cups.path
pi@raspberrypi:/etc/systemd/system $
```

```
pi@raspberrypi:~$ cat /etc/systemd/system/auto_start_yasin.service
[Unit]
Description="start Yasin"
After="bluetooth.service"

[Service]
User=pi
ExecStart=/home/pi/apps/sound/play_yasin.sh &
StandardOutput=journal
StandardError=journal
RemainAfterExit=yes
Restart=on-failure
Environment="DISPLAY=:0"
Environment="XDG_RUNTIME_DIR=/run/user/1000"

[Install]
WantedBy=multi-user.target

~
~
```

# Tasks

- Bringup LED
- Bringup DHT11
- Update kernel
- Play audio on startup with bluetooth

# Project

- Write cpp application read Humidity & Temperature ,with interval time 10 seconds
- Insert values into CSV file
- Led blinking once the update of CSV is done
- Write python GUI application Display average value of CSV DATA
- Write Bash Script send CSV file to your PC with interval time 60 minute

**Hint: All development will depend on Cross Compiling , don't use Hardware during development**