

LED Programming Tutorial

LED Simulation Example

- The simplest way to open the simulation is to select “LED Simulation” in the IoTrain-Sim interface
- Alternatively, you can open it manually as follows
 - Open Cooja
 - Click File > Open simulation > Browse...
 - Go to the folder “iotrain-sim/database/fundamental_training/single_node/actuation_control/led/simulation”
 - Select the file “led.csc”
 - Click Open
- Once the simulation control window appears, click the “Start” button
 - This simulation will stop automatically after 10 seconds

Source Code Commentary

- Use a Tmote Sky node that prints a message and turns on the red LED
 - Source code: `iotrain-sim/database/fundamental_training/single_node/actuation_control/led/simulation/led.c`

```
#include "contiki.h"
#include "dev/leds.h" ①
#include <stdio.h>
/*-----*/
PROCESS(led_process, "LED process");
AUTOSTART_PROCESSES(&led_process);
/*-----*/
PROCESS_THREAD(led_process, ev, data)
{
    PROCESS_BEGIN();
    printf("Turn ON the red LED\n");
    leds_on(LEDS_RED); ②
    PROCESS_END();
}
/*-----*/
```

Source Code Commentary (cont.)

- 1 We add “dev/leds.h”, which is used to manage the LEDs (for details check the file “contiki/core/dev/leds.h”)
 - Available LED commands
 - unsigned char leds_get(void);
 - void leds_set(unsigned char leds);
 - void leds_on(unsigned char leds);
 - void leds_off(unsigned char leds);
 - void leds_toggle(unsigned char leds);
 - Available LED constants
 - LEDS_GREEN
 - LEDS_RED
 - LED_BLUE
 - LED_ALL
- 2 We turn ON only the red LED

Exercise I

- Create a new application that turns on all the LEDs
- Verify the application by running it in Cooja and checking the LEDs status
- Hint
 - Remember to modify the Makefile by adding the new filename to “CONTIKI_PROJECT”

Exercise II

- Create a new application that gets the LEDs status and prints it to the console
- Hints
 - Use the function `leds_get()` to get the LED status
 - You can use `printf()` to visualize on the console/Mote output window what is happening in your application
 - If an LED is on, its corresponding bit in the return value will be set to "1"
 - Remember to modify the Makefile by adding the new filename to "CONTIKI_PROJECT"

Exercise II Sample Code

- Modify the code below to see what happens when you turn on more than one LED. What number will you get?

```
#include "contiki.h"
#include "dev/leds.h"
#include <stdio.h>
/*-----*/
PROCESS(led_process, "led process");
AUTOSTART_PROCESSES(&led_process);
/*-----*/
PROCESS_THREAD(led_process, ev, data)
{
    PROCESS_BEGIN();
    leds_on(LED_RED);
    printf("LED %u status is %u\n", LED_RED, leds_get());
    PROCESS_END();
}
```