

Multicolor LED handling under Linux

Description

The multicolor class groups monochrome LEDs and allows controlling two aspects of the final combined color: hue and lightness. The former is controlled via the `multi_intensity` array file and the latter is controlled via `brightness` file.

Multicolor Class Control

The multicolor class presents files that groups the colors as indexes in an array. These files are children under the LED parent node created by the `led_class` framework. The `led_class` framework is documented in `led-class.rst` within this documentation directory.

Each colored LED will be indexed under the `multi_*` files. The order of the colors will be arbitrary. The `multi_index` file can be read to determine the color name to indexed value.

The `multi_index` file is an array that contains the string list of the colors as they are defined in each `multi_*` array file.

The `multi_intensity` is an array that can be read or written to for the individual color intensities. All elements within this array must be written in order for the color LED intensities to be updated.

Directory Layout Example

```
root/sys/class/leds/multicolor:status# ls -lR -rw-r--r-- 1 root root 4096 Oct 19 16:16 brightness -r--r--r-- 1 root root 4096 Oct 19 16:16 max_brightness -r--r--r-- 1 root root 4096 Oct 19 16:16 multi_index -rw-r--r-- 1 root root 4096 Oct 19 16:16 multi_intensity
```

Multicolor Class Brightness Control

The brightness level for each LED is calculated based on the color LED intensity setting divided by the global `max_brightness` setting multiplied by the requested brightness.

$$\text{led_brightness} = \text{brightness} * \text{multi_intensity} / \text{max_brightness}$$

Example: A user first writes the `multi_intensity` file with the brightness levels for each LED that are necessary to achieve a certain color output from a multicolor LED group.

```
cat /sys/class/leds/multicolor:status/multi_index green blue red
echo 43 226 138 > /sys/class/leds/multicolor:status/multi_intensity
red -
    intensity = 138 max_brightness = 255
green -
    intensity = 43 max_brightness = 255
blue -
    intensity = 226 max_brightness = 255
```

The user can control the brightness of that multicolor LED group by writing the global 'brightness' control. Assuming a `max_brightness` of 255 the user may want to dim the LED color group to half. The user would write a value of 128 to the global brightness file then the values written to each LED will be adjusted base on this value.

```
cat /sys/class/leds/multicolor:status/max_brightness 255 echo 128 > /sys/class/leds/multicolor:status/brightness
adjusted_red_value = 128 * 138/255 = 69 adjusted_green_value = 128 * 43/255 = 21 adjusted_blue_value = 128 * 226/255 = 113
```

Reading the global brightness file will return the current brightness value of the color LED group.

```
cat /sys/class/leds/multicolor:status/brightness 128
```