MuntsOS Embedded Linux

Application Note #11:
`link-gpiochip`

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Introduction

The Raspberry Pi 5 introduced an unfortunate breaking API change for manipulating GPIO pins. For all previous Raspberry Pi boards, you needed to use `/dev/gpiochip0` to manipulate the expansion header GPIO pins. On the Raspberry Pi 5, the GPIO controllers enumerated differently, and you must now use `/dev/gpiochip4`. Furthermore, the Raspberry Pi engineering staff have indicated that the enumeration order may change in the future as well. This change has broken many Raspberry Pi GPIO libraries, including the **Linux Simple I/O Library** aka **libsimpleio**, which is used pervasively within **MuntsOS Embedded Linux**.

In order to preserve backward compatibility, **libsimpleio** has been modified with a fix that deals with dynamic and unpredictable enumeration of the GPIO controllers. The fix is implemented in two places: a new program named `link-gpiochip` and some mostly invisible changes to `libgpio`.

`link-gpiochip`

This new program must be run at system startup time, by `/etc/rc.local` for Raspberry Pi OS or by `/etc/rc` for MuntsOS Embedded Linux. It opens all `/dev/gpiochipN` device nodes, one by one, and queries the label string using `GPIO_get_chip_info()`. If it finds a matching label string (`pinctrl-bcm2835` for Raspberry Pi 1 to 3, `pinctrl-bcm2711` for Raspberry Pi 4, or `pinctrl-bcm2711` for Raspberry Pi 5), it symlinks `/dev/gpiochip-rpi` to the matching device node.

For Raspberry Pi 1 to 4, it presently symlinks `/dev/gpiochip-rpi` to `/dev/gpiochip0`. For Raspberry Pi 5, it presently symlinks `/dev/gpiochip-rpi` to `/dev/gpiochip4`. Although not strictly necessary at the present time for Raspberry Pi 1 to 4, it will likely become necessary with the next major Raspberry Pi kernel upgrade planned for 2024.

`libgpio`

The functions within `libgpio` have been modfied to open device node `/dev/gpiochip-rpi` instead of `/dev/gpiochip0` IFF the following conditions are true:

- `/dev/gpiochip-rpi` exists.
- The chip number argument is zero.
- `/proc/device-tree/model` contains `Raspberry Pi`.

This has the positive effect of making the fix transparent to upper software layers. In particular, Raspberry Pi expansion header pin 37, well known as `GPIO26`, can still be addressed by passing the GPIO chip and line tuple of (0, 26) to `libgpio`.

It has the possible negative effect of masking the actual `/dev/gpiochip0` device node. Since the additional Raspberry Pi GPIO controllers have always been mostly undocumented anyway, this was deemed an acceptable limitation.