Electronics
Bit-banging (or bit-bashing)

Terry Sturtevant

Wilfrid Laurier University

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Problems

What do you do if you want 3 SPI devices with the Raspberry Pi?

What do you do if you want 3 PWM devices with the Raspberry Pi?

What do you do if you want a UART sensor and the serial console with the Raspberry Pi?

What do you have a sensor that has no available library?

Solution:

Bit-bang more interfaces.
Problems

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- What do you do if you want 3 PWM devices with the Raspberry Pi?
- What do you do if you want a UART sensor *and* the serial console with the Raspberry Pi?
- What do you do if you have a sensor that has no available library?

**Solution:** Bit-bang more interfaces.
What’s the difference between multiple signals and an interface?
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- If there is no *library* then you have to handle all of the signals yourself.
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This process of handling all of the signals yourself is often called **bit-bashing** or **bit-banging**.
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- **Bit-banging** is the process of writing code to perform the necessary operations manually.

- If the code can execute within whatever timing window is required, then it is an acceptable solution.

**Note:** Because the Raspberry Pi has an operating system running, tight timing tolerances can’t be guaranteed this way.
Tips for bit-banging
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- Use bit-banging for the least frequent tasks.
- Avoid cumulative timing error by referencing a single event time.
- Create functions as similar as possible to those that are built-in.
Example: bit-banging a UART (Transmitting)
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- When transmitting, a UART basically needs to change a signal at fixed time intervals.
Example: bit-banging a UART (Transmitting)

- When *transmitting*, a UART basically needs to *change* a signal at fixed time intervals.
- When *receiving*, after the detection of a START bit, a UART basically needs to *test* a signal at fixed time intervals.
Transmitting

Set pin to START level
Transmitting

Wait one bit time before setting pin HIGH or LOW according to LSB
Transmitting

Wait one bit time before setting pin HIGH or LOW according to LSB
Transmitting

Wait one bit time before setting pin HIGH or LOW according to bit 1
Transmitting

Wait one bit time before setting pin HIGH or LOW according to bit 2
Transmitting

Wait one bit time before setting pin HIGH or LOW according to bit 3
Transmitting

Start

Wait one bit time before setting pin HIGH or LOW according to bit 4
Transmitting

Wait one bit time before setting pin HIGH or LOW according to bit 5
Transmitting

Wait one bit time before setting pin HIGH or LOW according to bit 6
Transmitting

Wait one bit time before setting pin HIGH or LOW according to MSB
Transmitting

Wait one bit time before setting pin to STOP level
Transmitting

Wait 1 bit time (if 1 STOP bit) before next START bit
Receiving

Poll for START level
Bits (or bit-bashing) Problems
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Example: bit-banging a UART (Transmitting)
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Receiving

Start

Wait one and a half bit times before testing pin for LSB
Receiving

Wait one *and a half* bit times before testing pin for LSB
Receiving

Wait one bit time before testing pin for bit 1
Receiving

Wait one bit time before testing pin for bit 2

Start

0 1 2

LSB

1 1 1
Receiving

Wait one bit time before testing pin for bit 3
Receiving

Wait one bit time before testing pin for bit 4
Receiving

Wait one bit time before testing pin for bit 5
Receiving

Wait one bit time before testing pin for bit 6
Receiving

Wait one bit time before testing pin for MSB
Receiving

Wait one bit time before testing pin for STOP level
Receiving

Poll for next START bit