MSP430 I2C firmware

The firmware must provide the following features

- I/O Expander API exposed on I2C (Stem)
- Support for two I2C ports; 1 USI driven and 1 GPIO
- Event driven using interrupts
- Configuration driven using function calls during init
- Support persisting an initial pin output state
- I/O Expander API compatible with Linux Device drivers (emulate PCA9555)
- Build script running in a docker container
- Docker build container Debian based
- I can modify and recompile the init/configuration with a common code editor
- Written in C, C++ or Rust

You will create a GitHub repo for building and flashing firmware on a MSP430FR2476 evaluation board. The build will output a binary image and be able to also flash the development board via USB. The build is made to run from a shell on Unix.

Init function can configure

- The USI pins used for I2C port to listen on
- The GPIO pins used for I2C port to listen on
- The I2C address to respond to
- I/O Expander registers
- GPIO pins as input to I/O Expander register
- GPIO pins as output from I/O Expander register
- Initial register value
- Register callback for reading custom register
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The firmware will ultimately be written in Rust using msp430_rt, with the initial version potentially being written in C or C++.

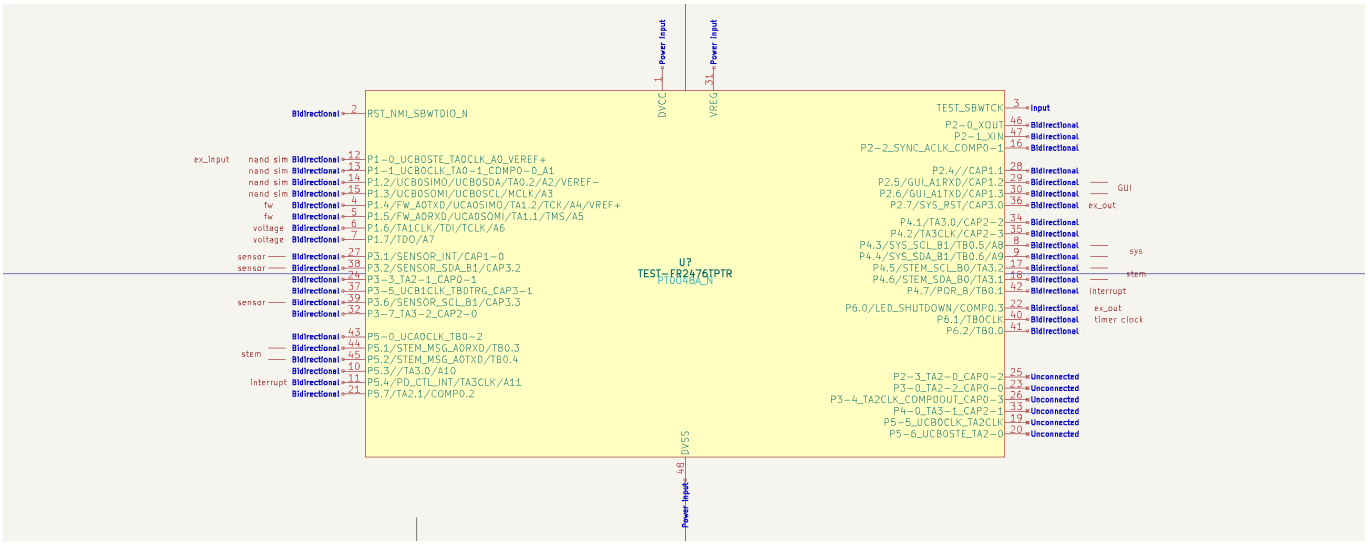
Test Hardware

Use a FR2476 LaunchPad

Pinout on the launchpad reserves pins for

- Two voltage measurements
- Input pins that trigger an interrupt message
- Input pins that update an input register
- Output pins driven by an output register
- Sensor I2C that can be proxied to an Expander register
- Stem I2C + 1-Wire negotiation pins

// diagram



MSP430 timer

Monitor I2C sensor

Respond to interrupt and read registers on sensor. Do computation of result and update local register. If passing threshold on local register trigger an interrupt or write I2C destination.

Register callback for reading custom register

You can register a callback that will be triggered when a specific register is read over I2C. The register would be uniquely reserved for this functionality. The callback would then fetch the information and send it as a response.

1-wire messaging (STEM INT/MSG)

An UART RXD capable pin from each MCU is used message between MCUs on the Stem. The pins are all connected together for low bandwidth message exchange.

Each MCU is required to listen in when they are not sending to track who is the master. Any MCU can send a request to be a master identifying itself using its I2C address

CCL & USART & 1-WIRE & MCU communication