Bit-Banging I2C

Emmett
Sebastian

01

Background

Background

- Interface with the DS3231 RTC using homemade i2c software
- We should be able to both read and write with the software
- We may not use any P.pin on the MSP430 which is connected to the i2c module
- read hr:min:sec and temperature from the RTC

02

Development Process

Development Process

01 FLOWCHART

Researched the i2c protocol
Based on function names provided, designed a flowchart for our i2c software
Reviewed flowchart and fixed any mistakes

02 I2C

Assigned functions to implement

Emmett: heartbeat, delays, start, stop, tx 0/1, send_address, tx ack/nack, rx ack, fixed i2c_write

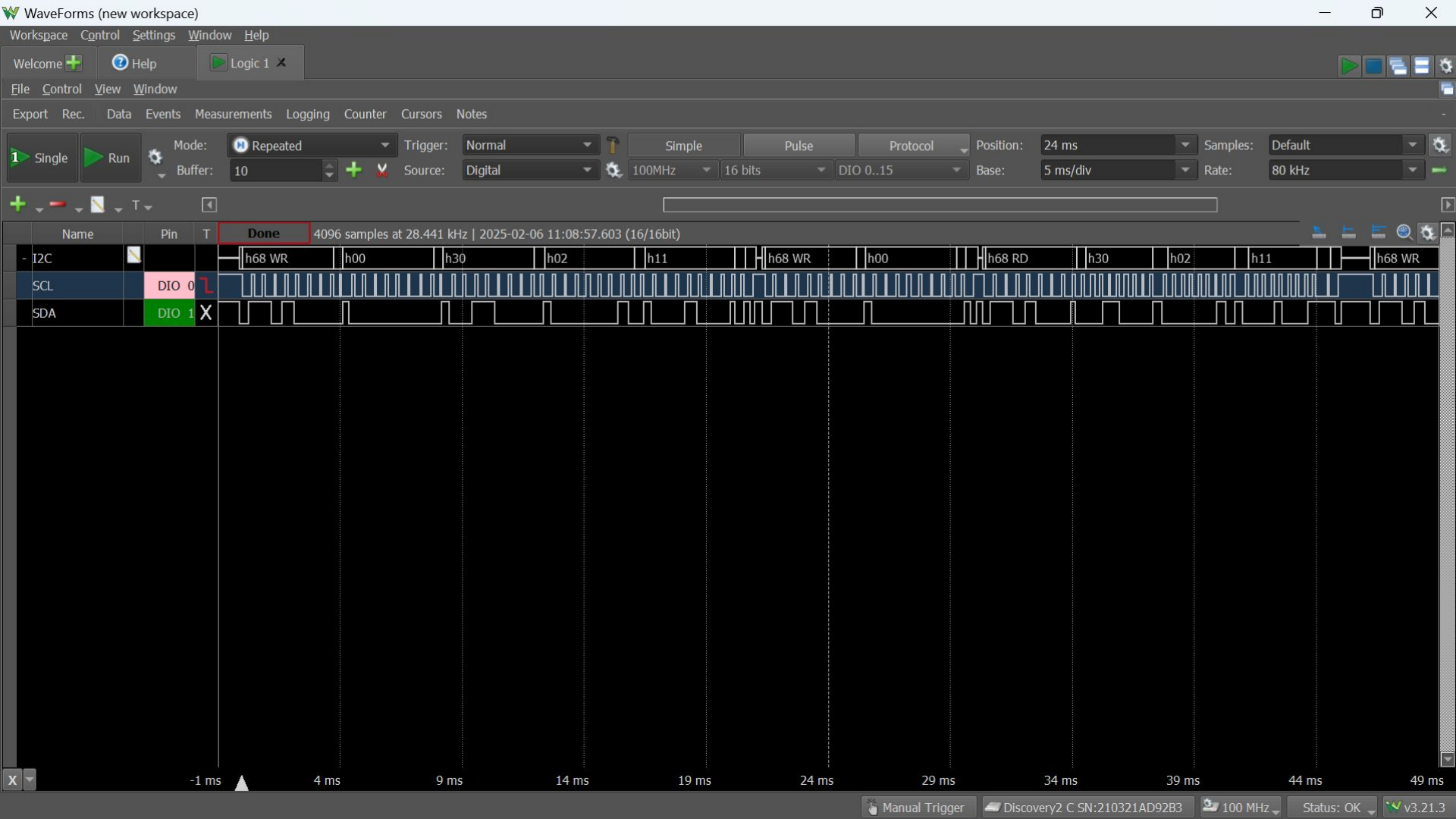
Sebastian: tx/rx byte, send read/write bit, i2c_write, i2c_read, modularized reading and writing, made arbitrary reading/writing

03 RTC

Assigned parts to implement

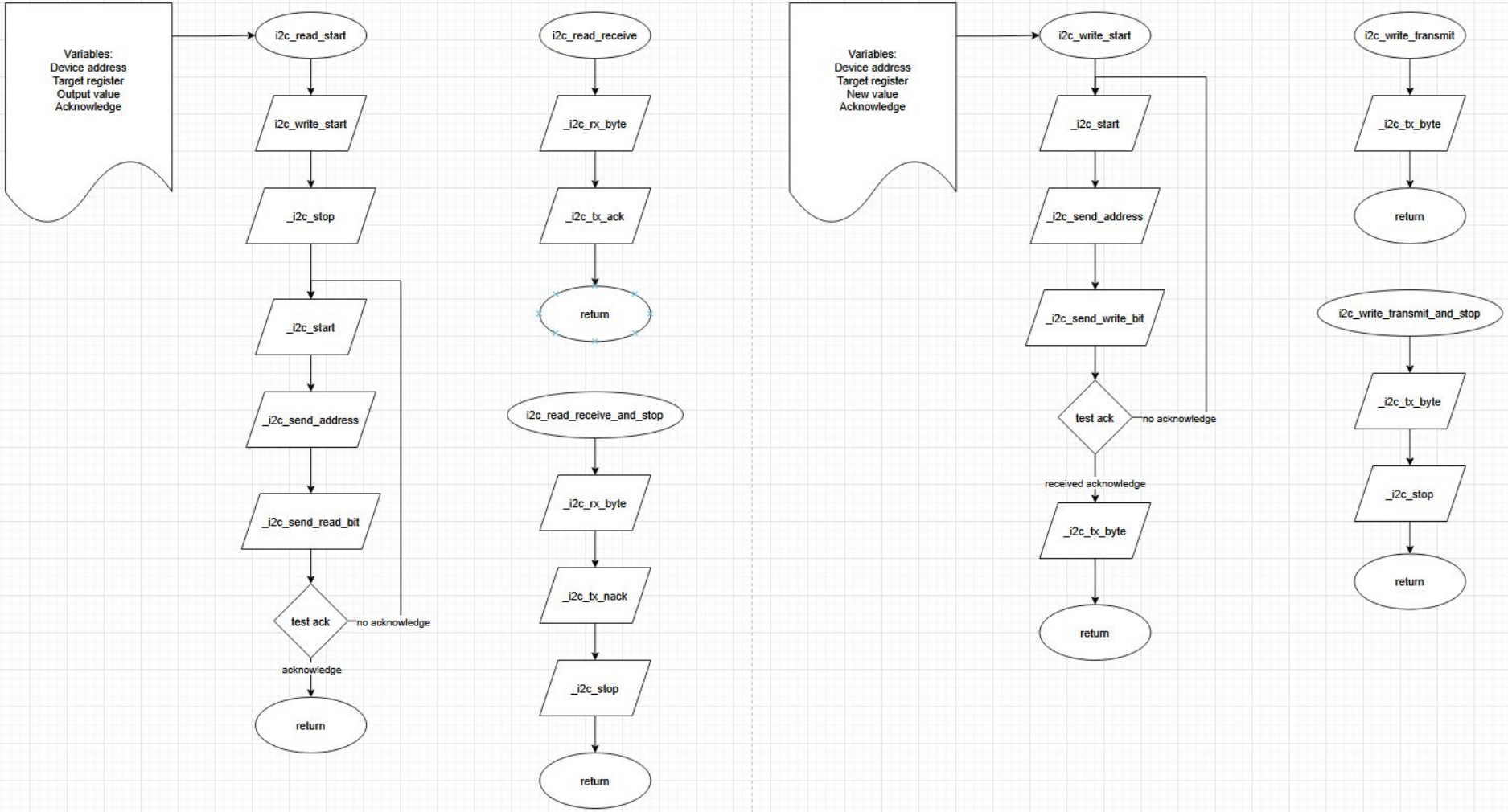
Emmett: reading and interpreting temperature

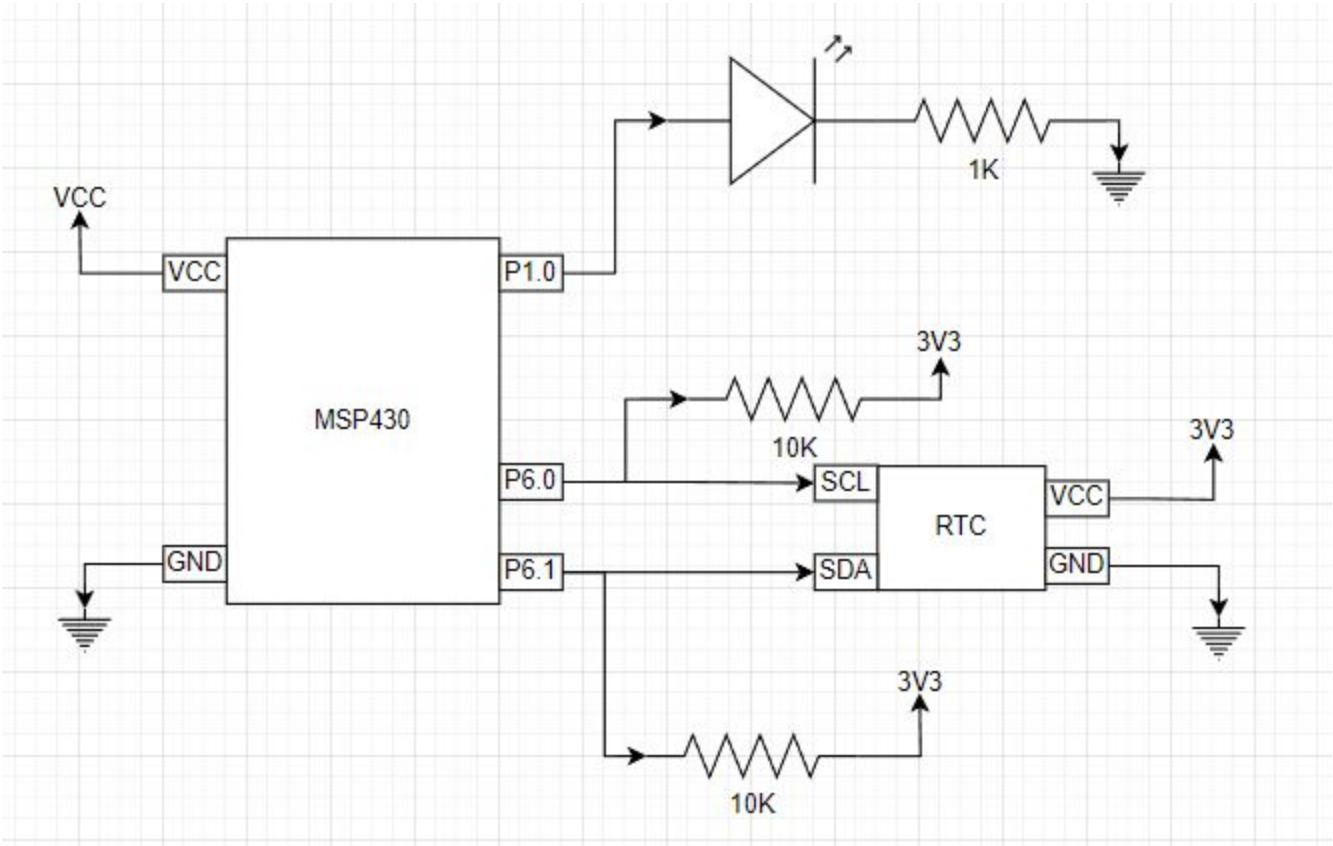
Sebastian: write/read time to/from rtc


WaveForms (new workspace)
Workspace Control Settings Window Help
Welcome Help Logic 1
File Control View Window
Export Rec. Data Events Measurements Logging Counter Cursors Notes
Single Run
Mode: Repeated
Buffer: 10
Trigger: Normal
Source: Digital
Simple Pulse Protocol
100MHz 16 bits DIO 0..15
Position: 24 ms
Base: 5 ms/div
Samples: Default
Rate: 80 kHz
Name Pin T Done
4096 samples at 28.441 kHz | 2025-02-06 11:08:57.603 (16/16bit)
I2C
SCL DIO 0
SDA DIO 1
h68 WR h00 h30 h02 h11 h68 WR h00 h68 RD h30 h02 h11 h68 WR
-1 ms 4 ms 9 ms 14 ms 19 ms 24 ms 29 ms 34 ms 39 ms 44 ms 49 ms
Manual Trigger
Discovery2 C SN:210321AD92B3
100 MHz
Status: OK
v3.21.3

03

Flowchart and Circuit Diagram


Variables:
Device address
Target register
Output value
Acknowledge
i2c_read_start
i2c_write_start
_i2c_stop
_i2c_start
_i2c_send_address
_i2c_send_read_bit
test ack
no acknowledge
acknowledge
return
i2c_read_receive
_i2c_rx_byte
_i2c_tx_ack
return
i2c_read_receive_and_stop
_i2c_rx_byte
_i2c_tx_nack
_i2c_stop
return
Variables:
Device address
Target register
New value
Acknowledge
i2c_write_start
_i2c_start
_i2c_send_address
_i2c_send_write_bit
test ack
no acknowledge
received acknowledge
_i2c_tx_byte
return
i2c_write_transmit
_i2c_tx_byte
return
i2c_write_transmit_and_stop
_i2c_tx_byte
_i2c_stop
return


VCC
VCC
MSP430
GND
P1.0
P6.0
P6.1
1K
3V3
10K
SCL
SDA
RTC
VCC
GND
3V3
3V3
10K

04

Demo

05

Extra Credit

Extra Credit

- Write an arbitrary number of bytes to an arbitrary device (+2)
- Read an arbitrary number of bytes from an arbitrary device (+2)
- Save hr:min:sec into variables (+1)
- Set RTC close to actual time (+2)
- Read temperature and convert (not perfect conversion)(+5)

THANK YOU

project2-sebastian-emmett