

Modular Rapid Monitoring System

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Bradley University Electrical and Computer Engineering

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Agenda

- Problem Overview
- Gateway Interface System Progress
- Sensor Interface System Progress
- Closing Remarks
- Q&A Session

Problem Background

- Sponsored by Martin Engineering
- Modular Rapid Monitoring System
 - Logs analog and digital signals.
 - Ability to easily add additional inputs.
 - Low cost design.
- Goal: Continue development to make a “proof-of-concept” system for sponsor.

Problem Background

- System logging data within 50 ms after boot.
- Accelerometer and ADC operating at 600 Hz.
- Permanently store the first five minutes of incoming data.
- Permanently store the five minutes of data after machine power down.
- Keep cost under \$300.

System Block Diagram

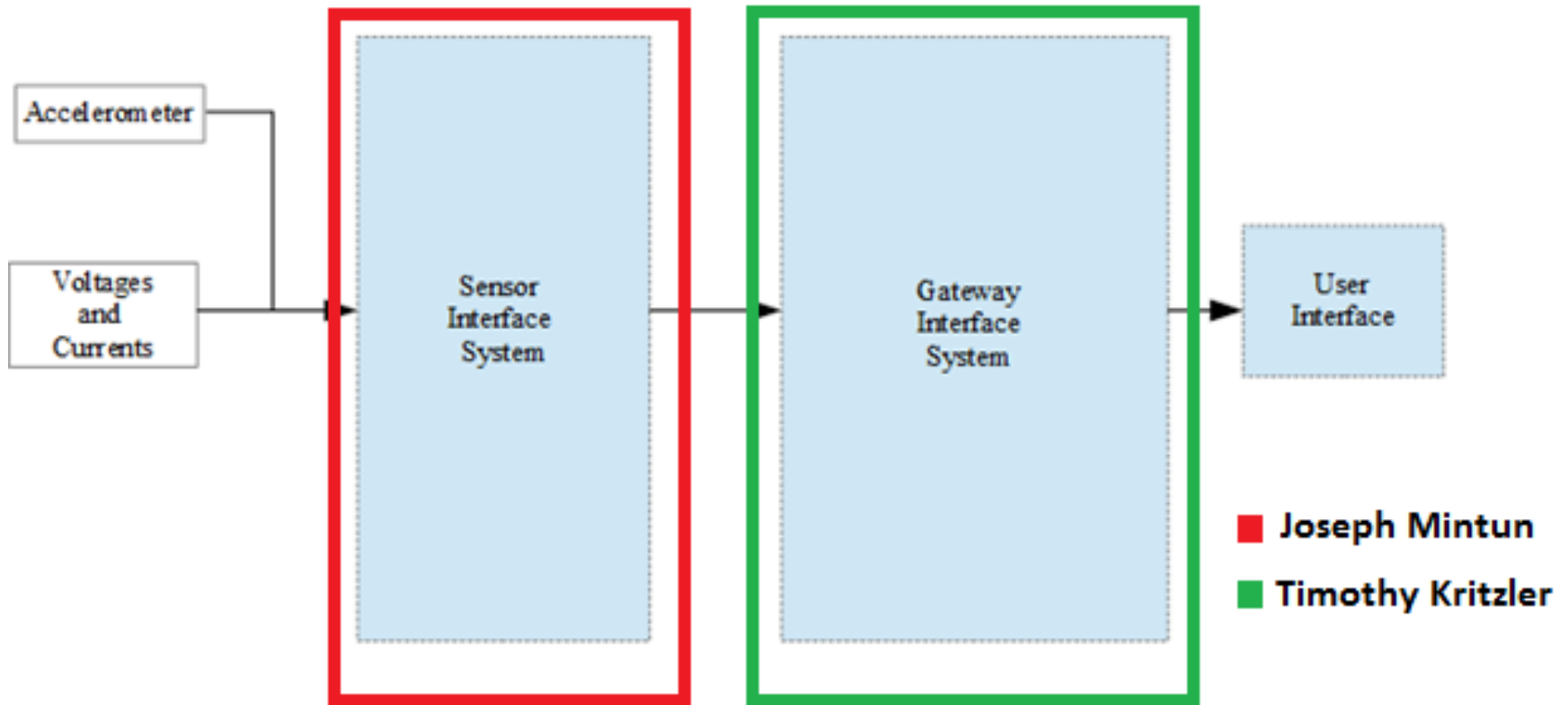


Fig. 1: Divided System Block Diagram

SIS Progress

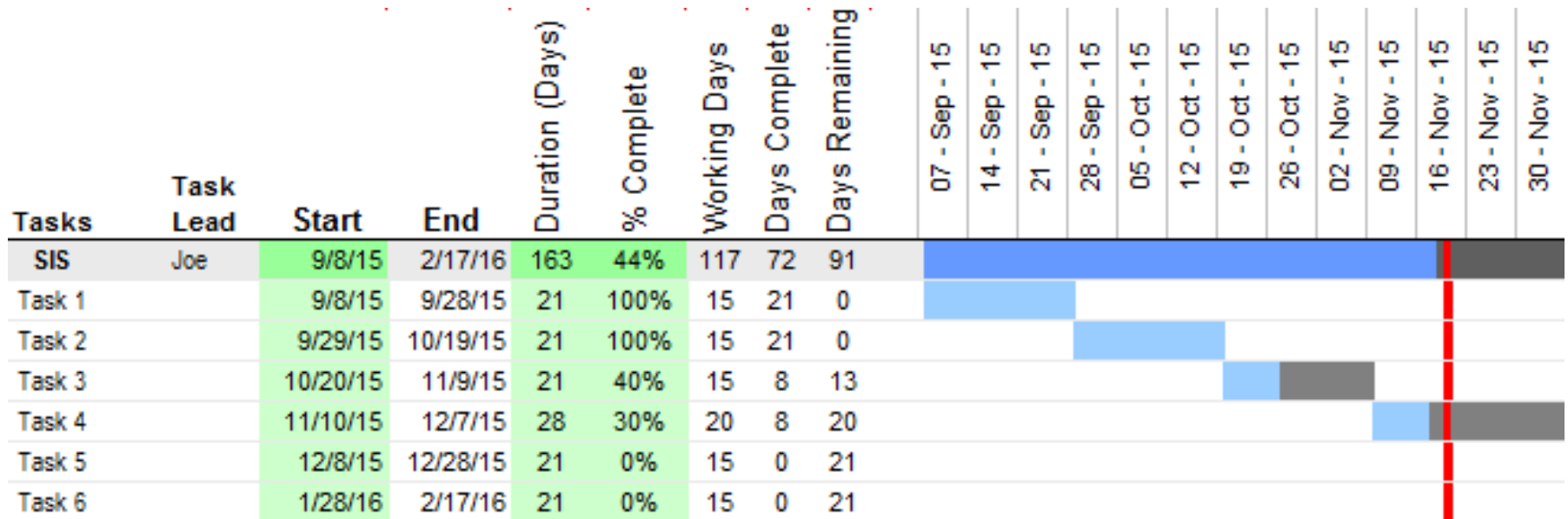


Fig. 2: SIS Gantt Chart

Task 1

- Initialization of the 600 Hz interrupt

```
// Initialize the timer/counter.  
tc_init_waveform(tc, &waveform_opt);  
//(fPBA / 8) / 600 for a 600 Hz Interrupt  
tc_write_rc(tc, EXAMPLE_TC_CHANNEL, (sysclk_get_pba_hz() / 8 / 600));  
// configure the timer interrupt  
tc_configure_interrupts(tc, EXAMPLE_TC_CHANNEL, &tc_interrupt);  
// Start the timer/counter.  
tc_start(tc, EXAMPLE_TC_CHANNEL);
```

Task 2

- Analog to Digital Converter
 - ADC Pins

```
const gpio_map_t ADC_GPIO_MAP = {
    #if defined(ADC_0_CHANNEL)
    {ADC_0_PIN, ADC_0_FUNCTION},
    #endif
    #if defined(ADC_1_CHANNEL)
    {ADC_1_PIN, ADC_1_FUNCTION},
    #endif
    #if defined(ADC_2_CHANNEL)
    {ADC_2_PIN, ADC_2_FUNCTION},
    #endif
    #if defined(ADC_3_CHANNEL)
    {ADC_3_PIN, ADC_3_FUNCTION},
    #endif
    #if defined(ADC_4_CHANNEL)
    {ADC_4_PIN, ADC_4_FUNCTION},
    #endif
    #if defined(ADC_5_CHANNEL)
    {ADC_5_PIN, ADC_5_FUNCTION},
    #endif
};
```


Task 2

- Enable the 6 channels

```
adc_enable(&AVR32_ADC, ADC_0_CHANNEL);
```

.....

- Inside the interrupt:

```
static void ADC_irq(void)
{
    buffer[i] = (adc_get_value(&AVR32_ADC, channel));
    i++;
    if (channel == 5)
    {
        channel = 1;
        results_done = 1;
        i = 0;
    }
    else
    {
        channel++;
    }
}
```

Tasks 3, 4, and Future Work

- Initialization of I²C communication
 - Handshaking
 - Power outage concerns
- Rotary buffer start
 - Store ASCII or binary?
 - Overwrite enable
- Accelerometer interfacing
 - 600 Hz interrupt

Gateway Interface System

Progress

- Progress at proposal presentation
 - Last objective completed was choosing Linux distribution.
 - TinyCore Linux designed for Raspberry Pi
 - Minimal features and low boot time
 - Reinstalls all additional software every boot
 - Fail safe if any glitches occur
 - Additional software raises boot time

Progress

- USB WiFi Adapter
 - Successfully installed driver and other software
 - Setup a startup script to configure driver every boot
- Persistence
 - OS would not save any changes from the original configuration
 - Add directory called “tce” to any partition on memory card

Progress

- Serial Port Communication
 - “Unlock” serial port from OS
 - OS uses it for SSH connection
 - Setup gcc on TinyCore for serial communication program
 - Modifying previous year C code for communication protocol is currently in progress

Progress

Original Schedule

Research and decide base OS	9/8/2015	9/24/2015	3 weeks
Interface Wifi	9/29/2015	10/8/2015	2 weeks
Develop UART Access program	10/13/2015	11/5/2014	4 weeks
Develop lightweight web server	11/10/2015	11/26/2015	3 weeks
Optimize boot time	12/1/2015	1/28/2016	3 weeks
Optimize Web server GUI	2/2/2016	2/11/2016	2 weeks
Combined SIS/GIS Testing and debugging	2/16/2016	3/10/2016	4 weeks

Revised Schedule

Research and decide base OS	9/8/2015	9/24/2015	3 weeks
Interface Wifi	9/29/2015	10/8/2015	2 weeks
Develop UART Access program	10/13/2015	11/26/2014	7 weeks
Develop lightweight web server	12/1/2015	1/28/2016	3 weeks
Optimize Web server GUI	2/2/2016	2/11/2016	2 weeks
Combined SIS/GIS Testing and debugging	2/16/2016	3/10/2016	4 weeks

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Full Gantt Chart

