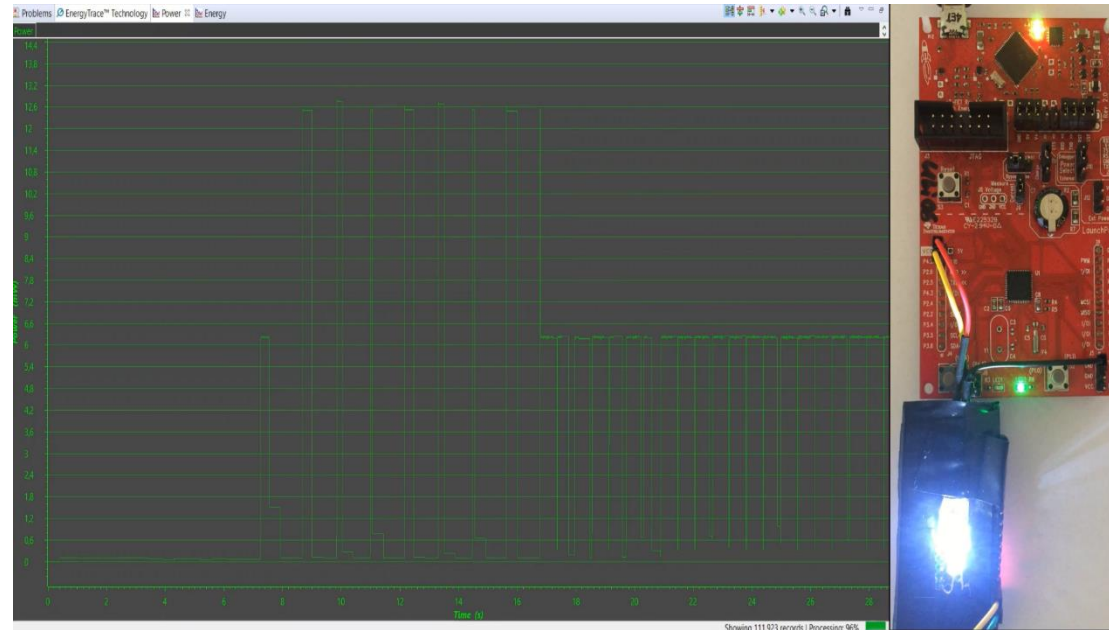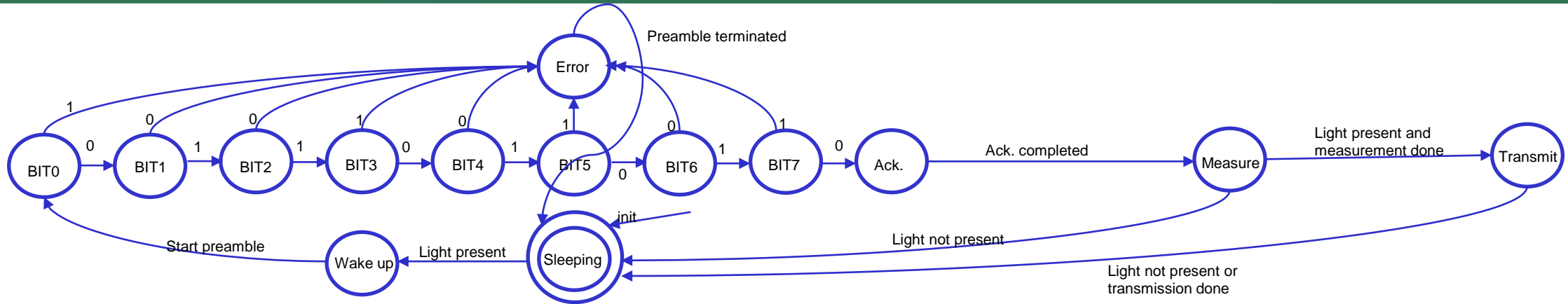# Final Project - Coin cell Challenge

Presented by
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on
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Ubiquitous Computing

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Preamble terminated

Error

1   0   0   1   0   1   0   1

BIT0 — 0 → BIT1 — 1 → BIT2 — 1 → BIT3 — 0 → BIT4 — 1 → BIT5 — 0 → BIT6 — 1 → BIT7 — 0 → Ack. — Ack. completed → Measure — Light present and measurement done → Transmit

Start preamble

Wake up — Light present → Sleeping ← init

Light not present

Light not present or transmission done

Sleeping
- Reset all flags just before sleeping.
- Just before sleeping turn on LED2 for 1 sec, if terminated abruptly.
- On sleep mode LPM3, ADC on 50Hz sampling using timer TA0 with ACLK 10kHz with prescalar of 4 to get 2500Hz.

Waking Up
- Flashlight and modulation with hand, implemented using a blinking code on ESP32 MCU.
- Light present for 3.27 sec Watch dog timer interval, go to 10Hz sampling rate for preamble.

ESP32   MSP430

Preamble
- ADC sampling rate of 10Hz (i.e. 1sample/0.1seconds) with TA0.
- Receiver circular buffer.
- FSM delay with LPM3, until new next bit is received.
- If preamble is correct, set 50Hz ADC sampling rate with TA0.
- On Bit error, quit program and go to Sleeping.

1 0 1 1 0 1 0 1 0 1

Preamble 1 Bit/0.5sec , +-20%,with 10Hz sampling rate, 5 samples (.) per Bit is counted.
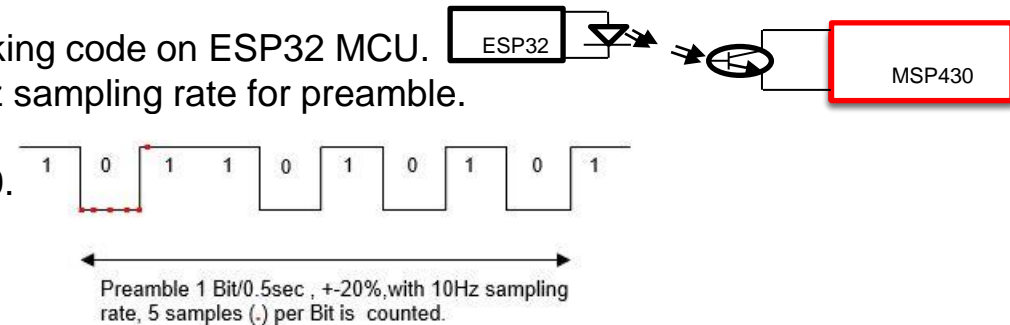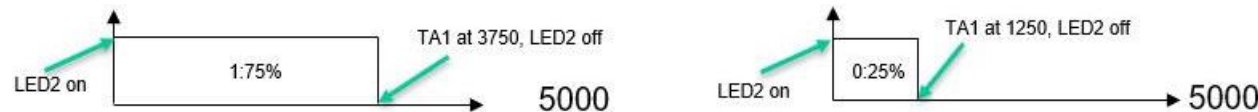
Acknowledgement
- Turn LED2 on for 250ms using TA1, with LPM3 as delay.

Stress and humidity measurement
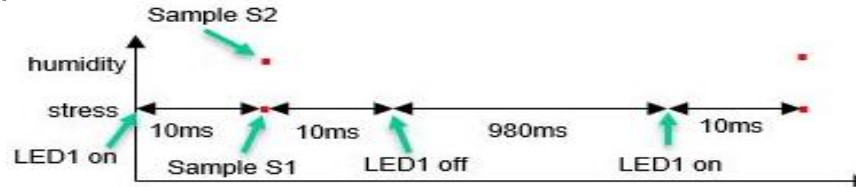
- Delay 10 ms with TB0CCR1 and LPM3, then turn off LED1.
- Delay 980 ms with TB0CCR1 and LPM3, then turn on LED1.
- Delay 10 ms with TB0CCR2 and LPM3, then read the state of S1 (stress) and S2 (humidity) simultaneously into transmit buffer.
- Repeat process 8 times.

Transmission

- TA1 in up mode with 10kHz ACLK , TA1CCR0 for 0.5sec bit period, and TA1CCR2 for Duty cycle (1:75% , 0:25%).
- Delay with LPM3 .
- In TA1CCR0 ISR, assign TA1CCR2 with appropriate count value to switch LED2, until transmit buffer is empty.
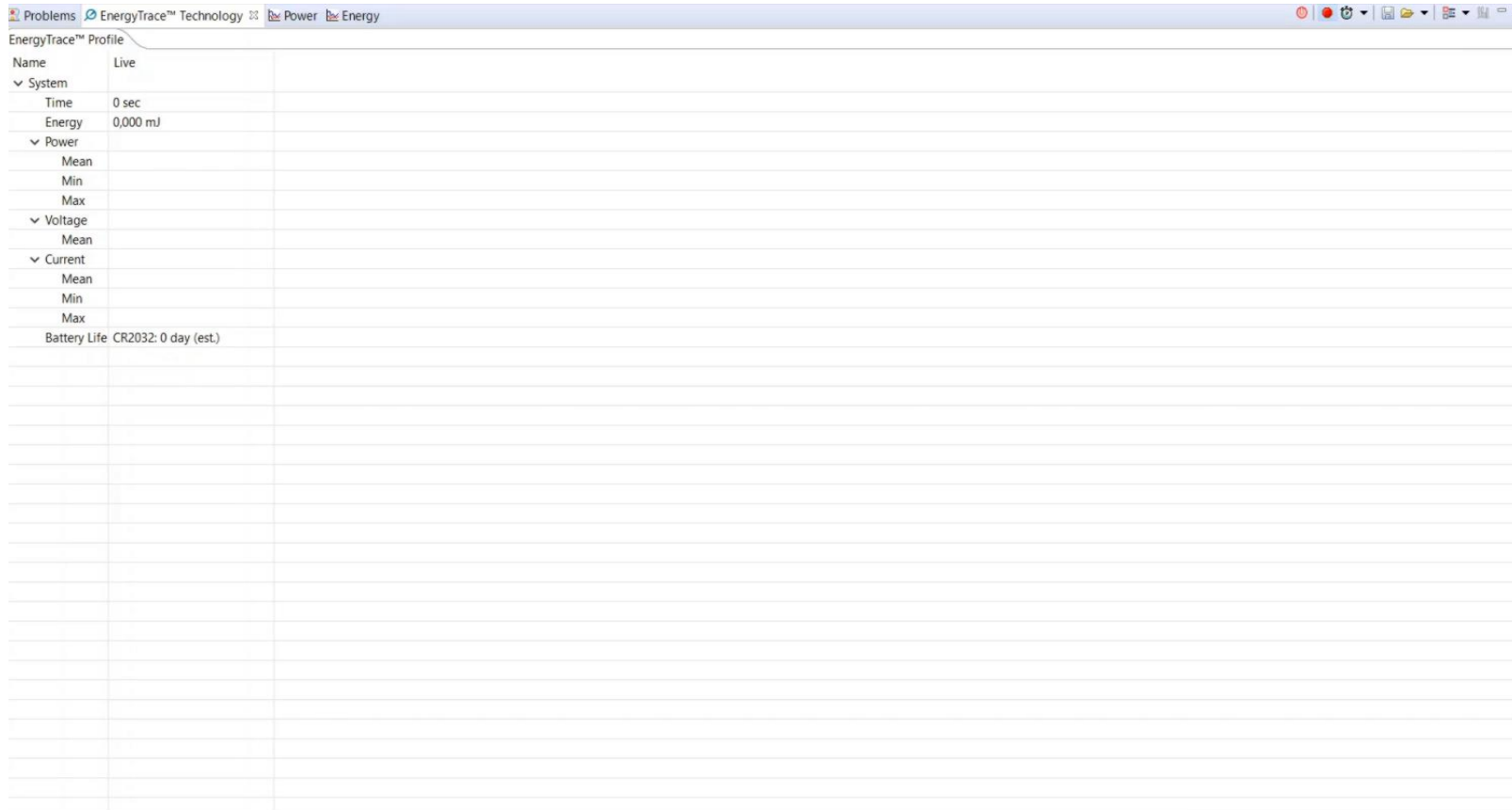- Quit program and go to Sleeping.

Termination

- If light source absent for 20ms, i.e. one ADC sampling period, set user defined exit flag, quit program and go to Sleeping.

Challenges: Reading the preamble

- Initial approach: +-20% error margin not considered.
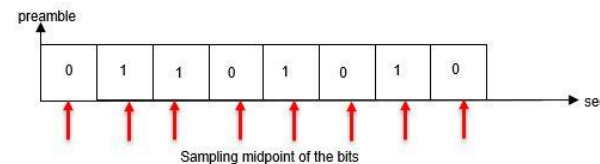
- Current approach: +- 20% error margin is considered but error margin realized is 0.45 sec to 0.675 sec bit period.

Main benefits of this approach
- User friendly design.
- Ultra low power consumption; Task mode: 0.87 mA, 3.12mW and Idle mode : 14.4µA , 51.7 µW.