Power Examination and Optimization of a Transcutaneous Oxygen Monitor

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Why Blood Oxygen Levels Matter

In 2017, almost 545 million people, which is approximately 7.4% of the global population, were affected by chronic respiratory conditions[1].

To maintain patients’ health, healthcare practitioners must closely monitor critical respiratory health metrics, such as Arterial Partial Pressure of Oxygen (PaO2).

UN Sustainable Development Goal

Transcutaneous Blood-Oxygen Monitoring

Clinical & Home Settings
Noninvasive & Comfortable for Patients

Higher Quality Treatments for Patients with Respiratory Illness
Reduces equipment and personnel needed, expanding healthcare capacity

Innovative Oxygen Monitor

The Integrated Circuits Systems lab at WPI is developing a much more suitable alternative: a wearable device which uses an unintrusive optical sensing technique to measure the partial pressure of oxygen diffusing through the skin (PtcO2), which is directly related to PaO2.

Power Examination & Optimization

The goal of this project is to contribute to the development of a novel, wearable transcutaneous oxygen sensor by studying its voltage consumption and optimizing its programming to ensure reliability and effectiveness.

Task #1
Determine operating voltage range with DC Supply

Task #2
Develop code to monitor battery voltage

Task #3
Develop code that saves important data to flash at critical voltages

During, Vbat monitoring r values are expected to deviate from the correct value.

Code Flow Chart

Variables Needed

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Vopt = Optimal Operating Voltage
Vth = Threshold Voltage
Vsh = Shutdown Voltage

Classroom Connection

• As part of the Research Experience for Teachers Program, this research experience will impact students at Leominster High School. Researchers have created a lesson plan for High School Physics students relating to this project.

Lessons Will Be...

• Dynamic
• Engaging
• Project-Based

Topics Include...

• TBD
• TBD

Special thanks to:
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All Members of the Integrated Circuits & Systems Lab
The Research Experience for Teachers Staff at WPI
The STEM Education Center at Worcester Polytechnic Institute

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During, \( V_{\text{bat}} \) monitoring \( \tau \) values are expected to deviate from the correct value.

Task #2 Develop code to monitor battery voltage

- Prepare Data for Saving
- Write Data to Flash Memory
- Check Flash Ready
- Verify Write
- Log the Operation
- Return to Main Loop
- End

Task #3 Develop code that saves important data to flash at critical voltages

- Initialize System
- Configure uC
- Initialize ADC
- Initialize Flash
- Read Voltage from ADC
- Is Voltage Critical?
- No
- Yes
- Loop Back to Read Voltage
- Write Data to Flash Memory
- Check Flash Ready
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- Return to Main Loop
- End

The Research Experience for Teachers Staff at WPI

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