



Dwight Look College of

ENGINEERING
TEXAS A&M UNIVERSITY

Project name: Fuel Cell Monitor
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Sameer Osama
Russell Wells
Sponsor: John Lusher



Project description

- Problem statement: A single fuel cell is an easy power source to monitor, but to achieve any level of real usable power they must be connected in a stack. The goal of this project is to design a monitor that displays individual cell voltages and warns the user of cell abnormalities as well as which cell requires maintenance or attention.

Diagram of subsystems and interface

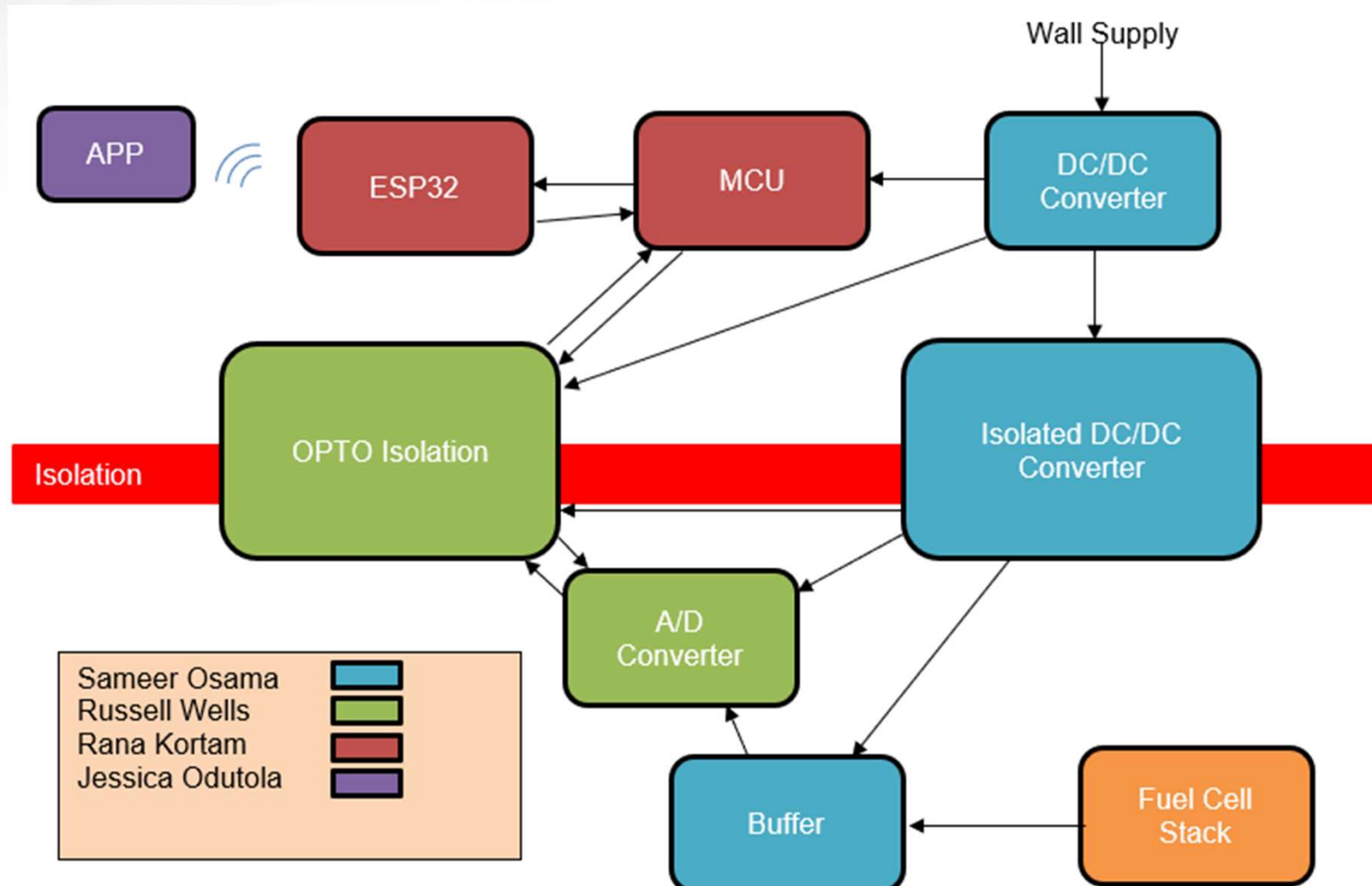


Figure 1: Fuel Cell Monitor Block Diagram

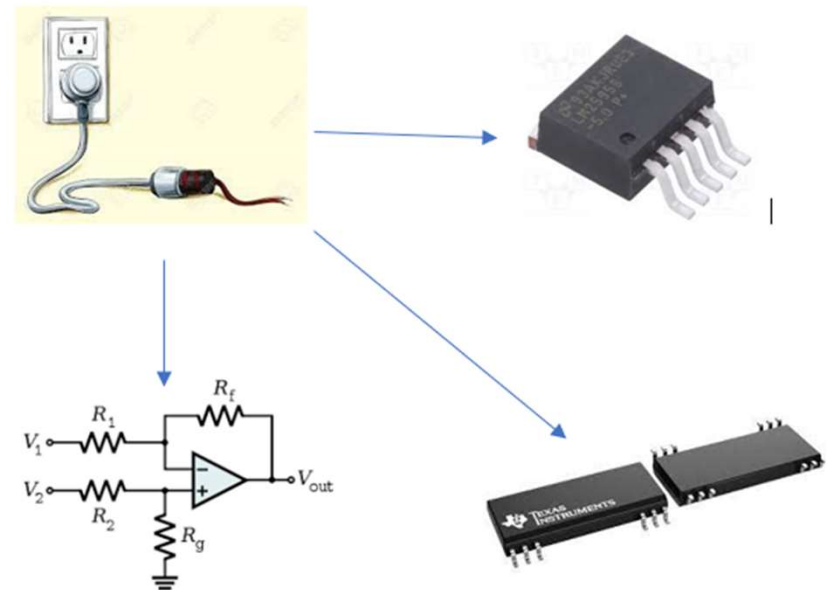


Task partition

- Sameer: Providing power to the system and the chips.
- Russell: Design internal, raw data manipulation prior to microprocessor.
- Rana: Design a microcontroller that will use Wi-Fi that will communicate with the android app.
- Jessica: Develop mobile android application to display voltage levels of the fuel cells. Application shall also alert users when errors occur with fuel cells.

Power Subsystem

- Provide power to system
 - Using wall wart, DC/DC converter and isolated DC/DC converter
- Designing a differential amplifier
 - Filter the signals from fuel cells



Internal Signal Transfer and Manipulation Subsystem

- Convert analog signal to microprocessor compatible digital signal.
- Transfer digital signal to microprocessor via Opto-Isolator.

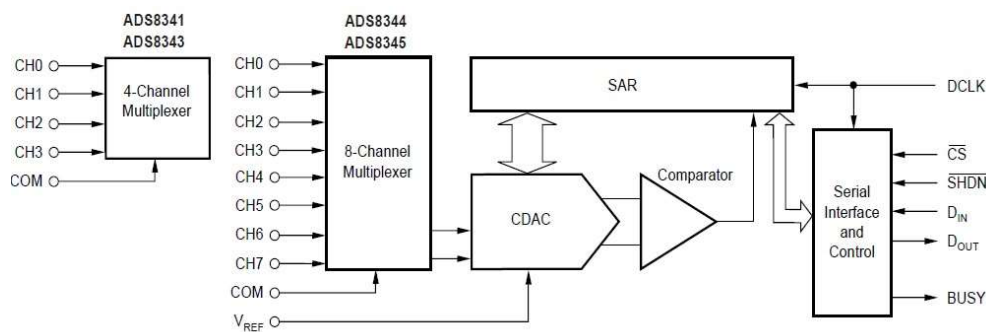
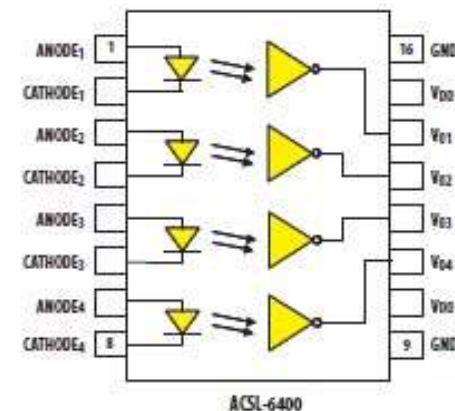
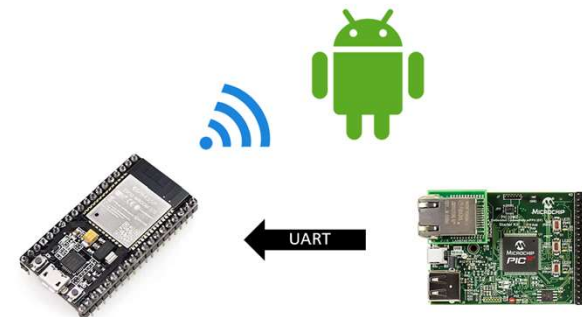


Figure 4: ACSL-6400 – Quad-Ch, All-in-One



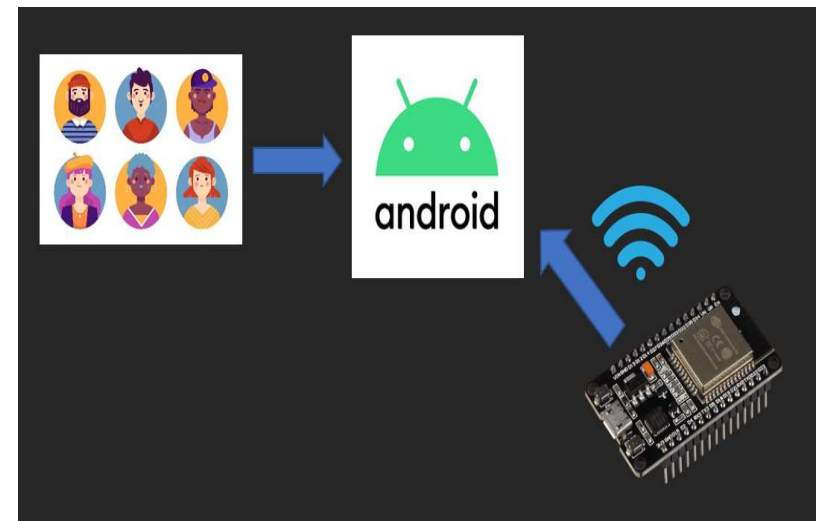
Microcontroller Subsystem

- PIC32 Microcontroller
 - Receives voltage signal from the OPTO isolation system
 - The MCU will connect to the ESP-32 microcontroller through a UART port. This allow to transfer the signal from the MCU to the ESP-32 microcontroller to send the signal to the application.
- ESP32
 - Communicate with the application via WIFI



Android Application Subsystem

- Provide GUI to user's android device
- Communicates with the Microcontroller via Wi-Fi
- Provides alerts via notification system to inform users of errors with fuel cells



Execution plan

[illegible]



Validation plan

| Test Name | Success Criteria | Methodology | Status | Responsible Engineer(s) |
|---|--|--|----------|-------------------------|
| Power Devices On PCB | PCB transfers power without overheating or burnout | Power Board and watch, smell, listen | Untested | Russell, Sameer |
| Internal signal voltage range | System can properly handle the specified voltages with minimal difference between tests. | Introduce voltages of 0-5V and measure output signals | Untested | Russell |
| Differential voltage tests | Pass a differential voltage through the Opamp buffer and receive the proper digital signal from the optoisolator | Introduce a range of voltages including edge cases and ensure proper output | Untested | Russell, Sameer |
| Android application graphical functionality | Application can properly display accurate voltage levels to user. | Use application on android device and verify voltages are accurately displayed | Untested | Jessica |
| Android Application alarm functionality | Application send alarm to user when voltage goes above or below ranges | Add set points to app and introduce alarm level voltages | Untested | Jessica |
| Power system functionality test | Power is applied from wall outlet and proper power transfer is read at outputs | Apply power to system and read voltage output at device trace | Untested | Sameer |
| Opamp system functionality test | Differential voltages are passed to the opamp and expected voltage is seen on the output | Power opamps and apply varying differential voltages and read output voltage | Untested | Sameer |
| PIC32 Microcontroller functionality test | The code for receiving the voltage signal for data acquisition | PCB board and coding on IDE | Untested | Rana |
| ESP32 Microcontroller functionality test | The code for communicating with the application | PCB board and coding on IDE | Untested | Rana |