

A hand is using a logic analyzer probe to test a green printed circuit board (PCB). In the background, a computer monitor displays a green sine wave on a dark screen. The scene is dimly lit, focusing on the technical work.

WDAQ: User Needs and Requirements

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Project Overview

Project: Wireless Data Acquisition (wDAQ) system to capture/transmit high-frequency analog signals to a device in real time using Wi-Fi technology

- The DAQ will amplify a 1 mV analog input signal to approximately 1-2 V before digitizing it
 - ADC will have a 12-bit resolution
- Wi-Fi will be used to wirelessly transmit signals to a computer
 - Bluetooth can be used for signal transmission, but has a significantly lower data transfer rate than Wi-Fi
- The DAQ will be fabricated on a small PCB with surface-mount components
- A graphical user interface (GUI), written in LabVIEW, will be used to analyze data



User Needs

- Portability/Mobility
- Wireless Connection
- User Interface for Data Analysis
- Accurate Data Collection
- Reliable Wi-Fi Communication
- Fast Learnability
- Minimal Setup
- Ease of Use



Requirements

- Compact Size and Mobility
- Wireless Communication with Laptop
- Low Cost
- Accurate Data Representation
- Longevity and Reliability



Key Requirement: Compact Size & Mobility

- Small size and ease of mobile use are important features for our application
 - The device will be used to analyze the anatomy of small animals
 - We will need the device to fit in about a 1" x 1" x 5" volume within a Photoacoustic Tomography (PAT) system in the ISU Biomedical Imaging Lab (BILab) with 10-20 duplicates of the devices placed in a rotating circular array and connected to transducers
 - The data acquisition systems will be attached to transducers, which convert real-world signals (e.g., a voice or heartbeat) into electrical signals that can be analyzed by our devices.
 - The PAT system only has a small space available for each data acquisition system in its rotational configuration, and the devices will be spinning around in a circle, so large devices with BNC cables and cords will not be compatible with the system
 - For later applications of the device beyond the BILab, users will still want a compact mobile device that can be used to gather data in places outside of the lab, such as in a field.

Key Requirement: Wireless Communication

- Wireless communication with software is another key attribute
 - With the PAT system, the data acquisition systems will be mounted to the transducers using a male-to-female SMA connection
 - Because of the small space and weight constraints needed to mount the devices on the machine, there will not be room for a graphical display on each DAQ system, and it would not make sense to have a separate display for all DAQ systems on the machine (up to 20)
 - Thus, we will need to use Wi-Fi or Bluetooth to communicate signals with software and create a program to view and analyze all the signals simultaneously on a graphical user interface

Engineering standards

- IEEE Bluetooth/WIFI Standards (Bluetooth: IEEE 802.15.1-2002; Wi-Fi: IEEE 802.11)
- Battery Protection Standards
- PCB Standards
- Circuit Schematic Standards
- Clean Coding Practices
- ACM Ethics
- IEEE Microcontroller Programming Standard (IEEE 1118.1 1990)
- IEEE Citation Format for Resources and References

Conclusion: Our Project Goals

- Create a small, compact device to replace a traditional oscilloscope
- Achieve user needs of increased mobility and easy learnability
- Achieve wireless communication and cordless power supply
- Perform accurate circuit analysis
- Follow and implement relevant engineering standards

Sources

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