# Wireless Data Acquisition System

# Team: sddec24-19

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## Introduction

**Problem:** Traditional oscilloscopes use BNC (coaxial) cables, a power cord, a built-in display, and buttons. These bulky, fragile, expensive tools make mobile data acquisition a challenge and hassle.

**Solution:** Creation of a compact, battery-powered, software-connected data acquisition system

**Intended Users:**

1. **Researchers:** educated professionals conducting research on noninvasive tissue imaging
2. **Lab Assistants:** users with formal education on existing technologies who desire a friendly user experience with a minimal learning curve
3. **Educational Institutions:** Establishments that may seek to acquire the devices for multifunctional purposes

## Design Approach

- **Start with system block diagram**
- Determine how inputs must be transformed at each of the subsystem blocks
  - Amplification, ADC, Serialization
- Inter-subsystem communication must propagate signal quickly with high integrity
  - SMA, MHz range sampling, SPI

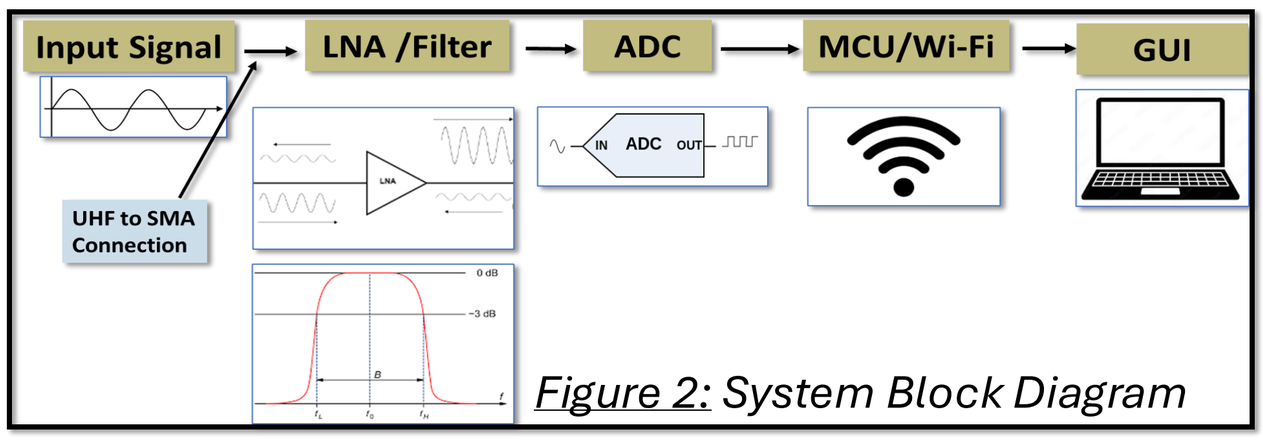


*Figure 2: System Block Diagram*

## Testing

- Integration Testing: Test with a combination of subcomponents to determine device interaction
- Regression Testing: As the project developed, tests were to ensure existing functionality
- User Testing: The Client used the device and software. Issues and limitations were identified and resolved

*Note: Testing was conducted almost weekly*

## Engineering Standards

- IEEE Wi-Fi Protocol (IEEE 802.11): ESP32
- IEEE Standard for Precision Coaxial Connectors at RF (IEEE 287.1-2021): Board Connectors
- IEEE Microcontroller Programming Standard (IEEE 1118.1-1990): Microcontroller Programming

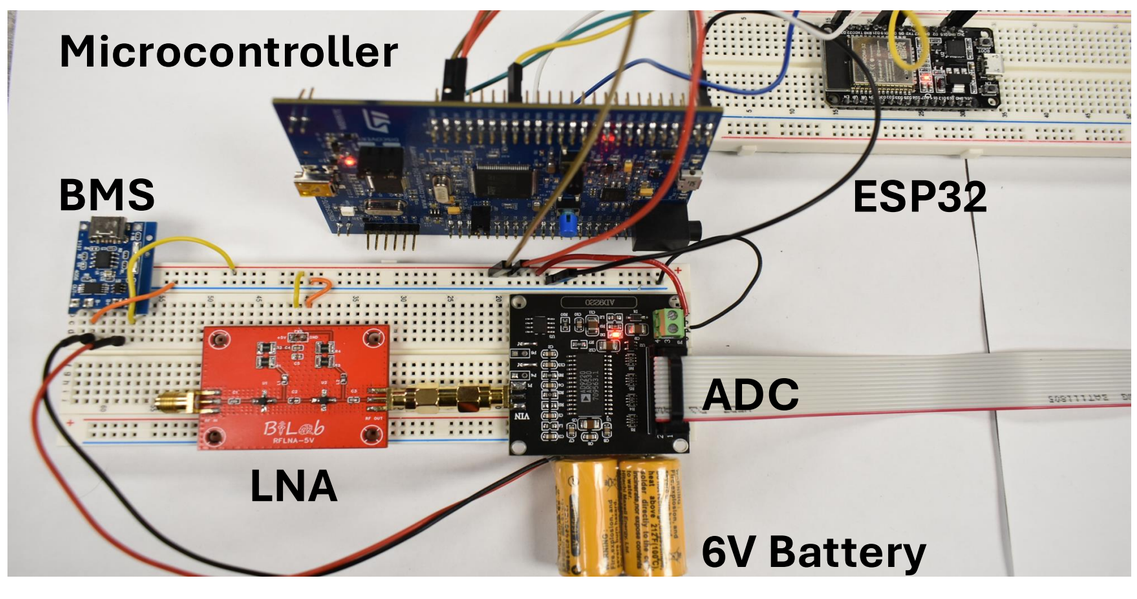


*Figure 4:* Finalized System Powered by Rechargeable Battery

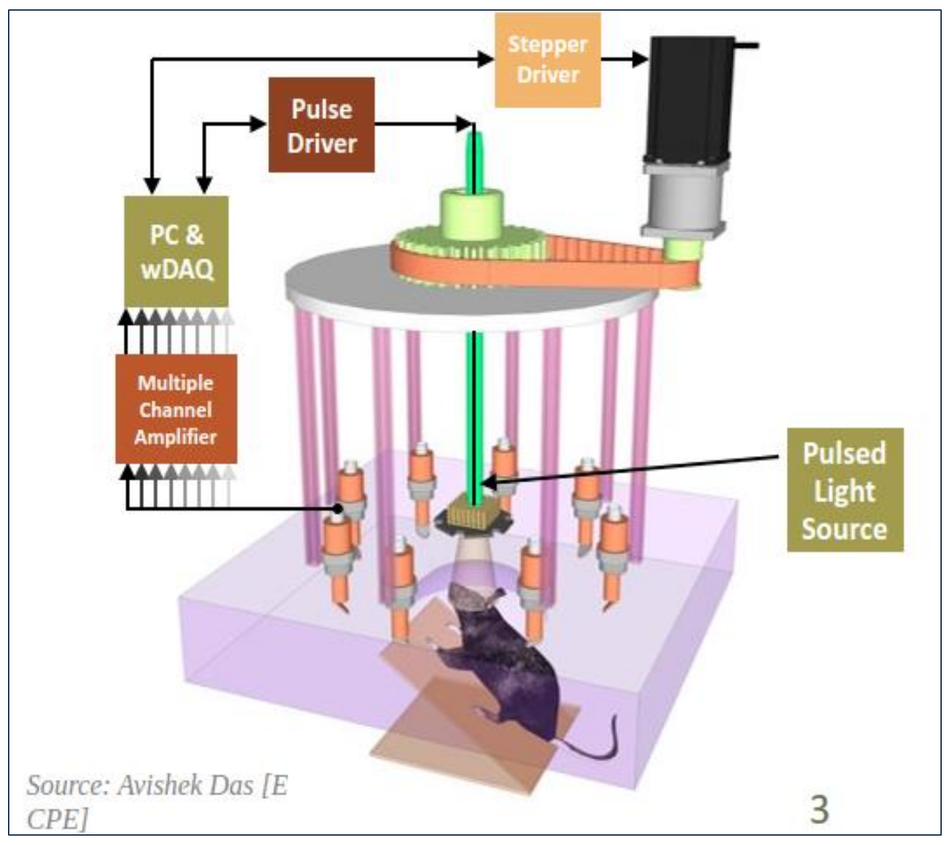


*Figure 1: Integration of wDAQ within Photoacoustic Tomography System*

## Design Details

**Functional Requirements:**

- Amplifier Gain: ~40 dB (100 V/V)
- System Bandwidth: 100 kHz up to 10 MHz
- Digital Resolution: 12 bits
- Sampling Rate: 10 MS/s
- System Channels: 2 Channels per Module
- Input Impedance: 50 Ω

**Non-Functional Requirements:**

- Easy to use interface
- Visually appealing GUI
- Minimally Sized

**Considerations:**

System should be designed in a manner that caters to a varying degree of expertise, while offering straight-forward configuration and reliable connection

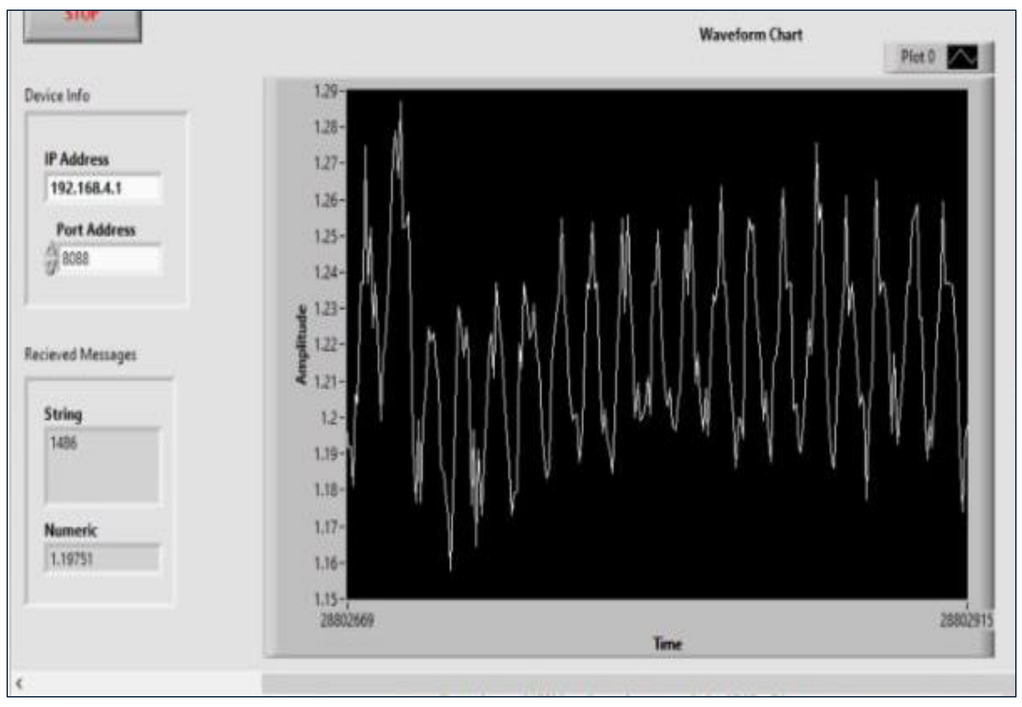


*Figure 3: LabVIEW Interface receiving transmitted signal from ESP32*

## Results

- Frequency Response Analysis: Device achieves a desired gain of 40dB and effective bandwidth
- ADC: Effective digitization of analog signal
- Wi-Fi Connectivity & User Interface: Continuous transmission, plotting, and data logging of voltage readings to LabVIEW







*Figures 5 & 6: Frequency Response Analysis (Left) and Digitization of 12-bit Analog Signal (Right)*