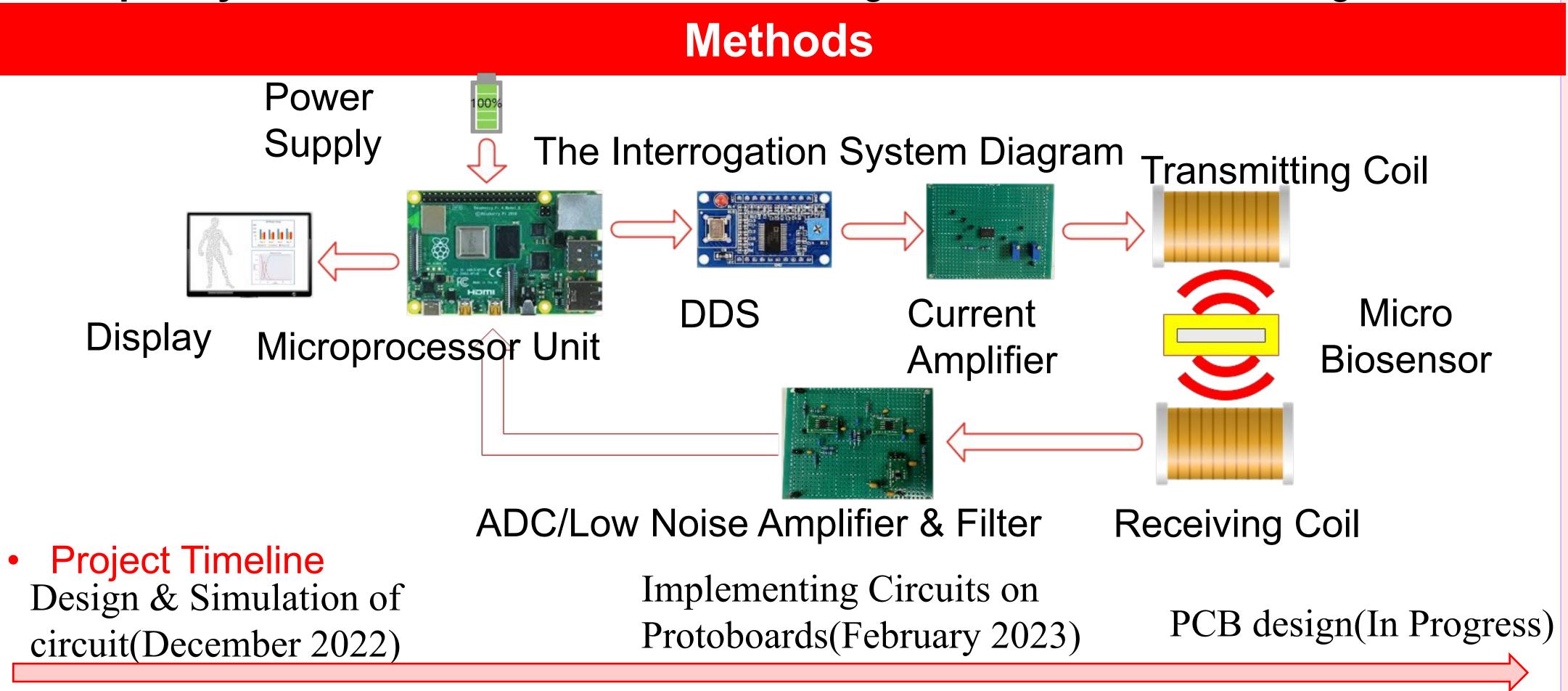


Wireless Sensor Interrogation System for Wireless Magnetoelastic Sensors

Hao Zhang, Yuming Wang, Haomin Zhu, Zhengcheng Feng Advisor: Tao Li

Background/Aims

- In recent years, magnetoelastic sensors (MES) made of amorphous metallic glass ribbons have been widely used in various fields, particularly in biomedical engineering. Their wireless and passive nature, without the need for a battery or antenna, makes them ideal for implantable devices, reducing complexity, size, and cost. They are used to detect biomarkers and bacteria in biomedical applications.
- A wireless ME sensor has been developed. However, an **interrogation system** is also required to **amplify the excitation signal** and **process the received signal**.
- To address these issues, a **current amplifier** will be designed for amplifying the excitation signal, a **low-noise amplifier** for processing the received signal, and a **Raspberry Pi with ADC and DDS modules** to generate and receive the signal.



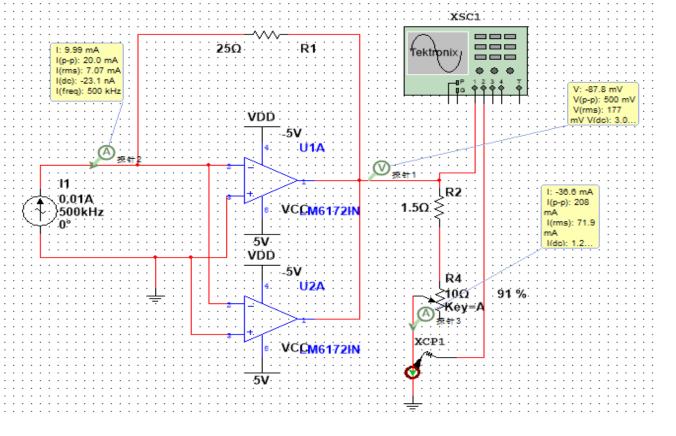
Implementation of DDS (January 2023) Circuit Testing (March 2023) Embedded System

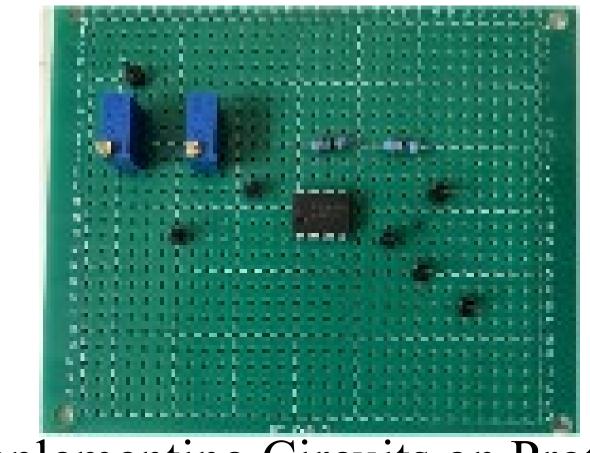
Embedded System Development

Embedded Systems include the Raspberry PI model, and DDS for generating signals to current amplifier circuits and receiving signals from ADC.

Current Amplifier

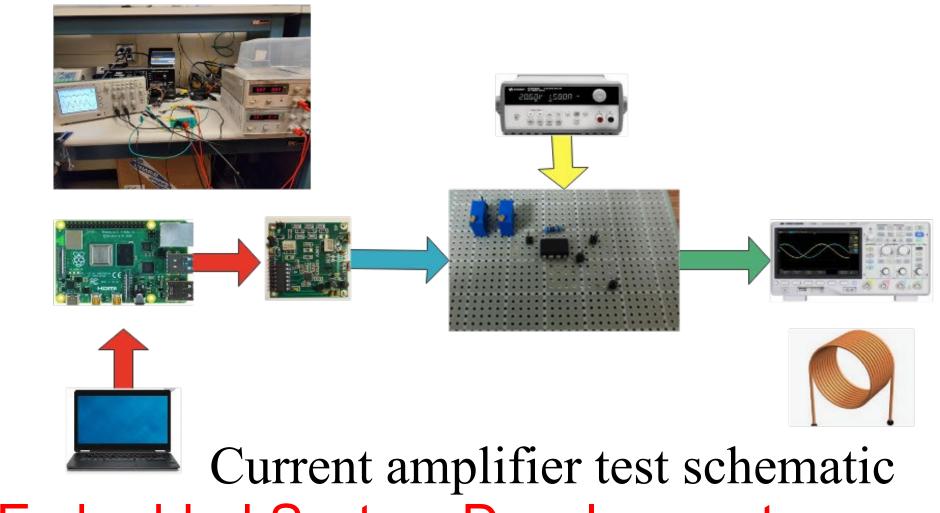
The current amplifier, designed to amplify DDS current, excites the transmitting coil with a sweeping frequency signal.

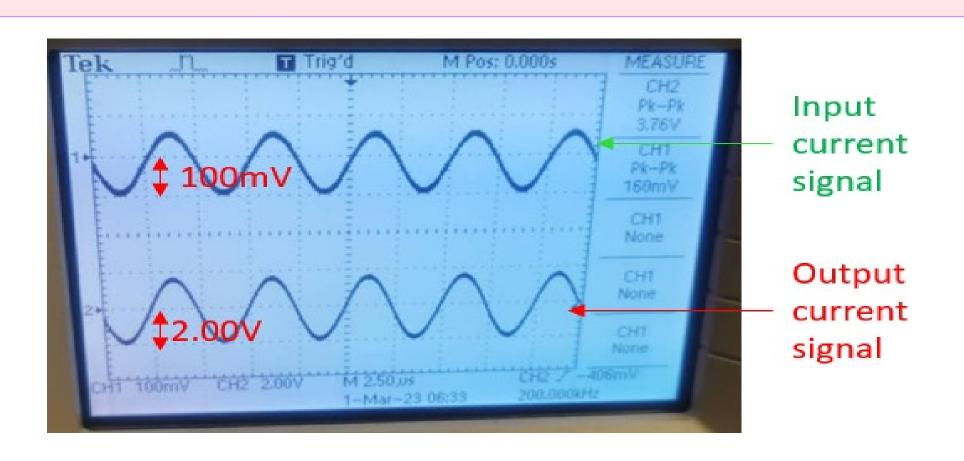




Simulation circuit of the Current Amplifier

Implementing Circuits on Protoboard

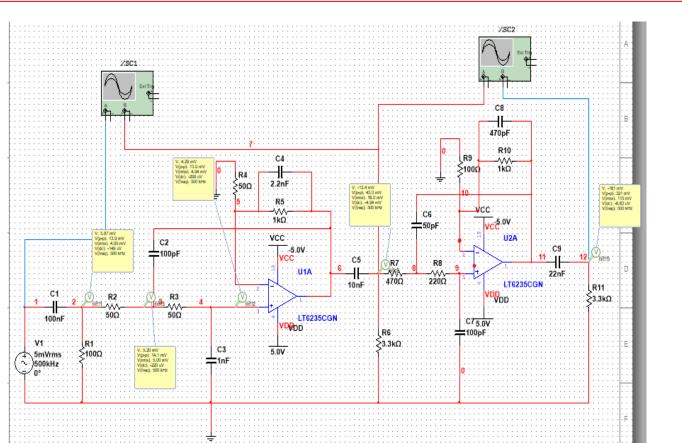




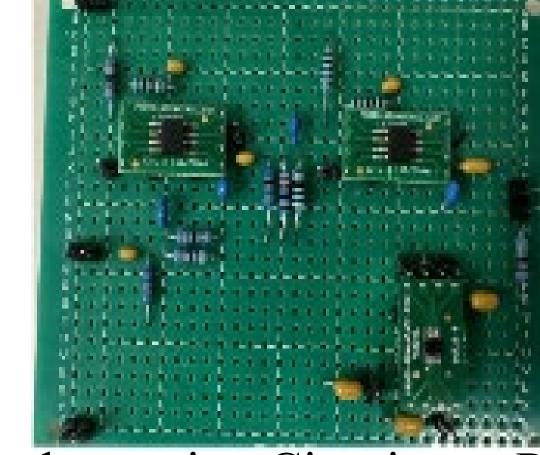
Output and input waveform of current amplifier

Embedded System Development

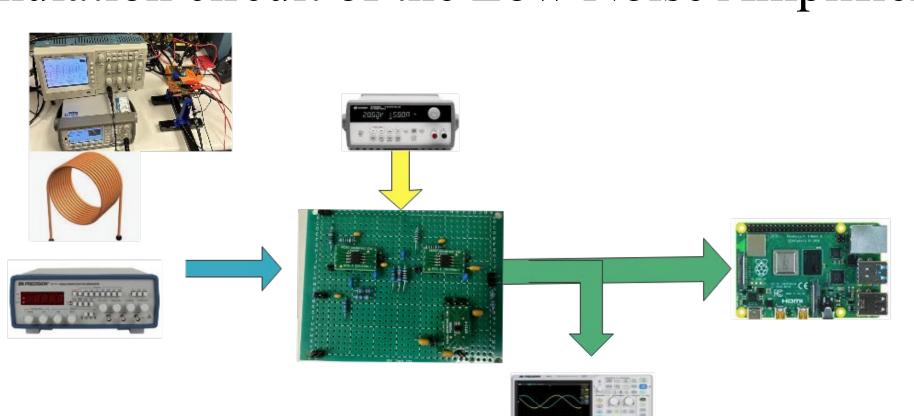
Low-noise amplifier and filter are designed to receive the signal from the sensor and transmit it to the ADC chip, processed by the ADC chip the signal returns to the microprocessor unit.



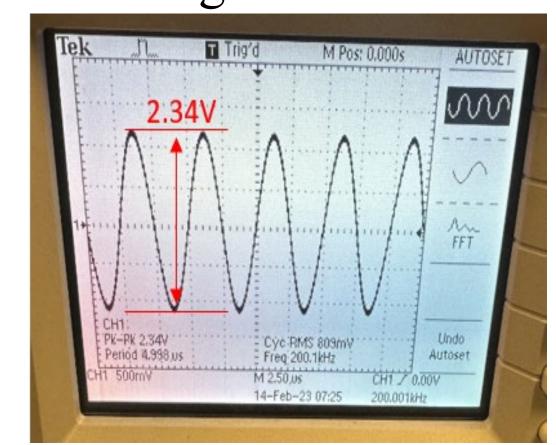
Simulation circuit of the Low Noise Amplifier



Implementing Circuits on Protoboard



Testing Platform for Low Noise Amplifier



Output waveform of Low-noise amplifier

Circuit Board Specifications

(Current	t Amplifier
C :	1.0	N I

bandwidth	Gain	Input Signal Range	Noise level	DC power supply				
1Hz-38MHz	7~18	10mA (P2P)	<50uA	5V				
Low-Noise Amplifier								
Bandwidth	Gain	Input Signal Range	Noise level	DC power supply				
80kHz-380kHz	80	2mV-10mV	<50mV	5V				

Budget

Mfr. Part #	LM6172IN/NOPB	TLV376IDR	Trimmer Resistors	Protoboards
Unit Price	\$6.47	\$1.27	\$3.78	\$1.29
Quantity	5	4	5	10

Conclusion/Future Work

Conclusion: This project successfully designed an Interrogation system for wireless ME sensor. This innovative approach demonstrates promising results in biomedical applications.

Future Work: To enhance the system's portability, a PCB design will be developed to integrate all components onto a single board, further streamlining the device.