

**FINAL PRESENTATION**



INDIAN INSTITUTE  
OF TECHNOLOGY  
**PALAKKAD**

# **DEVELOPMENT OF PORTABLE BIOSENSOR**

ID2802: Open Ended Lab Project

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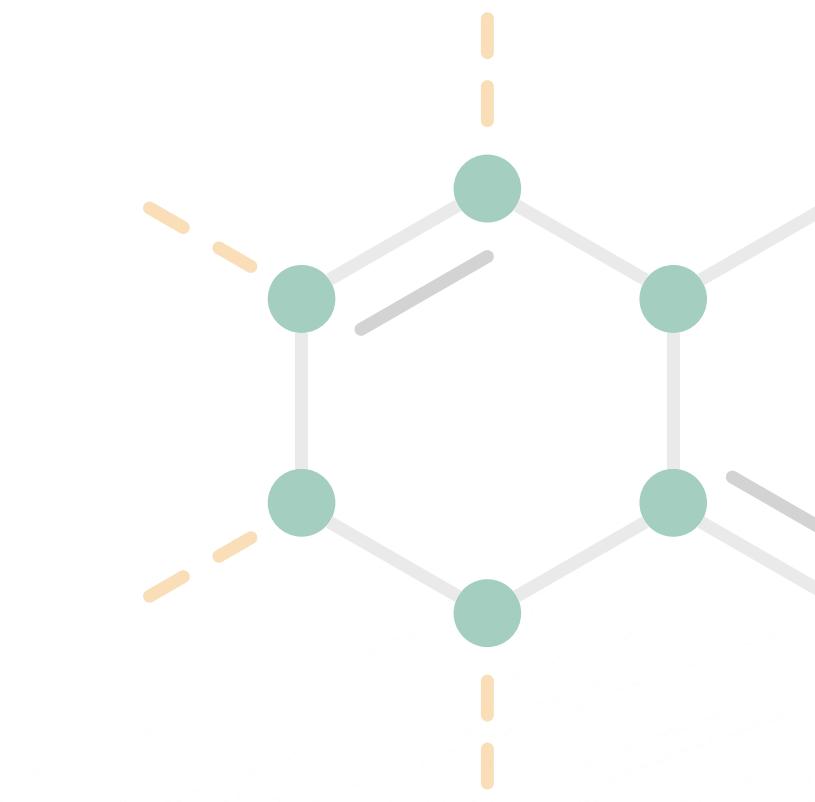
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# OBJECTIVE

To develop a portable biosensor that can  
measure the concentration of a biomarker using  
Amperometry method



# INTRODUCTION

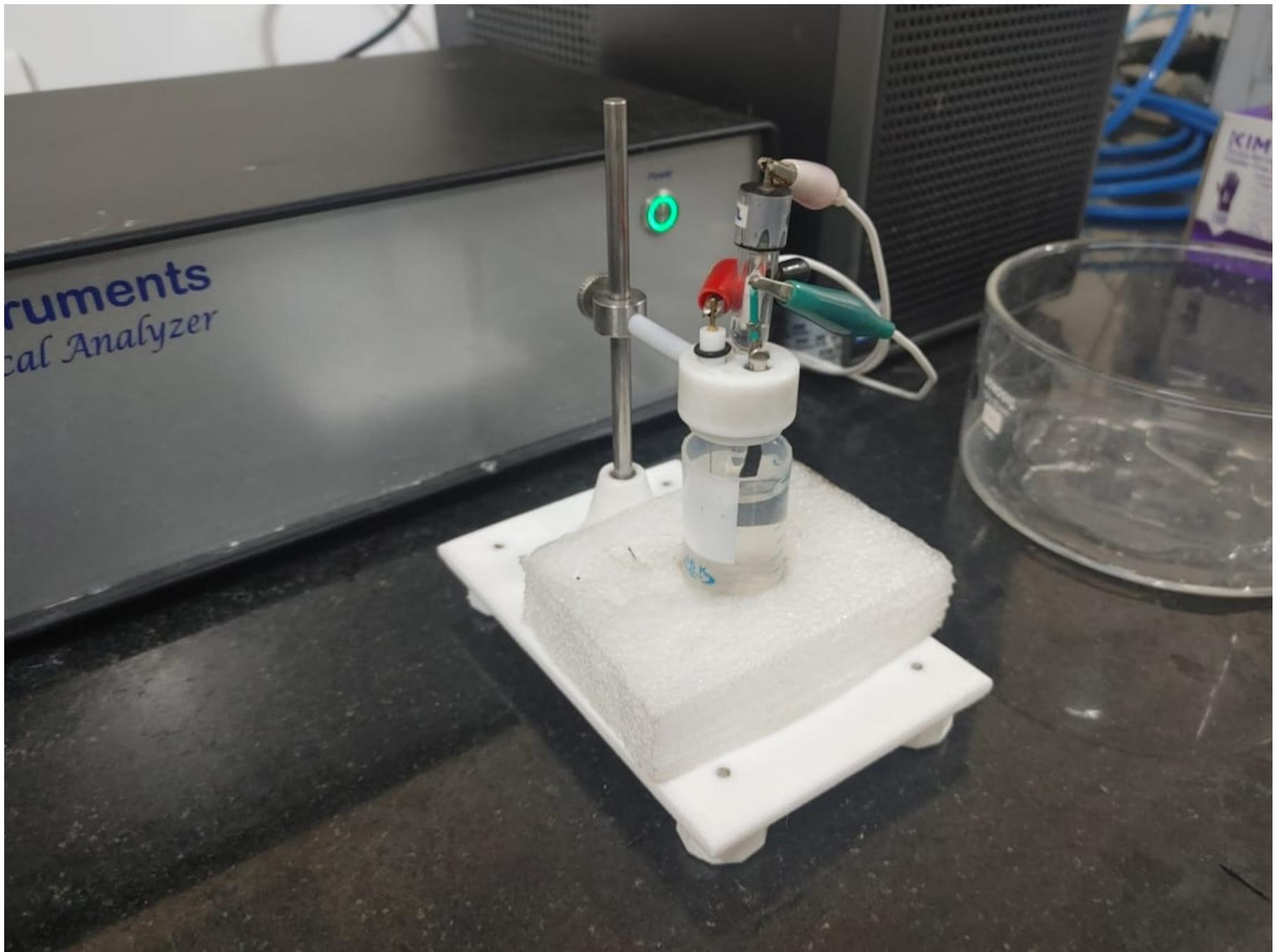
The current method for measuring microampere-level currents in biological measurements relies on large and expensive electrochemical workstations. These instruments provide accurate measurements but are not easily portable, limiting their accessibility and hindering widespread use in point-of-care diagnostics and remote monitoring. To address these limitations, a portable biosensor is being developed to achieve precise and reliable microampere current measurements in a compact device.

# INTRODUCTION



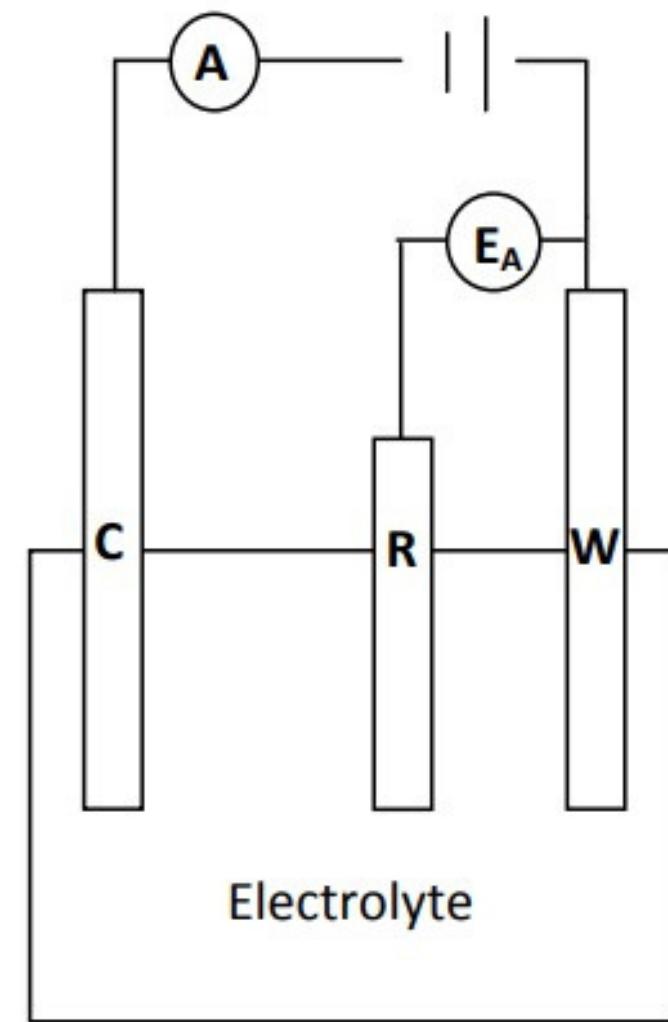
**Electrochemical Analyzer  
at Ahalia chemistry lab**

# INTRODUCTION



Three electrode system

- Working electrode
- Counter electrode
- Reference electrode



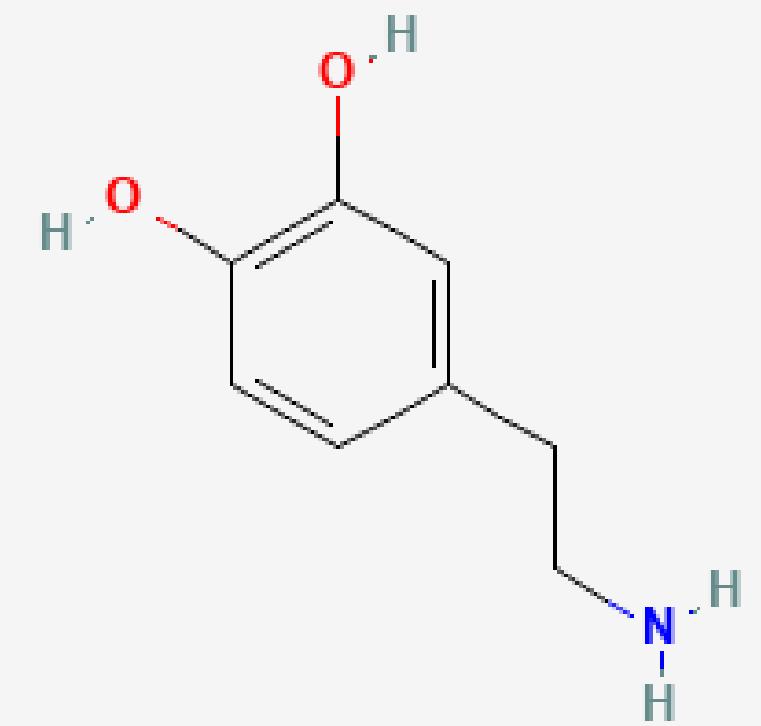
# APPLICATION OF BIOSENSOR

One specific application of the portable biosensor is **drug concentration measurement**. By accurately measuring microampere-level currents, the biosensor allows for the **quantification of drug concentrations, facilitating therapeutic drug monitoring and personalized medicine**. Its portable nature enables real-time monitoring of drug levels in clinical and non-clinical settings, enabling timely dose adjustments and optimizing treatment outcomes.

# DOPAMINE AS BIOMARKER

For the initial phase, we are using **dopamine** as the target biomarker. Dopamine has an oxidation potential of **0.6-0.7V**. On applying such potential, dopamine oxidises to quinones and semiquinones, giving an output current in the micro ampere range.

By measuring this microampere current and calibrating it, we can find the concentration of dopamine in the sample



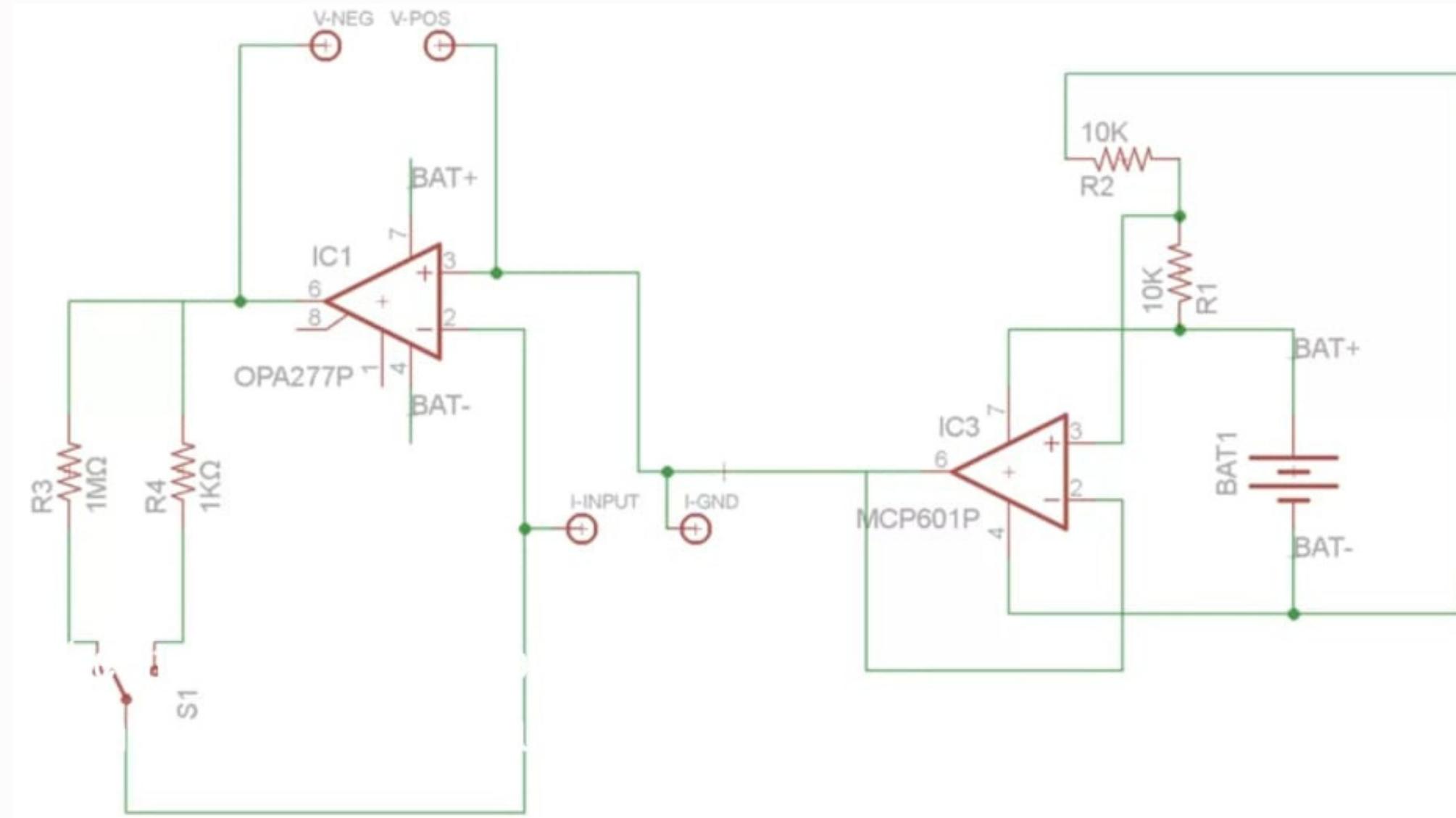


Measuring microampere-level currents can  
be challenging due to several factors



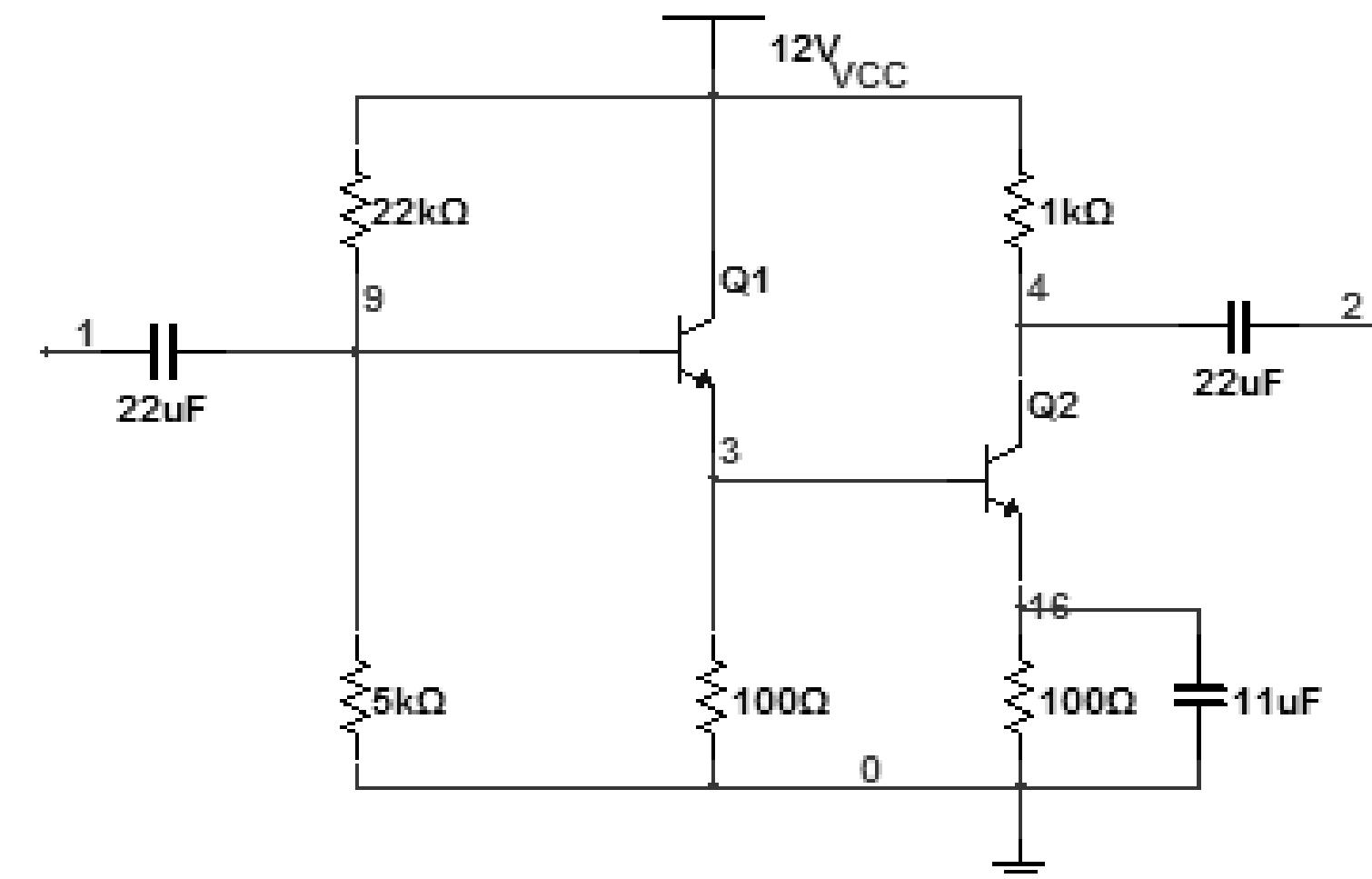
# FIRST ATTEMPT

We tried a current amplifying circuit using LM742 to amplify micro current to milli current. The resulting milli ampere current was to be calibrated to give concentration.



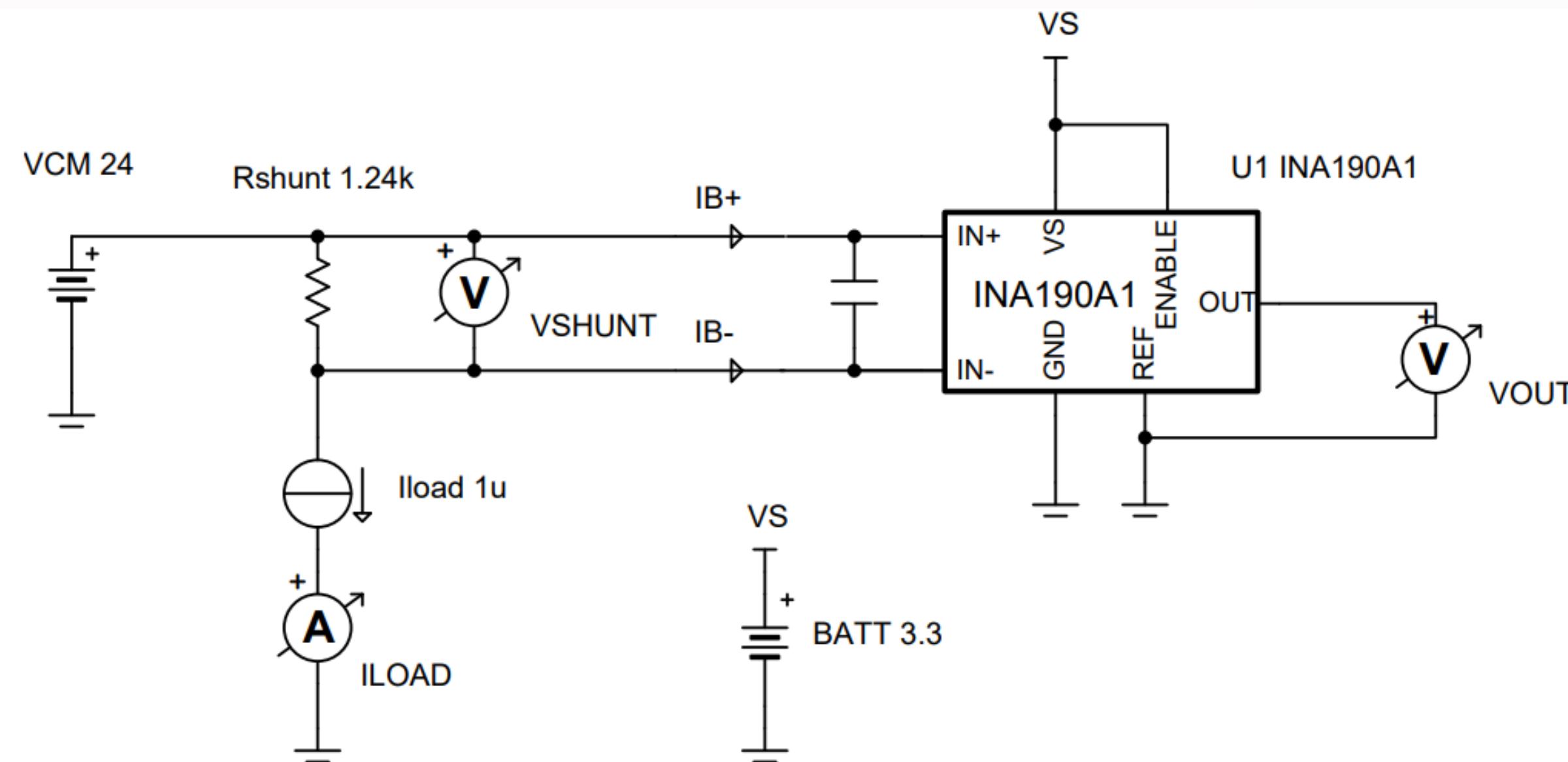
## SECOND ATTEMPT

We tried to use a Darlington pair circuit to amplify the current. using two BC548 transistors

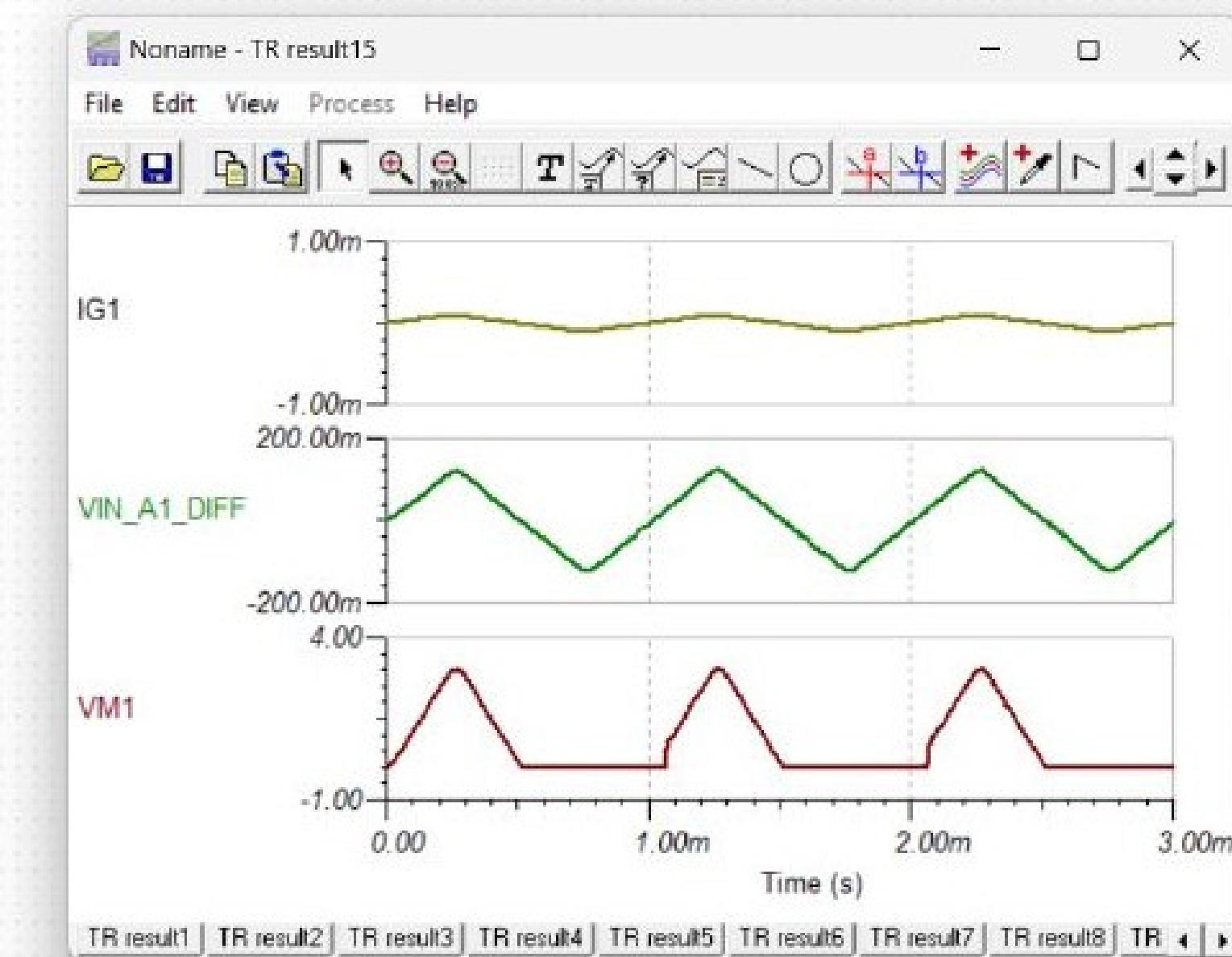
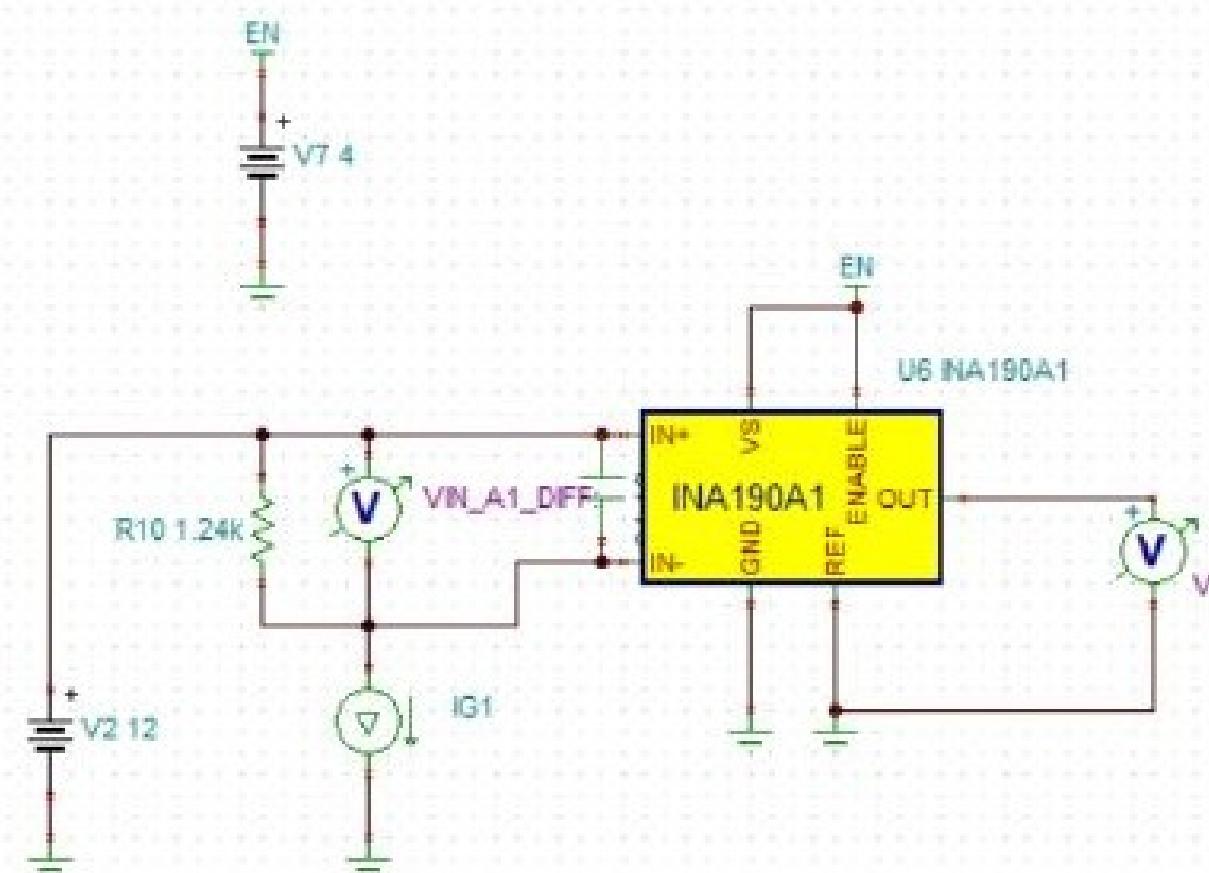


# THIRD ATTEMPT

We simulated INA190, a Bidirectional, Low-Power, Zero-Drift, Wide Dynamic Range, Precision Current-Sense Amplifier

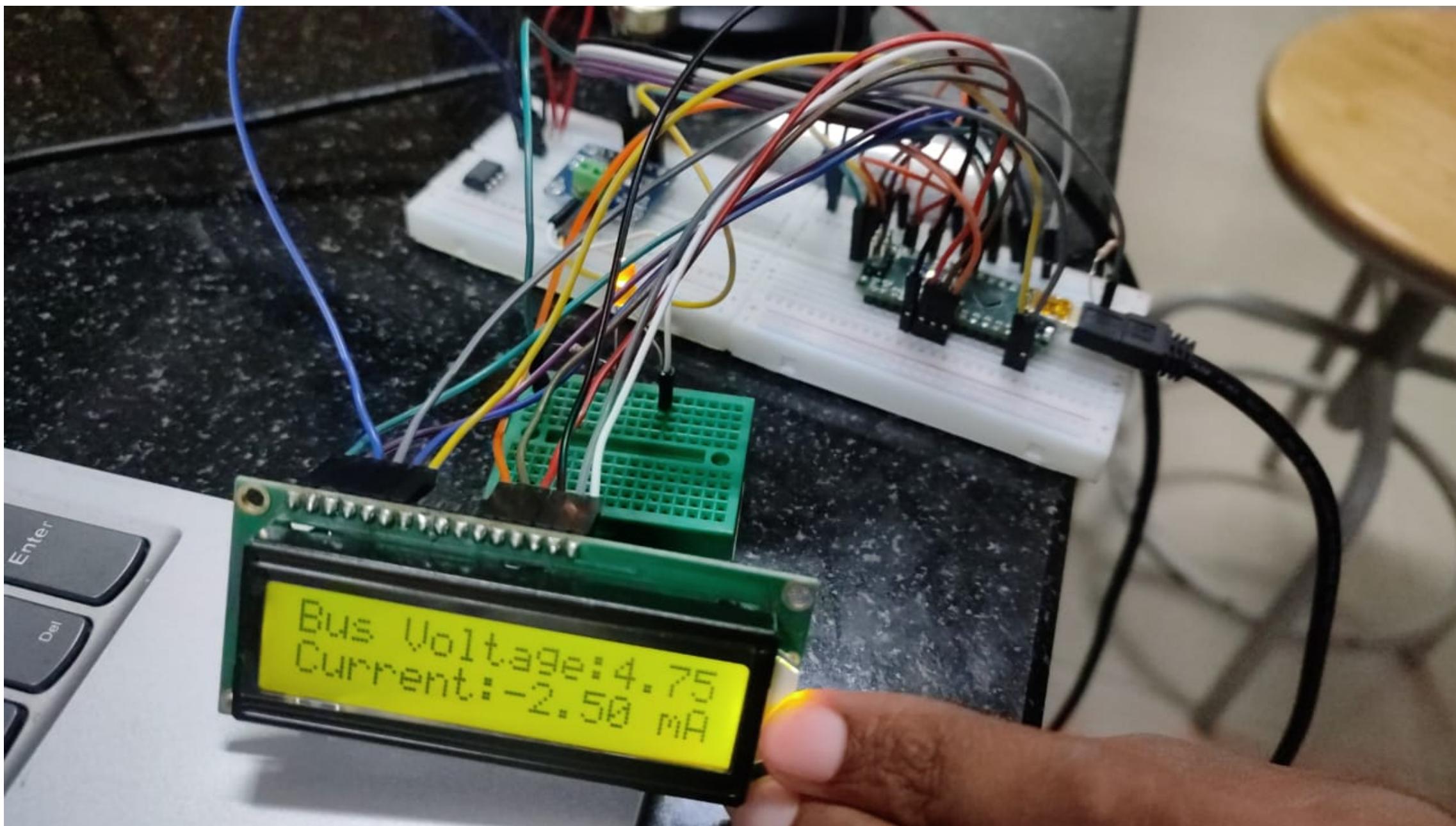


# INA190

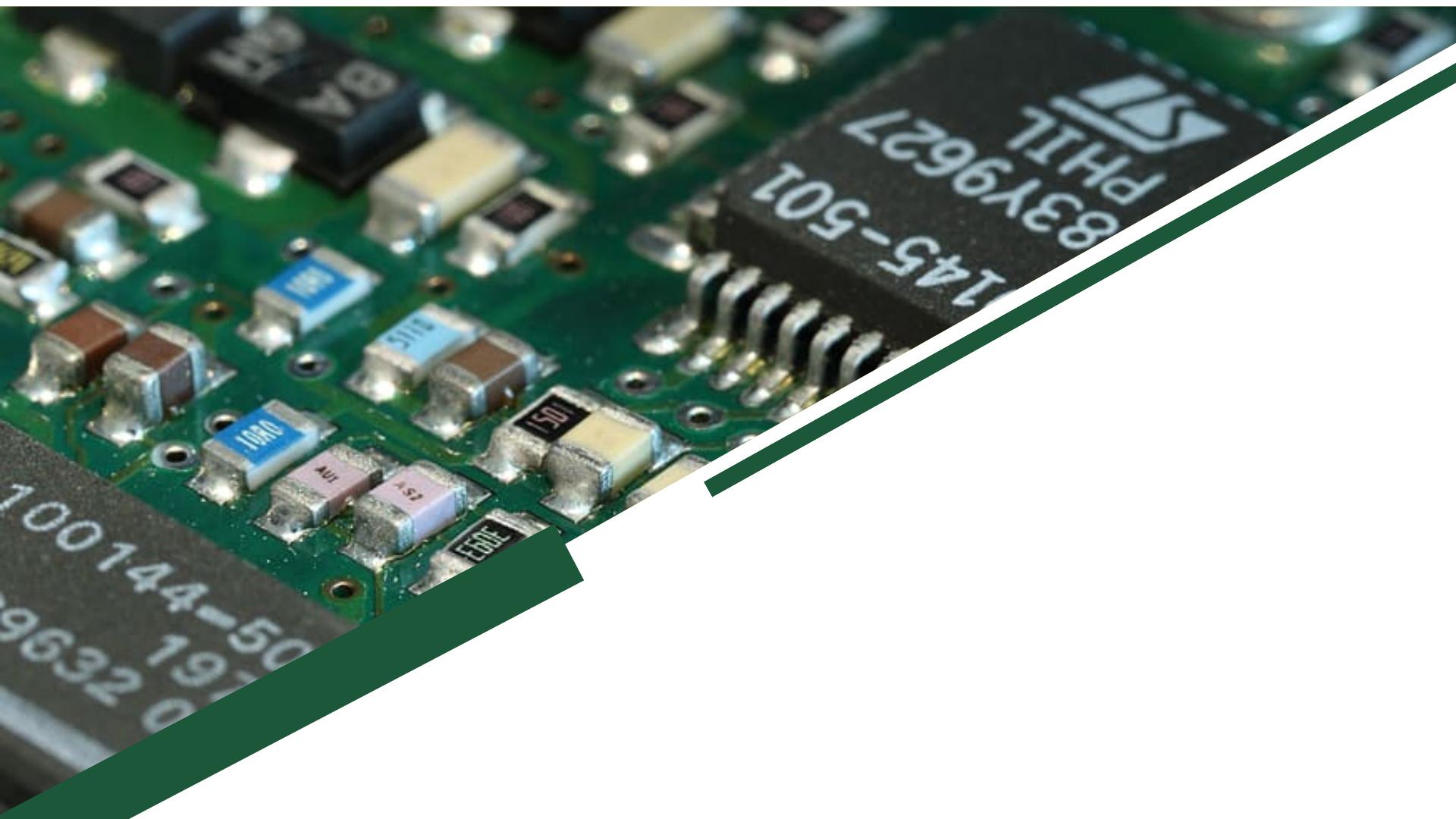


Simulation of INA190 using TINAcloud

# INA219



Measuring current in mA



# FUTURE PLANS

- 1 Testing of INA190
- 2 Fabrication of PCB
- 3 Integration with the 3 electrode System