Smart Energy Meter
Final deliverable

Group TUE-24

Dadhichi Telwadkar 20D070083
Atishay Jain 200070011
Yuvraj Singh 200070093

Faculty Guide: Anupama Kowli, Sandeep Anand

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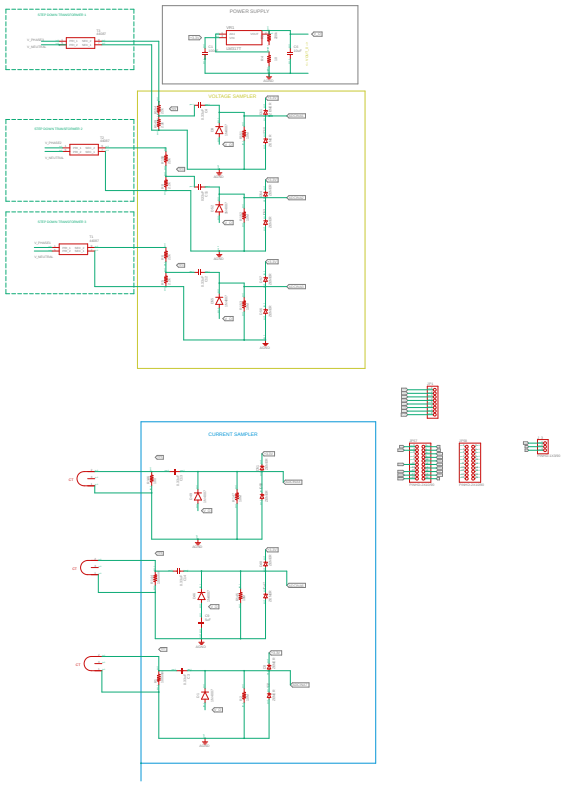
1 Circuit Schematic Layout



28-04-2023 19:06 f=0.40 C:\Users\wwwat\AppData\Local\Temp\Neutron\ElectronFileOutput\33384\sch-6b7e2c06-9efc-43b4-8289-6a

Figure 1: Schematic

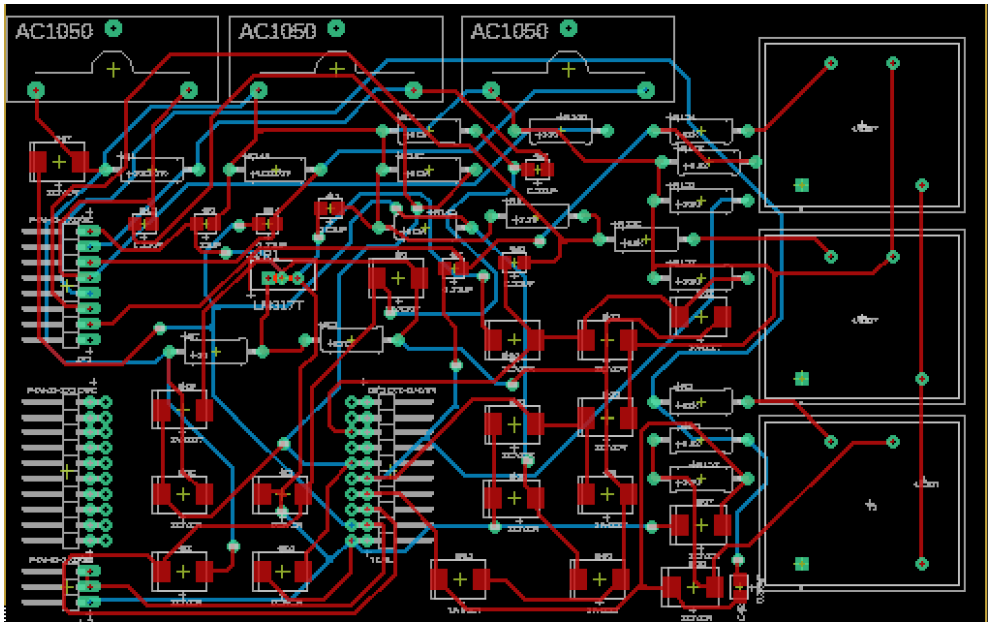


Figure 2: PCB layout

2 Testing setup and method

2.1 Isolation of circuit

For voltage isolation , a transformer is used which down converts 230V ac to 12V ac , to get it within the range of ADC we used a resistive divider .

For current isolation , we used a current transformer but to get the values in the ADC we measured the voltage by connecting the load across the current transformer.

2.2 Power Supply

For power supply we used a voltage supply of 3.3V(from microcontroller) which is followed a LM317T which regulates the voltage to provide a voltage around 1.2 – 1.5V.

2.3 Positive Voltage Clamper

As the ADC doesn't take negative values , we used a voltage clamper . The output diode supplies the reference voltage during the positive half cycle, and as the input voltage rises, the diode's cathode voltage rises relative to the anode voltage, stopping it from conducting. The diode starts conducting and gets forward biased in the negative half cycle. The voltage across the capacitor and the reference voltage work together to maintain the output voltage level. Offset was added so that the voltage falls in the range of ADC

2.4 Voltage and current measurement

We will divide and add offset to voltage so that it falls in range of ADC and measure it. We will remove offset and appropriately check the zero crossings of the incoming signal in microcontroller

3 Test results

3.1 Test results of subparts in circuit

We tried to add offset to the down-stepped AC with the available components using a breadboard as the ADC only takes positive values.

Voltage Clamper

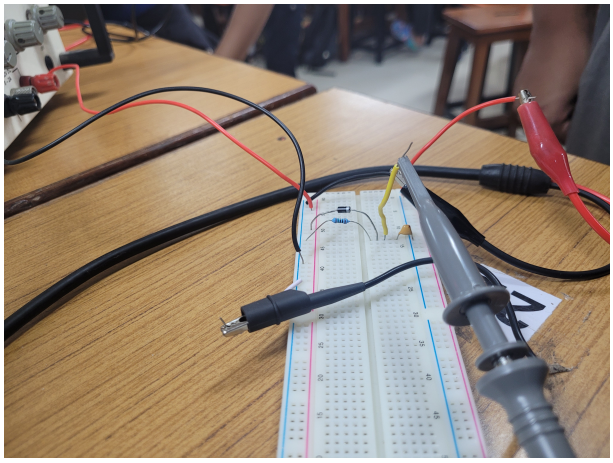


Figure 3: Breadboard design

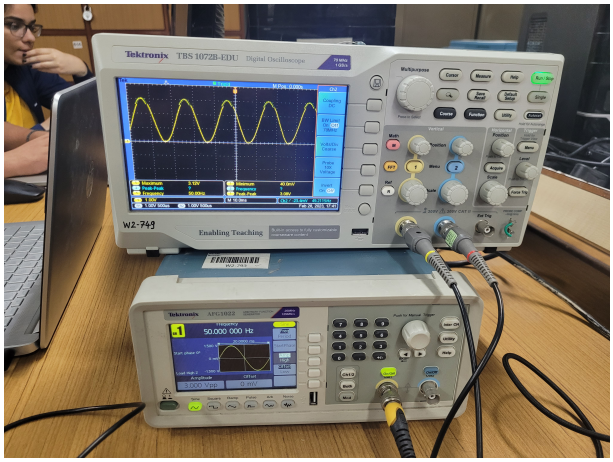


Figure 4: Results

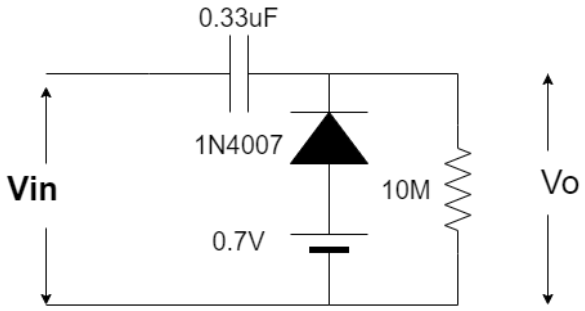


Figure 5: Circuit Diagram

Voltage Clamper worked as expected V_r which is 0.7V can be be controlled to change the range of Vo

3.2 Test result of finalized complete circuit

Voltage Sampler
We used input voltage of $20V_{pp}$ at $50Hz$ to test the circuit, reference voltage of $1V$ was used

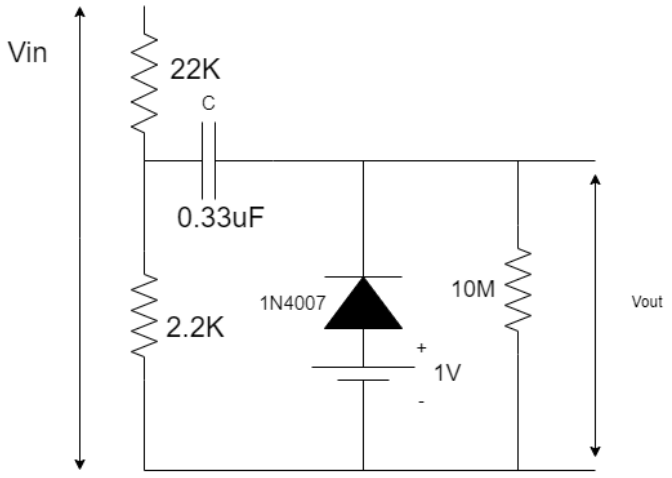


Figure 6: Circuit Diagram

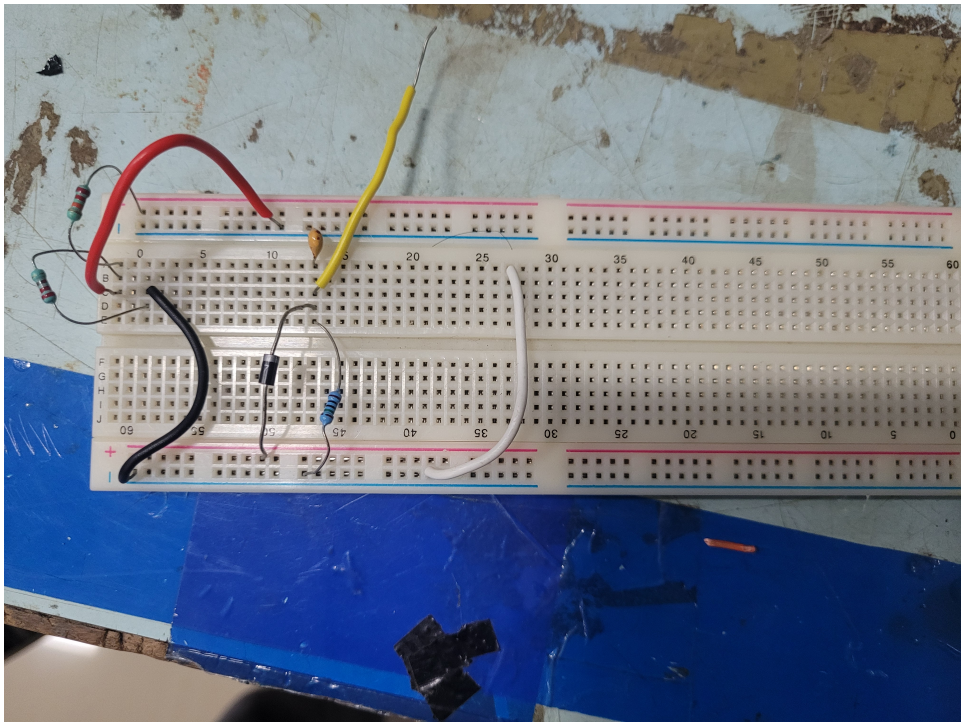


Figure 7: Breadboard design

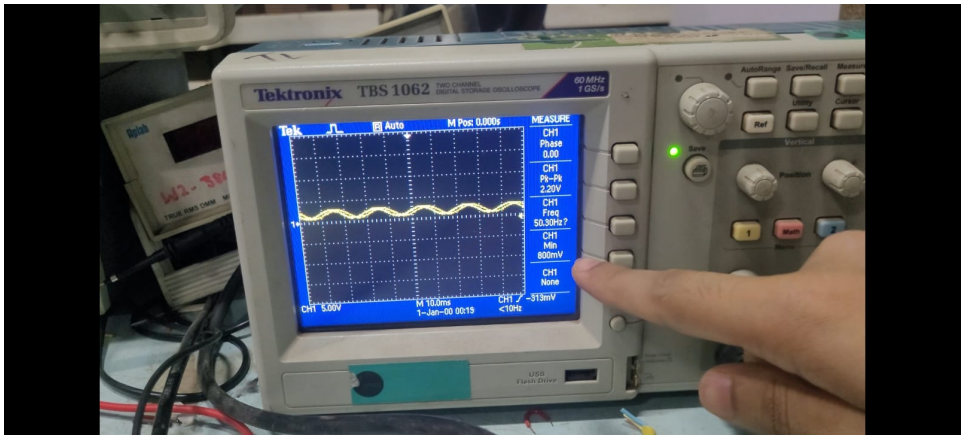


Figure 8: Results

Current Sampler

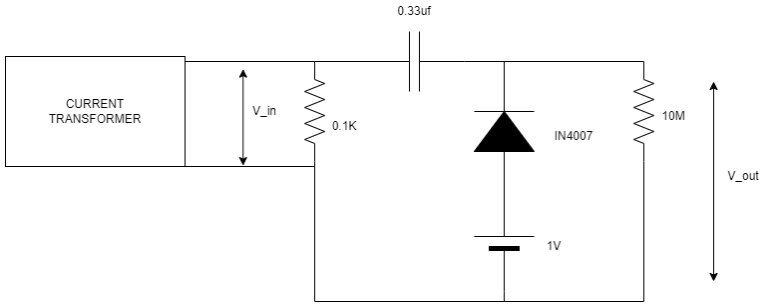


Figure 9: Circuit Diagram

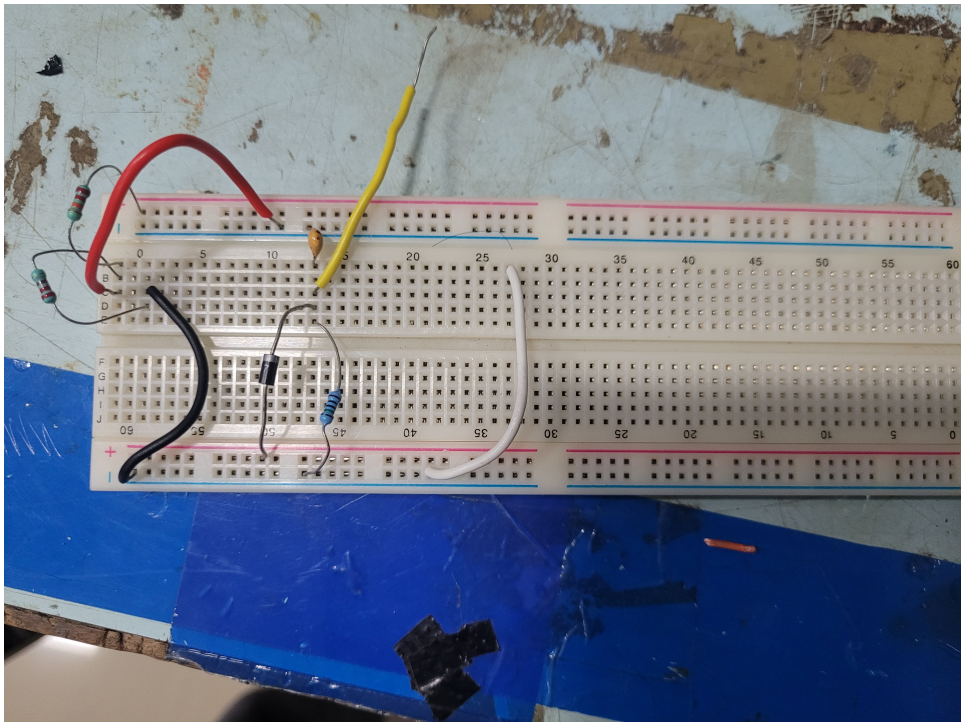


Figure 10: Breadboard design

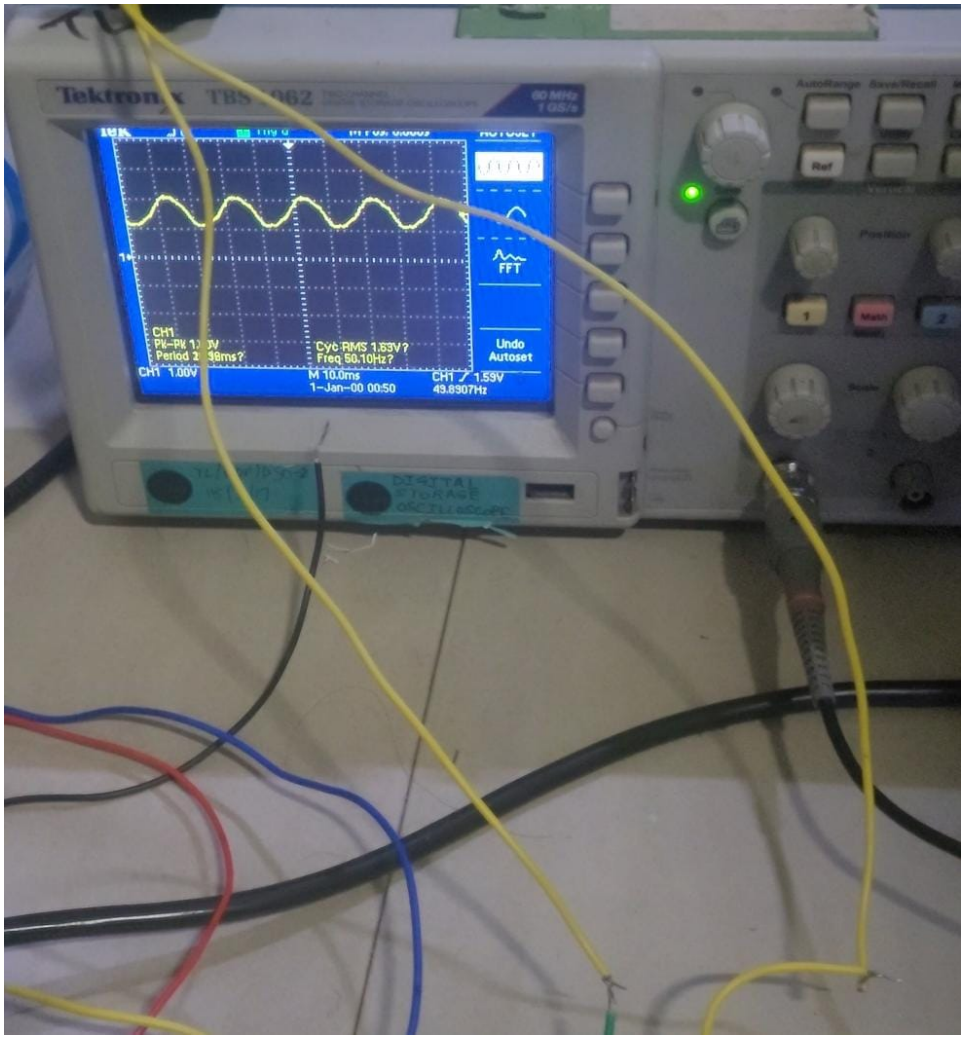


Figure 11: Results

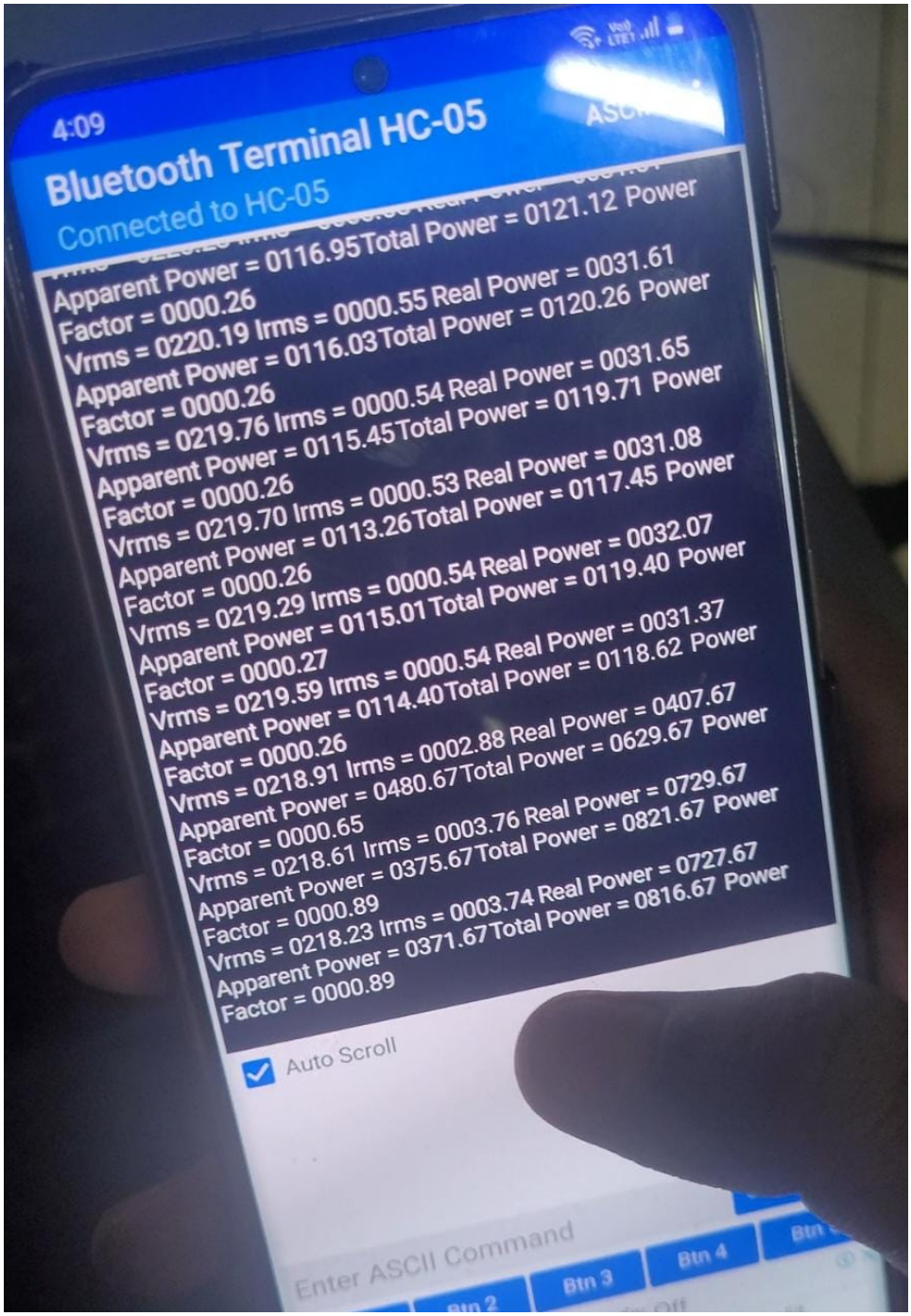


Figure 12: Results on mobile screen using bluetooth module displaying Vrms , Irms , Real Power, Apparent Power, Total Power and Power Fcator