

HOME ENERGY MONITOR

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EEGN383 – Final Project

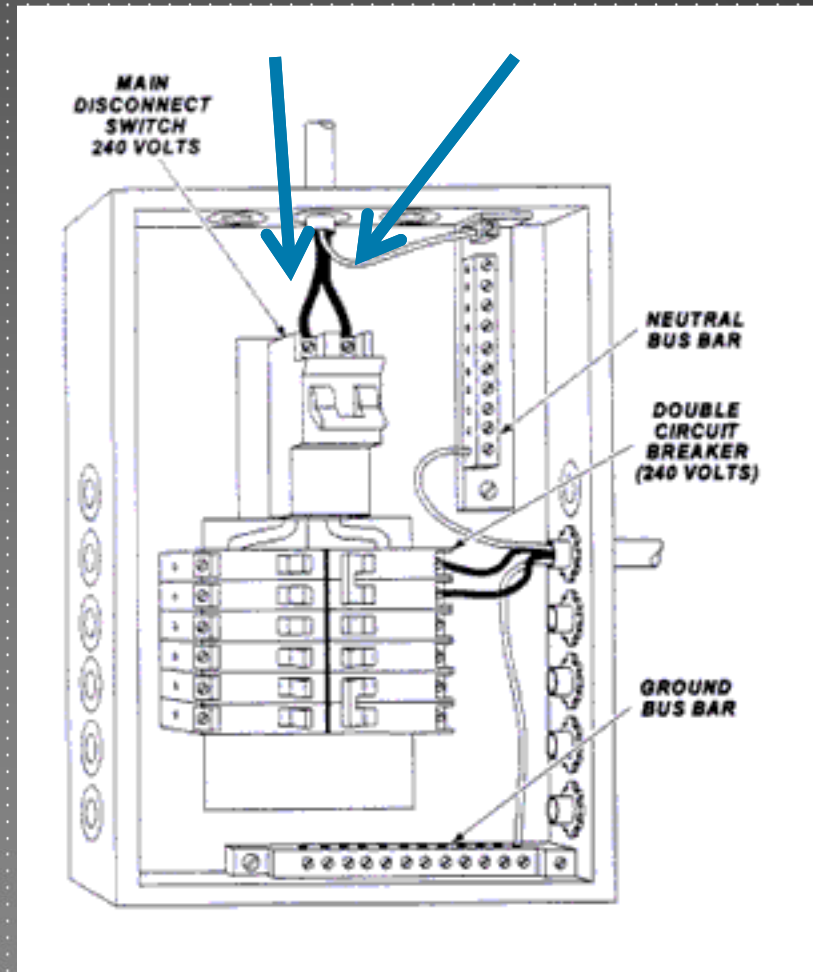


MOTIVATION

- ▶ Give people a better idea of how much energy they use
 - ▶ Typical residential power system
 - ▶ Monitor real-time power consumption
 - ▶ Monitor monthly accumulated energy consumption

BACKGROUND

- ▶ Residential Power:
 - ▶ Single Phase
 - ▶ Center-tap transformer
 - ▶ +/- 120VAC
 - ▶ Two “hot” lines connect to separates bus bars in breaker panel
- ▶ Each leg nominal 120V +/- 5%
 - ▶ Neglect change in voltage and assume 120V per leg

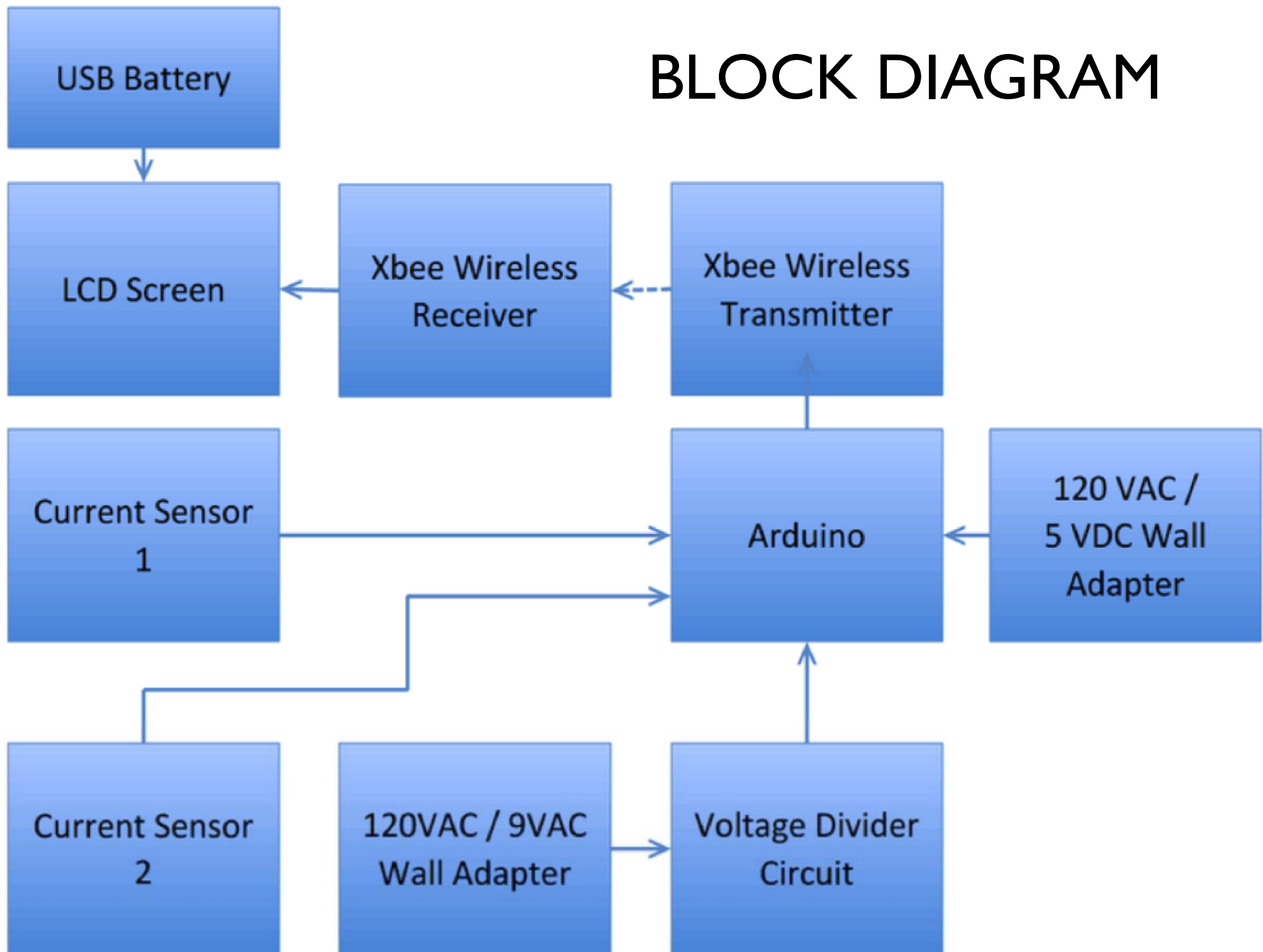


CURRENT SENSORS

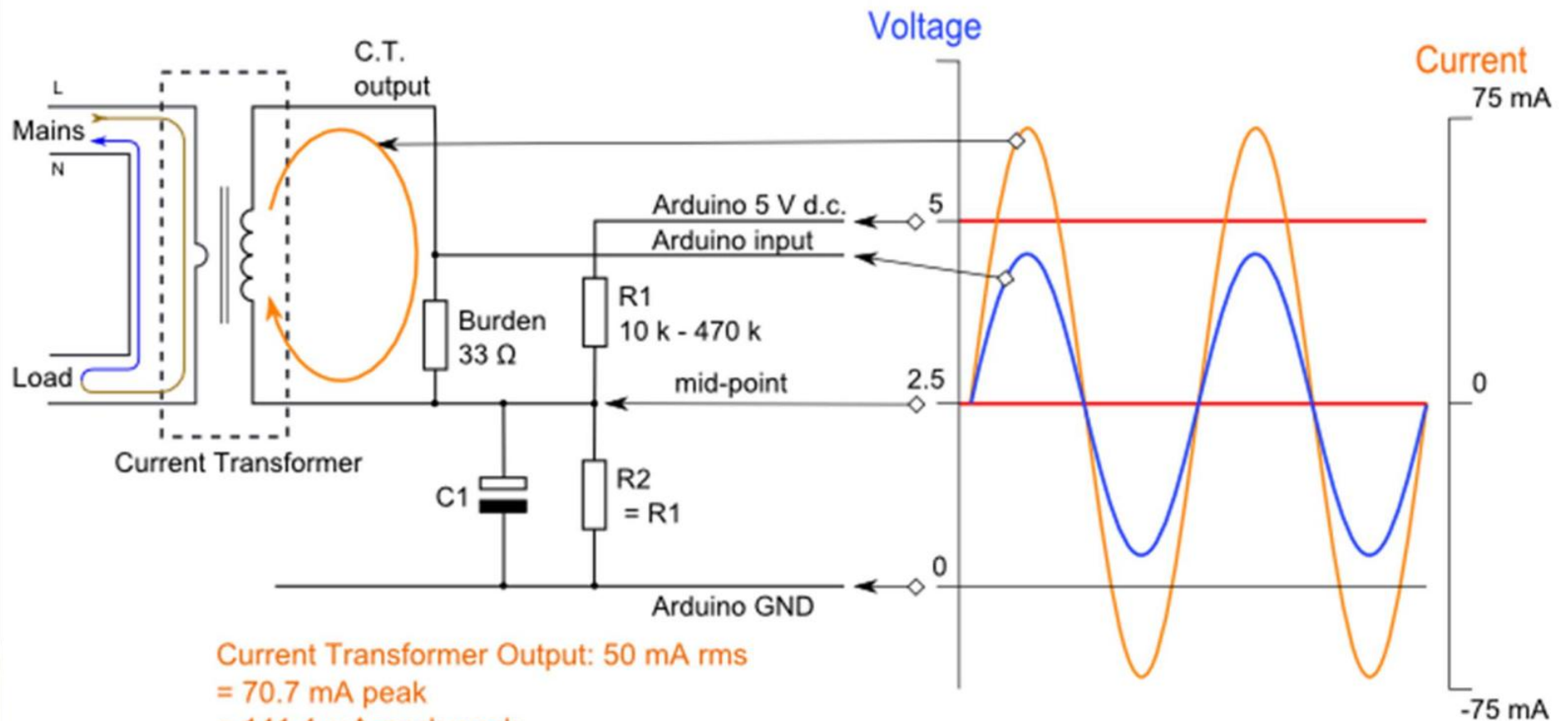
- ▶ Non-invasive current transformer
- ▶ Clip-on design
- ▶ 1:2000 turns ratio
- ▶ Use burden resistor to create voltage drop → measure with Arduino analog pin



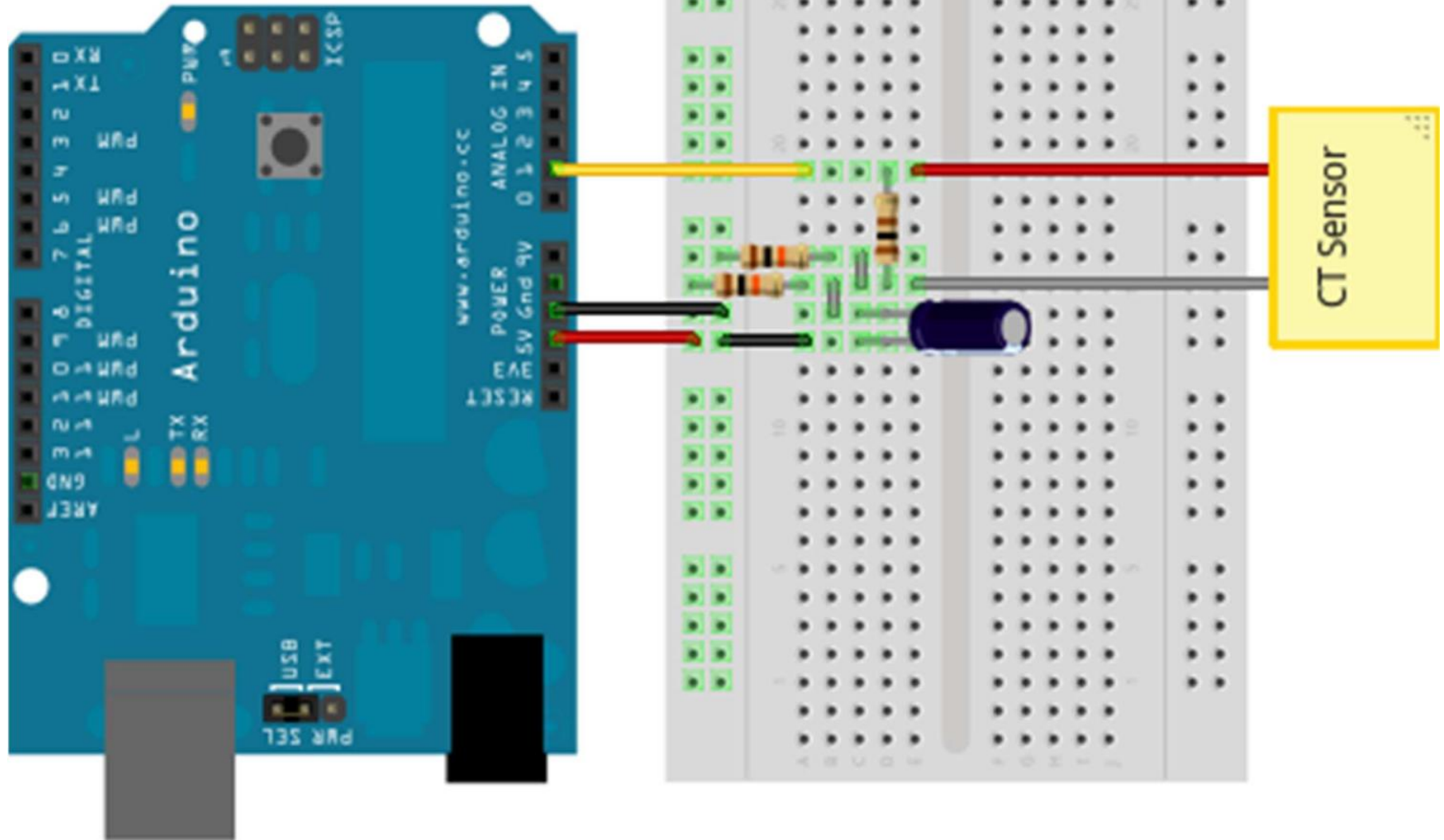
BLOCK DIAGRAM



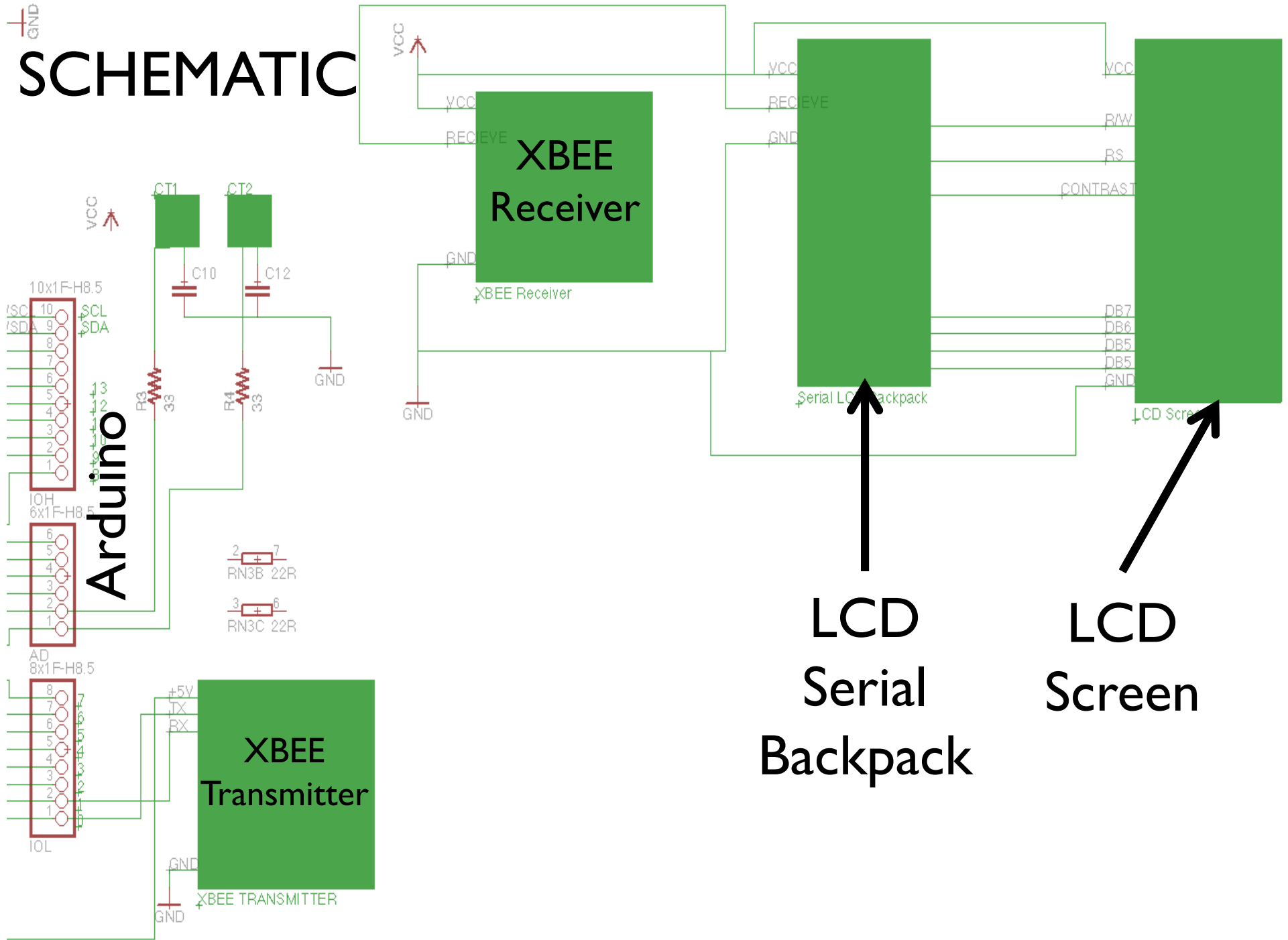
MEASURING CURRENT

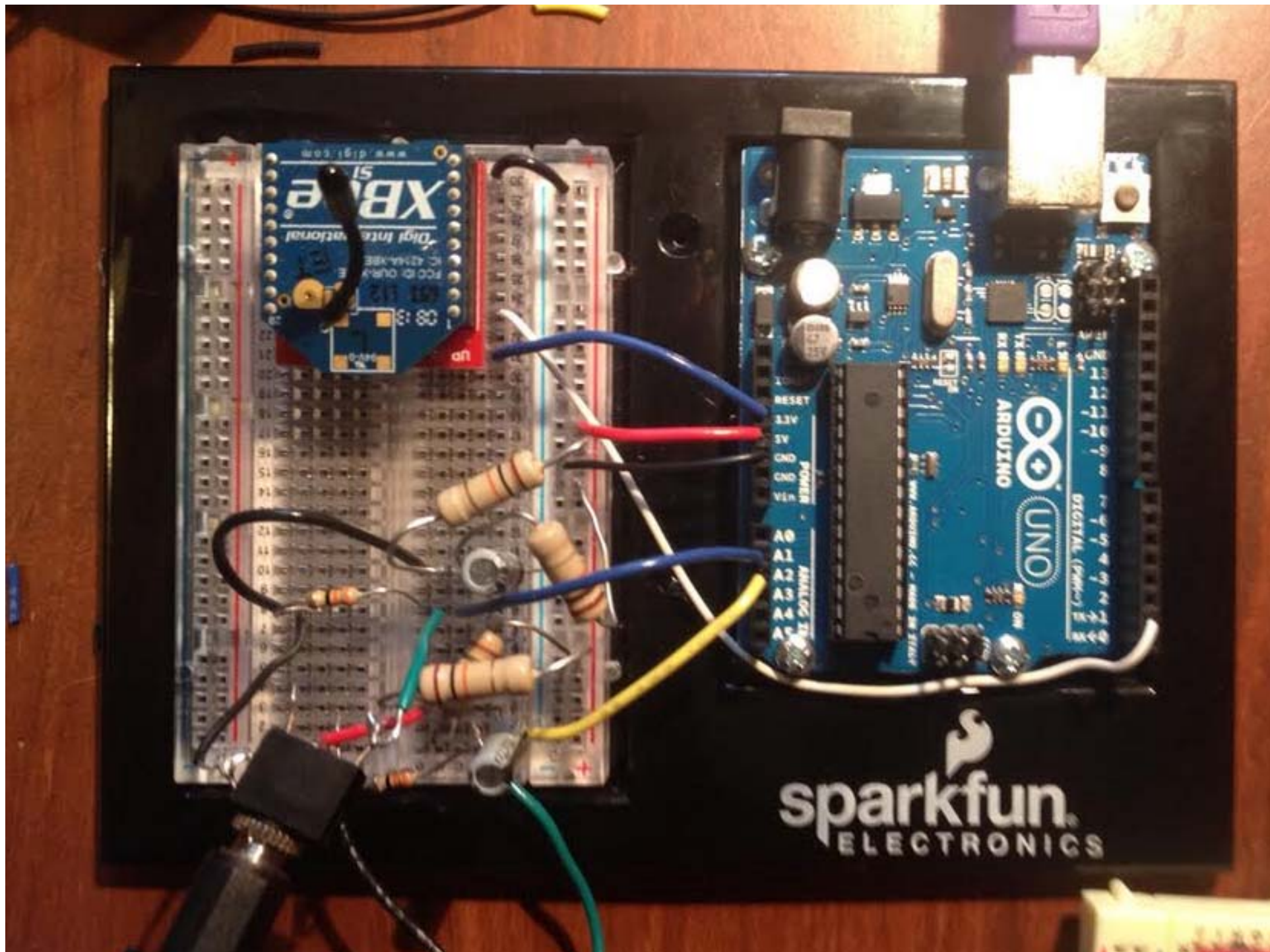


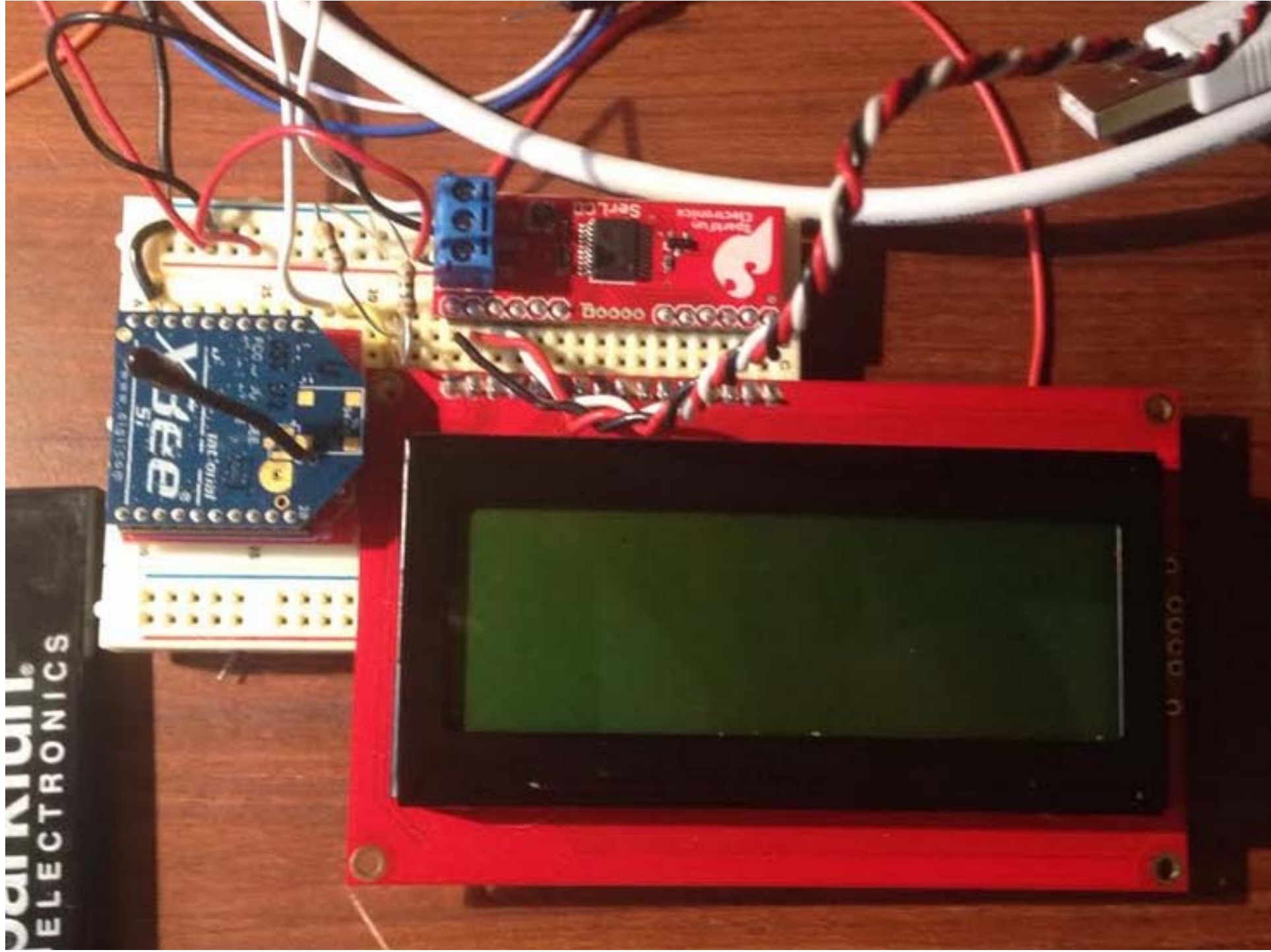
CURRENT SIGNAL CONDITIONING CIRCUIT



SCHEMATIC







```
#include <SoftwareSerial.h>
#include <serLCD.h>
#include "EmonLib.h"

serLCD          lcd(1);  // pin to transmit (1 = tx)
EnergyMonitor emonCT1;
EnergyMonitor emonCT2;

void setup() {
  lcd.setType(5); // setup for 4x20 lcd screen
  lcd.clear();
  lcd.setBrightness(30);

  setupCurrentSensors();
}

void loop() {
  lcd.setCursor(1, 1); // set position to first on screen (x, y)
  printMeasuredPower();
}

void setupCurrentSensors() {
  emonCT1.current(A1, 57.9); // Current: pin, cal; orig = 60.6
  emonCT2.current(A2, 57.9);
}

void printMeasuredPower() {
  double irms = emonCT1.calcIrms(1480) + emonCT2.calcIrms(1480); // sum, # of samples
  double voltage = emonCT1.readVcc();

  lcd.print("EMon: ");
  lcd.print(voltage);      // Voltage
  lcd.print(irms);         // Irms
  lcd.print(irms * 120.0); // Apparent power

  delay(50);
}
```


PROBLEMS ENCOUNTERED

- ▶ Measuring current on 100A current transformers
 - ▶ Need significant load to actually measure some current
 - ▶ 60W Light bulb only draws 0.5 Amps
 - ▶ Hard to detect on oscilloscopes
 - ▶ Used resistive load banks in Power Lab
 - ▶ Draw 4.25Amps
- ▶ Programming X-Bee requires other adapters and special cables
- ▶ Zero offset

POSSIBLE ADDITIONS

- ▶ Measure voltage of each leg of the transformer
 - ▶ More accurate measurement
- ▶ Integration to web application for remote monitoring
 - ▶ Graphs (Power vs Time)
 - ▶ Date range lookup
- ▶ Data Logging

QUESTIONS

THANK YOU