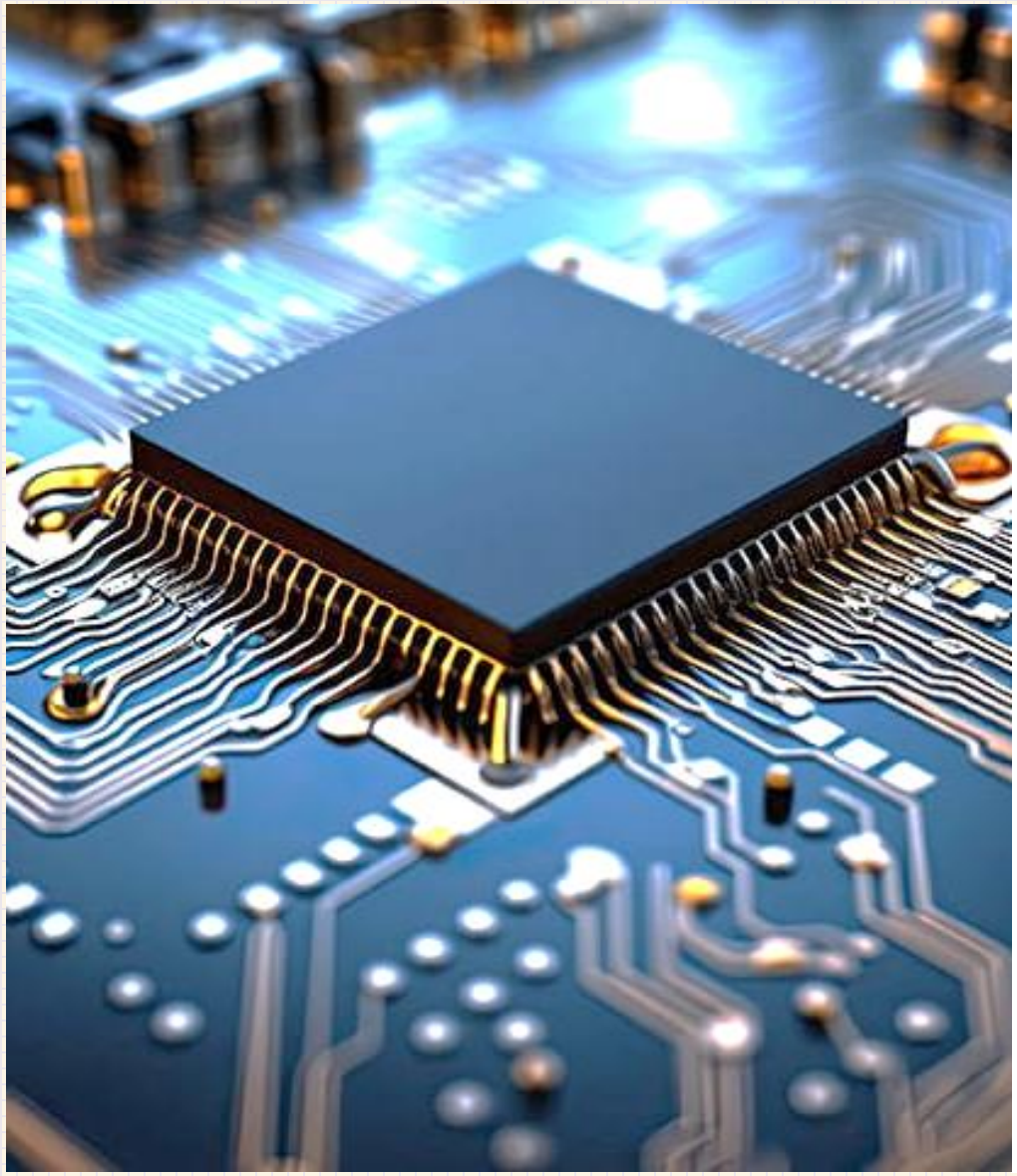


Microprocessors I Final Project

RANA SEIF

Design Steps

Old Design Analysis

Identified old components and sensors from provided slides.

Drew **Block Diagram for Old Design**.

Component Research

Researched sensors already being used for **Market Availability**, **Cost** and **Specs**.

Sensor Replacement Research

Identified Sensors that need to be replaced and **looked for alternatives with similar features**.

Edited Design

Created updated version of **block diagram**.

Created **schematic on KiCAD** based on new block diagram.

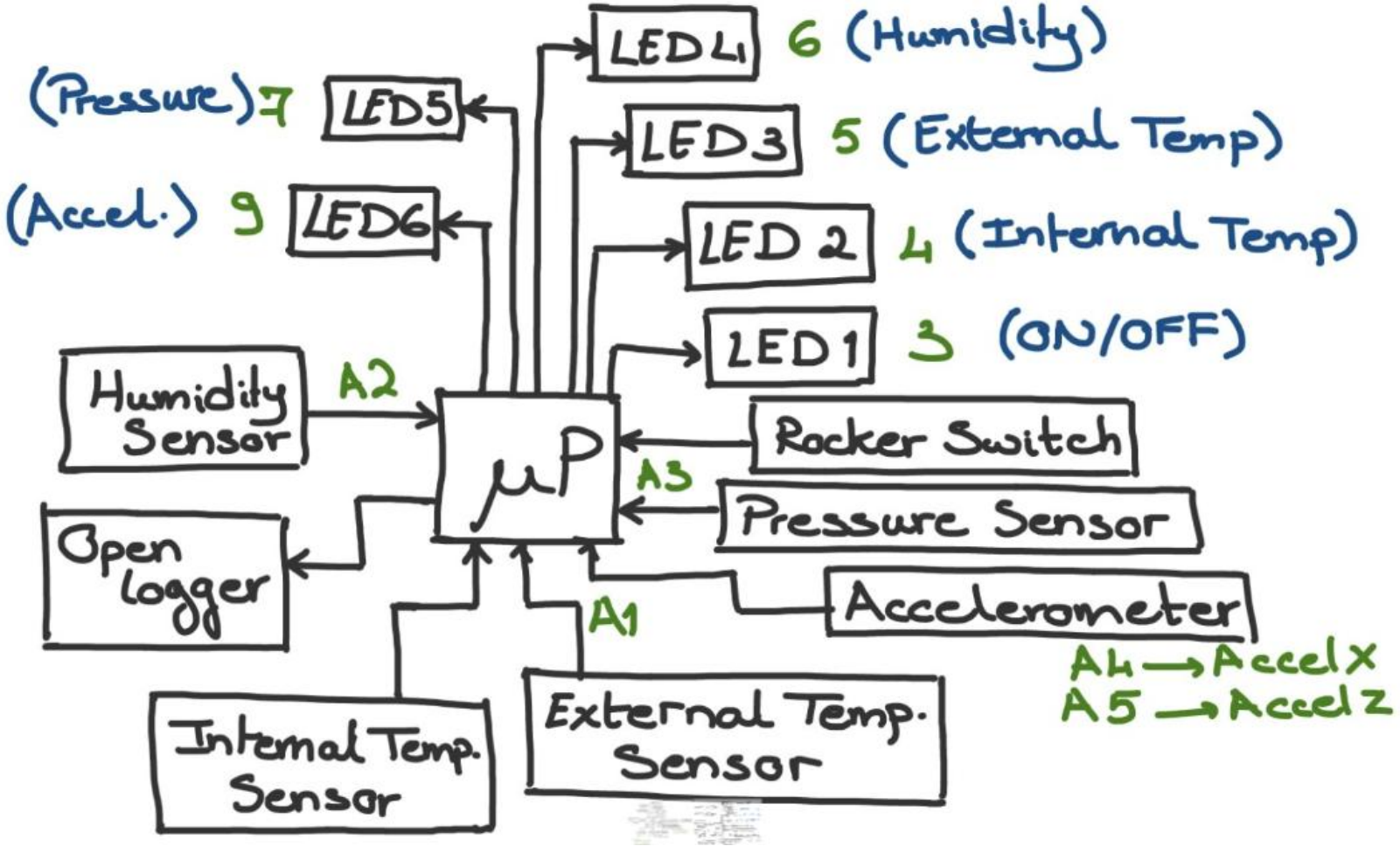
PCB Layout and Routing

Completed **PCB Layout and Routing** on kiCAD.

Final Calculations

Calculated **Cost, Weight and Power Consumption** based on Final Design created.

Old Design


LED4
6 (Humidity)
(Pressure) 7
LED5
LED3
5 (External Temp)
(Accel.) 9
LED6
LED 2
4 (Internal Temp)
LED 1
3 (ON/OFF)
Humidity Sensor
A2
μP
Rocker Switch
A3
Pressure Sensor
Open logger
Accelerometer
A1
A4 → Accel X
A5 → Accel Z
Internal Temp. Sensor
External Temp. Sensor

Old Component Details

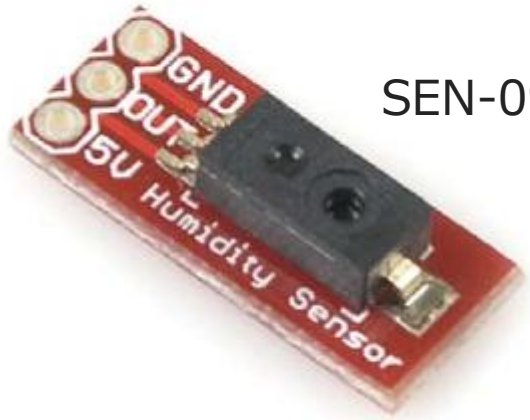
Part Description	Manufacturer	Component Number in Old Design	Cost per Unit	Weight per Unit
Humidity Sensor	SparkFun	SEN-09569	$4.79	2.5
OpenLog Board	SparkFun	DEV-13955	$17.50	2.5
Temperature Sensor	Analog Devices Inc.	TMP36	$1.65	0.208
Pressure Sensor	Honeywell	SSCDANV015PAAA5	$48.67	1
Accelerometer (IC: ADXL335)	SparkFun (IC by Analog Devices Inc.)	SEN-09269	$16.95	1.45

Humidity Sensor's IC (HIH-4030) has been discontinued by Honeywell.

*This table only includes sensors and ICs. Refer to BOM excel sheet for more details on wires, pin headers, resistors and diodes.

Alternatives for Humidity Sensor

OLD



SEN-09569

Parameter	Minimum	Maximum	Unit
Interchangeability (first order curve)	–	–	–
0% RH to 59% RH	-5	5	% RH
60% RH to 100% RH	-8	8	% RH
Accuracy (best fit straight line)	-3.5	+3.5	% RH

NEW Alternatives

HIH-4010-002

TABLE 1. PERFORMANCE SPECIFICATIONS (At 5 Vdc supply and 25 °C [77 °F] unless otherwise noted.)

Parameter	Minimum	Typical	Maximum	Unit
Interchangeability (first order curve)	–	–	–	–
0% RH to 59% RH	-5	–	5	% RH
60% RH to 100% RH	-8	–	8	% RH
Accuracy (best fit straight line)	-3.5	–	+3.5	% RH

Price:$26-70

Range of humidity measurement	20-90%RH
Humidity deviation	±5%RH

DHT11

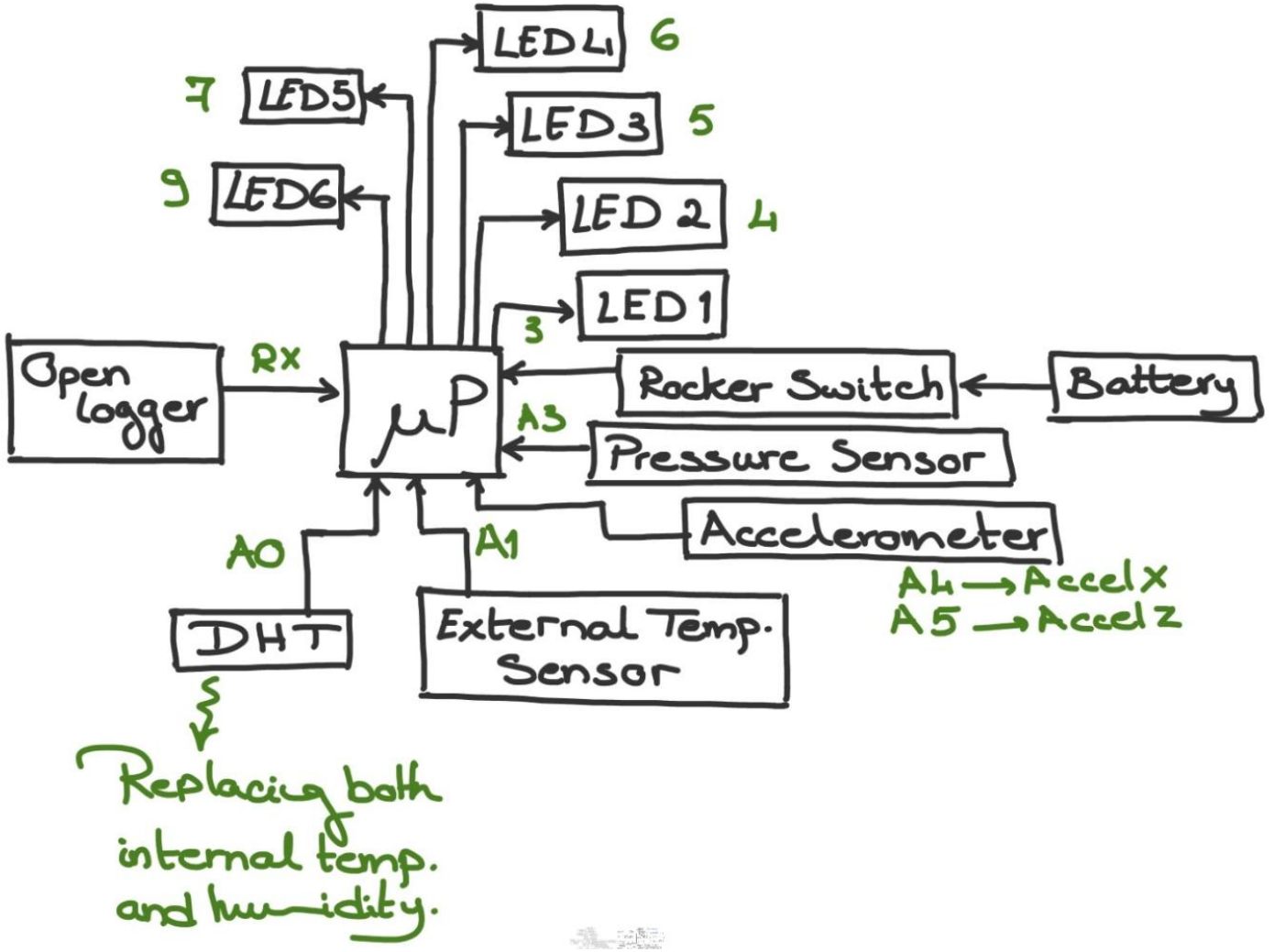
Price:$4.20

Range of humidity measurement	0-100%RH
Humidity deviation	±2%RH

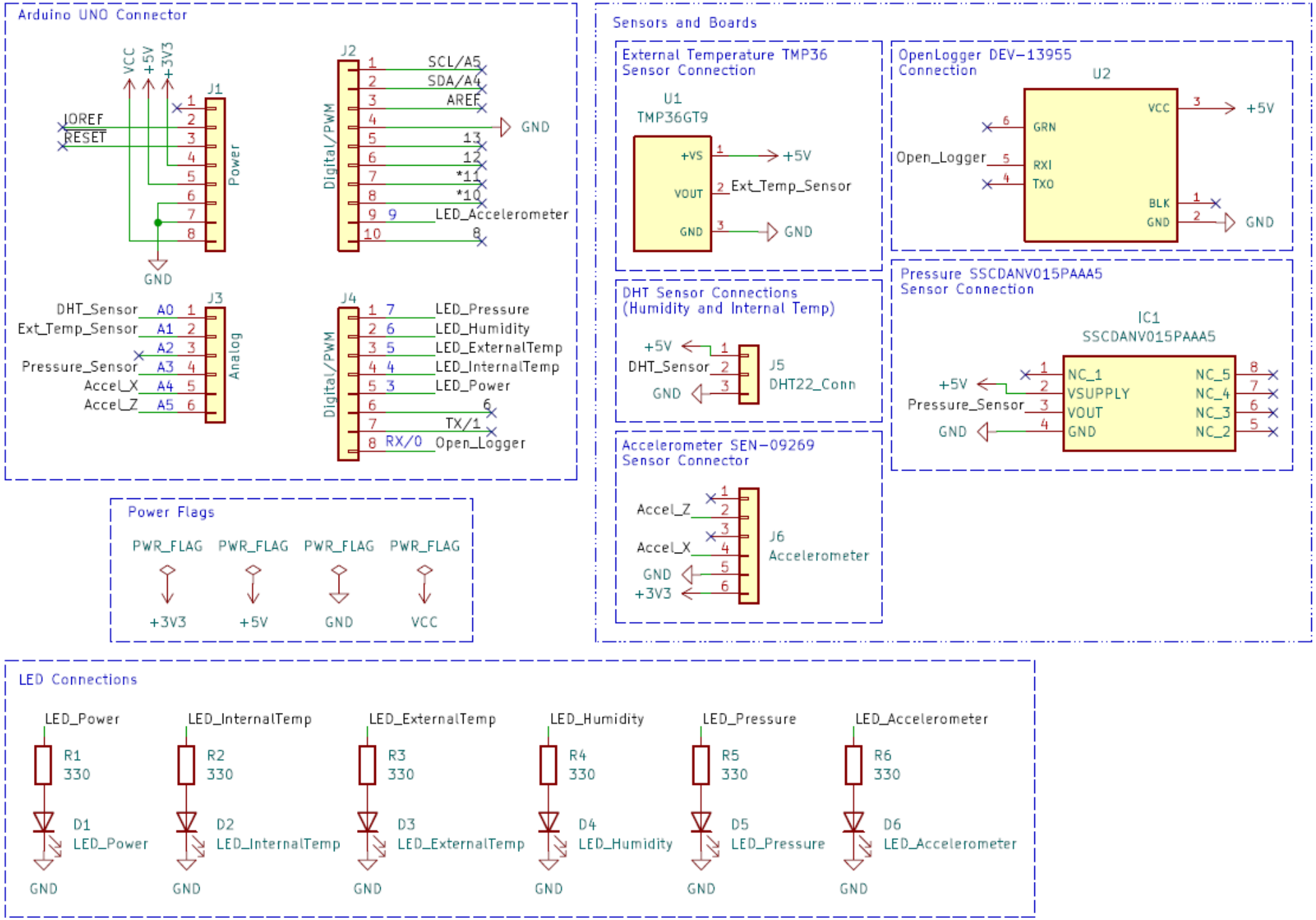
DHT22

Price:$8.90

New Design Block Diagram



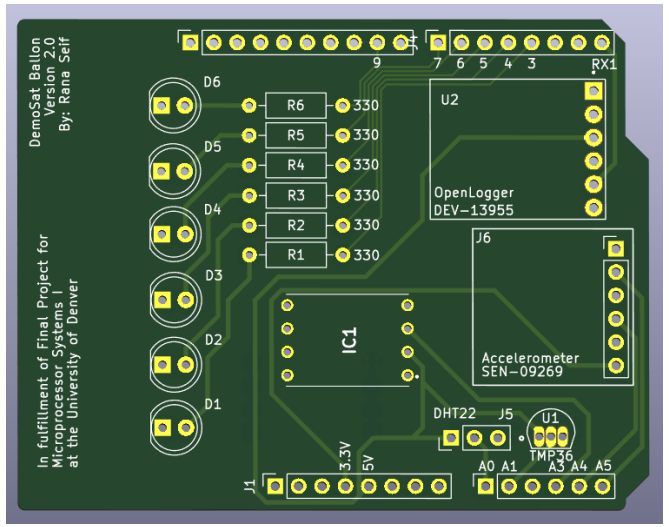
New Design Schematic

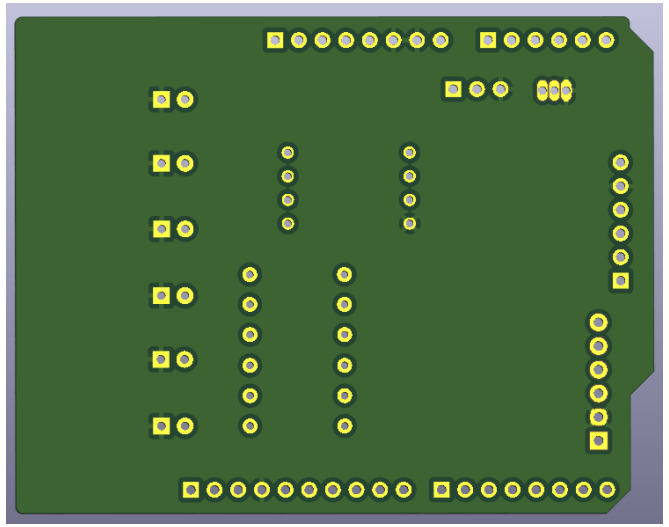


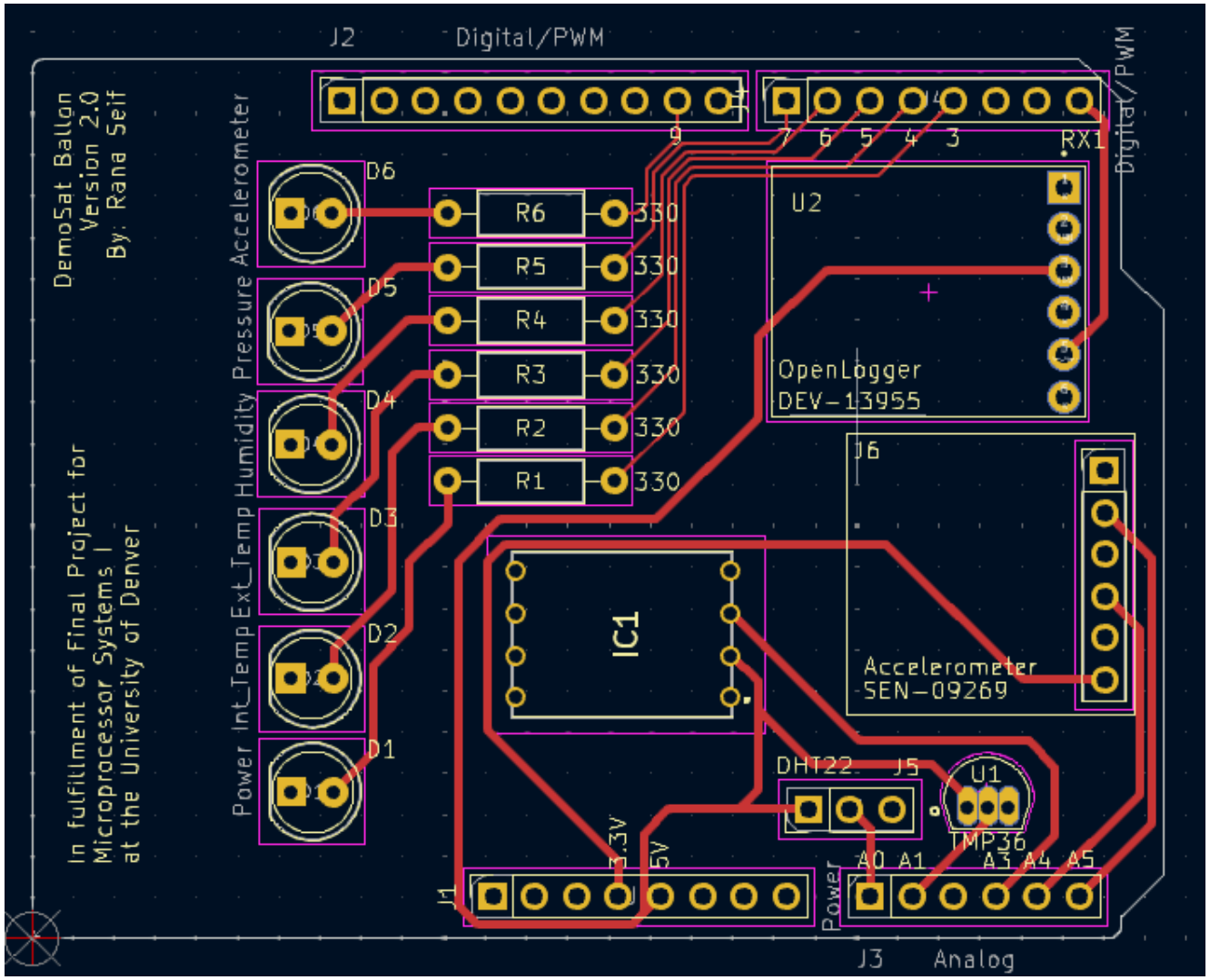
PCB Layout and Routing

FRONT

BACK







Final Cost and Weight

OLD DESIGN		NEW DESIGN		LIMIT	
COST	$140	COST	$130	COST	$145
Weight	105g	Weight	87g	Weight	200g

+ Full detailed calculation for new design cost and weight are in BOM excel sheet submitted in Docs.

Final Calculation (Power Consumption)

Power Consumption = $\sum_{n=0}^{K} i_n(V_n)$*

$$P_{Total} = 6(P_{Resistor}) + 6(P_{Diodes}) + P_{Humidity} + P_{OpenLog} + P_{Temp} + P_{Pressure} + P_{Accel}$$

$$P_{Total} = 6(0.25W) + 6(0.04W) + 0.3mA(5V) + 6mA(5V) + 50\mu A(5V) + 2.7mA(5V) + 350\mu A(3.3V)$$

$$= 1.79\ W$$ **(when all sensors are working at max power consumption)**

The power consumption of the wires and headers is ignored.

*If operating power consumption is given in datasheet, it was used as is instead of VI

Resources

- **Slides and Code from Old Design (including PCB)**

https://www.colorado.edu/center/spacegrant/statewide-programs/remote-kits-learning-modules/high-altitude-balloon-payload-remote-skill-module-0

- **Component Datasheets (Submitted with PCB files)**
- **Digital Footprints, symbols and CAD models from snapeda.com and componentsearchengine.com**