



Infant CPAP Machine for Developing Countries

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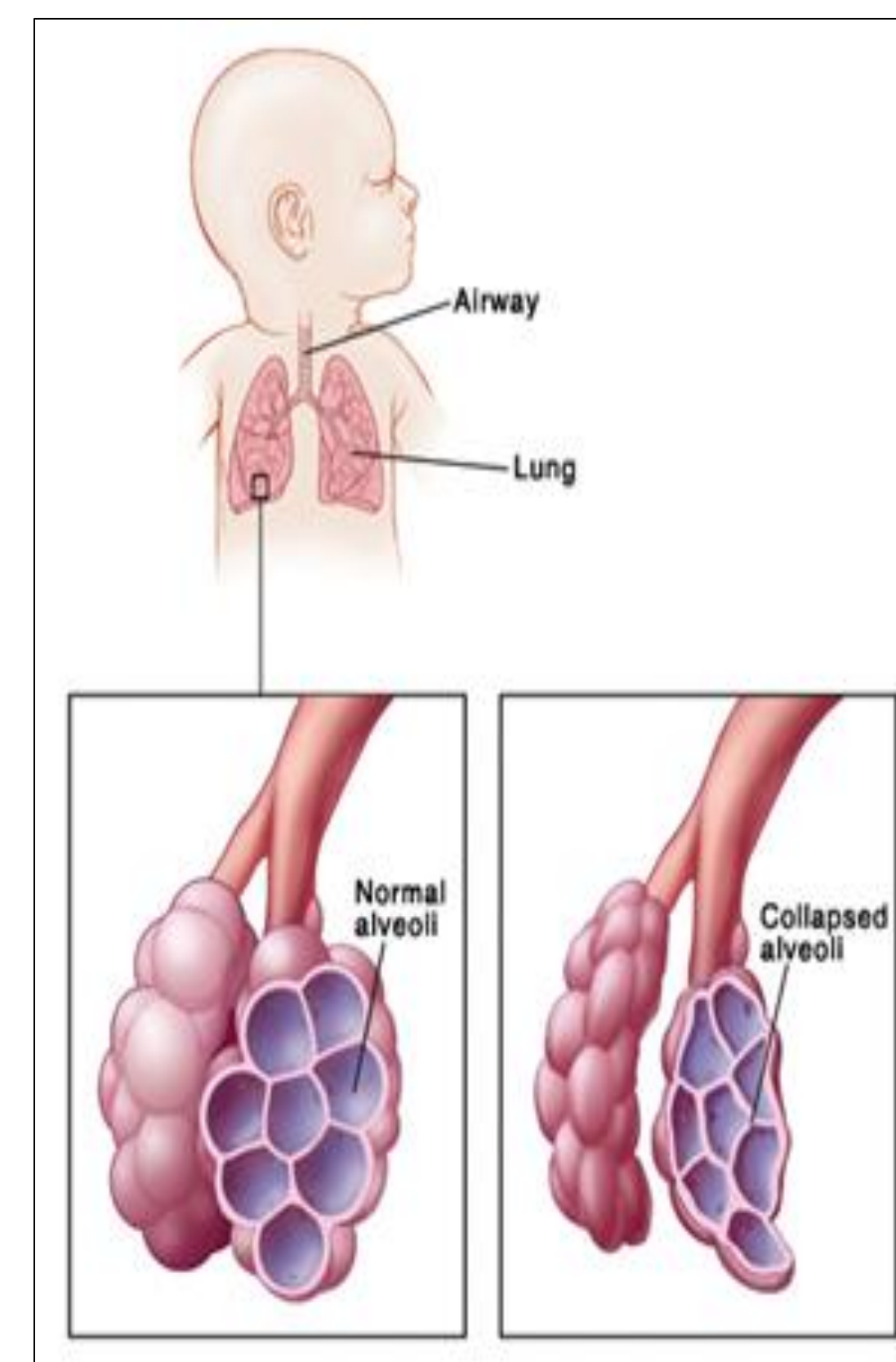


Objective Statement

The purpose of this project is to design and fabricate a CPAP machine that can be used in developing countries. The design should be affordable, reliable, transportable, and able to withstand the environment constraints of a developing country.

Background/Motivation

Respiratory Distress Syndrome (RDS) is a condition, commonly found in preterm infants, characterized by a lack of surfactant production on the lungs. RDS is one of the leading causes for preterm death, especially in developing countries where health care is severely limited. CPAP machines are commonly used to assist preterm infants in breathing by providing a continuous air flow to the infant. However, because of the lack of formalized healthcare in developing countries, there is a severe lack in medical technology to preserve infant life.



Respiratory Distress Syndrome

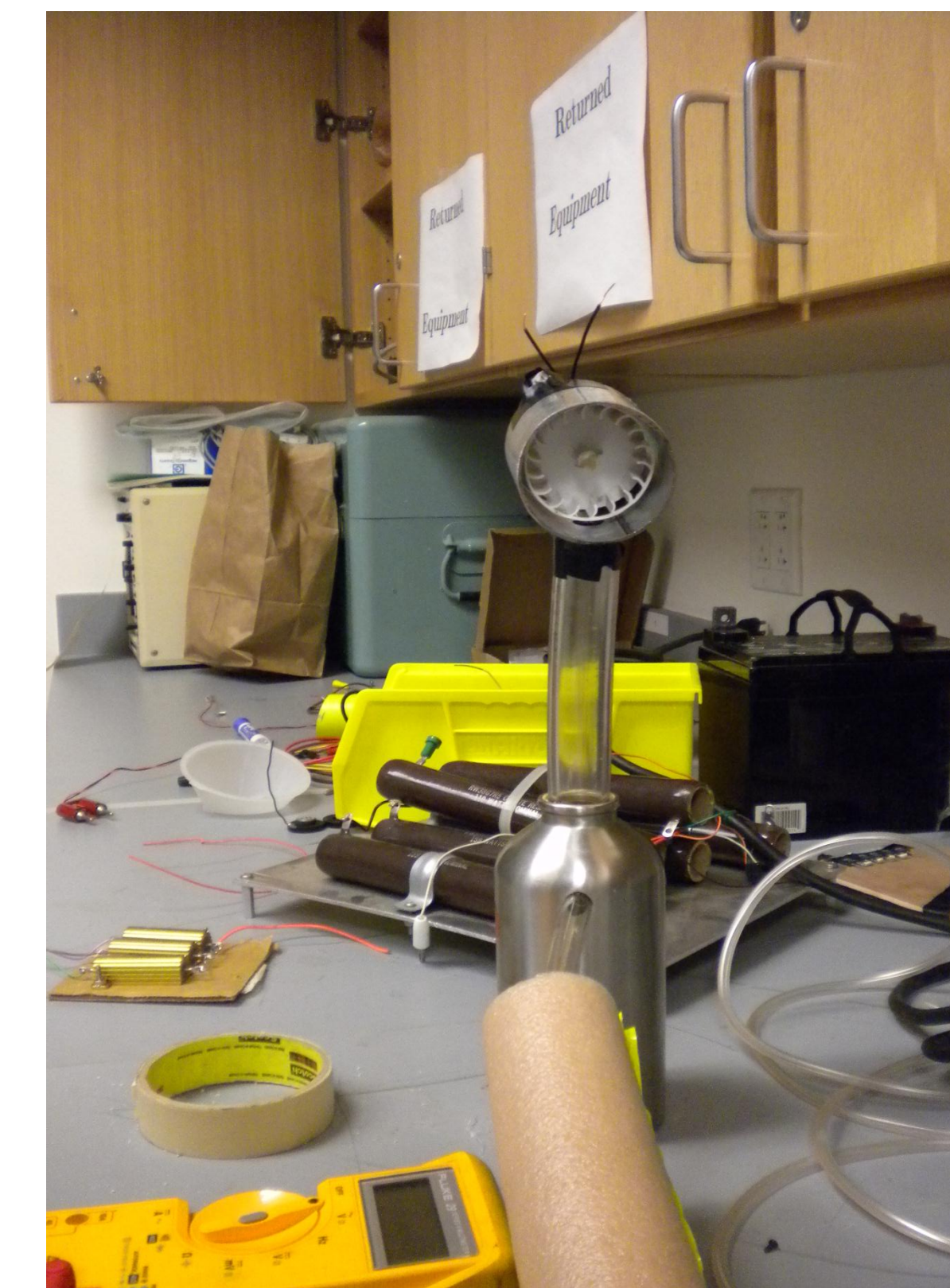
Design Specifications

- Must cost less than \$150
- Must provide continuous pressurized air (2-7mmHg)
- Must supply air at 36-37°C
- Must supply 100W to system for up to 2 weeks

Final Design

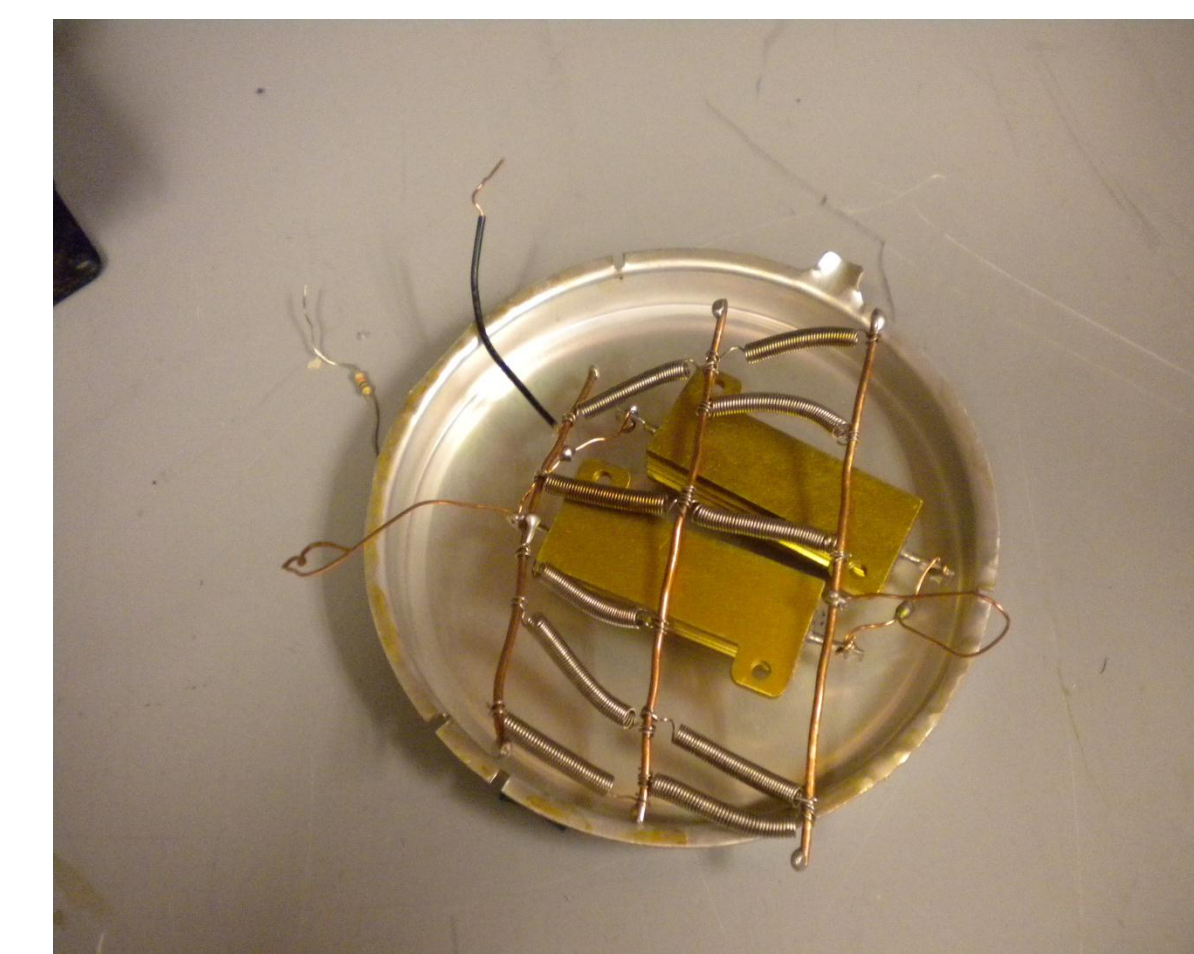
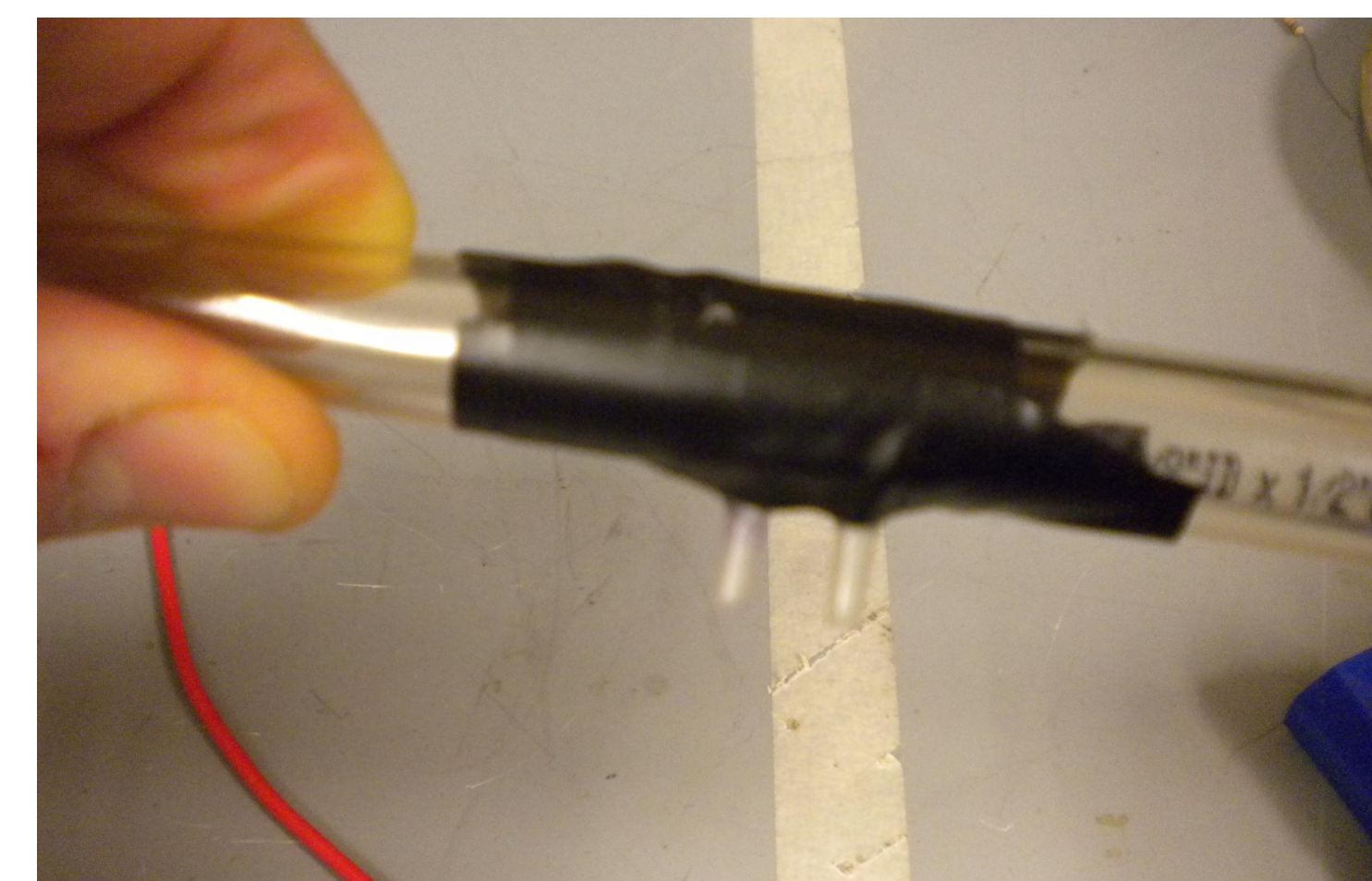
Air Input System

- Centrifugal fan
- 3/4" ID vinyl tubing
- 3/8" ID vinyl tubing
- 2 x 2.55mm diameter nasal prongs
- 12V deep cycle battery
- 1/2" pipe foam



Humidifier/Heater

- 1/2L aluminum water bottle
- 150mL water
- 10 segments nichrome wire
- 2 x 2Ω resistor
- Metal lid



Pressure Sensor

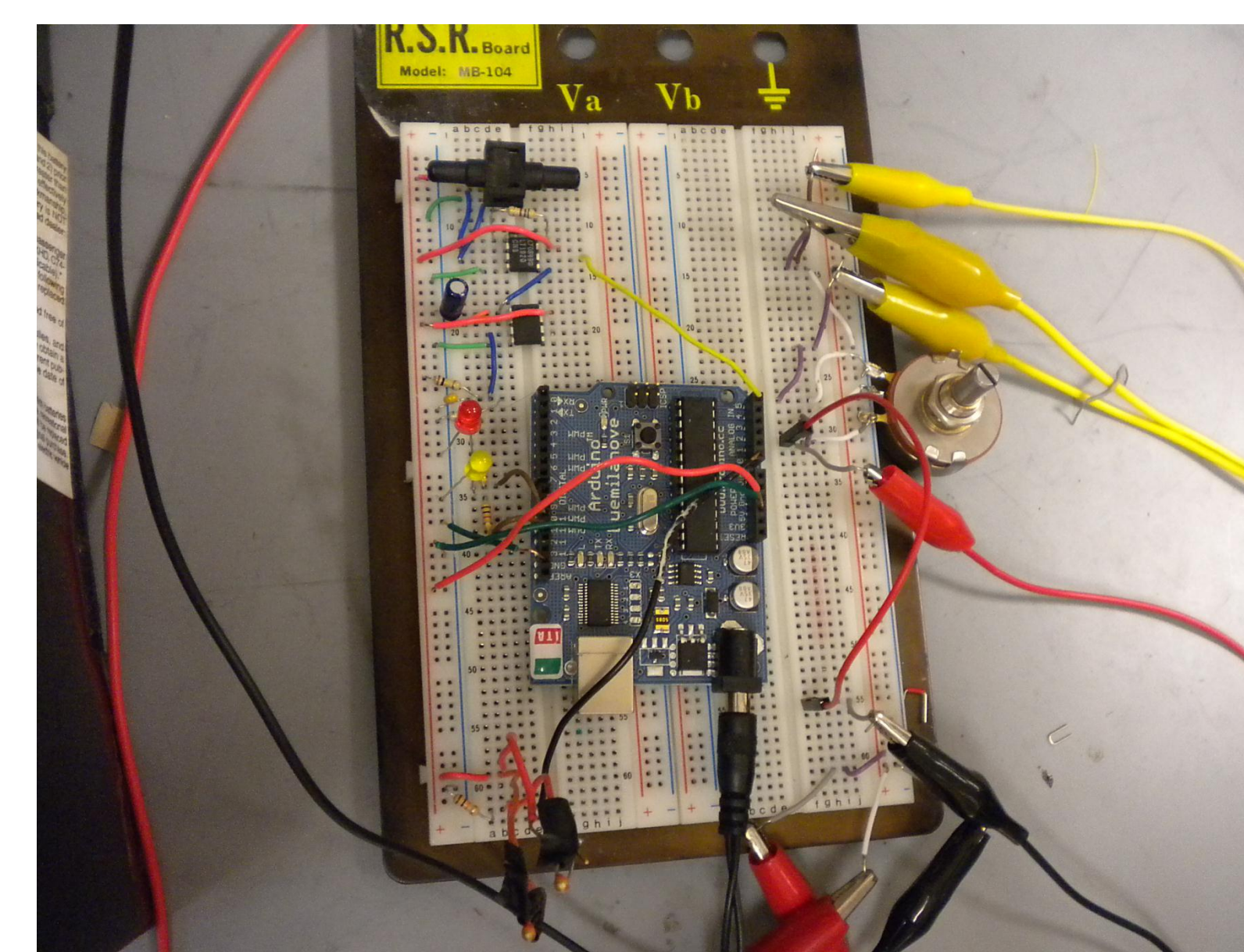
- 26PC SMT
- Between humidifier and nasal prongs

Arduino

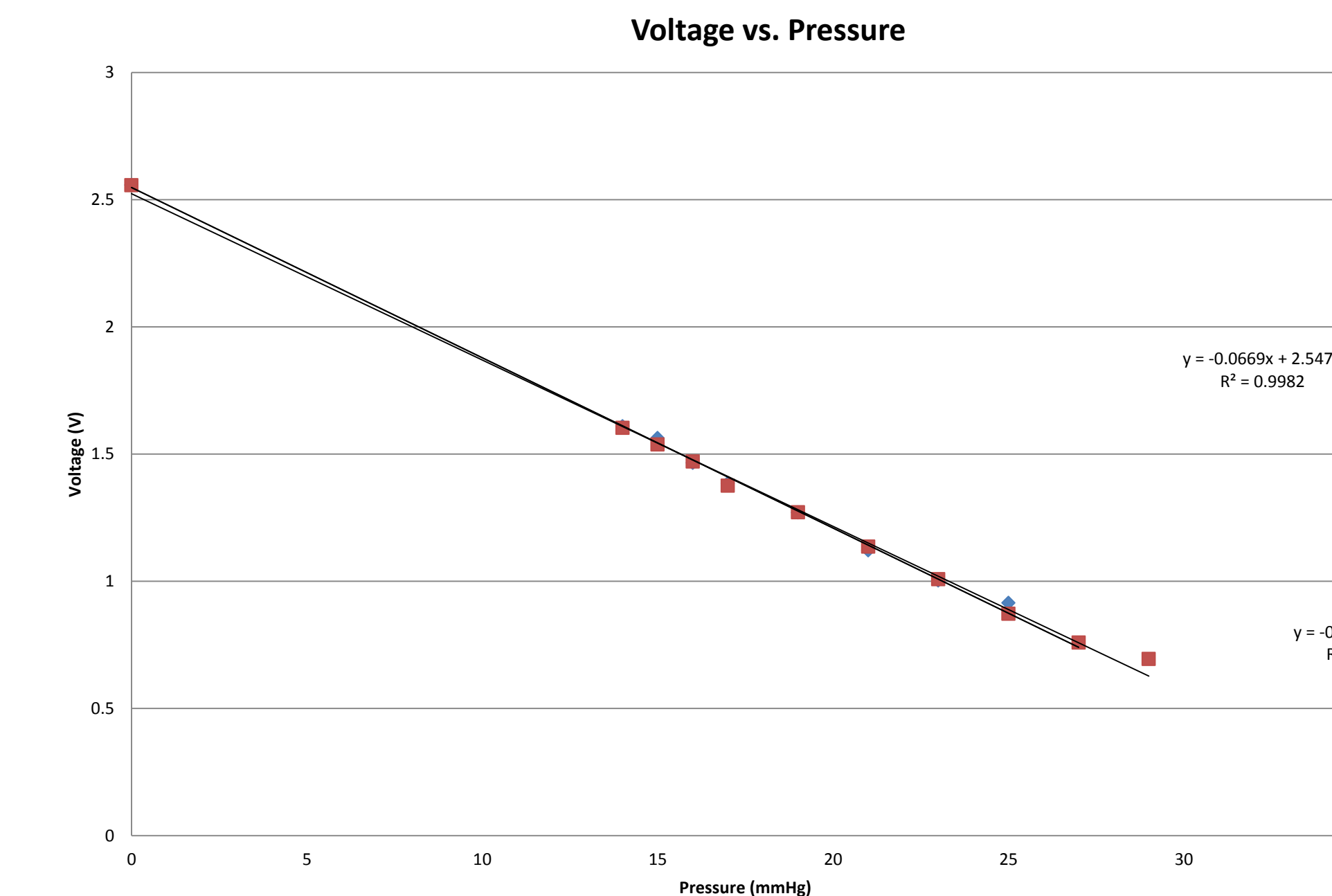
- Supplies 5V and 3V
- LEDs
- Thermistor

Bubble CPAP

- 1000mL beaker
- Exhalation tube submerged in water



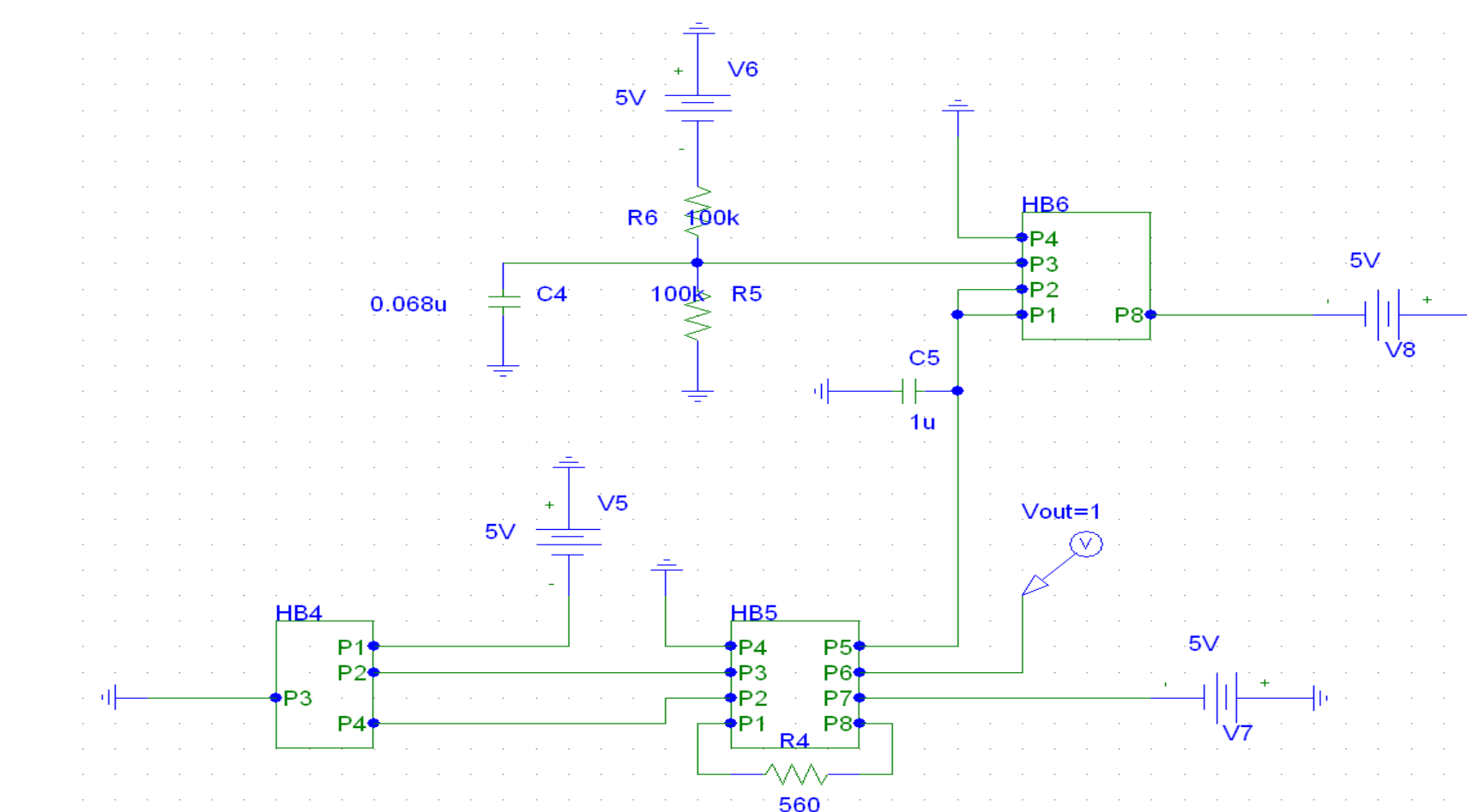
Testing



Pressure Sensor Calibration

Power Consumption:

- Watts
- Ah



Pressure Sensor Circuit

Time (min)	Temperature (Celsius)
0	25
5	27
10	30
15	34
20	38
22	40
25	42
30	46
35	50

Rate of heat transfer

Thermometer s (Celsius)	Thermistor (Celsius)	Time (min)
22	20	0
23	20	15
24	21	30

Thermistor Calibration

Future Work/Budget

- Recharging the car battery
- Water purification
- Heat plate
- Air filtration
- Centrifugal fan
- Testing on infants
- Make into a kit

Material	Cost
1/2" x 5/8" x 3' Pipe Insulation	\$3.29
1/2" x 5/8" x 3' Pipe Insulation	\$13.95
Arduino	\$19.95
3/4" I.D. x 1" O.D. Vinyl Tubing	\$1.44
3/8" I.D. x 1/2" O.D. Vinyl Tubing	\$1.93
Nasal Prongs	\$3.50
26PC SMT Pressure Sensor	\$3.94
Interstate Marine/RV 12V Premium Battery 24M-RD 5965	\$72.95
1939K17 12V Fan	\$15.32
Total	\$136.27

References/Acknowledgements

Respiratory Distress Syndrome: Respiratory Disorders in Neonates, Infants, and Young Children: Merck Manual Professional. Mar. 2009. Web. 29 Sept. 2010. <<http://www.merck.com/mmpe/sec19/ch277/ch277h.html#sec19-ch277h-924>>. Professor Amit Nimunkar, Professor John Webster, Dr. Mihai Teodorescu, MD, Dr. Pamela Kling, MD