Defogging Eyeglasses

Project Proposal

Grade: 23/25

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ECE 445

September 12, 2014

Table of Contents

1.0 Introduction

1.1 Statement of Purpose

Eyeglasses frequently fog up, causing a safety hazard for users. Our project aims to solve this problem. Since many Americans regularly wear eyeglasses, this product would have high impact. Our product will increase safety as well as convenience for the user. Since we both wear eyeglasses, this is of personal interest. This would not be a retrofit, but rather an add-on purchased with the eyeglasses.

1.2 Objectives

1.2.1 Goals & Benefits:

- Speed up defogging process
- No user input required
- Automatic activation does not require user's attention
- Increased safety in changing environments

2nd and 3rd items are really features.

1.2.2 Functions & Features:

- Sense relevant environmental conditions
- Interpret sensor data and determine if activation is required
- Activate heating elements to defog lenses
- Deactivate heating elements when unnecessary to conserve power
- All components mount on eyeglasses
- Maintain high visibility for user
- Balanced design for stability
- Light weight for user's comfort
- Common battery type for everyday user

Some of these could be reworded for clarity, for example, "standard battery cell that can be found in common stores." Maintaining high visibility is a benefit/goal rather a feature- be sure you are able to understand the differences in these categories.

2.0 Design

2.1 Block Diagrams

As shown in Figure 1, the electrical component of this project consists of two main parts: data collection/processing and execution.

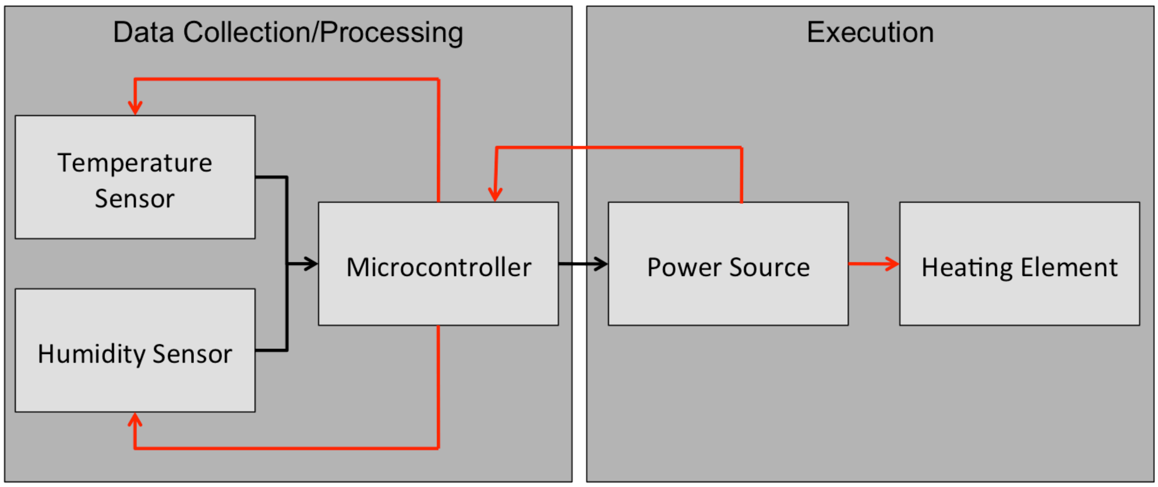

Figure 1. Block diagram of design where black lines indicate signals and red lines indicate power.

Great job with the overall boxes that show what each group of blocks accomplishes- while optional, this type of annotation makes things clear especially when you make diagrams in the future with more blocks/complexity than this particular one.

Don't combine the sensor streams into one- they are separate pieces of information that feed into the microcontroller. A block diagram is not a schematic (it may be the case that these communicate over the same bus physically).

2.2 Block Descriptions

2.2.1 Data collection/processing

The data collection/processing module will determine whether the heating elements should have current flowing through them or not. It will consist of a microcontroller, a temperature sensor, and a humidity sensor.

2.2.2 Execution

The execution module will apply power to the heating element when signaled by the microcontroller. It will consist of the microcontroller, a power source, and a heating element.

The organization of these is not great- since the bigger dark gray boxes are group descriptions, they shouldn't be listed at the same level as the specific blocks. They could be headers for the start of each list of blocks, which could reside under them.

2.2.3 Temperature sensor

This sensor will provide digital data to the microcontroller based on the analog environment. Temperature is one contributing factor to condensation on lenses. This sensor will connect directly to the microcontroller.

2.2.4 Humidity sensor

This sensor will provide environmental data to the microcontroller relating to the other contributing factor to condensation on lenses. This sensor will connect directly to the microcontroller.

These sensors can use more details- what kind of sensors are you using or planning to experiment with, what benefits are you weighing to decide, etc. You should figure out how they communicate (analog voltage output or digital data? What logic levels and protocol?) because it will potentially add more circuits to your design, like ADCs and level shifters.

2.2.5 Microcontroller

The two sensors will be connected to the microcontroller. It will be programmed to interpret the sensor data and determine if the situation requires activation of the heating element. If so, the microcontroller will send a signal to the power source to send power to the heating element.

You have power lines connected to the sensors from the microcontroller so you should note that it powers them as well. You really need more details here- what type are you considering and why, what your limitations are here- space, power consumption, memory, all of the above?

2.2.6 Power source

The power source will consist a logical switch (such as a relay) and a battery. The switch will be controlled by a signal from the microcontroller. The switch will either allow or interrupt current flow from the battery to the heating element.

2.2.7 Heating element

The heating element will consist of resistive wire on the edges of the lenses. It will receive power from the power source and dissipate the power through heat.

2.0 Requirements and Verification

Requirement	Verification	Points
1. Sensors a. Provide data that is accurate to +/- 2°C or +/- 2% RH (relative humidity) where applicable.	1. Sensors a. Compare the sensors' data to the data of the AccuRite 00611A3 wireless indoor/outdoor thermometer and humidity sensor. Data should be +/- 2°C or +/- 2% RH where applicable.	20
2. Microcontroller a. Output a low signal below the threshold voltage of the transistor (1V). b. Output a high signal above the threshold voltage of the transistor (1V).	2. Microcontroller a. Program the microcontroller to send a high signal. Place Digital Multimeter in parallel with the microcontroller. Voltage should be below 1V. b. Program the microcontroller to send a low signal. Place Digital Multimeter in parallel with the microcontroller. Voltage should be above 1V.	35
3. Heating Elements a. Heat up by 17°C +/- 2° C within 90 seconds when connected to the power source. b. Resistance must be 4Ω +/- 2Ω.	3. Heating Elements a. Measure the starting temperature of the element with ETC-8380 IR thermometer. Measure the temperature of the element after it is connected to the power source for 90 seconds. Temperature should read 17°C or more higher than the starting temperature. b. Measure the resistance of the full length of the elements. Resistance should be 4Ω +/- 2Ω.	35
4. Power Source a. Supply 5V +/-0.25V at a minimum of 1A +/- 0.25A.	4. Power Source a. Place Digital Multimeter in parallel with the power source. Measure the voltage difference across the power source. The voltage should read 5V +/- 0.25V b. Place Digital Multimeter in series with the power source and heating elements. Measure the current difference from the power source. The current should read 1A +/- 0.25A	10

Great job on being specific here- I like that all the requirements have NUMBERS that can be tested and a clear pass or fail threshold (in both + and – directions). Excellent details in the verification sections- someone other than your team members could perform these steps.

3.1 Tolerance Analysis – Heating elements

To assist in the defogging process, the heating elements must be able to produce enough heat to increase the temperature of the lenses and increase evaporation. To do this, the heating elements must increase their temperature by 17° C +/- 2° C when supplied with 6V. If it heats up too quickly, the heating elements will need to be disabled for safety reasons and not have time to assist in defogging. If they heat up too slowly, they will not have an affect of the defogging time.

Since the goal of this project is to decrease defogging time, the heating elements must have a resistance of 5883.0859 Ω, +/- 300 Ω to dissipate 1.079 J of heat in 75 - 100 seconds. If the resistance is too low, the heating elements will heat up too quickly and will need to be disabled, as to not burn the user, before the heating elements can increase the defog time of the eyeglasses. If the resistance is too high, the heating elements will not heat up quickly enough to have an effect of the defogging time of the eyeglasses.

Please show some more equations and math to prove how you got to the tolerance you need on those heating elements. I like the order of the analysis though- you should be determining the tolerance on specific subsystems/parts by figuring out A. how should the overall system behave, and then B. what is the worst max and min that this subsystem/part can have and still the overall system achieves its desired behavior. I think you were aiming for that.

4.0 Cost and Schedule

4.1 Cost analysis

4.1.1 Labor

Name	Hourly Rate	Total Hours Invested	Total = Hourly Rate x 2.5 x Total Hours Invested
Mary	$27.50	225	$15,468.75
Eric	$27.50	225	$15,468.75
Total		450	$30,937.50

4.1.2 Parts

Item	Quantity	Cost
Microcontroller	1	$30
Humidity/Temp Sensor	2	$15

26-Gauge Nicrome Wire	1	$8
Resistors and Capacitors	5	$2
Pack of batteries	2	$10
Battery Housing	1	$5
Relay	1	$10
Total		$80

Looking for part numbers/manufacturers here on everything but passive discretes (RLCs)

4.1.3 Grand Total

Section	Total
Labor	$30,937.50
Parts	$100
Grand Total	$31,037.50

4.2 Schedule

Week	Task	Responsibility
15-Sep	Finalize proposal	Eric
	Prepare mock design review	Mary
22-Sep	Research and select heating element and sensors	Eric
	Research and select microcontroller and power sources	Mary
29-Sep	Prepare design review	Eric
	Purchase parts and research and run tests on environmental conditions causing fogging	Mary
6-Oct	Run initial test on power source/heating element interaction	Eric
	Program microcontroller	Mary
13-Oct	Assemble power source for heating element	Eric
	Assemble relay and initiation circuit for heating elements	Mary
20-Oct	Run initial test on sensor/microcontroller interaction	Eric
	Run tests on relay and initiation of heating elements	Mary
27-Oct	Assemble external power source for microcontroller	Eric
	Prepare mock presentation	Mary
3-Nov	Run tests on output of microcontroller	Eric
	Prepare mock demonstration	Mary
10-Nov	Assemble all components	Eric
	Run tests on final project	Mary
17-Nov	Ensure functionality	Eric
	Fix remaining issues	Mary
24-Nov	Prepare presentation	Eric
	Prepare demonstration	Mary
1-Dec	Prepare final paper	Eric
	Finalize demonstration	Mary
8-Dec	Finalize presentation	Eric
	Lab checkout and finalize final paper	Mary