Automotive Icing Preventer

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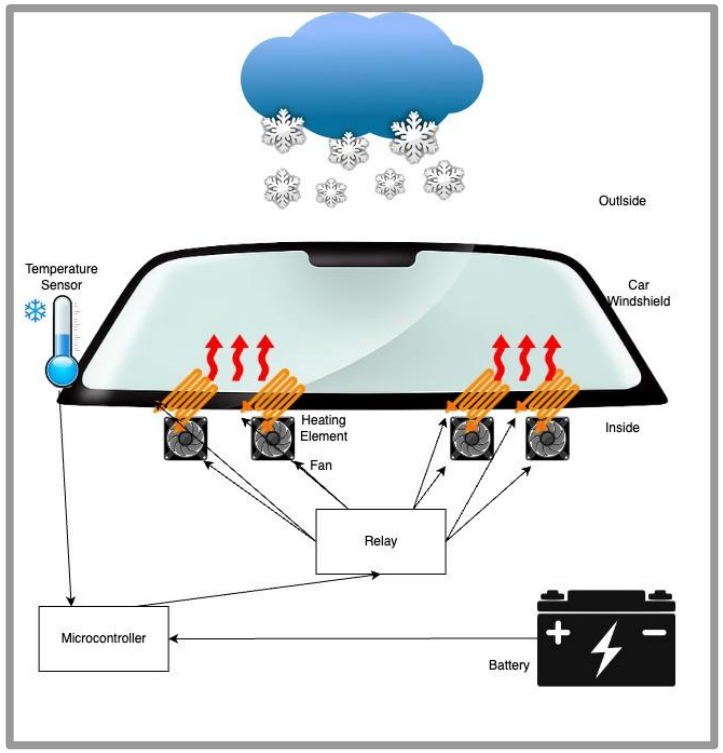
Introduction

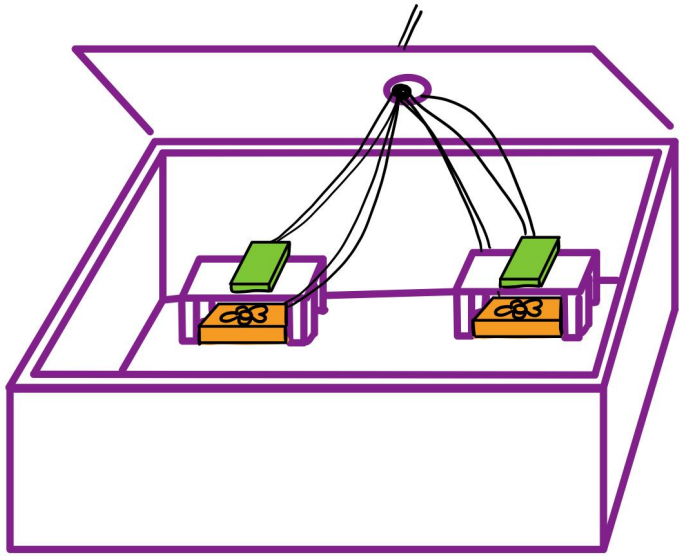
“Nearly 70 percent of the U.S. population lives in these snowy regions.”

- Federal Highway Administration of the US Department of Transportation

Objective


Outlside
Temperature Sensor
Car Windshield
Heating Element
Fan
Inside
Relay
Microcontroller
Battery

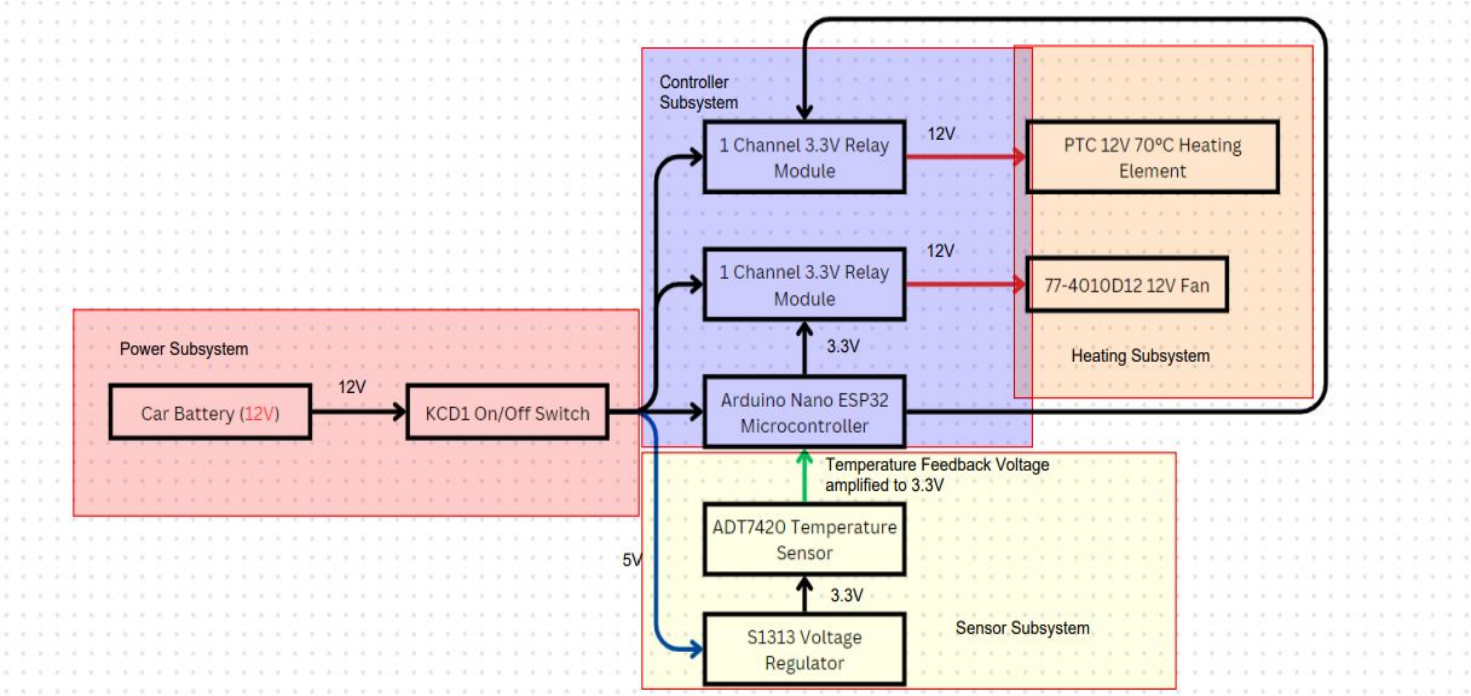
Design Choices



Final Physical Design

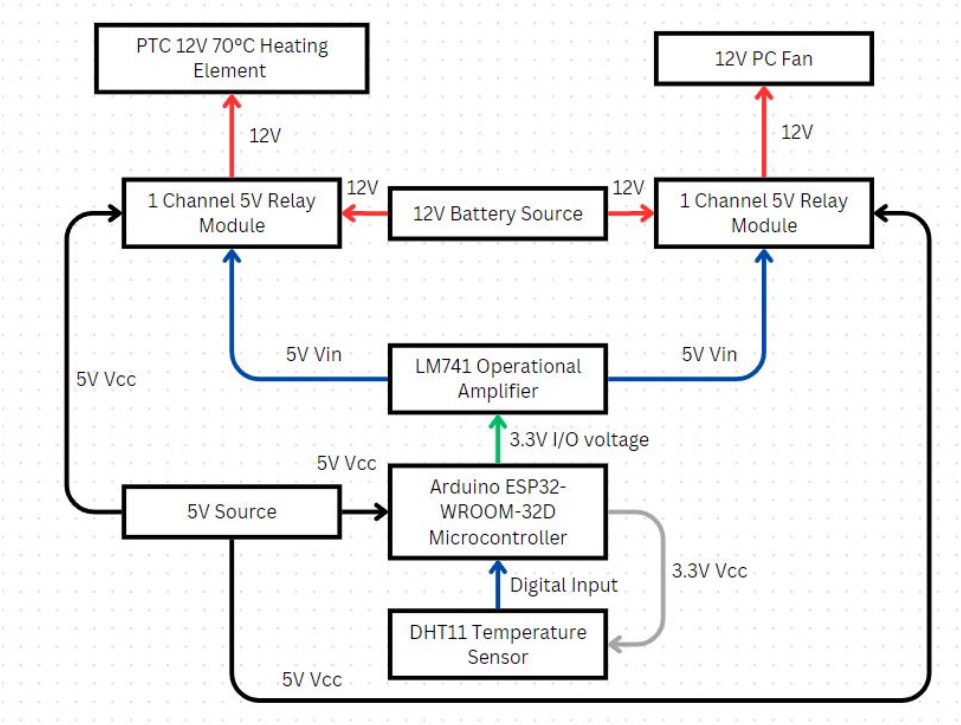
Design Choices Cont.

Original Block Diagram:



Design Choices Cont.

Updated Block Diagram:



Results

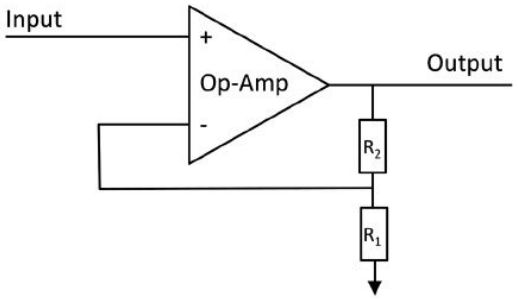
High Level Requirements

- Temperature Regulation
- I/O Implementation
- Power Distribution

R&V

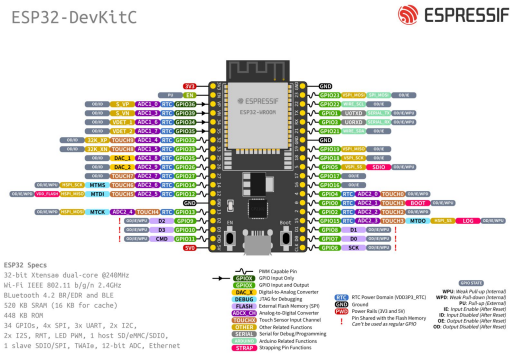
Requirement	Verification
5V output from Op Amp.	Microcontroller output 3.3V, LM741 chip output 5V
System can switch off despite temperature threshold.	Switch == OPEN -> no voltage Switch == CLOSED -> 12V to heating elements
PTC elements reach rated 70°C.	Thermometer
Fans receive 12V.	Prompt sensor/microcontroller 12V output
ESP 32 programmed to interpret DHT11 data.	Temperature read -> digital I/O conditions

Quantitative Analysis



- Operational Amplifier
  - $R_1 = 470\Omega, R_2 = 220\Omega$
- Output Power Requirements
  - Adjustment of # of elements to meet requirements
- Verification of Microcontroller GPIO voltages
  - Conditional to program

$$Gain = G = 1 + \frac{R_2}{R_1}$$



Successes and Challenges

Successes:

- I/O implementation for relays
- Fan power output
- Switch I/O functionality

Challenges:

- Circuit design changes
- PTC elements

Conclusion

Our Product:

- Driver Safety
- Convenience in Winter Conditions

Optimization:

- BJT usage
- Increased current analysis
- Physical design

Future Applications:

- Portable automatic AC
- Military and underprivileged regions