Team VentElation: Mighty Ducts

Objective

General Need for the Product
- Interior car temperature can increase up to 40 degrees Fahrenheit in the span of one hour (Null)

Constraints
- Independent energy source
- Realistic & competitive cost
- Weather-resistance
- Passenger safety

Customer Requirements
- Effective Cooling Temp. (4.55/5)
- Reliable System (4.66/5)
- Product Safety (4.79/5)

Highest Ranked CRs from Survey
- Effective Cooling Temp.
- Reliable System
- Product Safety

Engineering Characteristics

Top Four CTQ Characteristics
- Volume of Product
- Change in Temperature of Air
- Time of Maintaining Temperature
- Lifetime of Product

Test Results and Future Work

Heat Evacuation Test Results

Future Work
- Systems integration
- Evaluate alternative energy sources
- Battery-life testing

Design

Parameterization
- Designed 3D model in CAD software and evaluated pressure, temperature and velocity for 5", 7", and 10" openings

Compromises
- Divided into three sections for easy injection molding
- Combined mounting for portability and ease of installation, may decrease efficiency

Key Features
- Thermostat automatically adjusts temperature, batteries are easily replaceable and the system easily removable

Prototype and Testing

Prototyping
- Printed working 3D model of the casing design
- Mimicked the effect of a bimetal thermostat using an Arduino and thermistor combination

Testing
- Performed heat evacuation tests in a controlled environment
- Evaluated performance of Mighty Ducts system under realistic life-cycle conditions

Test Results
- Mighty Ducts improved heat evacuation results in the test environment
- ANOVA and Tukey-Kramer analysis showed significant difference in population means

Concept Generation

Peltier Window Fan
- Axial fan mounted in the front passenger window
- Fan triggered by opening the driver-side door
- Hot air within the car expelled through open door
- Cool air drawn into the car via axial fans

Human Powered Cooling
- Dual fans mounted in custom duct system
- Hot air drawn from the top of the car and directed out
- Outside air pulled downwards into the car via ducting and inlet fan
- Activation of the system controlled by bimetal thermostat

Directed Fans – Final Design
- Peltier Window Fan
- Human Powered Cooling
- Directed Fans – Final Design

Consultation

www.accuweather.com

Temperatures in Washington, D.C. (June - September)

- Average
- Record Highs
- Possible Temps Inside Car

Temperatures in Washington, D.C. (June - September)

- Average
- Record Highs
- Possible Temps Inside Car

Key Features
- Thermostat automatically adjusts temperature, batteries are easily replaceable and the system easily removable
- Dual fans mounted in custom duct system
- Hot air drawn from the top of the car and directed out
- Outside air pulled downwards into the car via ducting and inlet fan
- Activation of the system controlled by bimetal thermostat

Future Work
- Systems integration
- Evaluate alternative energy sources
- Battery-life testing
- Evaluating performance of Mighty Ducts system under realistic life-cycle conditions

ENME472 - Integrated Product and Process Design and Development

Hannah Allison, Hannah Baron, Elizabeth Sauerbrunn, Ashley Seto, Colin Vale