Abstract

FLIR Systems is a leading innovator in thermal imaging systems. FLIR developed an automotive night vision system, the PathFindIR™, that identifies pedestrians and animals as a pre-installed option on luxury cars. Interest in the system grew, and an aftermarket version was released. FLIR seeks to significantly reduce the high installation cost and complexity associated with the current system. The goal of this project is to design an electronics enclosure capable of transmitting video wirelessly to a Wi-Fi enabled smartphone.

Design Requirements

The focus of this project is on the mechanical aspects of the enclosure. Design requirements are provided by FLIR. Design features include universal mounting and the ability to withstand the harsher environment outside of the car cabin.

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Value</th>
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<tbody>
<tr>
<td>Temperature Range</td>
<td>-40°C to 80°C</td>
</tr>
<tr>
<td>Vibration Requirements</td>
<td>12 Hz in X, Y, and Z-Axes</td>
</tr>
<tr>
<td>Water Resistance</td>
<td>IP67: 1 meter submersion, 30 min</td>
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<tr>
<td>Shock Load</td>
<td>10 mph collision</td>
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<tr>
<td>Mounting</td>
<td>5 Cars at minimum</td>
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<tr>
<td>Wi-Fi Signal</td>
<td>2 Bars on Smartphone</td>
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</tbody>
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Design Overview

One challenge with designing the enclosure is determining a universal mounting location. In general, a car’s bumper area has ample space for the enclosure. This choice determines some of the enclosure’s features. Design features include:

• Gasket seals, O-Ring seals, and waterproof connectors to ensure a watertight enclosure.
• A Gore™ vent for internal pressure equalization.
• Molded plastic cover for Wi-Fi transmission.
• Full metal-on-metal contact to provide EMI shielding.
• Flanges with bolt holes and Velcro slots.
• Thermal pads for the hot circuit board components.
• Internal screw mounts to separate the Electronic Control Unit and the Wi-Fi board.

Testing

In order to ensure system stability in the expected environment, multiple tests were performed on the prototype enclosure model:

• Thermal analysis and testing in an environmental chamber to verify electronic functionality.
• Vibration testing as set by SAE J2139 standards.
• Waterproof testing for the IP67 rating.
• Mount testing.
• Shock testing set by NHTSA Report Number DOT HS 807 072.

Conclusion

Testing of the prototype shows that the design can be successfully mounted in 5 different cars with an installation time of less than 30 minutes. In tests conducted without the Wi-Fi board, the enclosure protects its contents in terms of vibration, shock, and temperature. However, the prototype failed the waterproof requirement due to a crooked grommet tap. All other design requirements are met and surpassed. Moving forward, the enclosure will be retested with a functioning Wi-Fi board.

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