

Air Flow measurement using 3-Axis
Positioning System
(Automotive Industry)



Client Background

Client is one of the largest international automotive parts manufacturer in the world. Known for specialization in Vehicle Interiors (dashboards, centre consoles, door panels, acoustic modules) and emission control technology.

Air-conditioning for automobiles came into wide use from the late twentieth century. Air conditioning in vehicle not only cools down temperature but also reduces moisture. Proper ventilation is necessary for the movement of air within the confined space. Proper design of air-vent makes good ventilation inside vehicle.



Challenge

Validating the functionality of vehicle air vents poses unique challenges, requiring an automated testing system. The air vent undergoes testing in various positions - Neutral, Top, Bottom, Left, and Right - demanding accurate assessment across orientations. The system must achieve three key objectives: identifying airflow regions, localizing maximum flow positions, and measuring maximum directivity angles. These tasks ensure consistent functionality and optimize airflow performance. Addressing these challenges will result in a robust testing solution, crucial for meeting customer demands and ensuring the reliability of air vent units in diverse operational conditions.

Engagement Journey

Started With



Extended To



Ongoing Support



Solution

Design of 3 axis Motion system integrated with Data acquisition hardware and software to perform automated test. The 3-axis Motion system is used to measure air flow from the air vent at different position. The 3-axis servo assembly covers area of (Height - 2000 mm X Width - 2000 mm X Depth - 2000 mm). The Anemometer sensor is used to measure air flow connected to Data acquisition system.

The 3-axis servo motion system moves the anemometer to measure air flow at frequent step size. The system is capable of movement of anemometer to defined region and acquire air flow data. The application plots the airflow data with respect to anemometer position in XYZ axis. The user can view the test results in three modes.

1. Tabulated sheet
2. Intensity graph
3. Contour Plot.

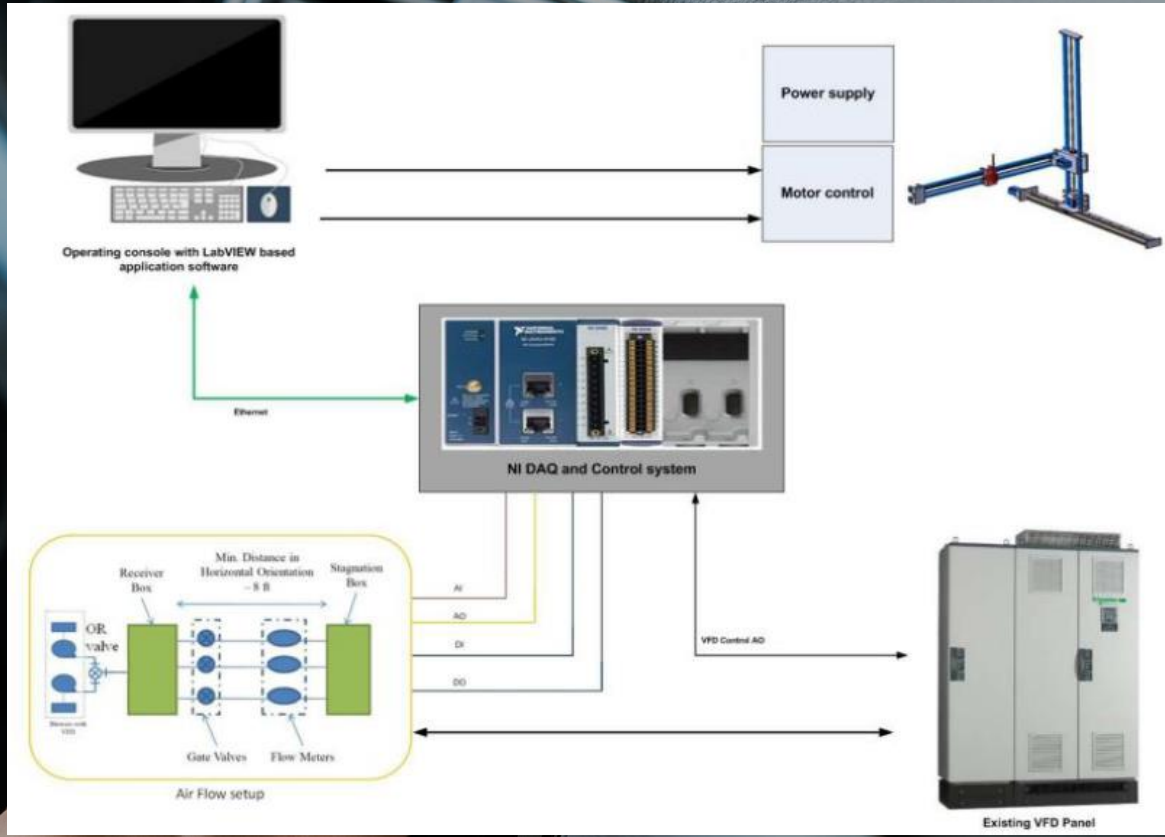
Based on the test results, the user can validate air vent design and its performance.

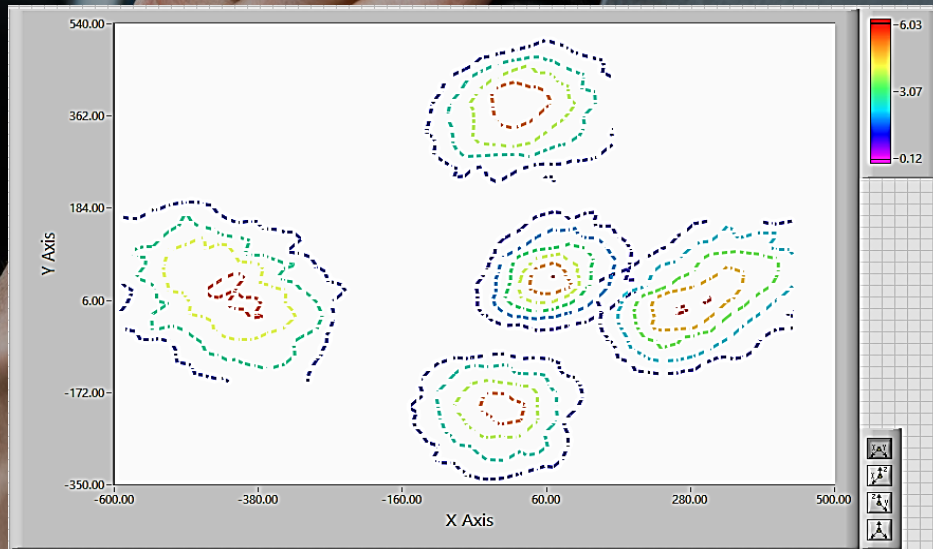
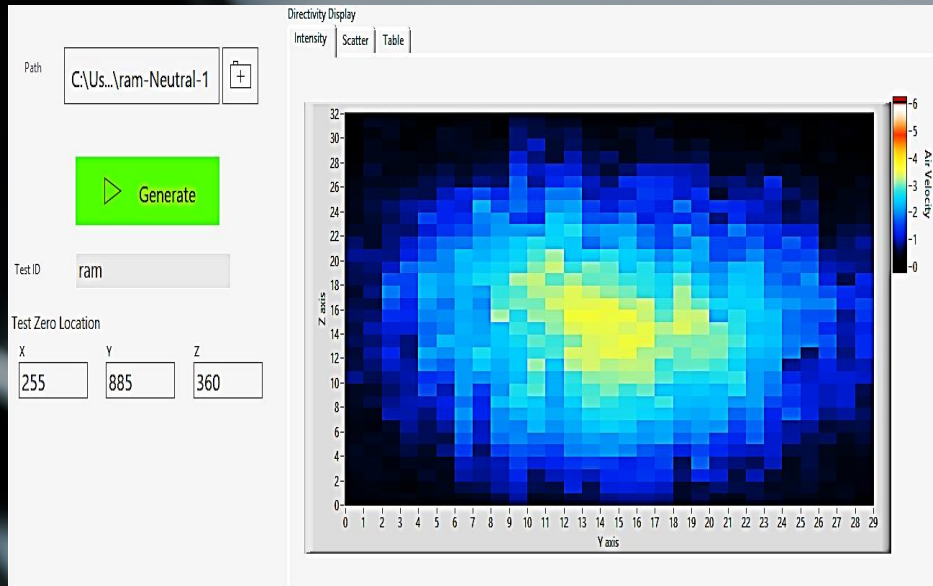


Solution

In the bead-making process diagram, the rubber coating on copper-coated bead wires is scrutinized for uniformity. Occasionally, incomplete rubber coating occurs, prompting the need for detection. The system employs two cameras positioned above and below to capture images swiftly, transmitting data to a real-time controller. This controller undertakes image processing, calculations, and decision-making, categorizing faults into major, minor, and system-related. Utilizing a predefined algorithm, real-time processing measures the tire bead rubber strip.

Generated reports detail error data, occurrence timestamps, and machine status. Automation of the software minimizes human intervention, streamlining operations. Additionally, the system supports offline analysis, amalgamating air directivity plots, determining maximum directivity angles, and generating comprehensive reports, enhancing efficiency and accuracy.





Benefits

- Significantly reduces human efforts during testing
- Test data stored in memory
- Post reports can be regenerated
- Alarms Indication
- Cost and time saving solution
- Precise motion
- Accurate measurement
- Fully automated system
- Helps user to validate design



Benefits against alternatives

The Air Directivity System excels in accurate positioning and data collection, outperforming manual testing which can exceed 3 hours per air vent. Its automation drastically reduces testing time with minimal human involvement. This system stores test data, enabling easy retrieval and report regeneration. Integrated alarms promptly alert to deviations, enhancing operational efficiency. Offering precise motion and measurements, it ensures reliability and consistency in testing. Compared to alternatives, this fully automated solution delivers substantial cost and time savings while empowering efficient design validation.



Value Proposition

A comprehensive solution is available for testing various types of air vents through the utilization of a sophisticated 3-axis Motion Control System. This solution includes a complete 3-axis motion assembly, a robust data acquisition system, and customized application software tailored to meet specific end-user requirements. By seamlessly integrating these components, precise control over the motion of the testing apparatus is achieved, facilitating thorough and accurate assessments of air vents. This value-added package enhances testing efficiency and provides users with a streamlined and user-friendly experience, ultimately contributing to improved product quality and customer satisfaction.

