Bosch
AI powered Sound Engineering Platform

SVENTA
SOUND ENGINEERING MARKET SCENARIO

SIZE
$10.96 B
By 2023 business of predictive Maintenance

IMPACT
0.7%
of Total Revenue spend on NVH related Warranty issues

GROWTH
5.3%
Of Field Complaints arise from Noise and Vibrations

High Growth
Sound Engineering Solutions
**SVENTA**: AI powered Sound Engineering Platform

**Agenda**

1. The business case: current situation and challenges
2. Customer needs
3. Our value proposition
4. Applications of Sound Engineering Solution
5. Harnessing Azure services
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Solution Approach

**Step 1**
Measurement Phase
Recording with SVENTA
Mobile Application

**Step 2**
Data Transfer
Cloud / Server

- Data storing and retrieving for Analysis
- Leverage the Cloud services for customizable application development

**Step 3**
Analytics and decision making with AI

- FFT
- FFT Vs Time
- Level Vs RPM

- AI / ML Interface
  Possible identification of fault related to sound using design and operational noise history data

- Noise levels (indicated for a specific time instant / date / RPM @ specified locations

**Step 4**
Results Dashboard

Diagnostic Dashboard

- Exhaust
- Steering, Tyre
- Engine, Gear

Service Notes: Replace / repair exhaust system.
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Our value proposition

**EASY OF USE**
Minimal expertise and less than 2 minutes for Data acquisition and results prediction

**LESS CAPITAL INVESTMENTS**
Minimal Instrument cost (less than 10 times of Conventional system cost)

**PORTABLE**
Portable and easy Connectivity with wireless sensors

**AI POWERED**
AI implementation with Deep learning and Self learning for problem identification

**INTEGRATION TO CLOUD PLATFORM**
Compatible to cloud platforms AZURE

**CLASS-I ACCURACY**
Ensuring the Sound data quality inline Class-1 accuracy
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Application Areas

- **Predictive Diagnostics**
  - Troubleshooting of Noise and Vibration issues
  - Less Dependence on Mechanic/expert service personnel

- **End of Line Assembly/Manufacturing Plant**
  - Avoid Subjective assessments
  - Minimize rejections
  - Connected Solution for improved Quality

- **Condition Monitoring**
  - Continuous Monitoring of Machine status in harsh environments
  - Service alerts to Maintenance teams
  - Reduce machine Down time

- **Field Service**
  - Quicker Response to Field Failure issues
  - Connect with Experts
  - Customer satisfaction
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Stakeholders and their needs

**NVH Experts**
- Quicker Analysis data from Field or Test Track
- Portable
- Faster Feedback to Test engineers

**End of Line Quality Teams**
- Avoid Subjective assessments
- Minimize rejections
- Connected Solution for improved Quality

**Maintenance Teams**
- Continuous Monitoring of Machine status in harsh environments
- Service alerts to Maintenance teams
- Reduce machine Down time

**Field Service Engineers**
- Quicker Response to Field Failure issues
- Connect with Experts
- Customer satisfaction
Use-case 1: Service center diagnostics – OEM in US

Project Description

- Integration of FFT spectrum based dB value into an existing diagnostic tool, for a US-based OEM service center.
- Analysis of Spectrum for a specific band for engine noise assessment. Frequencies addressed includes mid range of 500 Hz to 3 KHz.
- Tool is deployed as an additional check for abnormality in engine noise through in-cab measurements along with additional Engine parameters through OBD.

Key Feature

- Very quick and Effective Noise Analysis with minimum dependency on standard data acquisition system and expertise.

USP

- 100% Engine fault detection through sound
- < 2 minutes per vehicle for analysis
- Minimal Instrument cost (less than 10 times of Conventional system cost)
Use-case 2: Motor End of Line testing for Source Detection (Noise pattern recognition)

**KEY BENEFITS**
- Accurate Segregation of Component based on Noise types.
- Can identify abnormality in “samples termed as OKAY” in production line.
- Facilitates Root Cause Analysis.
- Can be Adapted to detect any noise type.
- Inline-with class I sound measurement device.

**USP**
- Increase in Source detection capability by >90%
- < 20 seconds of Cycle time / motor
- Complete Automation with no human dependence

EOL noise assessment - Manual

EOL Solution with SVENTA

EOL noise assessment - Manual

EOL Solution with SVENTA
Use-case 3: Field / Quality / Sales Engineers NVH Diagnostic tool

Solution Overview

- The Assist (Acoustic Sales and Service App) application is a mobile based iOS application, to record and analyze sound data radiated by a product. The app will be used mainly by field sales and service personnel, to record the noise data and share with R&D Rexroth acoustic experts for quick feedback and problem understanding or resolution.

Key Benefits

- Improves customer Satisfaction
- Quicker NVH Field problem investigation
- Connects Globally Field / sales personnel
- Instant connect with NVH Experts, Measurement Data shared with via SharePoint

USP

- Lead time to assess Field issues reduced by ~4 days to 1 hour
- Unique Sound Analysis modules and data helps in decision making by NVH experts
Overview

Conventional EOL tests in the Automotive OEM
- Post Vehicle Assembly at Plant/TCF vehicle subjected to EOL tests
- EOL tests include: Random full vehicle Audit (One Drive Tests)
- Full vehicle audits currently includes subjective tests for "Boom" Noise + "Whining Noise"

Current Drawbacks
- Current OEM one-drive tests cannot facilitate 100% NVH drive tests due to testing time for vehicles.
- Dependency on expert drivers as track testing, who assess boom + whining noise subjectively.
- No objective assessment available which could aid problem resolution and production trend.

Key benefits with Sventa
- Instant set-up and Minimal expertise
- Mobile / Tablet based Application can be interfaced with external microphone

USP
- Enables 100% Objective Sound Audit test
- Psychoacoustics metrics for assisting drive test. (Elimination of dependency of Expert test driver)
- Lead time to assess Acoustic issues reduced by ~3 weeks to 1 hour
- AI enabled Solution with Sound Engineering

Solution: Sventa (customized)
Use-case 5: Agro-Domain Application: Field Assist

Market Need:
- Cost efficient device for tracking agricultural operations (e.g. Ploughing, fertilizing, sowing etc.)
- Track farm productivity by mapping farm operations vis-à-vis output

Solution:
Mobile application based on Acoustic platform for noise identification with sound pattern recognition and deep learning

Key Feature:
- Advanced Audio pattern recognition algorithm for differentiating noise
- Integration of GPS & draw over map to identify farm and geo-fence
- Sensitivity calibration algorithm for different mobile microphones

USP:
- No external hardware required (only mobile device sufficient)
- Complete activity tracking and productivity reporting within application for farmers
- Offline functionally (App Works without internet)
- Captures 100% Field Activities
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Use-Case: AI based in-cab noise source detection

Vehicle with annoying In-cab Noise

- Abnormal firing (missing pilot)
- Cause: Gear (oil) pump whine
- Cause: Exhaust

OK vehicle without irritating in-cab noise

Source prediction on vehicle level with quick in-cab noise measurements with single microphone

Detection of sound in less than 1 min with use of ML training model for quick detection of source
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PoC: Predictive Acoustic Diagnosis of Hub Chain Wear on Fork Lift Truck*

*Note: Patent filed in Germany on this Innovation
Harnessing Azure services

- Integration to IOT data into cloud
- Storage to scale without latency
- Visualizations to surface insights
- Analytics to AI/ML based predictions
- Security to protect data
Ready to experience Sound Engineering Solutions your business?

- We will connect you with the Bosch SVENTA sales team: bhuvan.Shetty@de.bosch.com

- Learn more: bosch-india-software.com