Bosch
AI powered Sound Engineering Platform

BOSCH

Microsoft

SVENTA

SOUND ENGINEERING MARKET SCENARIO

$10.96 B

By 2023 business of predictive Maintenance

0.7%

of Total Revenue spend on NVH related Warranty issues

5.3%

Of Field Complaints arise from Noise and Vibrations

High Growth

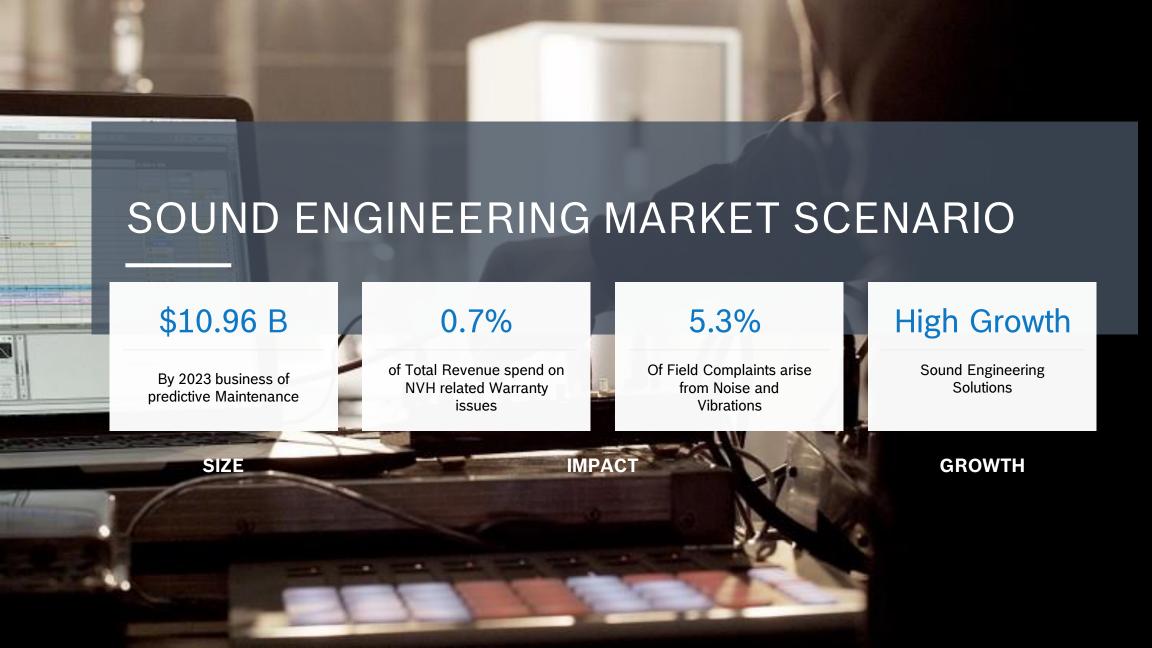Sound Engineering Solutions

SIZE

IMPACT

GROWTH

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 Azures services

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Solution Approach

Step 1 · **Step 2** · **Step 3** · **Step 4**

Step 1
Measurement Phase
Recording with SVENTA
Mobile Application

Vehicle 1

Vehicle 2

Vehicle 3

Step 2
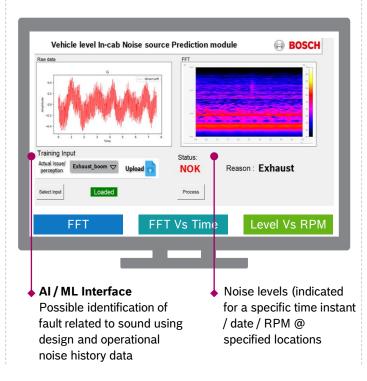Data Transfer
Cloud / Server
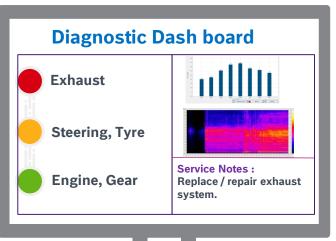
▶ Data storing and retrieving for Analysis

▶ Leverage the Cloud services for customizable application development

Step 3
Analytics and decision making with AI

Vehicle level In-cab Noise source Prediction module · **BOSCH**

Raw data

FFT

Training Input

Actual issue/ perception · Exhaust_boom · Upload

Select input · Loaded

Status: **NOK** · Reason : **Exhaust**

Process

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 Dash board

● 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

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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

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NVH Experts

- ► Quicker Analysis data from Field or Test Track
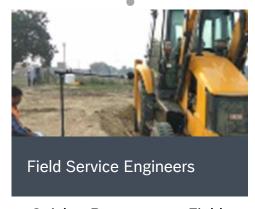- ► Portable
- ► Faster Feedback to Test engineers

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

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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)

Integrated with Bosch sound module

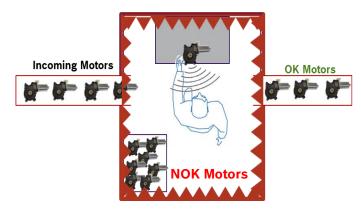# Use-case 2: Motor End of Line testing for Source Detection (Noise pattern recognition)

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

Incoming Motors   OK Motors

NOK Motors

EOL Solution with SVENTA

NOISE BOOTH

SVENTA EOL

OK Motors

NOK Motors

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

Use-case 4: Vehicle End of Line Audit Testing – OEM Europe

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

Microphone placed inside cabin

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:

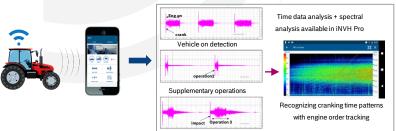Mobile application based on Acoustic platform for noise identification with **sound pattern recognition and deep learning**
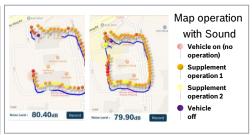
Key Feature

▶ 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)
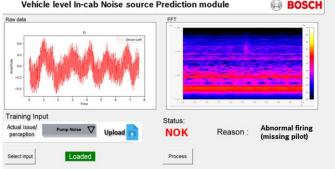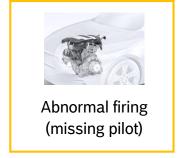▶ Captures 100% Field Activities

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Use-Case: AI based in-cab noise source detection

Vehicle with annoying In-cab Noise

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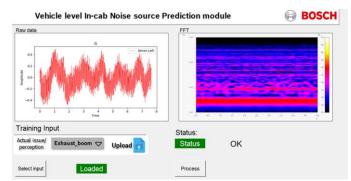
Cause: Gear (oil) pump whine

Cause: Exhaust

OK vehicle without irritating in-cab noise

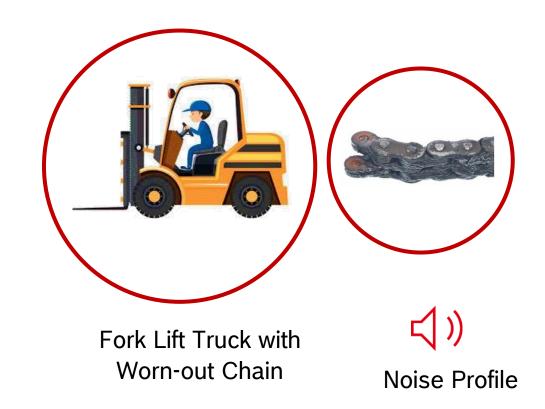Source predication on vehicle level with quick in-cab noise measurements with single microphone

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*

Fork Lift Truck with New Chain

Noise Profile

Fork Lift Truck with Worn-out Chain

Noise Profile

*Note : Patent filed in Germany on this Innovation

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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