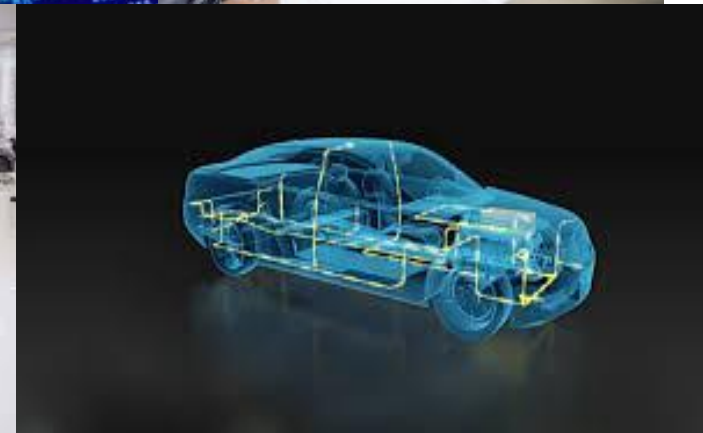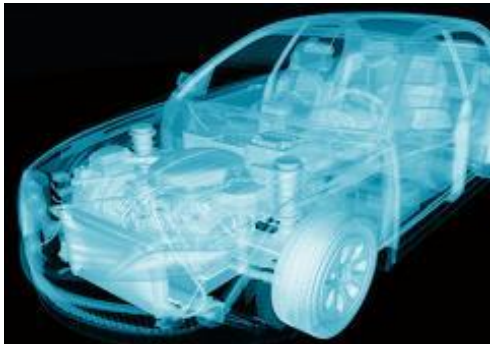# Annotation, Model-Based Development
&
Mechanical Engineering Design Capabilities

Focus-Innovate-Expand & Differentiate

TechnoPro Group

Corporate Name	**TechnoPro Holdings, Inc.**
Business Outline	Technology-focused staffing and service companies with more than 25,000 engineers and researchers, with expertise in fields such as machinery, electrical/electronic engineering, information systems, chemistry, biotechnology, and energy
Head Office	35F, Roppongi Hills Mori Tower, Roppongi 6-10-1, Minato-ku, Tokyo, Japan
Established	April, 2012
Company CEO	Takeshi Yagi
Employees	25000+
Annual Sales	158.4 billion yen ≒ 1.5 billion USD
Branch Offices	127 sales offices Development Center : 27 Branches Training Facilities : 63 Locations

**TechnoPro Holdings, Inc.
Head Office**

TECHNOPRO

TechnoPro Overview : Established in June 1997

Competitive Edge

✓ Listed on Tokyo Stock Exchange: Market Cap of JPY **418 Billion**
✓ **Aim** : **Global Expansion** through **Organic and M&A Route**

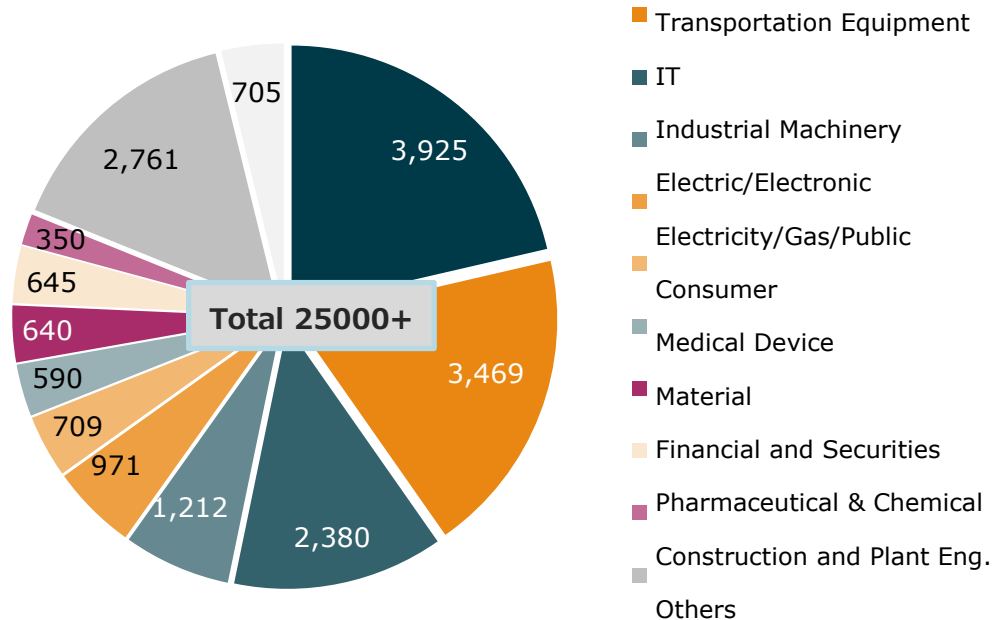| Market Leader	■ **Market Leader with** 8% Market share in **Professional Services (Specialized Engineers)** in Japan ■ Comprehensive Engineering Consulting footprint in Japan
Diversified Client Base	■ Over **2,200 clients** among well-diversified industries with Long Term Strategic relationships ■ Top 10 Customers account for **13%** of total Sales; One of the best **Customer Diversification** in the Industry
#1 Engineer Base with Best Recruiting Team	■ Wide range of Technology offerings with over **25,000 engineers** ■ Strong capability to recruit new engineers (nearly **4,300 new hires**)
Management Capability Mitigates Bench Risk	■ Over **95% Resource Utilization** by Robust & Structured management system – (All Engineers are engaged as as full-time employee) ■ Established **Training & Educational capability** to improve engineer quality

TECHNOPRO

TechnoPro Global Customer Base

Serving through 25 Years of different Industry

Total 25000+

- 3,925
- 3,469
- 2,380
- 1,212
- 971
- 709
- 590
- 640
- 645
- 350
- 2,761
- 705

Legend:
- Transportation Equipment
- IT
- Industrial Machinery
- Electric/Electronic
- Electricity/Gas/Public
- Consumer
- Medical Device
- Material
- Financial and Securities
- Pharmaceutical & Chemical
- Construction and Plant Eng.
- Others

- # of clients is over **2,200** as of June 2022.

- Top 10 clients accounts for **13%** of total sales.

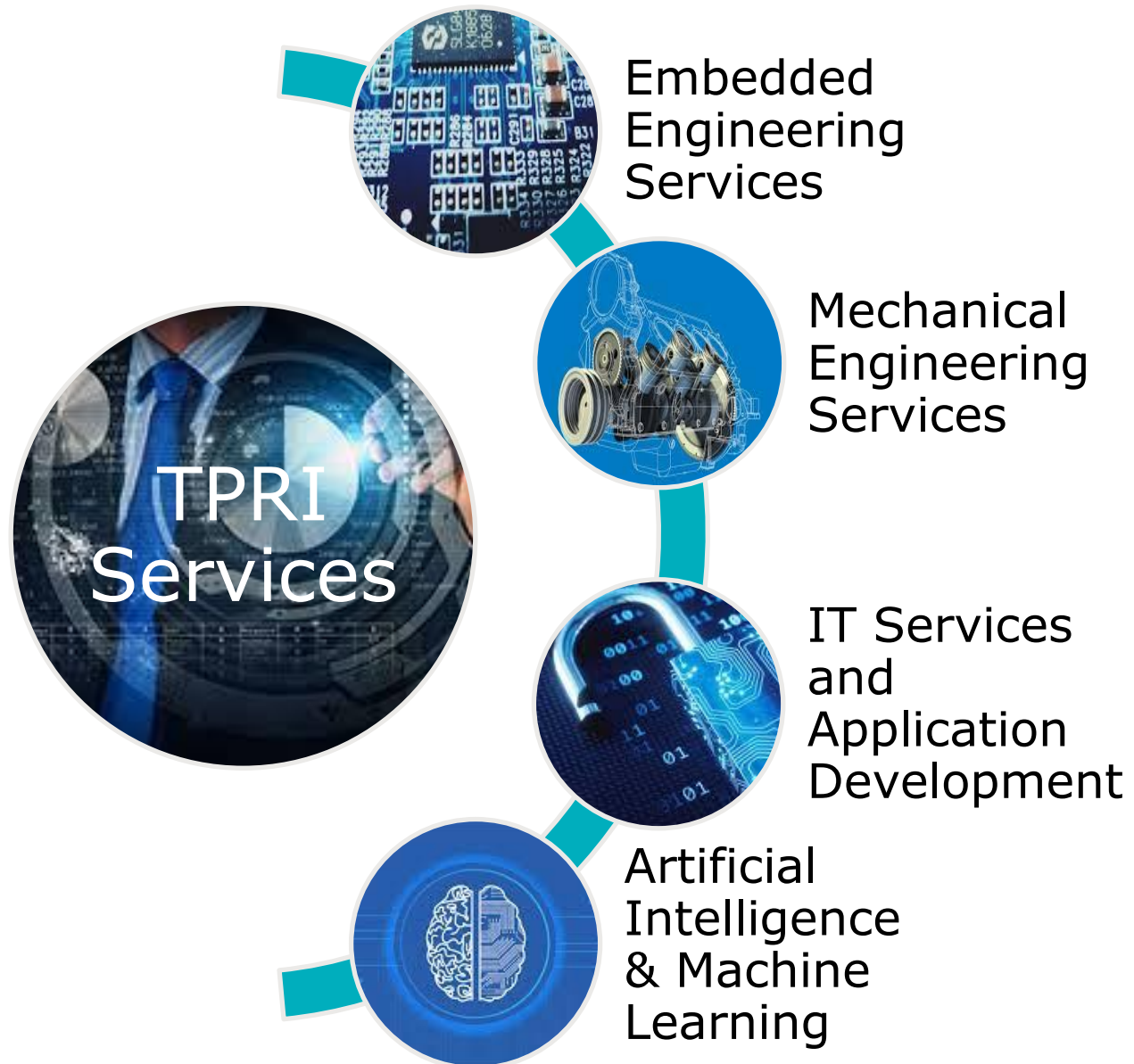### TechnoPro India Customer(s):

TOYOTA | HONDA
TADANO | faurecia
TIEI India | nexar

Trusted and Diversified Customers across Various Industry Sector

Transportation	IT	Telecom	Machinery	Electronic	Pharma And Chemical	Construction
NISSAN TOYOTA	HITACHI Inspire the Next FUJITSU	docomo	IHI HITACHI	MITSUBISHI Changes for the Better FUJITSU TEN	IDEMITSU kaneka	TAKENAKA
YAZAKI HONDA	IBM NEC	Designing The Future KDDI	KOMATSU MES	SANYO RICOH imagine. change.	TEIJIN TEIJIN PHARMA LIMITED	OBAYASHI TAISEI
Pioneer	Rakuten	SoftBank	Kawasaki	KONICA MINOLTA	MITSUBISHI CHEMICAL astellas Leading Light for Life	SHIMZ KAJIMA CORPORATION
BRIDGESTONE		MITSUBISHI SPACE SOFTWARE CO., LTD.			SEKISUI SEKISUI CHEMICAL CO.,LTD.	KANDENKO

Introduction of Services

TPRI
Services

Embedded
Engineering
Services

Mechanical
Engineering
Services

IT Services
and
Application
Development

Artificial
Intelligence
& Machine
Learning

TECHNOPRO

Service Offerings

Embedded Engineering Services

Electric Mobility
- BMS
- Motor Controller
- DC/DC Converter

Model Based Development

Model Based Testing

Mechanical Engineering Services

New Technology Development

Product development for Automotive

Sustaining & Manufacturing Engineering for Automotive

IT Services and Application Development

Application Development & Maintenance

Rapid Control Prototyping

TAAS (Testing as a Service)

VAPT(Vulnerability and Penetration Testing)

Artificial Intelligence & Machine Learning

Data Preparation: Collection and Cleansing

Signal and Image Processing

Feature Engineering & Annotation

Data Modeling & Optimization

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ANNOTATION

Annotation Service offerings

Image annotation is the labelling or tagging of objects such as person, car, road, traffic signs, etc. Image annotation is the foundation for many Artificial Intelligence (AI) products especially for computer vision process ,where it entirely depends on the object that we have annotated to recognise them from the model, these images are tagged to train the computer and ask with computer for prediction by providing them unlabelled image.

With the increased availability of image data for companies pursuing AI, the number of projects relying on image annotation has grown exponentially. Creating a comprehensive, efficient image annotation process has become increasingly important for organizations working within this area of machine learning (ML).
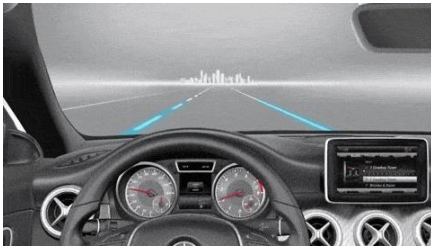
Applications:

Advanced driver assistance systems (ADAS), Healthcare, manufacturing, Industry 4.0

Types of Image Annotations:1) Classification, 2) Object Detection, 3) Semantic and Instance segmentation

In object detection we have carried out Bounding box, Cuboid, polygon, poly-line and key points annotation. In segmentation we are well versed with Semantic and Instance segmentation

TECHNOPRO

Annotation Service offerings

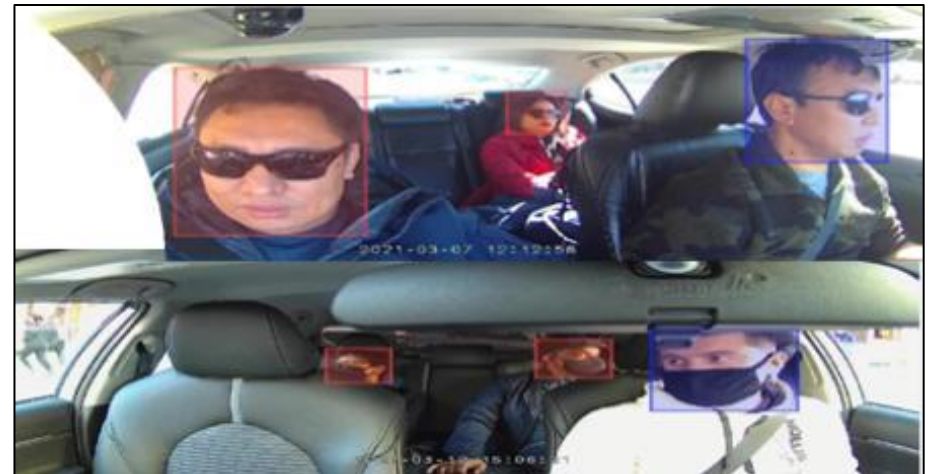**1. Bounding Box annotation for different type of cars using Label Box**
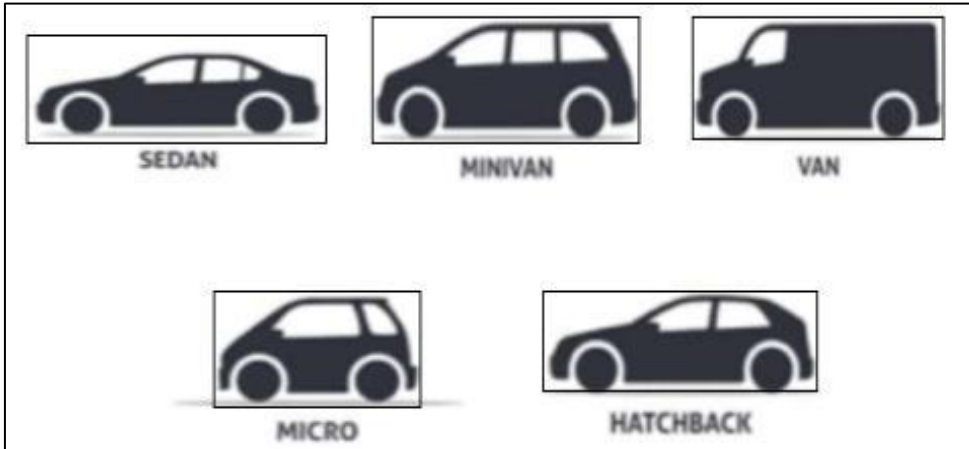
2. Bounding Box annotation for different sides of the cars using Label Box

3. Driver Behavior Annotation
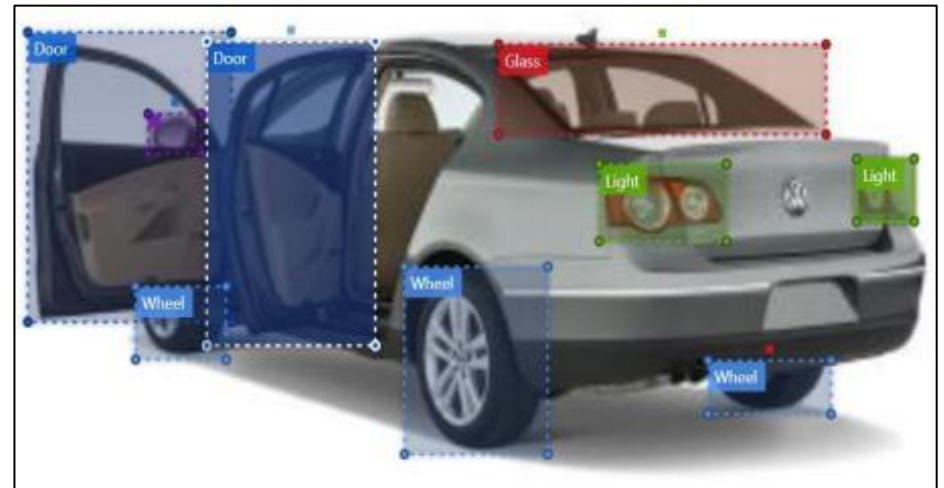

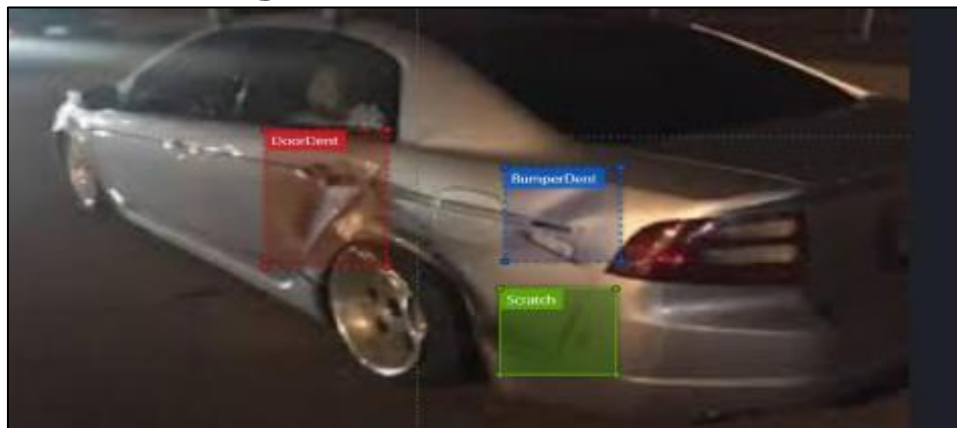
4. Driver Face Monitoring Annotation

Cont..

5. Identifying Traffic Signs as same / different

6. Annotation for car parts using Bounding Box

7. Annotation of Car Damaged Parts using Bounding Box with VoTT

8. 2D Annotation Using Bounding Box with Playment tool

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Cont..

9. 2D Annotation for cars Bounding Box using Playment

10. Cuboid Annotation for Cars, road traffic signs using Playment

11. Polyline Annotation for person, cyclist, traffic signs using LabelBox

12. Polygon Annotation for cars using LabelBox

Cont..

13. Landmark / Key Point Annotation for cars using playment tool
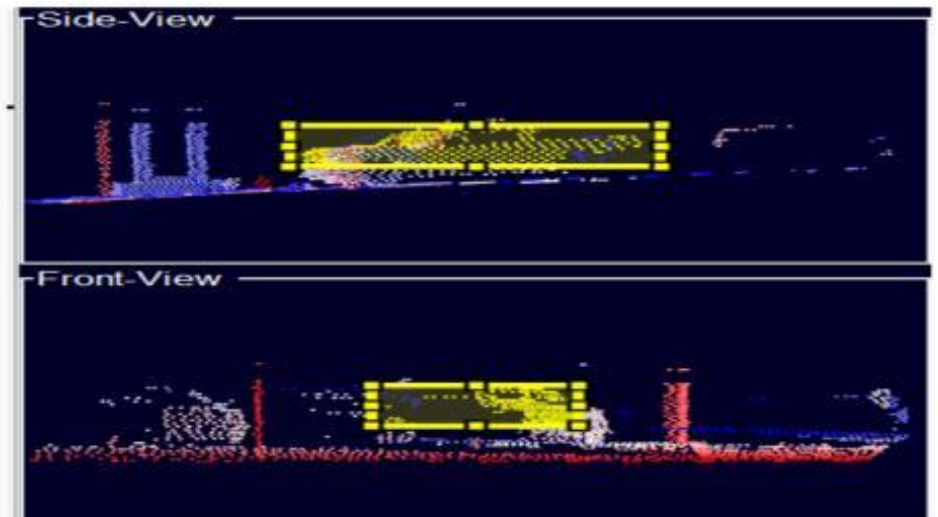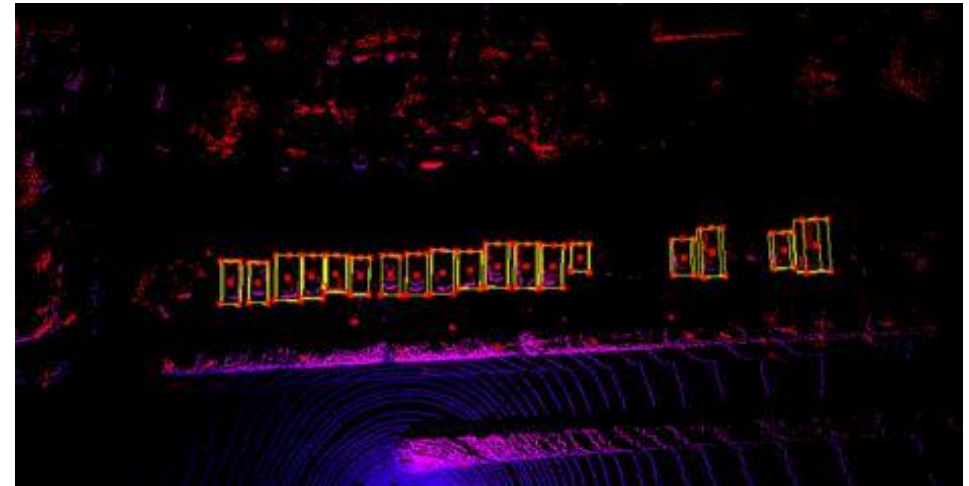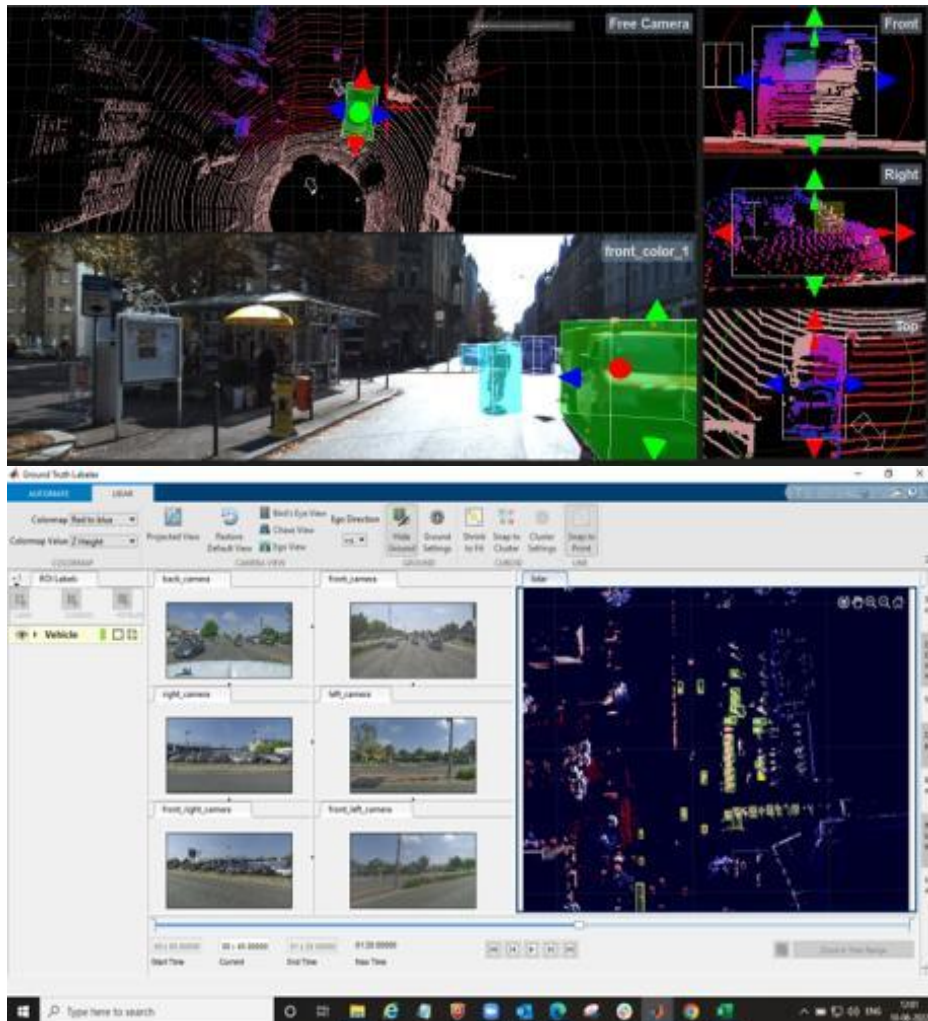

14. Incident Annotation Task
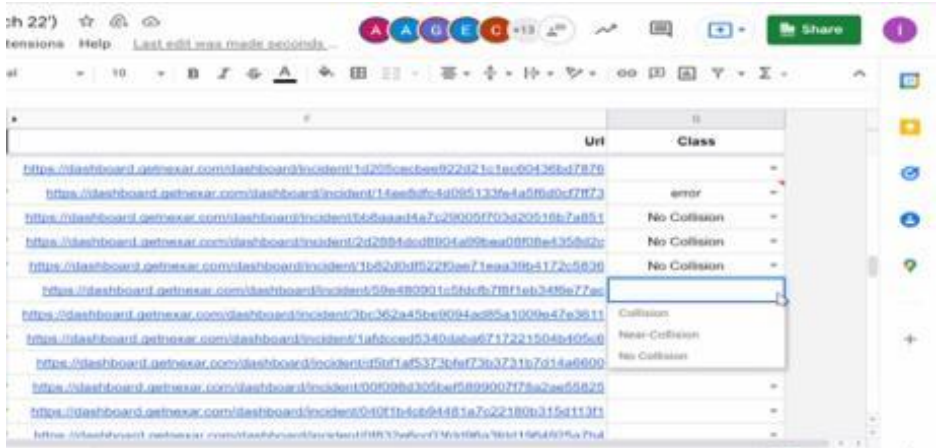
15. Manual & Semi-automatic Semantic and Instance annotations for cars, person using CVAT
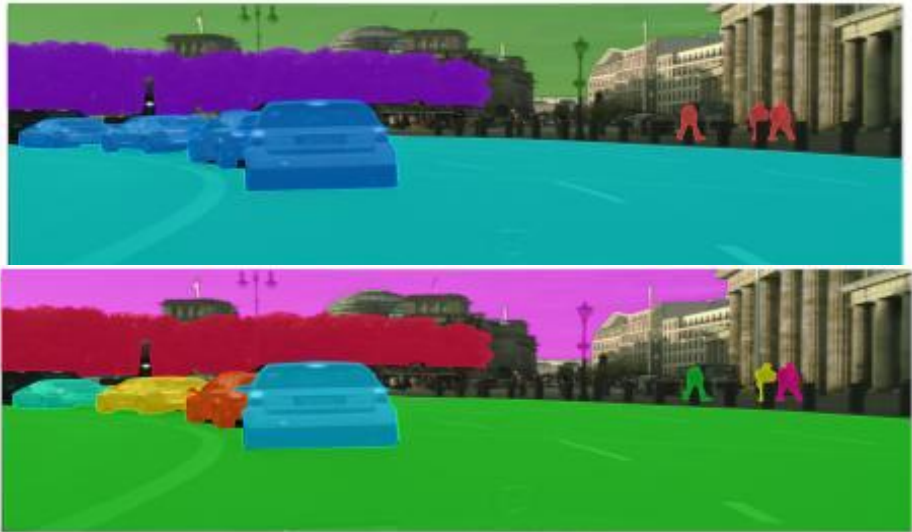
Cont..

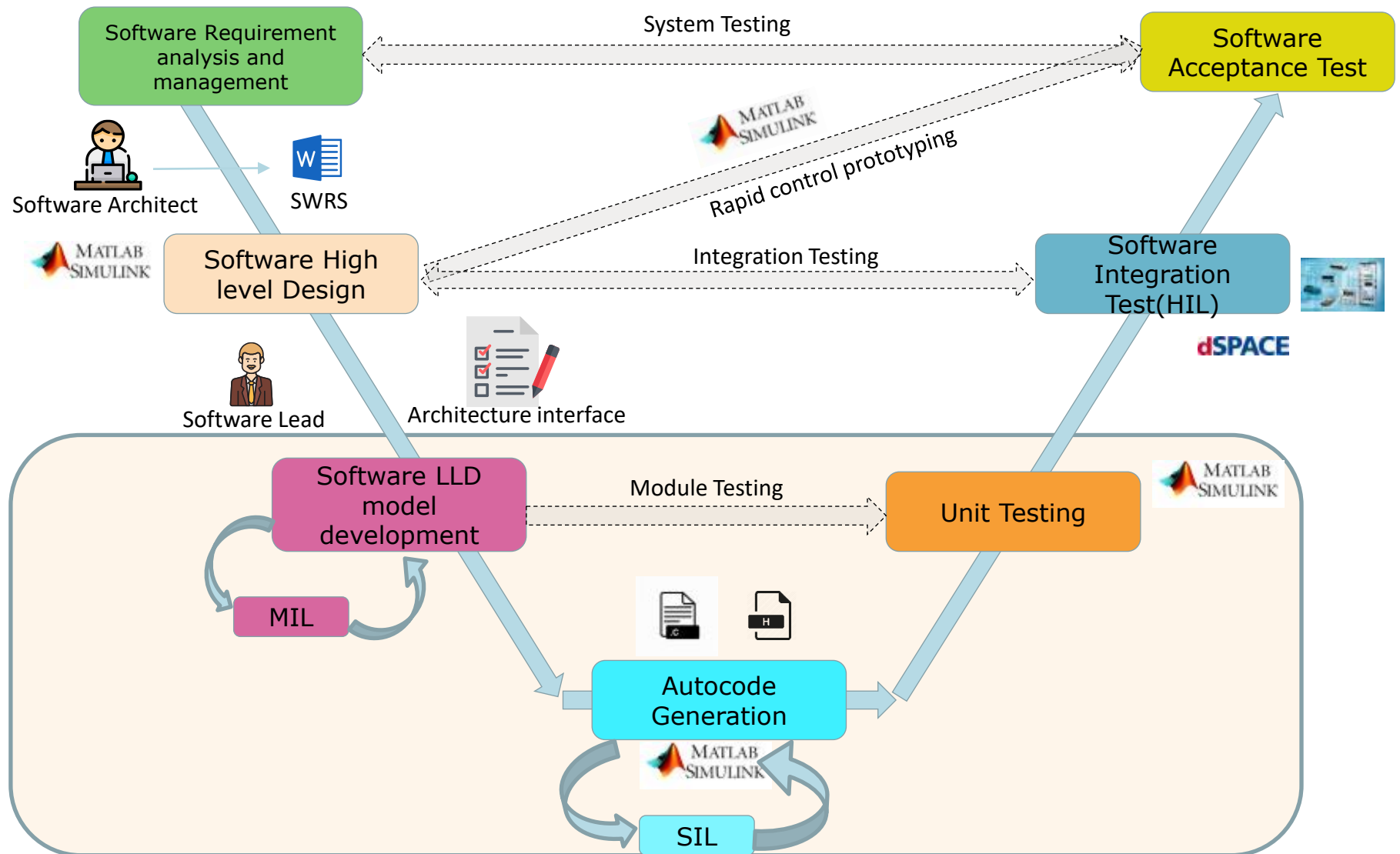## 16. 3D annotation for cars, cyclist and person using Understand.AI and MATLAB

Annotation capabilities and Team Structure

| lo	Type of Annotations	Tool used
1	Bounding Box for car types	Label Box
2	Bounding Box for car sides	Label Box
3	Driver Behavior Annotation	Google Spread sheet
4	Driver Face Monitoring Annotation	LabelBox
5	Identifying Traffic Signs as Same/ Different	Google Spread sheet
6	Car Parts Annotation using Bounding Box	Vott
7	Car Damaged Parts Annotation using Bounding Box	Vott
8	2D Annotation Using Bounding Box for cars, cyclist, traffic light and road signal	Playment
9	Cuboid Annotation Task cars, cyclist, traffic light and road signal	Playment
10	Landmark / Key Point Annotation for cars, cyclist, traffic light and road signal	Playment
11	Polyline Annotation for cars, cyclist, traffic light and road signal	Label Box
12	Polygon Annotation for cars	Label Box
13	Image Segmentation Annotation for cars	Label Box
14	3D Annotation Task for cars, cyclist and person	Understand.AI
15	Semantic and Instance based Image Segmentation for all objects (Manual and Semi-Automatic)	SemaSeg/CVAT / Matlab
16	Incident Annotation for anyazing the video of a car	Google Spread sheet
17	Semi Automated Annotation for cars	CVAT

MODEL BASED DEVELOPMENT
# MODEL BASED TESTING

Software Development Process: V-model

Software Requirement analysis and management

System Testing

Software Acceptance Test

Software Architect

SWRS

MATLAB SIMULINK

Rapid control prototyping

Software High level Design

Integration Testing

Software Integration Test(HIL)

dSPACE

Software Lead

Architecture interface

Software LLD model development

Module Testing

Unit Testing

MATLAB SIMULINK

MIL

Autocode Generation

MATLAB SIMULINK

SIL

Model Based Development Services

Model Based Development Services

- Model Development
- MAAB Guideline Check(Model Advisor)
- AutoCode Generation using Embedded Coder
- Static Code Analysis using Polyspace
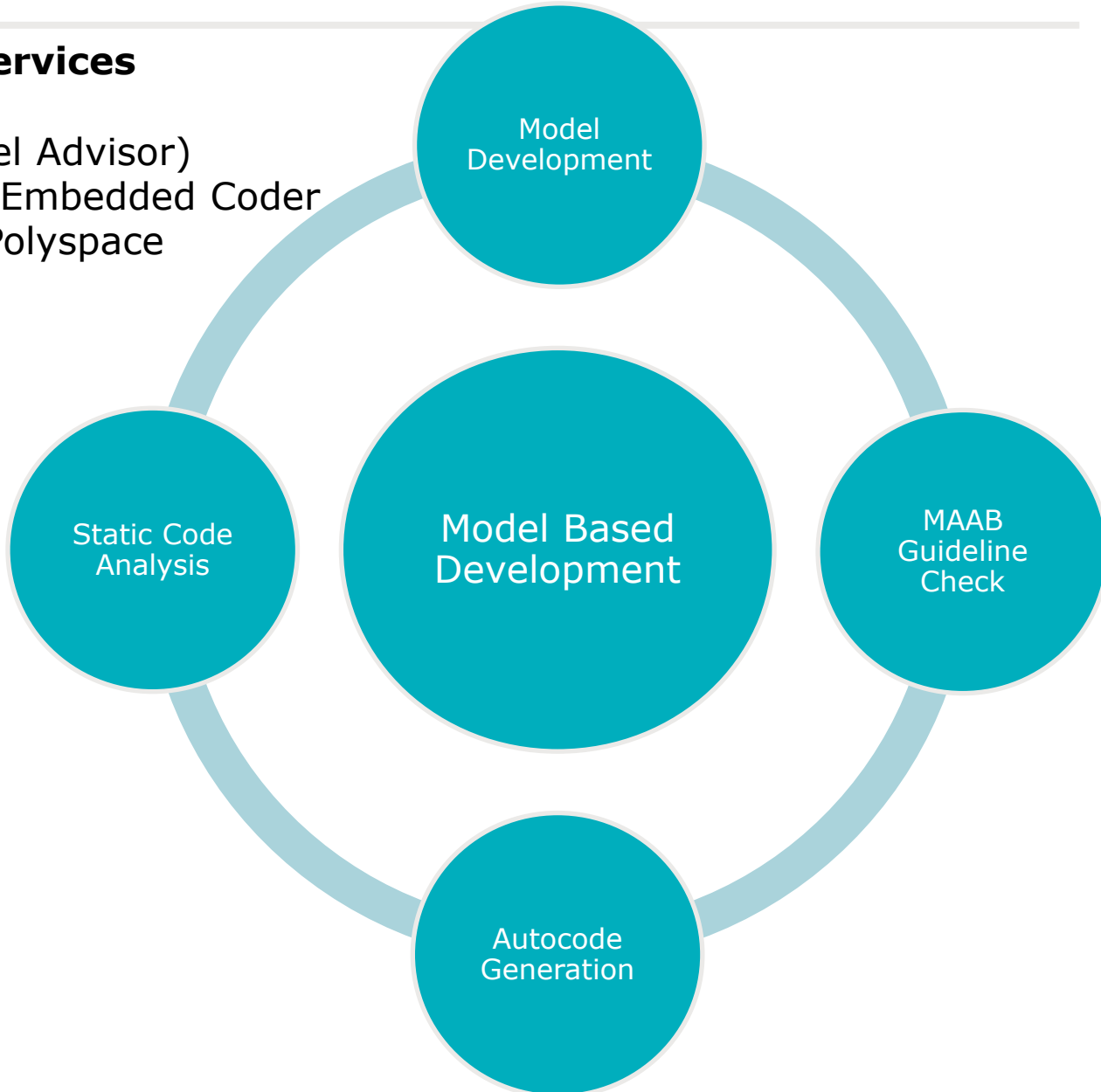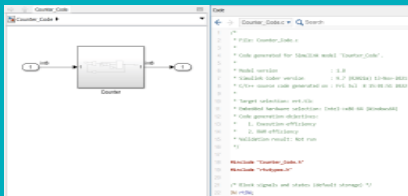
Model Based Development Services
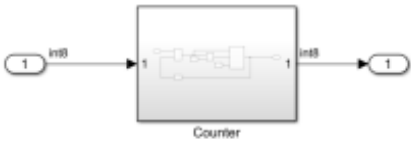
Model Development Services
- Customer Input Analysis
- All the supporting documents
- Start Model Development

MAB Guideline Check Services
- MAB Guideline Check
- MAB Guideline Report

Autocode Generation Services
- Model files as input for Autocode Generation
- Autocode Generation using Embedded Coder

Static Code Analysis Services
- Static Code Analysis using Polyspace
- Polyspace Reports

Model Based Testing Services

Model Based Testing Services
- Requirement Based Testing
- Automatic Test Case Generation
- Model-In-Loop(MIL) Testing
- Software-In-Loop(SIL)Testing

Requirement Based Testing

Software-In-Loop (SIL) Testing

Model Based Testing

Automatic Test Case Generation

Model-In-Loop (MIL) Testing

Requirement Based Testing on Simulink Model
- The Requirement Based testing is similar to functional testing.
- Writing the functional test cases based on the Requirement provided by the customer.
- Software Requirement Documents are inputs to write the Test cases.

Software-In-Loop(SIL)Testing
- Check the Behavior of MIL vs SIL, If any differences.
- Validating the Code against Test cases(functional and Coverage Testing).

Model-In-Loop(MIL) Testing
- Checking the Model Behavior with software Requirement.
- Validating the Model against Test cases(functional and Coverage Testing).
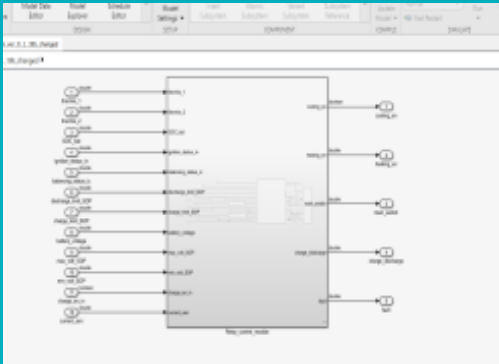
Automatic Test Case Generation
- Automatically generating the test cases based on model and Supporting files using the Reactis Tools.
- After Test cases are generated and export .CSV file to write additional test cases to cover 100% MCDC Coverage.

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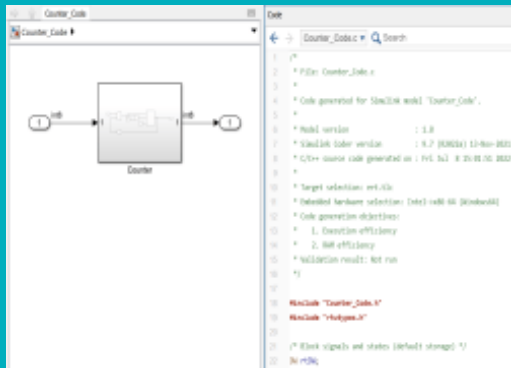
Model Based Testing Services

Model-In-Loop(MIL) Testing
- Check all the inputs for MIL Testing
- Develop test cases for MIL Testing
- Checking the Model Behavior with software Requirement
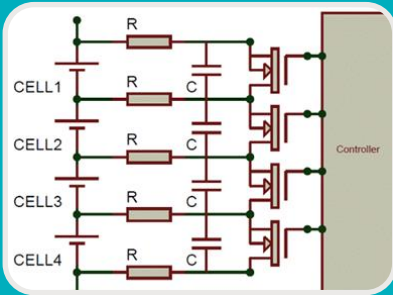- Validating the Model against Test cases

Software-In-Loop(SIL) Testing
- Reuse the test cases from MIL to SIL Testing
- Check the Behavior of MIL vs SIL, If any differences
- Validating the Code against Test cases

Battery Management System (BMS) Services

Algorithm Development

- Requirements gathering and system design Development.
- Model Based Development in MATLAB/Simulink/Stateflow.
- MAAB Guideline Check
- Auto code Generation using Embedded Coder
- Static Code Analysis using Polyspace
- Custom Stack Development.

Algorithm Testing

- Automatic Test case generation or Manual Test case writing
- For Coverage and Functional Testing
- Model In Loop (MIL) Testing and Software In Loop (SIL) testing
- Customer's algorithm testing

Embedded Engineering: BMS

- System architecture Design
- Software architecture Design
- Software Requirement Document Design.

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Reference Block Diagram of BMS
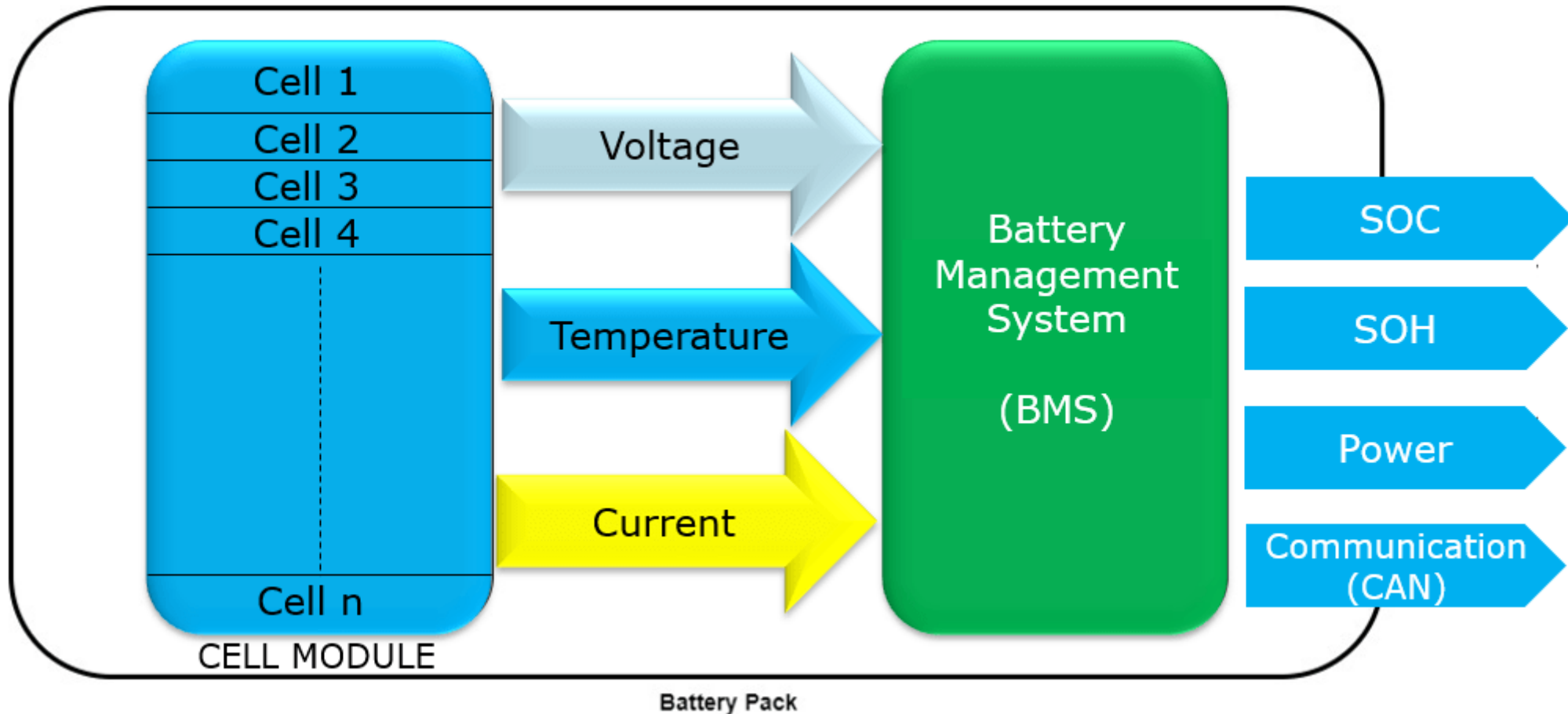
Case Stusy- Model Based Development and Testing

Model Based Development for EPS (Electric Power Steering)

Requirement Analysis
- Input Requirement Analysis

Model Development
- Model Based Development using MATLAB, Simulink, Stateflow, Targetlink
- Automatic Code Generation(TargetLink)
- Unit-Component Design Document Creation

SWC Test Specification Creation
- SWC Test Specification Creating a functional perspective.
- Functional/structural test (SIL - Test specification creation only)- BTC Embedded Tester.

Static Code Analysis using Polyspace
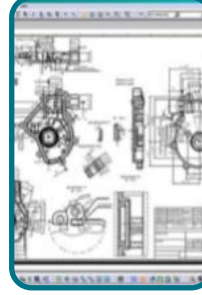- Static Code Analysis (Polyspace BF/CP)

MECHANICAL ENGINEERING

Mechanical Engineering

New Technology Development

- Market Research
- New Technology Development
- Concept Development using CATIA, Pro-e, UGNX & Auto cad
- Computer aided engineering (CAE) support
- Continuous Improvement

Sustaining Engineering

- Existing Design Updation
- Existing Drawing Updation
- CR/CO Management
- PLM & PDM Support

New Product Development

- Concept Development using CATIA, Pro-e, UGNX & Auto cad
- Drawing creation, GD&T Allocation,
- Tolerance Stack up Analysis
- Product costing
- Computer aided engineering (CAE) support

Tool Design

- Moulding tool design & Drawing
- Casting tool design & Drawing
- Machining tool design & Drawing
- Jigs and Fixture Detailing and Designing
- Computer aided engineering (CAE) support

TPRI Current Mechanical Engineering Capabilities

Tool proficiency

- **CATIA V5**
- **SOLID WORKS**
- **UG NX**
- **PLM ENOVIA**
- **TEAMCENTER**
- **AUTOCAD**

TPRI – OEM Mechanical Engineering overview

Following activities are performed by our engineers in OEM

BIW Jigs and Fixture Design

Creating manufacturing drawing with allocation of GD&T

Design support for Trim & Chassis

Designing of normal Fixtures, SPM, Pallet

Machine Maintenance

Process layout design

Equipment Selection

Preparing BOM

PLC programming and Robotic trouble shooting

Imitation and reinforcement learning

Electronics and electrical support

Robot Cell & Transfer system

Control Panel Wiring

PLC Programming

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TPRI – Tier 1 Auto Mechanical Engineering overview

Following activities are performed by our engineers in Tier 1 Auto

Maintenance of following machines - Microsmatic Cylindrical & Angular Grinding, J-teck Honing and EFD Induction Hardening Machine, Grind master Paper lapping machine.

Design & development of different clamping equipment model and its 2D drawings.

Design and development of sheet metal parts using Catia
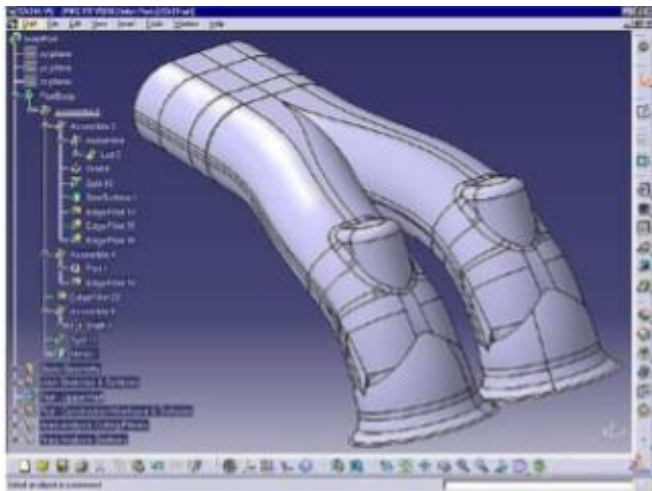
Document creation and updating of new product and change request

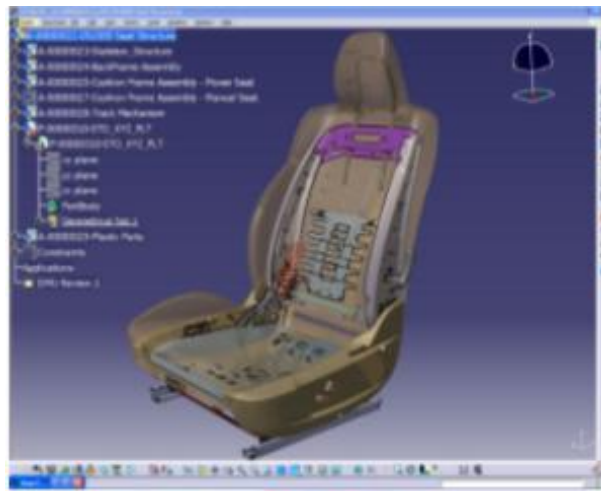Piping and hose routing

Existing Part & drawing update

Managing Bill of material (BOM)

Product life cycle management using PLM tool - Enovia
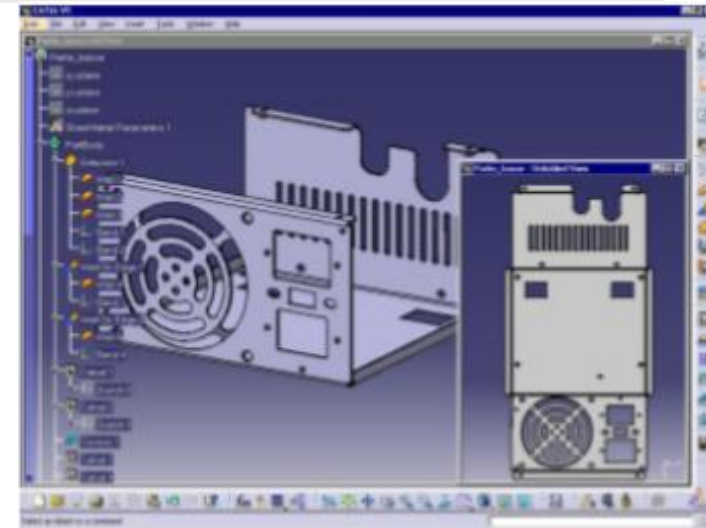
TECHNOPRO
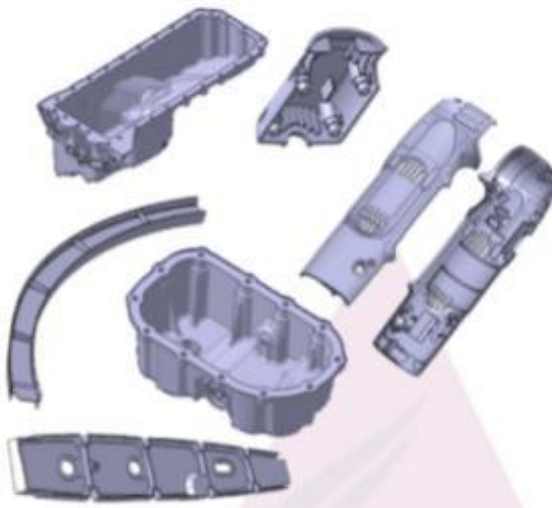
Case Study:- Design Capabilities
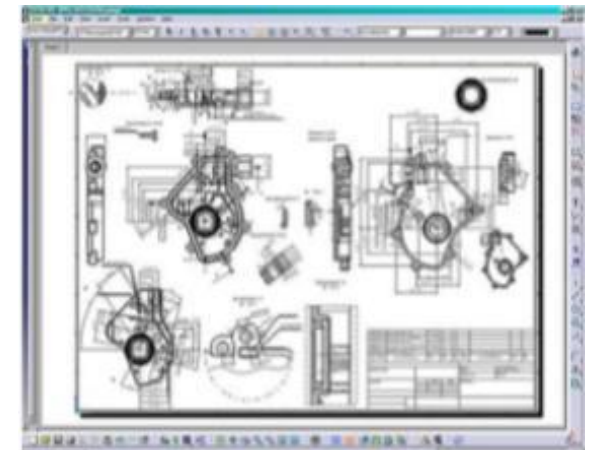

Part Design

Assembly Design

Sheetmetal design

Functional molded parts

Functional tolerancing & annotation

CATIA -Drafting

TECHNOPRO

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