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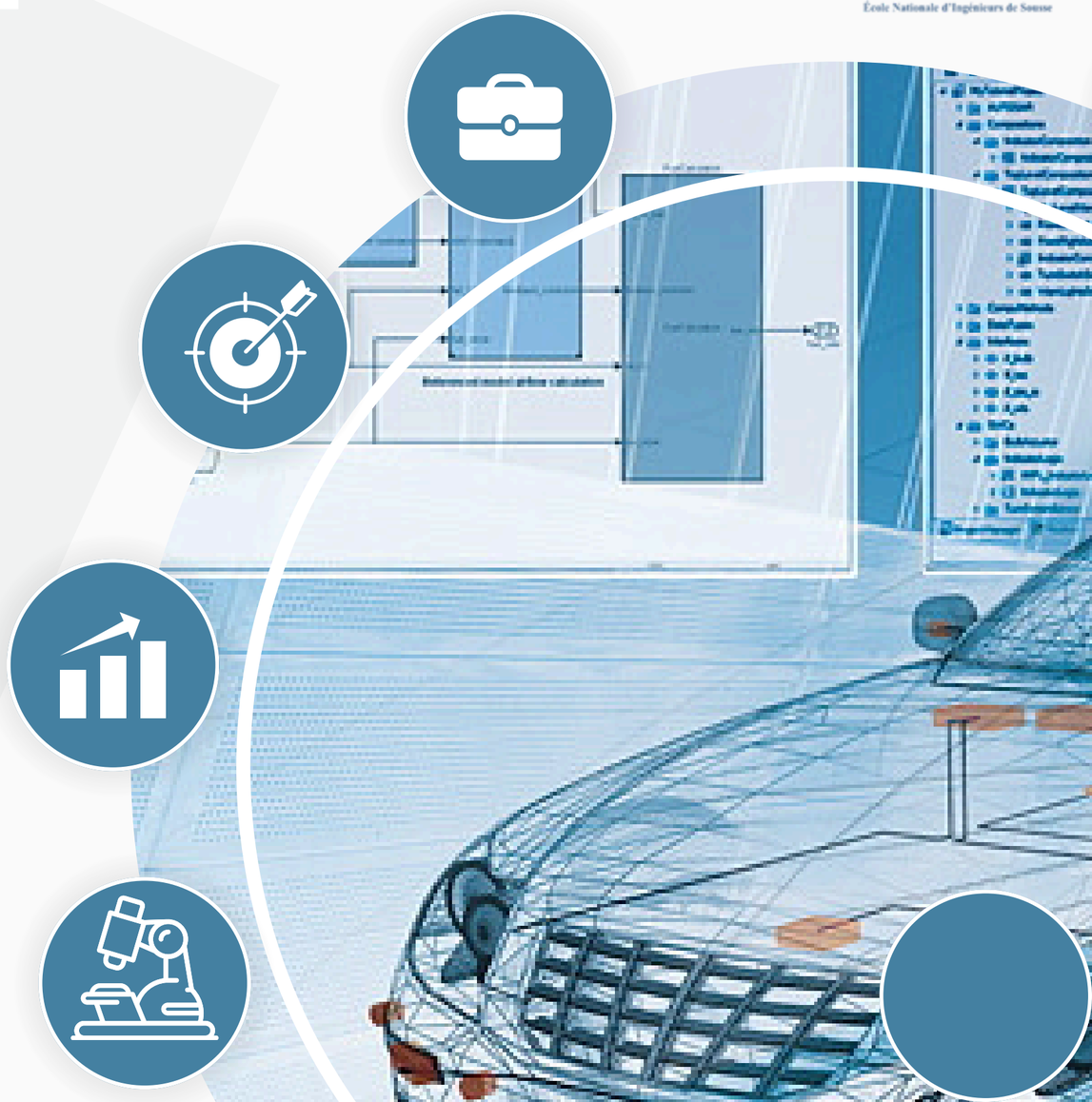
Summer Internship Report:

Development of AUTOSAR-Compliant Automotive Applications

LATIS
Laboratory of Advanced Technology and Intelligent Systems



Supervised By :M. Adel BOUALLEGUE, ENISo

Presented by: MHAMED Mohamed

July 1, 2024 – August 31, 2024

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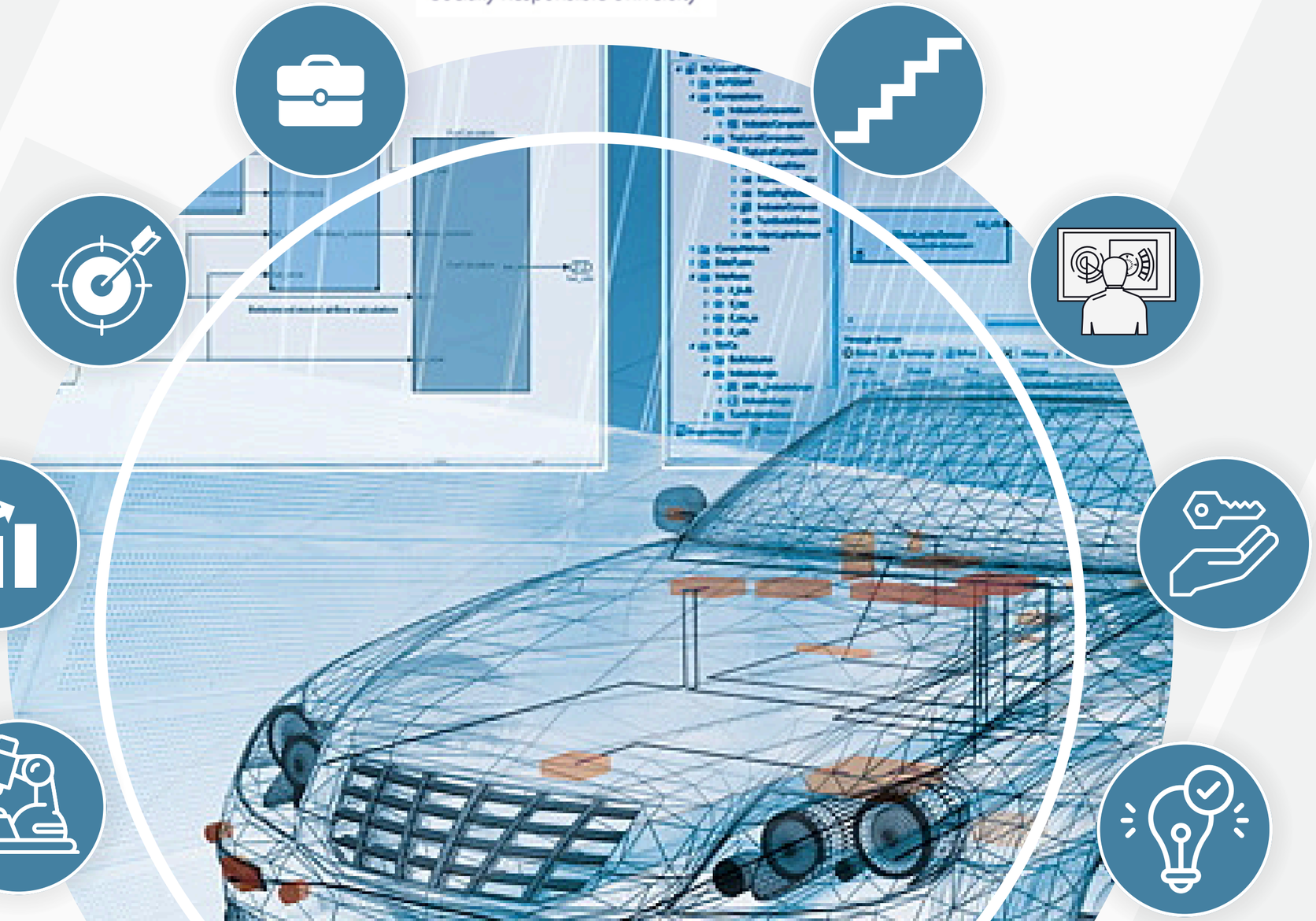

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- Host Organization
- Challenges and Solutions
- Internship Tasks
- Future Directions
- Application Development
- Key Learning Outcomes
- Testing and Validation
- Conclusion

Host Organization

LATIS (Laboratory of Advanced Technologies and Innovative Systems)

Its research focuses on four main areas:

- SID (Signal, Image, and Document)
- CEM–SdF (Electromagnetic Compatibility)
- Smart Grid & Renewable Energies
- Diagnostics & Monitoring

Host Organization

LATIS (Laboratory of Advanced Technologies and Innovative Systems)

- **Analysis and Processing of Images from Ancient Document Heritage**
- **Security of Individuals and Virtual Worlds:**
- **Analysis and Interpretation of Biomedical Signals:**
- **Medical Image Processing**
- **Integration of Electromagnetic Compatibility in Virtual Prototyping**

Internship Tasks

- Studied AUTOSAR concepts and developed expertise in MATLAB Simulink and ECU programming
- Developed exterior light control applications for low beam, turn signal, and brake lights
- Integrated applications into the AUTOSAR architecture
- Conducted simulations and testing for system validation

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Application Development

Exterior Light Control Application

BeamLight

BrakeLight

TurningLight

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Application Development

The standard ISO 26262 is divided in 10 parts:

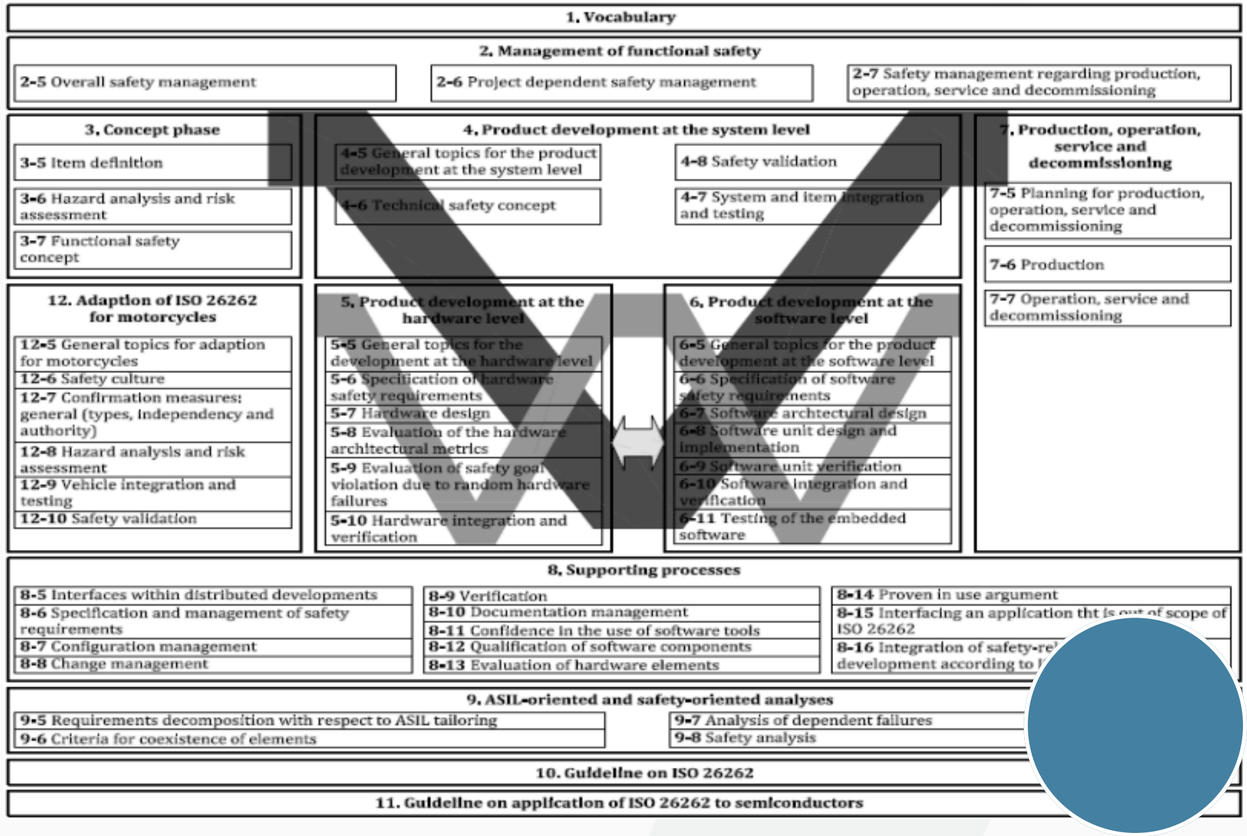
1. Vocabulary

2. Management of functional safety

3. Concept phase

4. Product development at the system level

5. Product development, hardware level



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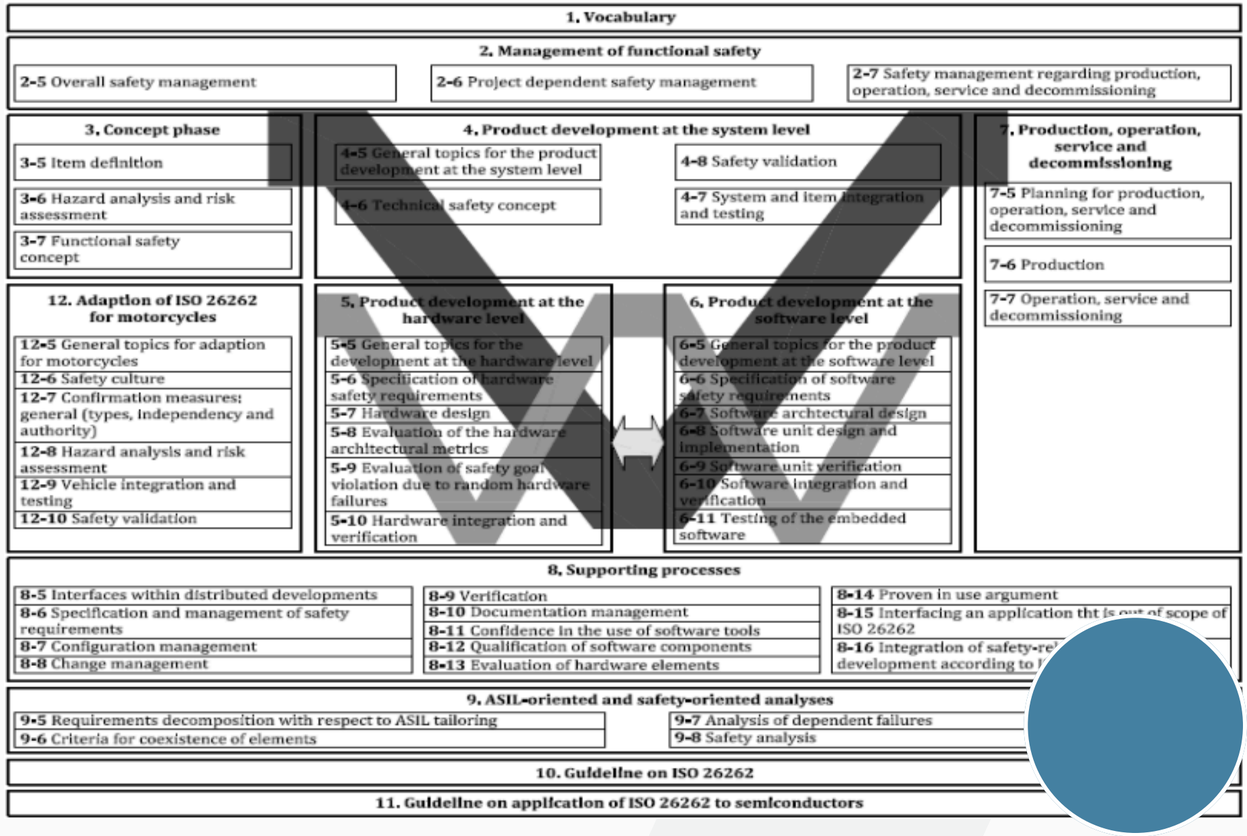
Application Development

6. Product development, software level
7. Production and operation
8. Supporting processes
9. ASIL-oriented and safety-oriented analysis
10. Guideline on the safety standard



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BrakeLight

Architecture :

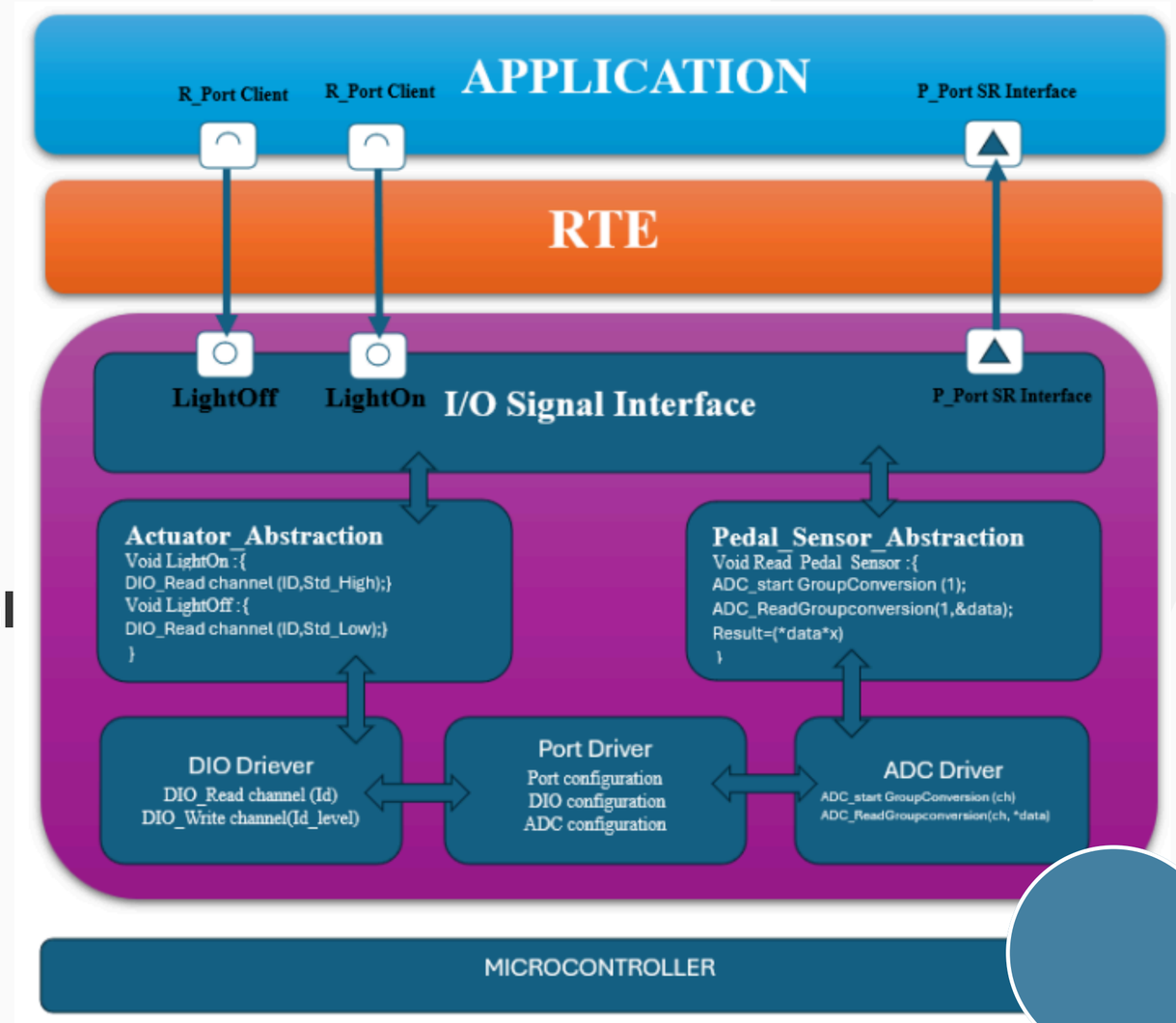
1.Application Layer

2.RTE (Runtime Environment)

3.BSW Layer:

- I/O Signal Interface Layer:Manages signal communication between the abstracted components
- Abstraction Layer
- Driver Layer

4.Microcontroller



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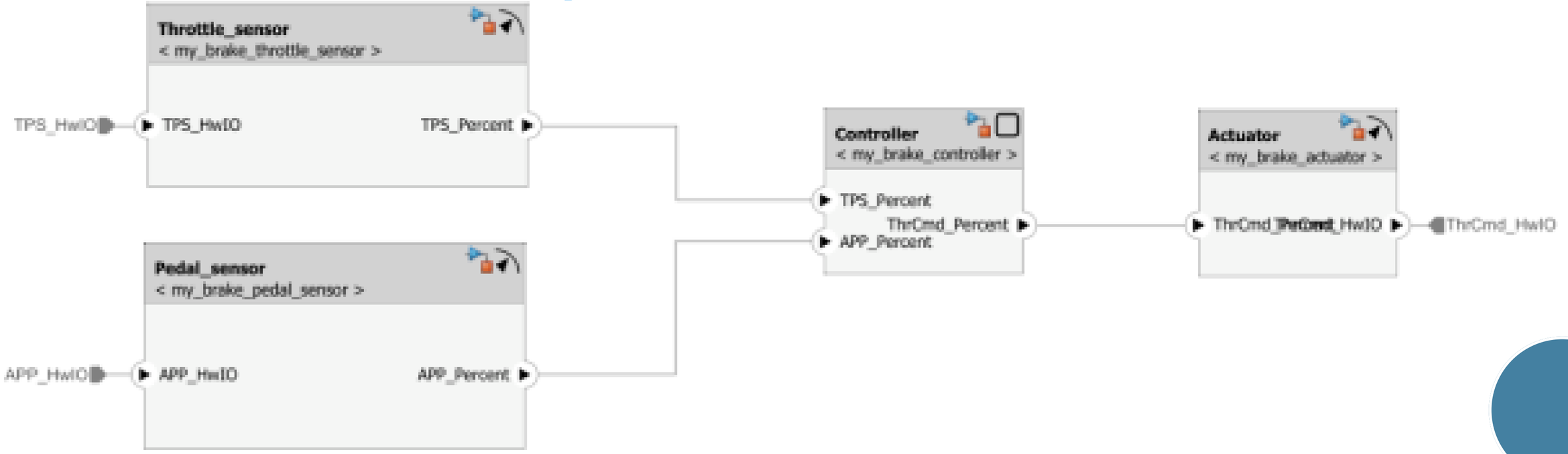
Simulink Model Development



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Simulink Model Development

Step 1: Creation of Simulink Data Dictionary File (SLDD)

Step 2: Requirement Tagging

Step 3: Configuration Parameter Update

Step 4: Model Configuration for AUTOSAR Code Generation

Step 5: Mapping Simulink Model Elements to AUTOSAR Software Components:

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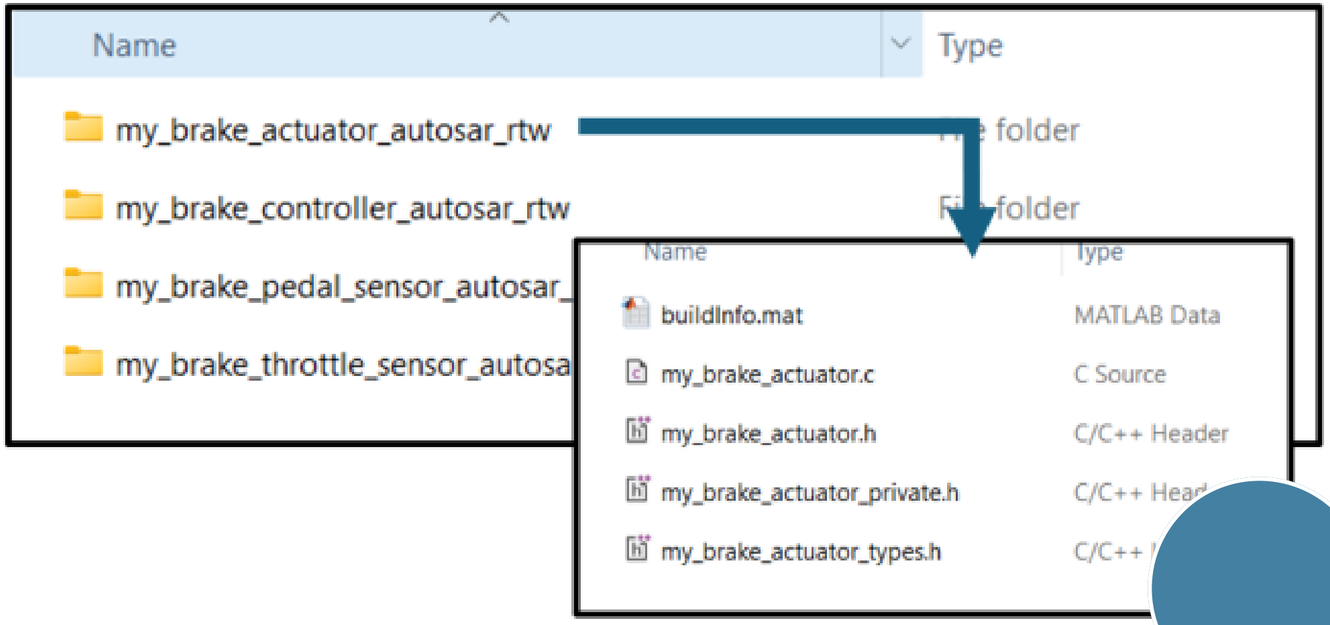
Simulink Model Development

Step 6: AUTOSAR Quick Start:

- C Code Generated



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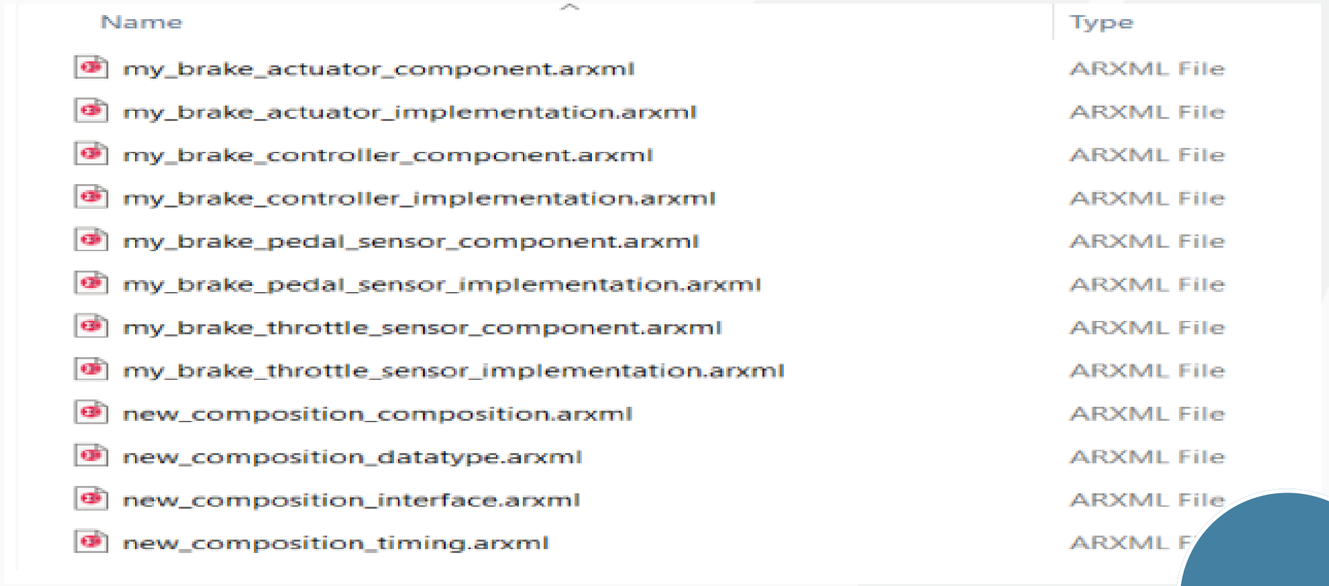
Simulink Model Development

Step 6: AUTOSAR Quick Start:

- **ARXML Files Generation**



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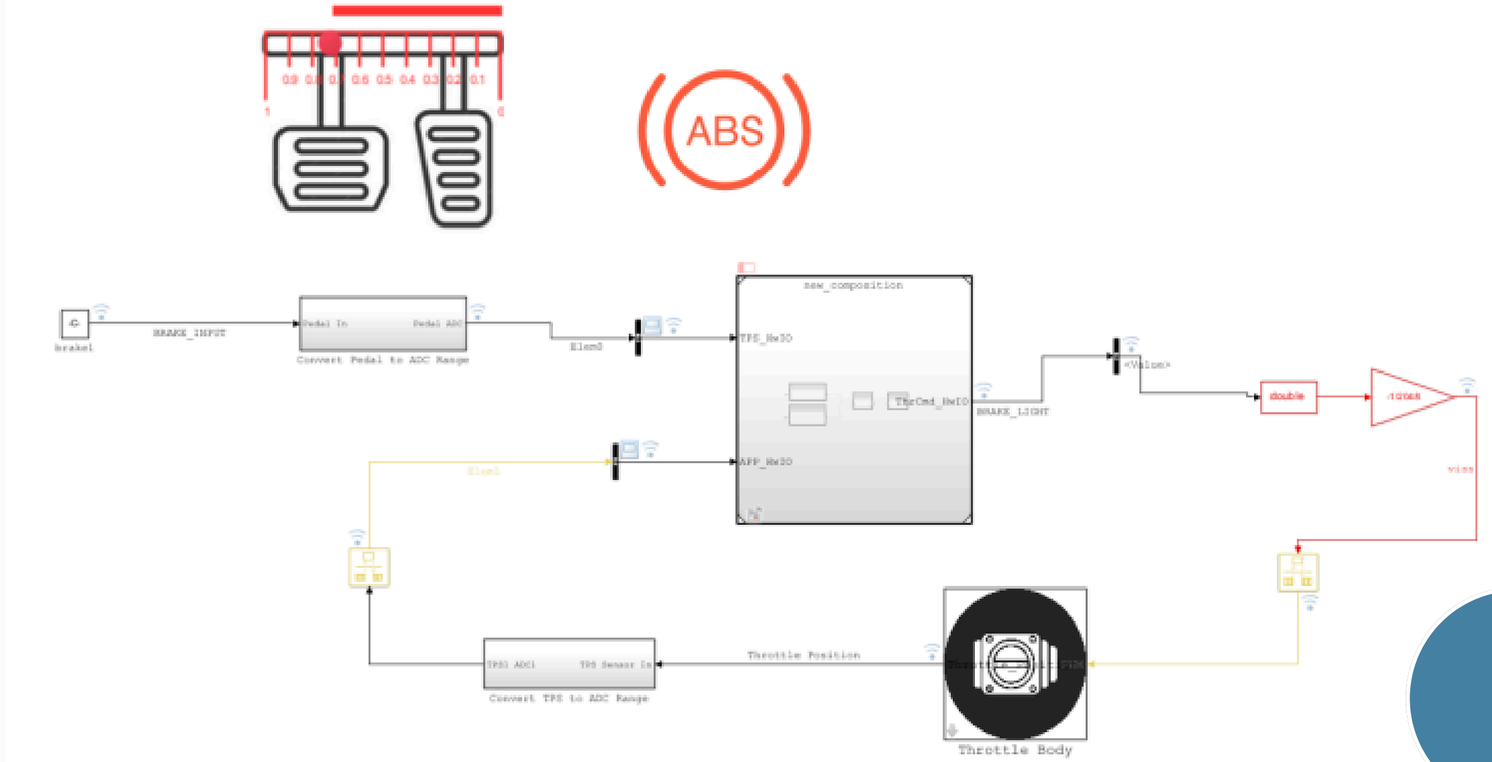
Testing and Validation

Testing and Validation Model-in-the-Loop (MIL)



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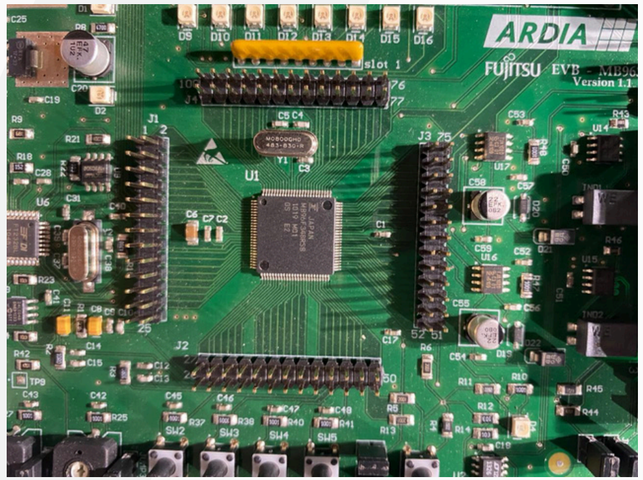
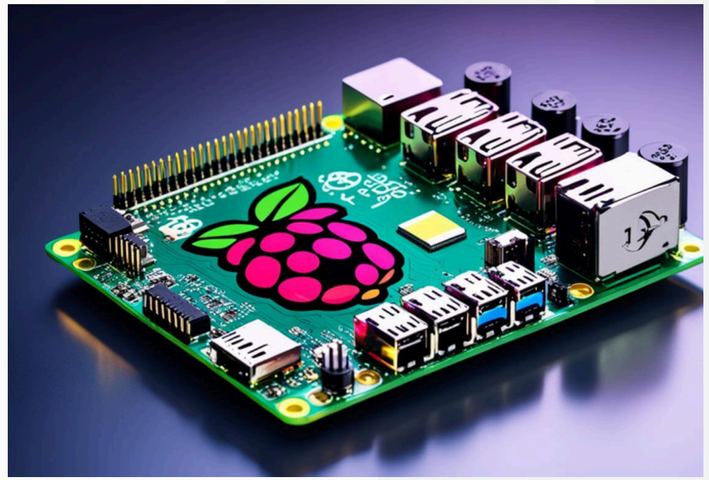
Challenges and Solutions

Integration issues with the Fujitsu MB96340 ECU due to software limitations



Propose alternative hardware like Raspberry Pi for future implementations



Future Directions

- Further refinement of AUTOSAR-compliant software for real-world deployment
- Explore opportunities for implementing advanced driver-assistance systems (ADAS)
- Continuation of work in automotive embedded systems for my next internship (PFE)

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Key Learning Outcomes

Technical Skills:

- Gained expertise in AUTOSAR architecture
- Developed Simulink models and generated ARXML files
- Proficiency in ECU programming for automotive applications

Methodology:

- Applied ISO 26262 for functional safety
- Followed V-Model for rigorous testing and validation
- Hands-on with AUTOSAR Blockset, C code generation, and simulation

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Conclusion

In conclusion, my internship at LATIS was a transformative experience that enhanced both my technical and professional skills. I gained hands-on expertise in developing AUTOSAR-compliant automotive applications, from modeling in Simulink to integrating software with ECU systems. Despite challenges in hardware implementation, I successfully validated the software through simulations. This opportunity has solidified my passion for automotive embedded systems and prepared me for future endeavors in this field.

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