Communication Networks in Modern Vehicles

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1 Enhanced Safety

2 Spatial Awareness

3 Complex Environments

1. Relationship between car crashes and the lack of ADAS integration in modern vehicles

2. Ensuring accuracy when displaying the real-time changes in the vehicular surroundings on driver-assistance systems

3. Comprehensive testing of ADAS functionalities in simulators

4. Reduction in crash potential with the incorporation of ADAS technology

Introduction to ADAS Technology

Evolution

- Closely linked to advancements in sensor technology, computer vision

Benefits

- 17% reduction in collision rates compared to those without these features [1]
- 27% reduction in rear-end collisions[1]

Challenges

- Sensor reliability in adverse weather
- False positives

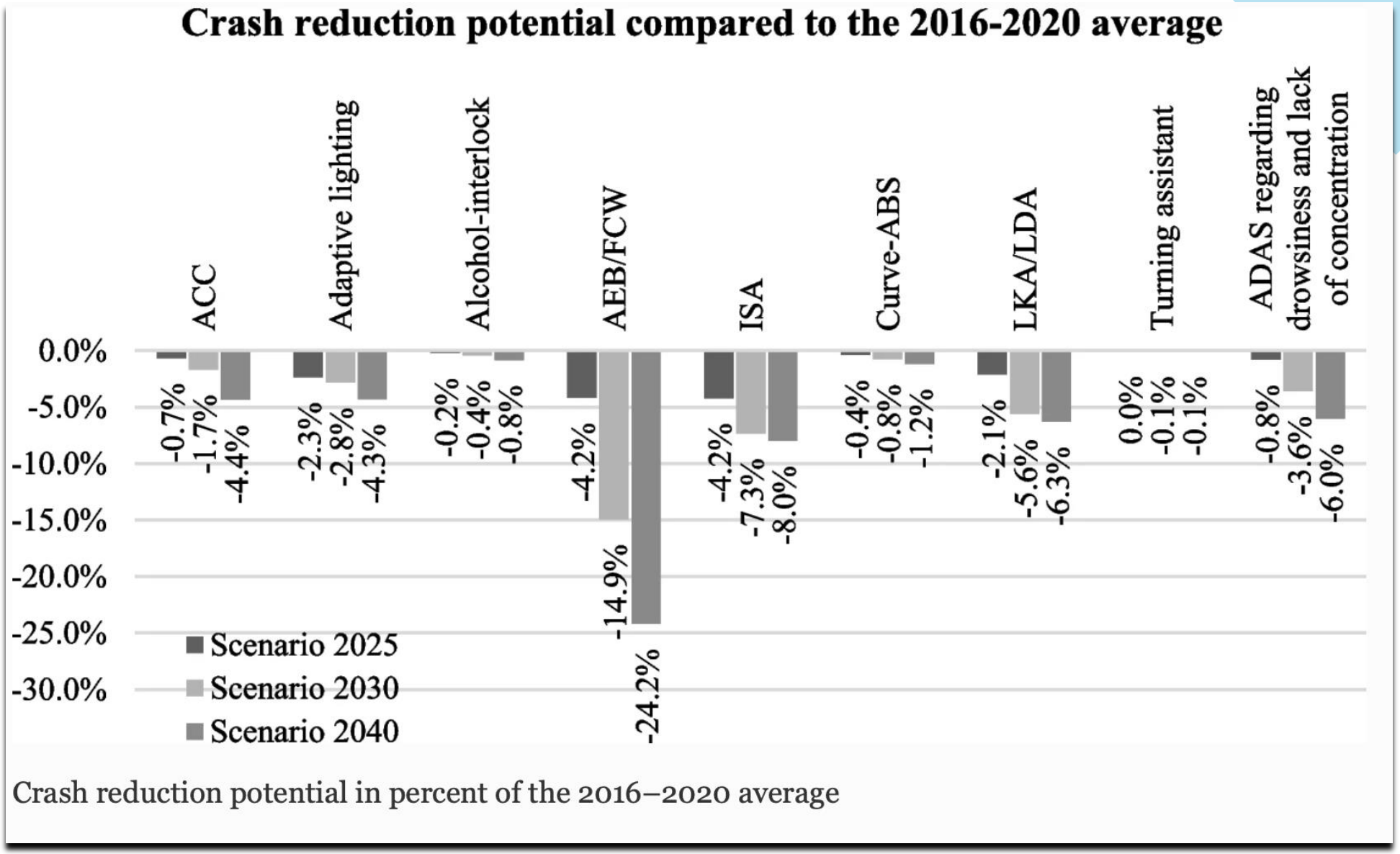


Figure 1: Crash Reduction Potential Compared to 2016-2020 Average [1]

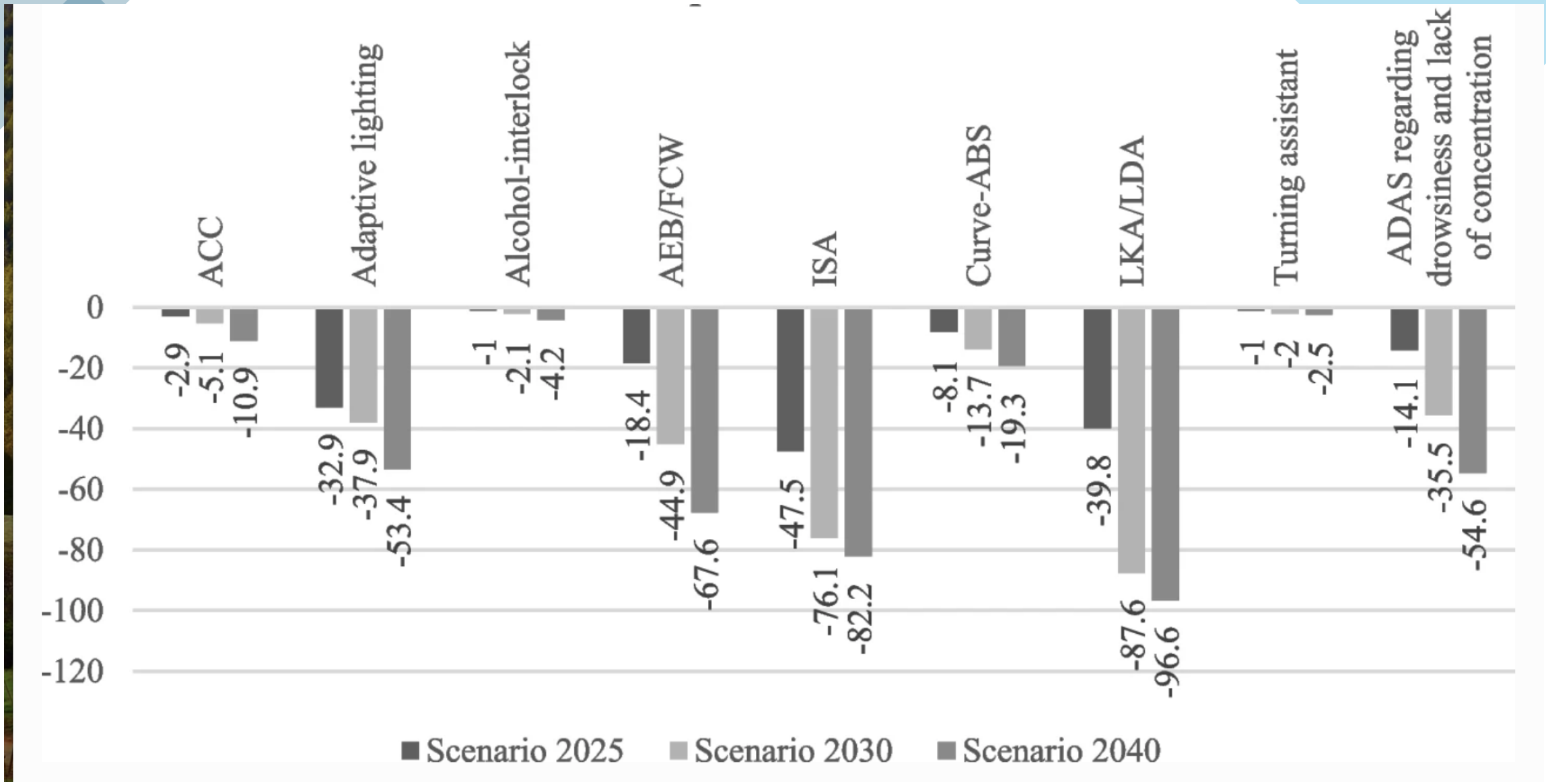


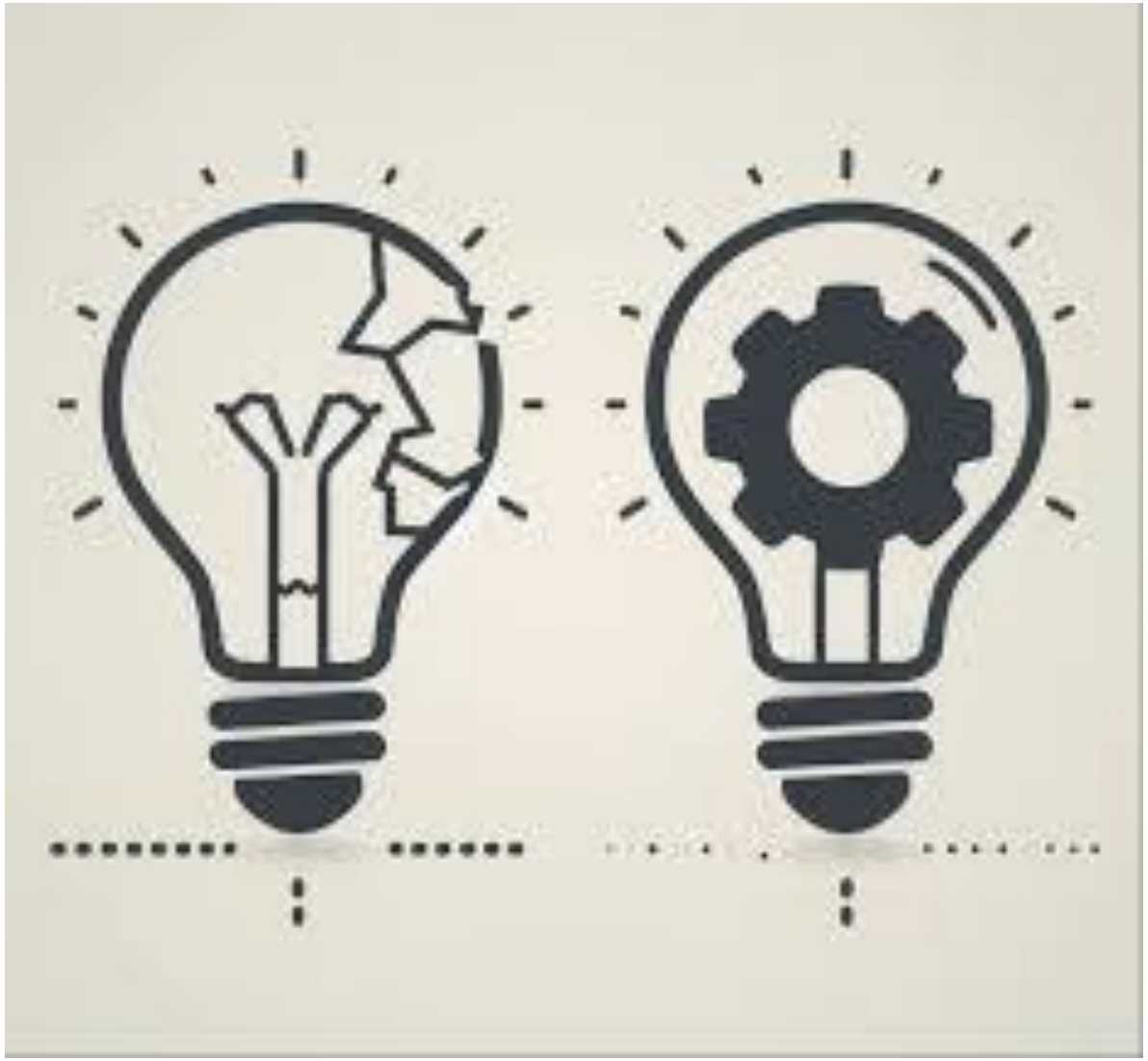
Figure 2: Reduction Potential in Fatalities[1]

Introduction to ADAS Technology: Important Finding

Role of Sensor Fusion in Enhancing Accuracy

- Combines data from LiDAR, radar, cameras for enhanced accuracy
- Improves spatial awareness, reducing false positives

With growing ADAS integration and increasing traffic complexity, there's a clear need for precise real-world rendering in vehicles to improve spatial awareness.



Stakeholders and Targeted Audience

- End Users
- Regulatory Bodies
- Automotive Manufacturers & Suppliers
- Engineering Experts
- Insurance Companies
- Business Professionals
- Practitioners

Resources Required

ARDUINO

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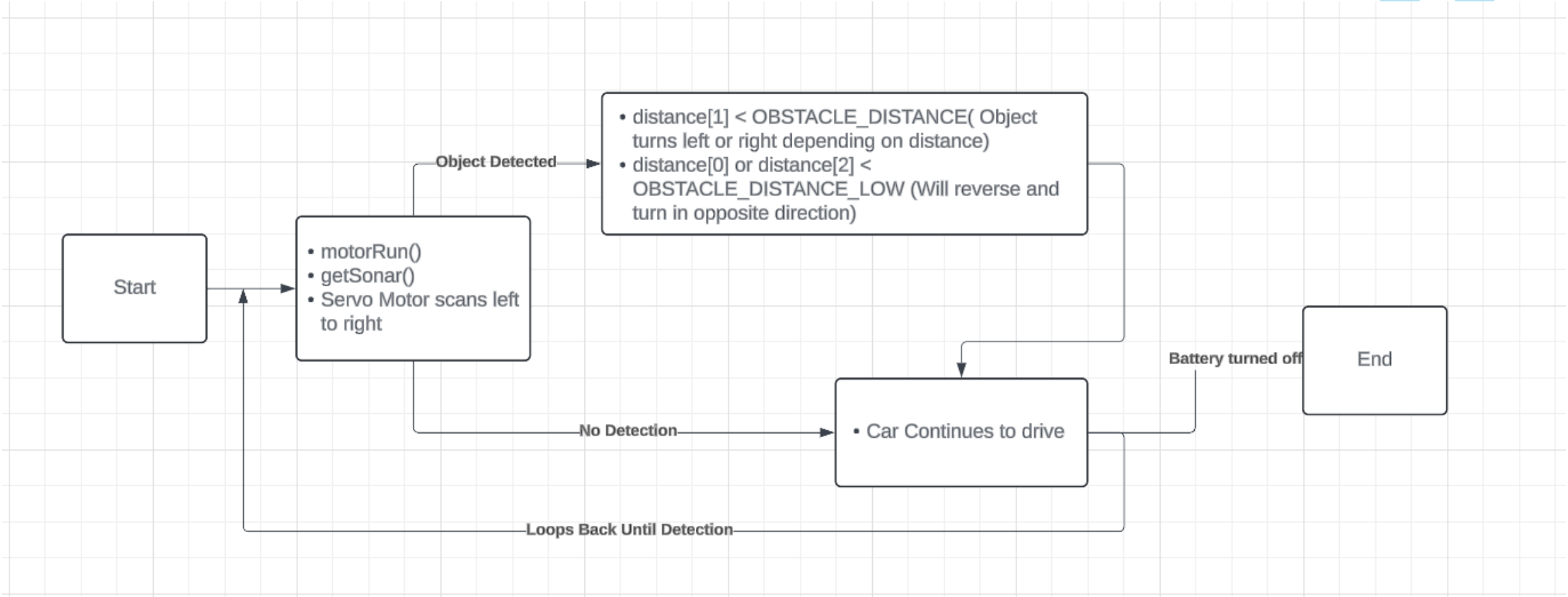
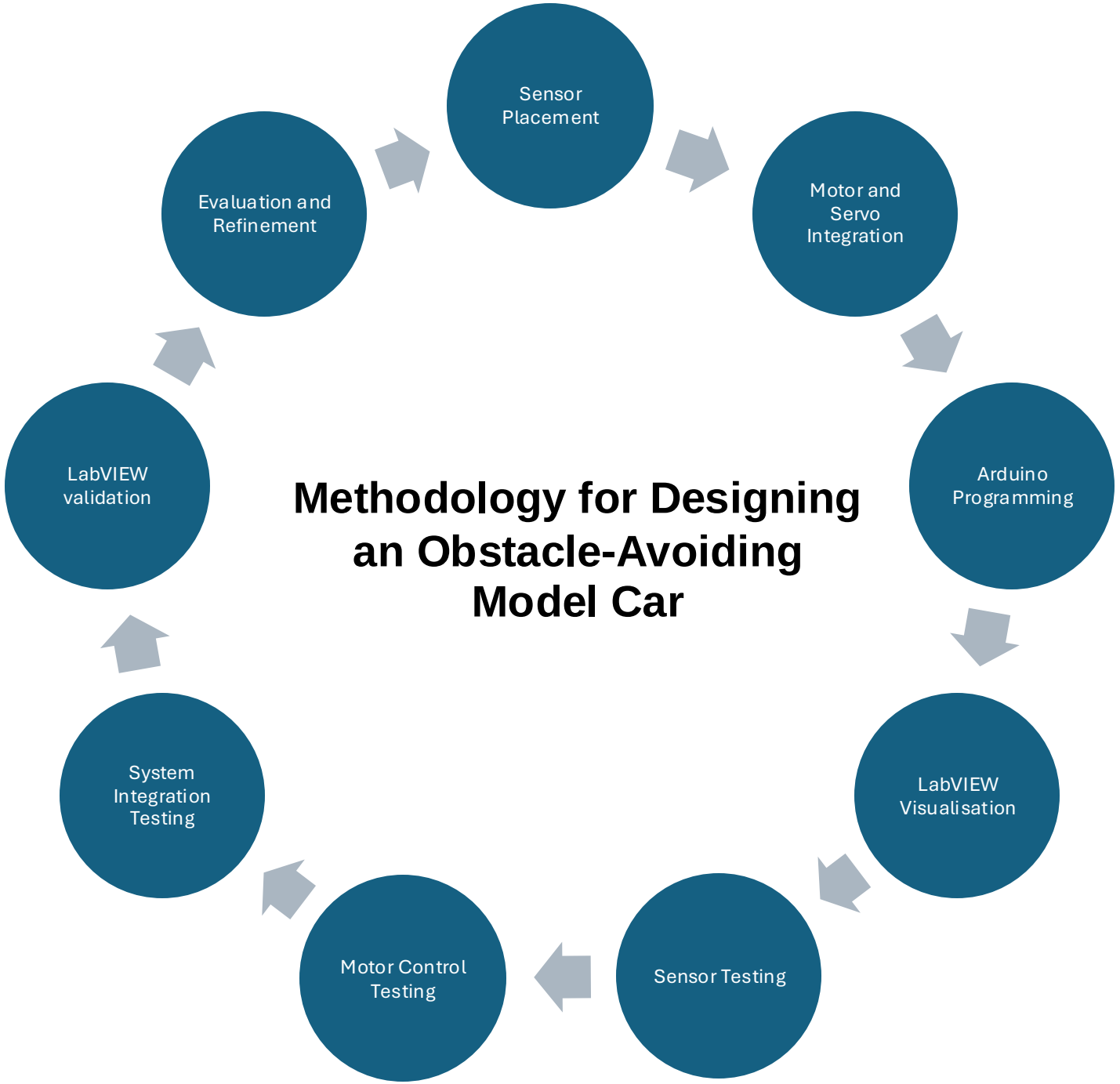
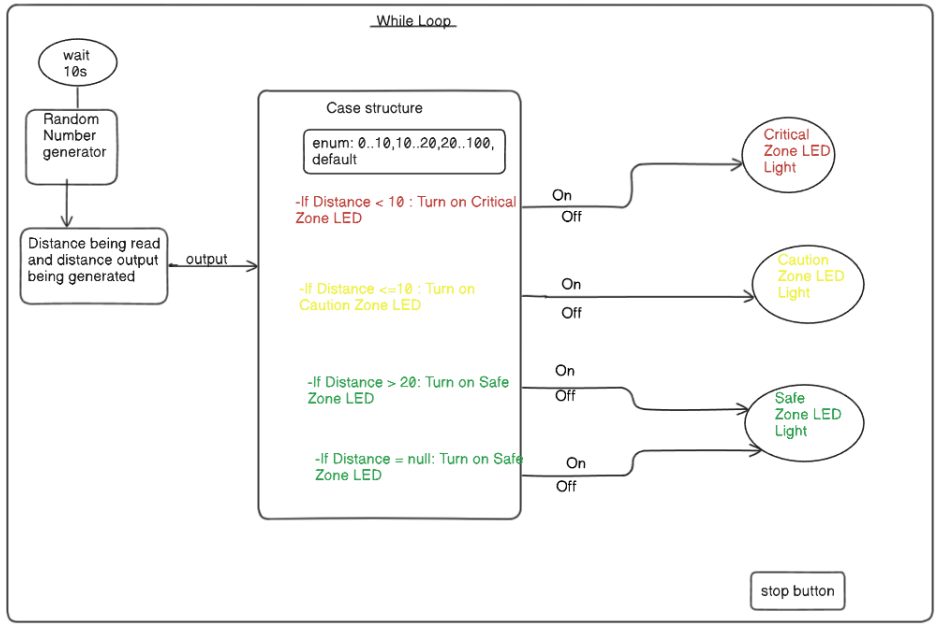
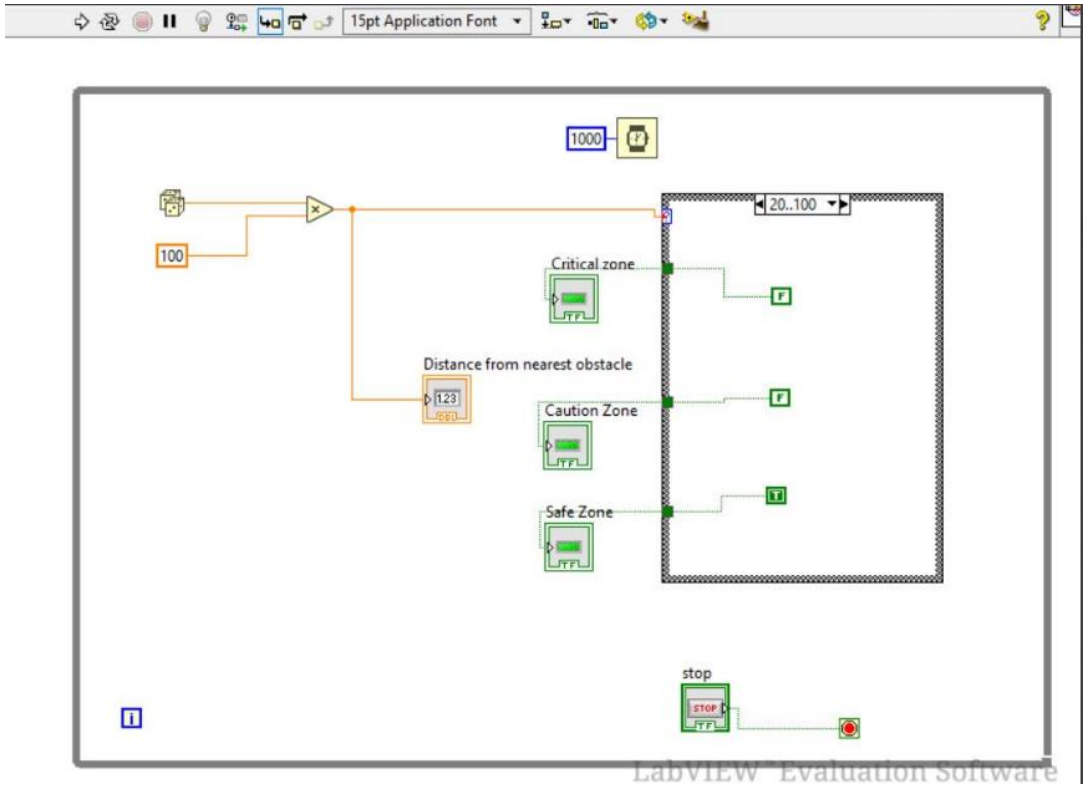


Figure 3: Sensor Integration and Data Collection Logic [2]

Methodology for Designing an Obstacle-Avoiding Model Car




While Loop
wait 10s
Random Number generator
Distance being read and distance output being generated
output
Case structure
enum: 0..10,10..20,20..100, default
-If Distance < 10 : Turn on Critical Zone LED
-If Distance <=10 : Turn on Caution Zone LED
-If Distance > 20: Turn on Safe Zone LED
-If Distance = null: Turn on Safe Zone LED
On
Off
Critical Zone LED Light
Caution Zone LED Light
Safe Zone LED Light
stop button


15pt Application Font
1000
100
20..100
Critical zone
Distance from nearest obstacle
123
Caution Zone
Safe Zone
stop
LabVIEW Evaluation Software

Deliverable Outcomes

	Assigned To	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12
Planning													
Defining Project Goals and deliverables	All Members												
Making project plan and timeline	All Members												
Resources allocation and responsibilites assignment	All Members												
Concept Development													
Research and conceptualize	All Members												
Develop initial prototypes	Jordan, Lomi												
Gather feedbacks and refine concepts	All Members												
System Level Design													
Design sensor detection system	Jordan, Lomi												
Plan head unit display and data flow	Alisha, Abid												
Define component interaction	All Members												
Detailed Design													
Detailed schematics and documents	Jordan, Lomi												
Develop algorithms for data processing	Alisha												
Finalize material and component selections	Jordan, Lomi												
Testing													
Conduct unit testing	Jordan, Lomi												
Perform integration testing	Alisha, Abid, Mark												
validating and feedback	Alisha, Abid												
Refinment													
Project completion													

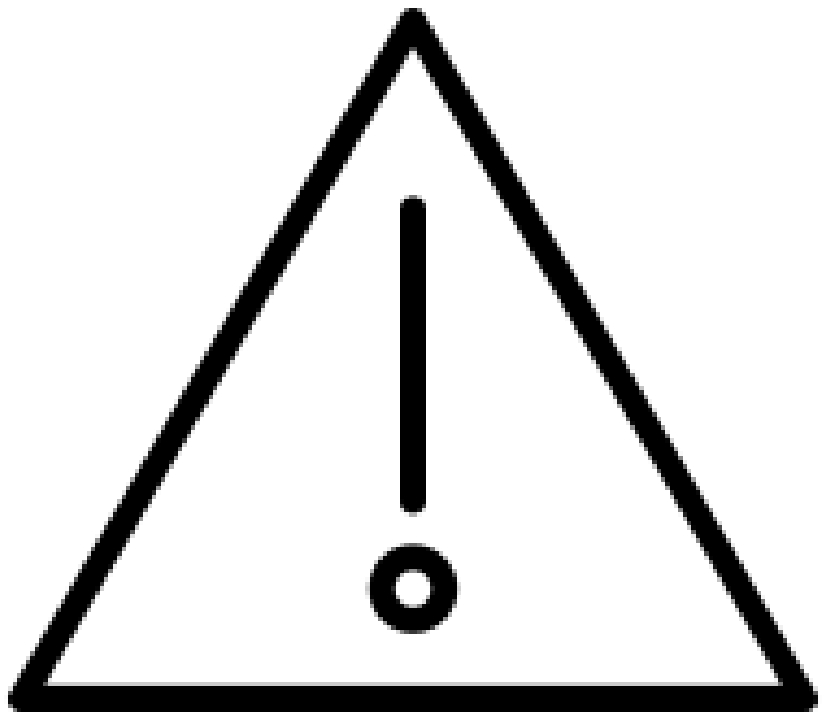
Figure 4: Deliverable Outcomes [3]

Comparison with Existing Approaches

Feature	Other Approaches	Our Approach
Single-Feature Implementations	Focus on individual features (i.e. braking)	Integration of multiple features for synergy
Reliance on Basic Sensor Technologies	Basic sensors with limited accuracy	Advanced sensor fusion using LiDAR, cameras, and ultrasonic sensors
Limited Testing Environments	Limited testing	Use of advanced simulators to replicate diverse real-world conditions

Lacking Comprehensive Integration of ADAS Functionalities

- Adaptive Cruise Control
- Lane Departure Warning (LDW) and Lane Keeping Assist (LKA)
- Automatic Emergency Braking (AEB)




Any
questions?

References

[1] Aleksa, M. *et al.* (2024) *Impact analysis of advanced driver assistance systems (ADAS) regarding road safety – computing reduction potentials - European Transport Research Review*, *SpringerOpen*. Available at: https://etrr.springeropen.com/articles/10.1186/s12544-024-00654-0#:~:text=For%20the%20Forward%20Collision%20Prevention,could%20reduce%209%25%20of%20crashes. (Accessed: 13 September 2024).

[2] Created by Jordan Armstrong

[3] Created by Alisha