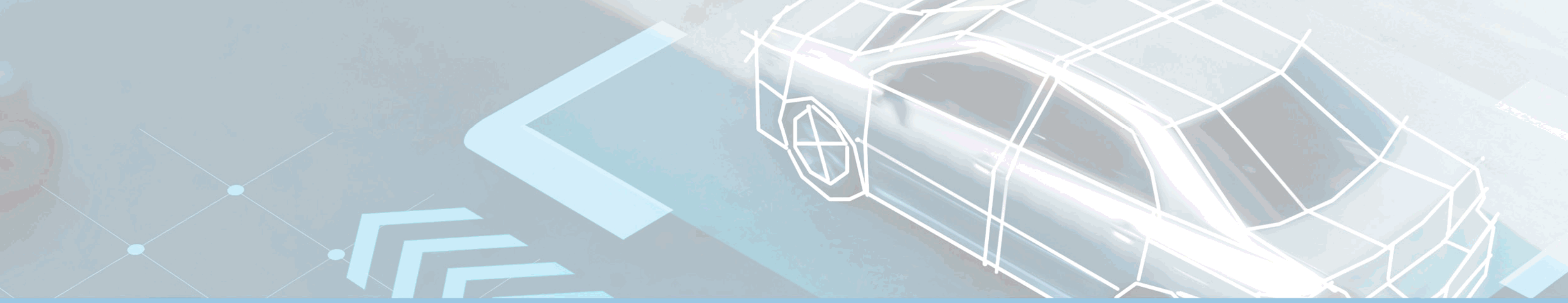

인간중심 자율주행 및 기능안전: Rising Star

ISO 26262 기반 기능안전 이론 및 중요성

황수정*

Theory and Importance of Functional Safety Based on ISO 26262

Soojung Hwang*

Key Words : Functional safety(기능안전), E/E system(전기전자 시스템), ASIL(안전 무결성 수준), Safety goal(안전목표), FSC(기능안전 컨셉), TSC(기술안전 컨셉)

ABSTRACT

With the recent advancements in the automotive industry, the complexity of E/E System(Electric and Electronic System) has been increasing. Accordingly, the application of the international standard ISO 26262 has become essential to ensure functional safety of vehicles. This standard defines development and verification processes and requirements from the concept level to the system level and hardware/software levels to prevent accidents caused by vehicle-level hazards.

At the concept level, after Item Definition, HARA(Hazard analysis and Risk Assessment) is conducted to identify vehicle-level hazards, leading to the derivation of the item's safety goals and ASIL(Automotive Safety Integrity Level). Subsequently, the FSC(Functional Safety Concept) is designed as a high-level blueprint to achieve these safety goals. At the system level, the FSC is further refined. Through safety analysis methods such as FMEA(Failure Mode and Effects Analysis)/FTA(Fault Tree Analysis)/DFA(Dependent Failure Analysis), the TSC(Technical Safety Concept) is derived and refined to ensure that the safety goals are met. At the hardware/software level, the safety mechanisms defined in the TSC are translated into specific hardware/software implementations. As vehicles become increasingly software-driven and interconnected, ensuring these implementations becomes even more critical to address emerging risks and system complexities.

As SDV(Software-Defined Vehicles) and V2X(Vehicle-To-Everything) technologies rise, functional safety faces new challenges, such as cybersecurity risks, and the need for adaptive safety mechanisms. To address these challenges, ongoing research and continuous advancements in ISO 26262 are essential to ensure the safe integration of these emerging technologies.

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SUV-트레일러 운전자 조향 보조 및 자율주차 제어를 위한 트레일러-커플러 간 거리 실시간 추정

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Real-time Estimation of Trailer-Coupler Distance for Automated Driver Assistance System of Vehicle-Trailer

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Key Words : Advanced Driver Assistance System(첨단 운전자 보조 시스템), Vehicle-Trailer systems(차량-트레일러 시스템), Trailer parameter estimation(트레일러 파라미터 추정)

ABSTRACT

This paper presents a real-time estimation method for trailer-coupler distance in automated driver assistance system of vehicle-trailer. Existing automated driver assistance system of vehicle-trailer typically require manual input of trailer specifications, causing inconvenience and increasing the potential for error. To overcome these limitations and enhance driver convenience, we present a novel method that accurately estimates trailer parameters in real-time, eliminating the necessity for manual data input. A vehicle-trailer kinematic model is employed to derive the trailer-coupler distance estimation formula. Parameters necessary for estimating trailer-coupler distance are obtained from MATLAB/Simulink based vehicle-trailer simulations, including sensor noise to mimic realistic vehicle conditions. Using the extracted simulation data, a reference curve is generated based on estimations within a 5% error margin relative to ground truth. Valid data points are distinguished from outliers using the generated reference curve and Euclidean distance metric. Subsequently, the trimmed mean of valid data points is used to calculate the trailer-coupler distance. Validation conducted using real-world vehicle-trailer driving data demonstrates that the proposed method achieves stable estimation performance, with an average estimation error below 5%.

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Behaviorally-Aware Autonomy: Integrating Human Modeling into Robotic Planning

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Key Words : Behaviorally-aware autonomy, Human-centric motion planning, Multimodal perception, Data-driven human motion prediction, Uncertainty-aware decision-making

ABSTRACT

As autonomous systems increasingly operate in human-centric environments—on sidewalks, in hospitals, in homes, and on the battlefield—traditional planning approaches that treat humans as dynamic obstacles fall short. This talk presents a shift toward behaviorally-aware autonomy, where robots not only model physical trajectories but also reason about human behaviors, intent, and social norms. By integrating human modeling directly into motion planning and decision-making pipelines, we can create agents that are more predictable, trustworthy, and effective collaborators.

The talk will explore the full stack of behaviorally-aware planning, from real-time multimodal perception and data-driven human motion prediction to neural and physics-informed models of interaction and trust. We will discuss how foundational models, neural operators, and geometric approaches can be combined to understand and generate complex human motions—enabling safe navigation in dense crowds, partner-dependent action generation (e.g., dancing, collaboration), and socially intelligent agents. Applications span both virtual agents in immersive environments and embodied robots navigating in the physical world.

Drawing on recent work from the IDEAS Lab and collaborators, this talk will highlight technical contributions in probabilistic trajectory prediction, behavior-conditioned planning, and uncertainty-aware decision-making. We will also discuss open challenges and future directions at the intersection of human modeling, planning, and foundation models for real-world, behaviorally intelligent autonomy.

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주차장내 자동차 사고 개요: 유형, 영향 및 해결책

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A Survey of Automotive Accidents in Parking Lots: Types, Implications, and Solutions

Hong Bae*

Key Words : Automotive safety(자동차 안전), Accidents in parking lots(주차장 사고), Financial implication to stakeholders(구성원에게 미치는 금전적 영향)

ABSTRACT

Parking lot accidents account for approximately 20% of all vehicle collisions in most of the automotive markets. These accidents are often caused by limited visibility, crowded conditions, and the presence of pedestrians, making parking lots hazardous for both drivers and walkers. The economic impact of parking lot accidents is also significant, and these accidents can lead to increased insurance premiums and legal fees, adding further financial burdens on victims. In addition to individuals involved in parking lot accidents, the insurance industry in the US also suffers from the yearly payout of about $14 billion due to accidents in parking lots.

To mitigate these risks, effective safety measures are necessary. Improved parking lot design, enhanced visibility, advanced technology, and increased awareness among drivers and pedestrians are essential for reducing accidents. However, challenges such as balancing cost implications with stakeholder support for new technologies, including advanced surveillance systems and better lighting, can complicate implementation. In this talk, a simple and cost-effective safety strategy based on advancements in technology is proposed.

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Redundancy 전략 불가 상황의 단계별 Safety Mechanism

조호현* · 박진용* · 우승훈**

Step-by-Step Safety Mechanism for Redundancy Strategy Impossible

Hohyeon Cho*, Jinyong Park*, Seunghoon Woo**

Key Words : ISO 26262(자동차 기능 안전), Safety Mechanism(안전 메커니즘), Degradation Mode(기능 저하 모드), Minimal Risk Maneuver(최소 위험 기동)

ABSTRACT

As the automobile industry shifts to Software-Defined Vehicles(SDVs), autonomous driving systems are becoming a core technology. As a result, the complexity of Electric/Electronic systems in vehicles is increasing, and ISO 26262-based safety mechanisms are attracting attention to prevent serious accidents caused by system failures.
Currently, most systems adopt a Fail-Safe method that stops functioning in the event of a failure, but this is not sufficient at the level of highly autonomous driving. A Fail-Operational method that can maintain the operation of the system even in a failure situation is essential, and a redundancy-based solution is used for this. However, in multiple failure situations, such a redundancy strategy may not be possible, and in this case, the system may lose its self-diagnosis ability, leading to a dangerous state. To solve this problem, this study proposes a step-by-step safety mechanism based on functional degradation mode for an autonomous driving system.
The proposed mechanism includes sequential Fail-Operational and Fail-Safe methods such as speed deceleration, driver control request, performing Minimal Risk Maneuver(MRM) without the driver's response, and stopping the shoulder. Before performing the MRM, the Time to Collision(TTC) is calculated using front and side sensors to secure a safe area, and during the MRM, the target yaw rate-based Rear Wheel Steering(RWS) improves lateral stability.
Model-in-the-Loop Simulation(MiLS) using MATLAB/Simulink and CarMaker was performed to verify the proposed mechanism. As a result of experimenting with multiple failure scenarios including cognitive sensor failures, stop vehicles, and dynamic situations of nearby vehicles, it was confirmed that the proposed mechanism successfully performed fault tolerance control and stable stopping without collisions even in situations where no redundant strategy was applied.

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