자율주행차량 플랫폼 기술

자율주행 차량 플랫폼 구축을 위한 분산 에지 컴퓨팅 구현

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Implemention of Distributed Edge Computing for Autonomous Vehicles

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Key Words : Autonomous system, Edge computing, Edge devices, Distributed embedded system

ABSTRACT

Autonomous systems, such as self-driving cars, unmanned aerial vehicles (UAVs), and industrial robots, are becoming increasingly prevalent in our world. A key requirement of these systems is that they must operate reliably and autonomously in challenging environments with minimal human intervention. However, these systems face problems, such as high cost, power consumption, potential for overheating, and occupying a large area, which can limit their efficiency and effectiveness in real-world.

To address these challenges, we propose a distributed system for autonomous vehicles that utilizes three edge computing devices (i.e Jetson Xavier NX) to replace the workload of an existing industrial PC. By decentralizing the traffic light recognition function, which requires GPU acceleration, and the lidar sensor-based obstacle detection function, which requires a lot of data processing and resources, we were able to improve the safety and responsiveness of the autonomous system with migrating egde computing devices. This approach allows for efficient parallel processing of sensor data, enabling the system to make rapid and accurate decisions in real-time. Additionally, using multiple edge computing devices offers the advantage of modularity, where each device can be dedicated to a specific task. This modularity can also make the system easier to troubleshoot and maintain, as each edge computing device can be independently upgraded or replaced as needed. Furthermore, this distributed system approach allows for minimalistic packaging for other uses. In conclusion, we applied a distributed system using edge computing to effectively process sensor data, efficiently manage software through modularization, and make more space available inside the vehicle.

In the future works, we plan to develop a redundancy fail-safe system using edge computing, which will ensure continuous data transmission and prevent data loss in case of failures or errors in the autonomous system module.

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3차원 정밀도로지도의 데이터 검증 방안 연구

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A Study on Data Verification Methods for 3D HD Map

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Key Words : HD map(고정밀 지도), Data verification(데이터 검증)

ABSTRACT

HD Map is a map that have three-dimensional spatial informations including roads and lanes with centimeter-level accuracy, and is generally drawn based on data collected through MMS (Mobile Mapping System) equipment. However, due to the characteristic of HD Map, which requires a large number of objects to be built accurately, various errors occur during the construction process. In the case of such an error, the HD Map verification process is an essential step because an accident may occur due to incorrect information being delivered during the autonomous driving support process.

In this paper, a study on the design and implementation of HD Map verification methods was conducted to reduce errors in HD Map and increase the safety of autonomous driving. First, data integrity errors, logic errors, and shape errors were analyzed based on the HD Map model provided by the National Geographic Information Institute. Based on the analysis, 243 verification logic cases for each error were designed, and verification SQL was implemented on PostgreSQL.

As a result of testing the verification logic implemented through the HD Map data of the National Geographic Information Institute, it was possible to detect error objects in various cases. Data integrity, logic, and shape errors were all detected, and in the case of logic errors, it was analyzed that some automatic correction is possible. However, in the case of data integrity or shape errors, automatic correction is considered to be almost impossible. It is expected that the reliability and stability of the HD Map can be increased through the verification logic presented in this study, and a method for automatically correcting detected errors will be studied in the future.

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정밀지도를 활용한 자율주행 차량의 경로 내 주의구간 데이터 생성

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Generating Caution Zone Data in the Trajectory of Autonomous Driving Vehicles Using HD Map

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Key Words : Autonomous driving(자율주행), High-Definition map(고정밀 지도),Caution zone(주의 구간), Trajectory (자율주행 경로)

ABSTRACT

As the autonomous driving industry has grown in recent years, the importance of safe driving for autonomous vehicles has increased. To ensure safe driving, both the safety of passengers and surrounding objects must be guaranteed. Therefore, various sensors are used to collect and analyze object information around the vehicle, and HD Map are also used. However, relying only on sensors limits the detection area around the vehicle.

In this paper, we study a method for generating caution zone data in the trajectory of autonomous driving vehicles using HD map. By matching the trajectory and caution zone data, the presence of caution zone information at the point where the vehicle will be driven can be determined in advance. The generated data includes crosswalks, traffic lights, stop lines without traffic lights, and expected merging sections.

This study was verified by creating caution zone data that matched the trajectory using HD Map data from the Seongnam Pangyo area and the Daegu Technopolis area.

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운전자 부주의로 인한 사고 방지를 위한 DMS(Driving Monitoring System) 기술 개발

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Development of Driving Monitoring System (DMS) Technology to Prevent Accidents Caused by Driver Carelessness

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Key Words : DMS(운전자감시장치), Sleepiness(졸음), Euro NCAP, Global shutter(글로벌 셔터), Image sensor(영상센서) , Deep learning(심층기계학습)

ABSTRACT

The purpose of this paper is to develop a DMS to prevent accidents caused by driver carelessness. The experiment was conducted based on the DMS camera to prevent accidents caused by drowsy driving, forward gaze, and cell phone use. However, normal cameras have disadvantages for dark environments and noise. To improve these weakness, we propose an IR camera. The camera detects the position of the head, whether or not a mask is worn, the driver's personal authentication, and the direction of the face through face detection, through part detection, it detects the iris of the pupil, blink detection and driver's opening and closing of mouth are detected. Also detects whether a mobile phone is used and smoking conditions through detection outside the face. Based on the detected information, the HW and SW algorithms analyze it. With the analyzed information, it is expected that a number of accidents can be prevented by expressing notification sounds in case of a crisis. Therefore, it is expected to contribute to safe driving and vehicle safety when using DMS technology, and furthermore, it will secure the performance to drive autonomously. The technology aims to meet the equirements for the Euro NCAP DMS evaluation. The implementation method of the DMS algorithm can be implemented through Machine Learning and Deep Learning. Also, DMS camera is developed with lens, Image Sensor, IR LED, and Global Shutter technology.

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자율주행 로보택시 서비스 이용 경험이 수용성에 미치는 영향 – 관광형 자율주행 시범서비스 사전분석 결과를 중심으로

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The Effect of Autonomous Driving Robotaxi Service Experience on Acceptance - Focusing on the Results of the Preliminary Analysis of the Tourist Type Autonomous Driving Pilot Service

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Key Words : Autonomous vehicle, Robotaxi service, Social acceptability

ABSTRACT

As autonomous driving technology advances, autonomous robotaxi services are expected to play an important role in future mobility. However, there is still a need to increase the acceptance of robotaxi services. In this study, we hypothesize that the positive experience of a robotaxis that can operate safely and reliably will increase the trust and acceptance of autonomous vehicles.

This study was conducted as a pilot service for tourist-type autonomous driving in Gangneung, Korea, and aimed to find out how the experience of robotaxi services can affect social acceptance based on the pre and post-use evaluation of autonomous robotaxi services.

The autonomous driving service was conducted on the historical, cultural, and ecotourism route from Ohjukheon to Chodang(Gangmun) in Gangneung City, a round-trip distance of 24 kilometers. The robotaxi service has been operated for around four months. During the service period, 65 passengers were responded to the survey. The survey questions sought to understand the perception and acceptance of the new technology at the beginning of the autonomous driving service, including safety, reliability, convenience, and affordability (price acceptance).

The analysis results showed that the perceived safety of the robotaxi service was significantly improved after the ride with 81% of all respondents responding from 35% before the ride. In addition, 91% of respondents responded positively that autonomous driving services would help revitalize tourist destinations, indicating a high level of positive perception and willingness to use tourism-type autonomous driving services.

In conclusion, positive experiences with autonomous driving services can help promote trust and trust in emerging technologies.

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