자율주행차량 플랫폼 기술

자율주행 차량 플랫폼 구축을 위한 라이다 측위 적용 사례

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Implementation of LiDAR SLAM for Autonomous Vehicle

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Key Words : Autonomous Driving Platform(자율주행플랫폼), LiDAR(라이다), SLAM(동시적 위치 추정 및 지도작성)

ABSTRACT

Localization is one of the most important technologies in autonomous driving systems. Most Level 4 autonomous vehicles rely on high-definition (HD) maps to navigate their driving routes based on ego position. Therefore, we need various methods to measure its position robustly. Especially, in the areas outside of the GPS signal such as tunnels and bridges, it is difficult to obtain an accurate position. These issues can cause fatal errors in the autonomous driving system.

To solve these problems, we implemented LiDAR-based SLAM (Simultaneous Localization and Mapping) algorithms to estimate location even in a poor GPS environment. In this study, a loop-closure map was built with a vehicle equipped with 32ch LiDAR and IMU sensors, then autonomous driving was successfully performed in an indoor environment without a GPS signal.

In addition, we will develop a robust localization technology by sensor fusion of GPS and LiDAR-based SLAM for a safer autonomous driving system.

본 연구는 산업통산자원부 한국산업기술평가관리원의 자율주행기술개발혁신사업(과제명 : 지정구역기반 Point to Point 이동 Lv.4 승합차급 자율주행 차량플랫폼 기술개발, 과제번호 : 20014361)의 연구비 지원에 의해 수행됨

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정밀지도 기반 자율 주행 경로 생성

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A Method of Generating Trajectory based on HD MAP

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Key Words : Autonomous driving(자율주행), High-definition map(정밀지도), Trajectory(궤적), Global path planning (전역 경로 계획)

ABSTRACT

Level 4 autonomous vehicles should be driven on a safe and efficient route to their destination without driver intervention. To this end, it is necessary to provide a route to the destination through a lane-level global path planning, and organized data with information that can flexibly respond to unexpected situations that may occur while driving. The HD Map is evaluated as suitable map for autonomous driving because it expresses the road accurately and in detail.

In this paper, we study a method of generating SD Map-based global path data and then generating HD Map-based lane unit Trajectory. Trajectory data was scored by evaluating the driving priority of each lane. If the vehicle follows the high-priority lane of the trajectory, optimal driving is possible. In addition, by using the data, a method that can efficiently avoid obstacles while driving illegal parking and accident vehicles was suggested.

This study was verified by creating a trajectory using SD map and HD map data of the Seongnam Pangyo area and Daegu Technopolis area.

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자동차 안전을 위한 신뢰도와 안정도를 향상시키는 카메라 영상 기술 개발

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Camera Image Processing Technology for Improving Vehicle Reliability and Stability

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Key Words : WDR(역광), Night Vision(야간), Defog(안개), HDR, AE(자동노출), ADAS, Autonomous Vehicle

ABSTRACT

The purpose of this paper is to develop a camera image processing technology system that is improving reliability and stability for vehicle safety. Most related autonomous vehicles and ADAS(Advance Driver Assistance Systems) projects conducted the experiments based on sensor fusion: camera, lidar, radar and other vision-based systems. Especially, for the camera, it is designed to warn the driver's situational awareness and road safety. Also, it is adopted for their usefulness for implementing the applications: object detection, line detection, acquiring accurate and real-time information and so on. However, a vision-based camera system has some drawbacks in terms of image processing: wide dynamic range, night vision, defog system, high dynamic range, auto expose and so on. Most camera-based autonomous vehicles and ADAS systems implemented image processing on the application software level. Not only it requires a complex, high-performance, and low-power computing hardware system for acquiring a clear image but also it may occur a software latency problem during driving. To improve the weaknesses, the recommended camera image processing technology was proposed. In this paper, the camera performed the image pre-processing and transmitted only the data that the main application function desired to receive. The experiments were about comparing the before and after images of the camera image processing technology. There were five methods for the experiments: WDR, Night vision, Defog, HDR and AE. For maximizing the image processing effect, each method was performed in different weather situations. From the result of the experiments, the image with the proposed processing technology showed the better result in terms of accurate visual information and clear image. Therefore, according to the results, using the recommended image processing technology is more efficient for the vision system on the autonomous vehicle and ADAS.

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실제 자율주행차에 필요한 자율주행지도 규정

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Regulations on Autonomous Driving Guidance Required for Actual Autonomous Vehicle

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Key Words : HD map(고정밀지도), GIS(공간정보시스템), ADAS map(첨단운전보조시스템 전용 지도)

ABSTRACT

Maps are essential for LV4 level cars to take autonomous driving one step ahead. The current problem in the field of Maps is that the definitions of shapes and properties required for each precision map for each autonomous vehicle are being varied for HD maps for autonomous vehicles. However, through the data format prescribed by the National Geographic Information Institute, which is actually used, a total of 13 layers and attributes are processed as 3D absolute coordinated data for maps of everything on the road, and all these data are used in autonomous vehicles. it is intended to define the shape and properties required for an autonomous vehicle that is actually used and to define a map required for actual autonomous driving.

In order to make a map that can actually drive the HD map that has various problems, it is necessary to investigate the autonomous driving map that is being used globally. Standards and regulations of ADAS Map need to be investigated. In addition, feedback is required through verification with companies that can autonomously drive this autonomous driving map and HD map, and improved self-driving maps suitable for autonomous vehicles are provided and delivered in the form of safe, accurate and rapid data. This experiment is carried out by dividing the required and optional layers through the GIS standard format created based on the National Geographic Information Institute, centered on Pangyo Station, and through experiments with autonomous driving companies. As a result, the autonomous vehicle driving at the intersection showed a different aspect from the guideline in the actual 3D spatial information. Accordingly, the shape of the map required for autonomous vehicles should be made based on actual road driving.

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SOTIF 설계검증을 위한 도심 자율주행 시뮬레이션 환경 구축

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Urban Automated Driving Simulation Environment for Testing Safety of the Intended Functionality (SOTIF)

Myoungouk Park*, Yunmin Oh**, Joonwoo Son***

Key Words : SOTIF(의도된 기능의 안전), Autonomous vehicle(자율주행자동차), Simulation (시뮬레이션)

ABSTRACT

Automated driving vehicles promise a safe, comfortable and efficient driving experience. However, the full potential of automated driving (AD) cannot be realized unless the robustness of state-of-the-art is improved further. Although there are a variety of emerging standards such as ISO/PAS 21448, UL 4600 and ISO/TR 4804 that relate to the safety of AD, these standards leave freedom for developers to reason about the safety of their systems by calling for the achievement of high-level goals or objectives. Thus, current safety standards for automated driving vehicle recommend the extensive development of safety cases and reduce the risks known and unknown risks through SOTIF process.

To accelerate the SOTIF process, it is to essential to conduct virtual driving simulation tests with various scenarios and safety analysis over the iterations. There are several commercial-grade simulators, such as Simcenter Prescan, rFpro, and Cognata, and open-source simulators, e.g., CARLA ad LGSVL. Among these advanced simulation tools, we selected the CARLA simulator for testing autonomous driving scenarios in urban traffic environments. This paper introduces the overall SOTIF process and CARLA simulation environments for a commercial autonomous robotaxi service route in Daegu.

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