OBVIOUS RECORDER G500

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1 Introduction

Safety systems for vehicles have been dramatically improved in the last 20 years. In order to protect occupants in vehicles at the time of an impact, vehicles with the safety system are increasingly common from around 1995 due to establishment of safety criteria for vehicle bodies against impacts and installation of airbags as standard equipment. Moreover, companies in the transportation industry have been actively enhancing their efforts for safety of vehicles partly because ISO39001, the international management system for road traffic safety, came into effect and also because authorities and interest groups are promoting (providing subsidies) use of safety and environmentally-friendly products and devices. Along with that, in addition to the function of recording accidents, the market needs for safety functions of drive recorders are growing. Therefore, this time, we added a lane departure warning (LDW) function as a safety function, to our current model G400. Moreover, for the purpose of safe driving support, we also added an inter-vehicular distance measuring function, based on preceding vehicle detection (VD). Image recognition technologies of FUJITSU LABORATORIES LTD. and Fujitsu Limited are utilized for these functions, and we are mass-producing our new product G500 including those functions.

Fig.1 External Appearance of Product

2 Characteristics of Product

2.1 Lane Departure Warning (LDW)

The LDW function measures the distance between the host vehicle (vehicle on which the device is mounted) and a white line by recognizing captured images, and if it detects lane departure of the host vehicle without operation with the blinker, it outputs sounds to bring driver's attention. Accurate detection of white lines generally needs a dedicated narrow-angle camera (horizontal angle of view of 40 deg. to 70 deg.).

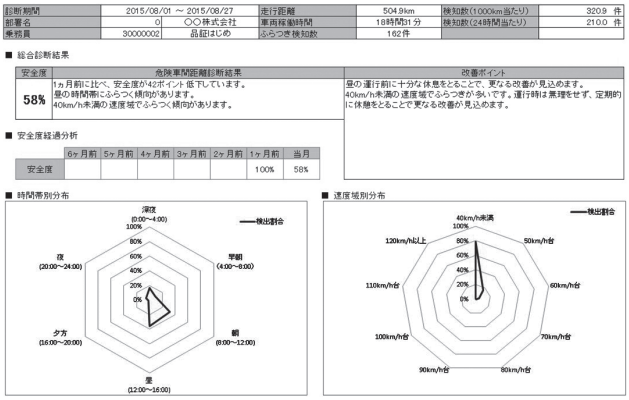

Fig.2 Diagnosis Result of Staggering

We realized the LDW function for the model developed this time by use of images captured by wide-angle cameras (horizontal angle of view is 110 deg. and one million pixels) for a drive recorder.

Further, the drive recorder records distances between white lines and the host vehicle. The tendency of the driver's driving can be analyzed by sending the recorded distances to the cloud computing center. **Fig. 2** illustrates analyzed results of such a tendency. The staggering of the vehicle driven by the driver can be diagnosed based on the results.

Table 1 shows the comparison of LDW performance among products of competitors and our new model. Use of the algorithm*(1) of FUJITSU LABORATORIES LTD. allows us to materialize the product with the performance better than the one of other companies' products in regard to the white line detection rate and the correct detection rate of white lines, due to smaller difference between calculated distances and actual distances from the host vehicle to white lines on curves.

The performance satisfies the requirement for lane departure warning systems defined in the Summary of the Phase 3 ASV Promotion Project (Main technical issues) released by MLIT.

* (1) Refer to the press release dated June 10, 2014 of FUJITSU LABORATORIES LTD.

Table 1 LDW Performance Comparison among Competitors' Products and G500

Manufacturer		FUJITSU TEN Wide-angle camera	Company A Narrow-angle camera	Company B Wide-angle camera
LDW performance	White line detection*(2)	98.39%	89.34%	68.32%
	Correct detection rate of white lines*(3)	93.79%	87.72%	80.68%

2.2 Inter-vehicular Measuring Function based on Preceding Vehicle Detection (VD)

Our new model identifies the traffic lane on which the host vehicle is traveling by the foregoing white line detection function and measures the inter-vehicular distance to the preceding vehicle traveling in the same traffic lane. The inter-vehicular distance data is stored in the drive recorder and the driving tendency of the driver can be analyzed by using the cloud computing service. **Fig. 3** illustrates an example of the analysis results. Whether the inter-vehicular distances were appropriate at the time when the driver of the host vehicle was traveling can be determined based on the results.

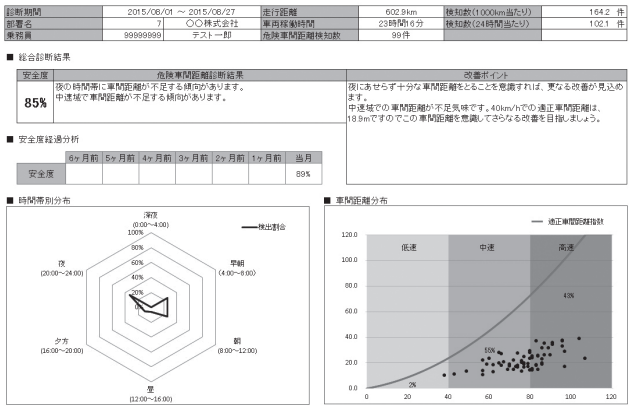

Fig.3 Diagnosis Result of Dangerous Inter-vehicular Distance

Currently about 40% of accidents between cars are caused by inappropriate inter-vehicular distances. We believe that we can contribute to safer driving by assisting drivers to recognize the appropriate inter-vehicular.

2.3 Calibration

For the LDW function, calibration is necessary after the camera is mounted on the vehicle. Tablet computers and special poles are used for simple and short-time calibration. The result of comparison with a product of our competitor is listed in **Table 2**. As shown in **Table 2**, our product can be mounted in shorter time in a smaller work space than the product of the competitor.

Table 2 Calibration Method Comparison between Competitor's Product and G500

Manufacturer	FUJITSU TEN	Company A
Necessary man hour (2 workers)	20 min.	60 min.
Work area	Not specified (flat floor)	Only automobile plant with equipment specified by company A
Preparation for calibration	Set special poles at approx. 1.3m in front from front tire of the vehicle	Set traffic corns approx. 7m in front from front tire of the vehicle
Setting of calibration	Automatic setting by connecting tablet PC to G500 via wireless LAN	Manual setting by connecting PC to vehicle-mounted camera via USB

2.4 Automatic Extraction of Near Miss by Automatic Image Analysis

Among companies in the transportation industry, there is growing demand to use images captured by drive recorders for safe driving education. However, to use them for the education, supervisors need to watch all the video footages themselves to extract dangerous driving scenes and near miss scenes from the footages. It takes so much time that the time-consuming work prevents the footages from being used for the education. This time, we began to provide service that analyzes the stored images as well as data of measured white lines and the inter-vehicular distances, by the cloud computing, and then automatically extracts near miss scenes (**Fig. 4**). We believe that we will contribute to spread of the safer driving education by introducing this function because the supervisors can provide the education without taking much time.

Fig.4 Image of Extracted Near Miss Scene

∗(2) The rate is calculated based on the detection of white lines during traveling on high ways.

∗(3) Correct detection rate is calculated based on a definition of correct detection that is ±20cm or less of difference between the calculated and actual distances.

3 Product Specifications

Table 3 shows specifications of the OBVIOUS drive recorder G500. As a drive recorder, the basic specs. of the G500 are higher (better image quality) as compared to its previous model. Moreover, being connected to a cloud computing center via a communication module, the location and the state of the vehicle can be checked, on a real-time basis, on a computer in an office of a company that possesses the vehicle.

Table 3 Specifications of OBVIOUS Drive Recorder G500

Image recording	W recording (event/normal)
Record medium	Dedicated SDHC/SDXC card Sold separately: 8GB/16GB/32GB/64/128GB
Connectable cameras	Up to 5 cameras
Camera	Standard: 1 million pixels, Angle: Horizontally 110 deg./Vertically 70 deg. Option: 310 thousand pixels, Angle: Horizontally 135 deg./Vertically 105 deg.
Recording of sound	OK
Card slot	1
Image frames	Up to 28 frames/sec.
Image recordable hours	Up to 150 hours ※1 camera, 128 GB card Frame rate: 14 frame/sec.
GPS receiver	OK
Wireless LAN	OK
VD/LDW	OK
Setting for optional accessories	Tracking camera, infrared camera kit, 6-button operation unit, microphone, ETC connection cable, communication unit
Contents of recorded data	Time, location, G detection, engine rotations, vehicle speed, distance to traffic white line, distance to preceding vehicle

4 Conclusion

The drive recorder developed this time as a product is additionally equipped with a function of collecting and managing recorded images as time-series data by associating time information with, inter-vehicular distances, distances to white lines and the traveling data of the vehicle. Being storing in an easy-to-use structure for other purposes, as described above, those data can be handily used by different systems. We will further analyze a large amount of accumulated vehicle information and enhance functions that will be realized through connection to the cloud computing center. Thus, we will make an effort to grow our business, placing the networked drive recorder at the center of the Future Link™.

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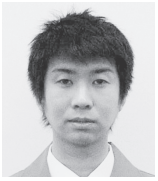

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