# A Driver Dangerous Behavior Detection System Based on Object Spatiotemporal Relationships

Chuan-Wang Chang, Hsun-Yu Li, and Dong-Yuan He

***Abstract*— In recent years, numerous car accidents have been caused by driver distraction. Therefore, developing and deploying safety-driving behavior monitoring systems have been increasingly emphasized. Although traditional driving monitoring camera has recording and playback functions, they only have the function of recording the monitoring area. It cannot provide real-time warnings or reminders for sudden abnormal events. Therefore, this paper proposes a driver dangerous behavior detection system based on object spatiotemporal relationships to identify dangerous driving behavior in the monitored screen and timely issue warnings to remind drivers to stop risky behavior to reduce the occurrence of accidents immediately.**

***Index Terms*—dangerous driving behavior detection, object detection, object spatiotemporal relationship**

## I. Introduction

News reports and multiple investigation reports show that car driver distraction and fatigue are important causes of accidents. Statistics from the National Highway Traffic Safety Administration also point out that traffic accidents caused by driver distraction and fatigue are conservatively estimated to account for at least 10% of all traffic accidents every year; therefore, NHTSA and the European Union have both stated that they will formulate regulations for the installation of driver monitoring systems.

This paper uses a camera lens to capture the whole body image of the driver in the cabin, then uses object detection technology [1] combined with the spatial-temporal relation of objects to implement a driver dangerous behavior detection system. Once the dangerous driving behavior is determined, a warning alarm will be issued timely to remind the driver to stop the risky driving behavior immediately.

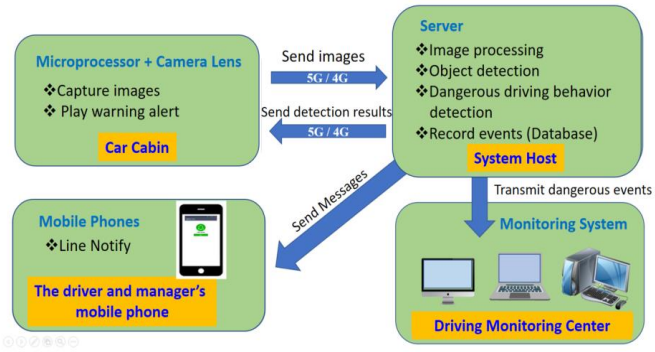


Fig.1. System Architecture.

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## II. System Architecture and Method

We proposes a solution for detecting and reminding car drivers of dangerous behaviors. The system architecture is shown in Fig. 1. We define many different spatial events based on the positional relationship and overlap of various objects in space. In addition, we also consider the temporal relation of spatial events. When a spatial event is identified, the system will calculate the duration (frame count). Once the frame count exceeds the definition of each event, the event would be considered dangerous driving behavior.

## III. Experimental Results

Fig. 2(a)-(c) shows some results of dangerous driving behavior detection, and Fig. 2(d) shows the warning message received by the driver's mobile phone.

(a) Mobile phone detectection

(b) Dozing detectection

(c) Eating/drinking detectection


(d) Alert messages received on mobile phones

Fig.2. System Demostraction

## IV. Conclusion

The experimental results show that the method proposed in this paper has a good detection ability for abnormal driver behavior. The system has a fast response time and the practicality of real-time warning.

## References

[1] A. Bochkovskiy, C.Y. Wang, H.Y.M. Liao, "YOLOv4: Optimal Speed and Accuracy of Object Detection," arXiv:2004.10934 [cs.CV], https://doi.org/10.48550/arXiv.2004.10934.