

Basic Study on Detecting Vehicles Outside the Field of View Using Acoustic Signals

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Drive-aid system is required to have a function to prevent sudden head-on or side collision accidents at road intersections that cause serious personal injury. Therefore, we devised a method to utilize the diffraction and reflection of sound waves in detecting vehicles outside the field of view that cannot be detected by sensors such as cameras and radars that are currently used. Our method employing a microphone array, digital signal processing and road geometric vehicle position information was proved to achieve the intended function in real road intersections.

Firstly, we geometrically examined the path by which such sound waves propagate from a vehicle outside the field of view toward a typical intersection and reach the vehicle. (Fig.1)

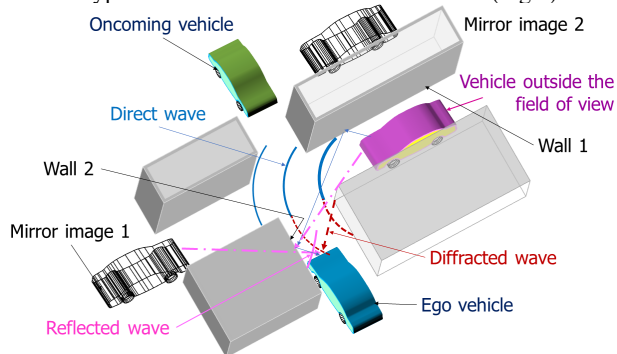


Fig. 1 Conceptual geometrical diagram of sound wave propagation in and around an intersection

Then, beamforming method using a microphone array was applied as shown in Fig.2

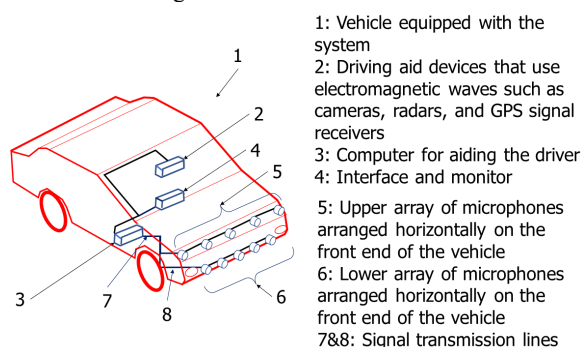


Fig.2 Diagram of the detection system hardware arrangement

One of our on-road experiment results are depicted in Fig.3. As shown in this figure, by superposing the acoustic intensity distribution information on video camera images, a vehicle approaching an intersection from out of the sight can be detected.

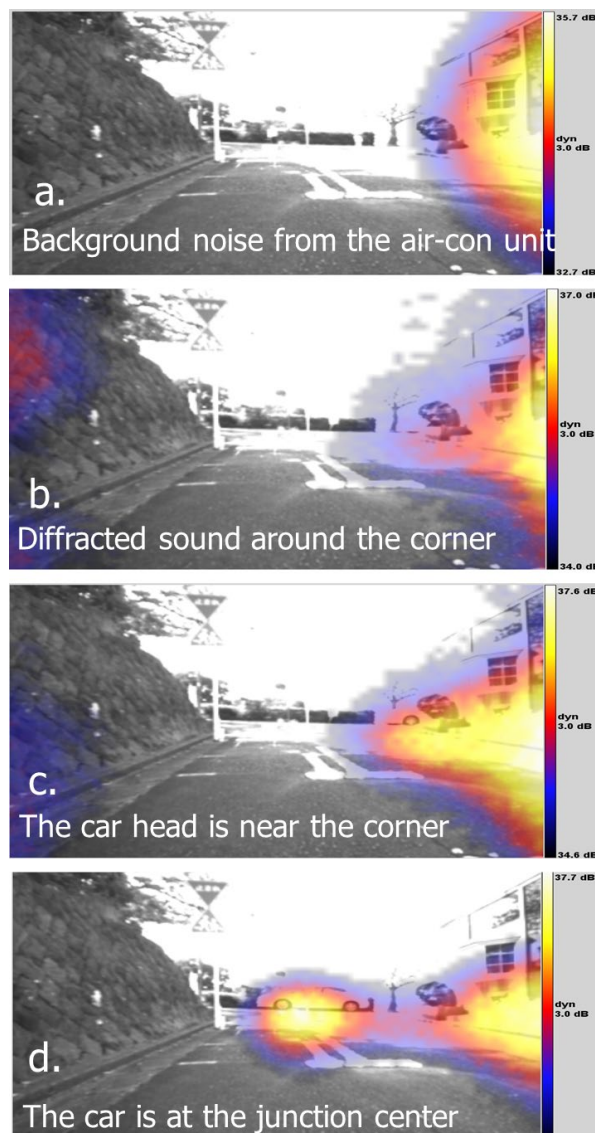


Fig.3 Fusion of geometrical information from a video camera and a microphone array obtained by the on-road experiment

Future tasks are as follows: 1) Confirm the effectiveness of this method in more complicated situations. 2) Numerical simulation for quantitative study, and 3) Development of signal processing method that can suppress adverse effects such as noise generated by the own vehicle.