Development for polarization monitoring method of black ice area on roads

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The fatal accidents on the frozen road including black ice occupy about twenty-five percent of all the traffic accident. The melted snow and raindrop frozen in snow area, black ice is sheeted on the road by large temperature differences in the morning and the evening. The partially frozen road due to black ice looks like just a wet road, causing the difficult identification of black ice. In several previous studies the polarization dependence of brightness was useful to identify the road surface. However, they can predict only in point, not in area. Here, we developed method for monitoring a area with or without black ice in extensive.

The polarization experiment was performed for water and ice surface (1) in the flat trays and (2) on the rough asphalt mat. Then, we took the photo by camera which attached polarization filter (figure1). The light source placed in front of camera, and both incident under same degrees to the center of case. It is an ideal condition to see the polarization effect between water and ice. We cut the area of photo where was the strong reflection caused, and compared. Next we used asphalt mat made of same raw materials as real popular asphalt road. The light source and camera placed same position and degrees. We made similar situation like wet road and icy road to be distinguished eventually.

The result of first experiment which to take the photo of flat water surface and icy one, we could find the differences between water and ice(figure2). The brightness value of flat water surface is uniform and indicated almost the same value. On the contrary, the brightness value of ice surface is not uniform because of rough surface. It means our method which use the polarization and brightness value is useful, in order to distinguish flat water surface to ice surface. Secondly, verified the result of experiment by using asphalt mat. According to our hypothesis based on first experiment, we thought the result would be different between wet and icy mat surface condition. The result was almost as the hypothesis. We could see the differences of brightness between wet mat and icy mat.

In conclusion, the new combined method between polarization and brightness is conducted to distinguish wet mat with icy one. The polarization degree is highly depends on the incident angle of light source and receiver, camera for instance. Therefore we have to divide the area according to the incident angle of light sauce, then we statute each brightness value which able to separate wet and ice in respective small area. In order to distinguish wet road and icy road at the wide area, we plan to gather the angle-sensitive data to incident angle and azimuth among light souse, objective and camera.

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