Feasible Experiment to Predict Road Surface Temperature using Vehicle Ambient Temperature Sensor

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This study performed investigating and analyzing for predicting surface road temperature by employing roadside temperature data obtained from vehicular sensor (vehicle ambient temperature sensor). For this, it is necessary to verify pattern of the change in road surface temperature under various weather conditions. Consequently, a statistical significance was tested for the correlation between road surface temperature and one collected from vehicular sensor (Vehicle Ambient Temperature Sensor) measured at the same section and hour. According to the results, it is identified whether the latter can be applied to forecast road surface temperature. Data collection was conducted for a flat section that includes a tunnel, at the same hour (05:00~06:00am), based on three round trips on different dates. The vehicle maintained constant speed (80km/hr) and ran on the same lane in order to collect appropriated temperature data. Initial weather condition was based on weather forecasts information provided by Korea Meteorological Administration. In order to analyze pattern of the change in road surface temperature under different weather conditions, they were grouped into three types as shown in table 1. The purpose is to reflect the fact that pattern of the change in road surface temperature is directly influenced by current weather condition.

[Table 1] Grouped Weather Condition

Type	Description
A	Clear and windless
B	Slightly cloudy and windy
C	Cloudy, humid, and windy

The survey section was analyzed by route and by direction, based on statistical data on road surface and ambient temperature. Thermal mapping system was employed to collect road surface temperature whereas vehicular sensor (Vehicle Ambient Temperature Sensor) was used to obtain roadside temperature. To verify whether forecasted weather conditions through different survey dates corresponds to actual weather condition, a linear correlation analysis was done. Reliability of the collected temperature data was tested by applying a paired t-test. This can compare averages of two different populations, and is known to be suitable for analyzing significant relationship between two different sets of data measured in different methods. What has been estimated so far is that there could be discrepancy in the pattern of temperature changes on road surface temperature and temperature collected from vehicular sensor. Thus, null hypothesis was established that there is a statistical significant between the two sets of data, and alternative hypothesis was set that there is statistically no significance.

H_0: $\bar{x} \neq \bar{y}$: A pattern of temperature change in two data is not identical.

H_1: $\bar{x} = \bar{y}$: A pattern of temperature change in two data is identical.

According to the results, p-value was smaller than level of significant at 0.05. Since p-value < 0.05, the alternative hypothesis was accepted eventually that assumed ‘the pattern of temperature change in two data is identical.’ The study demonstrated that the pattern of temperature change based on data collected from Vehicle Ambient Temperature Sensor had similar features with the pattern of temperature change based on surface road temperature data collected from thermal mapping device, at a statistically significant level.