

## 1B4) **An Introduction of Perceptual Visibility Monitoring Technique and Its Adjustment Using Meteorological Parameters**

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### 1. Introduction

The atmospheric visibility refers to the clarity of the atmosphere and is observed in terms of contrast of scenic vista. The visibility, which is expressed in visual range(VR), is estimated with the reference of apparent contrast of scene and light extinction coefficients. Visibility impairment is the complex phenomenon influenced by numerous natural and artificial factors such as airborne particles, gases, humidity, temperature etc. therefore there is not a single instrument that can predict true visibility yet.

The atmospheric visibility is usually monitored by using various instruments and techniques. Horvath used telephotometer for visibility monitoring in Europe and evaluated the visibility in terms of spectral extinction coefficient. Jayaraman used both nephelometer and athelometer to evaluate the total extinction coefficient where the total extinction coefficient was the sum of scattering and absorption coefficients. Transmissometer was introduced as the most accurate instrument that has a function of total extinction coefficient. The visual range was also estimated in terms of total extinction coefficient. Human-eye observation was another visibility monitoring technique based on perceptual visibility. Similarly, recently the distant contrast measurement method was also tested to evaluate urban visibility. Although several techniques are available for visibility monitoring, those have their own limitations. In this study, we introduce the perceptual visibility monitoring technique using digital image analysis and we will also identify the significant factors impairing visibility. The result and implication will be presented in this paper.

### 2. Material and Method

A study site was selected at urban area of Seoul where CCD(Charged Coupled Device) camera, air quality monitoring system and meteorology monitoring system were installed and monitored the data continuously. In addition, visual range was monitored by human eye observation technique during the day time only. The data were monitored in one hour interval. Figure 1 shows the algorithm for visibility monitoring.

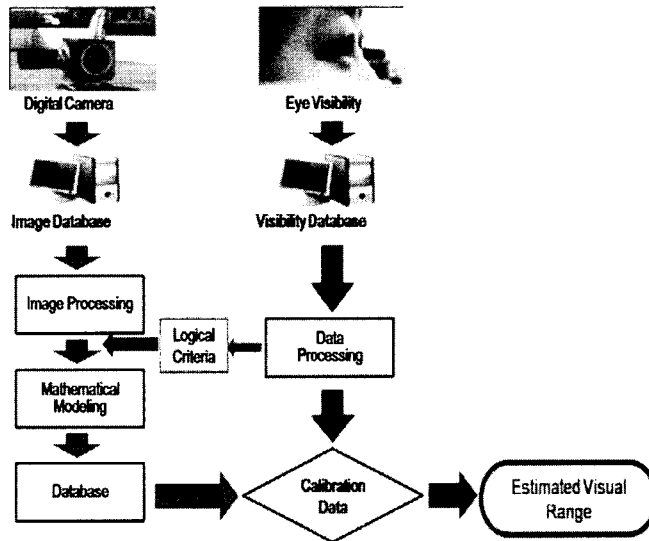


Fig. 1. Algorithm for the visibility estimation.

Digital image was filtered using the different digital image filtering techniques and the absolute luminance value was extracted from the filtered image based on the given logical criteria and mathematical modeling. The extracted luminance value was modeled with monitored visual range and found the desired algorithm for visibility monitoring. Subsequently, the computed algorithm will be adjusted using meteorological and air quality data using the multi regression and multi-variate analysis.

### 3. Results and Discussions

Image data and consequent visual range was monitored during different climatic conditions. A case study was conducted during different visibility condition where visual range varied from 6km to 30km. The contrast of the digital image dramatically decreases during hazier environmental condition than normal environmental condition.

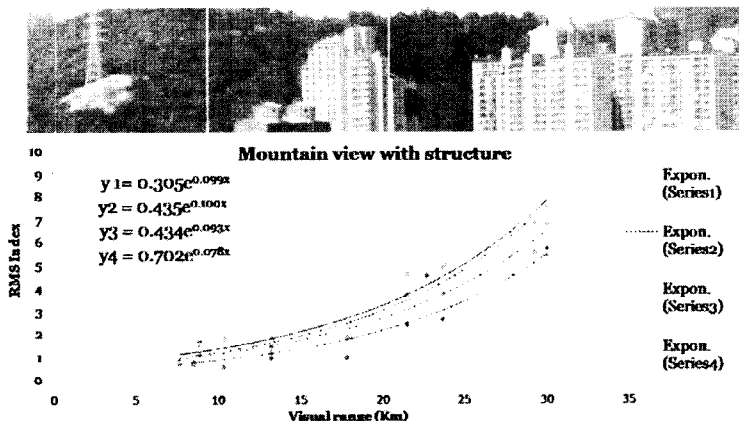


Fig. 2. Variation of RMS index during different visual range.

Sample digital image were divided in different parts by considering sky and land use pattern. The index values were different at different segments of image which can be seen in figure 2 despite the visual range was same. It indicated that the contrast of digital image vary with the types of scenic vista. Finally, the contrast adjustment will be essential for developing the visibility monitoring technique using digital image analysis which will be done based on the geological and atmospheric data. Further update will be presented later.

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