

Development of a low-cost high-resolution multi grating Spectrometer controlled by Arduino

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A low-cost and high-resolution spectrometer was developed as a substitute for the very expensive spectrometers available in the market, for the analysis of spectra in the visible region. Collimated light from standard sources were directed towards a transmission grating using a pin hole, slit and a convergent lens. To observe a wider spectral region in single acquisition, a transmission grating with 600 lines/mm was used and dispersed light was directed towards the photodiode array detector (TSL1406RS) by using a focusing lens and a rotatable mirror. Parallel to that another independent transmission grating with 1000 lines/mm was used to acquire a highly resolved spectrum. The whole spectral region that can cover by this grating was directed towards the photodiode array detector by parts using the same focusing lens and the rotatable mirror. An Arduino software program and a software interface (HRS_Graph v1.0) were designed to control all the functions of the spectrometer. The software interface is capable of representing the data which were obtained by the photodiode array detector as a graph. Standard spectral lines were used to calibrate the spectrometer and it was found that this spectrometer can be used to study the region from 352 to 663 nm with the spectral resolution about 0.6 nm. Thus, the reading error of the spectrometer is about ± 0.6 nm. Spectra of a compact fluorescent lamp were acquired by using our spectrometer and compared with standard spectral lines arise due to the elements in the lamp. Acquired spectral lines were in good agreement with their standard values. Approximately 30,000 LKR was spent on this spectrometer and a commercially available one with similar resolution is about 6,000 USD.

Key words: *spectrometer, arduino, grating, high-resolution, photodiode*

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