Spectral Smartphone: Rapid Prototyping Mobile Platform Diffraction Spectrophotometry

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Spectrophotometers are optical instruments which analyze substance samples using electromagnetic spectra. Traditional professional spectrophotometers have extensive applicability in physics, chemistry, biology, ecology, health, industry, and education; however, they are limited in situ due to cost, fragility, and bulk, excluding them from field and low-capital usage. The purpose of this research was to create and evaluate a proof-of-concept for mobile spectrophotometry, a novel approach to spectrophotometry: since mobile platforms are equipped with LED lamps and CCD-based sensors, they could offer much more field-appropriate and economical solutions. A diffraction grating-based design was created in 3D software for the Galaxy SIII platform and a physical model produced alongside distributable stereolithography files for universal production potential. A mobile application for spectrophotometry data capture and analysis was written for the testing model. The mobile spectrophotometer was tested using standardized solutions at several wavelengths against a calibrated Thermo Scientific SPECTRONIC Educator: a 2-tailed paired t-test found no significant difference between the two sets of measurements in most cases. Thus the mobile spectrophotometer verified the concept by achieving accurate results with instant data analysis and storage, and by offering a more economical and field-appropriate solution: a complete ABS model was over 15 times lighter and over 130 times less costly than the SPECTRONIC Educator (a low-end spectrophotometer). In addition to field usability, mobile solutions offer internet and GPS networks, enabling collaboration and large-scale GIS analyses. Mobile spectrophotometers thus offer considerable improvements for global education, research, and health.

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