Smartphone-Controlled Portable Phoropter Powered by Variable Focal Length Liquid Lens

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In order to determine corrective eyeglass prescription, large and expensive phoropters, devices which use precisely machined lenses to subjectively determine the prescription providing the clearest vision. Can a cheaper, portable device be designed to accurately determine the degree of spherical impairment? The hypothesis is if a voltage-controlled liquid lens is used to change the focal length used to view a screen projected to optical infinity, the final voltage of the lens that provides the clearest vision can be used to determine the correct eyeglass prescription. A liquid lens was selected for the ability to change focal length in response to applied voltage. The Arduino board was wired to the Liquid Lens Driver IC, and I programmed a C++ script that provides I2C commands to direct the applied voltage in response to wireless calls to a custom-implemented REST API. I programmed an app for the smartphone that runs the algorithm to zero in on the prescription by displaying pairs of lens powers and allowing the user to select which of the two is clearer with push-button input. The smartphone also displays a LogMAR visual acuity chart to give a point of reference for subjective clarity. An array of lenses was designed in order to project the test chart to a virtual image at optical infinity. The sample data provided the following linear regression: (Official Prescription Power in Diopters) = 0.3235 * (Final Lens Voltage) - 17.8150 with R^2 = 0.8350 The data from 26 eyes yielded a linear relationship with a relatively large R^2 value of 83.50%: relationship being accounted for by the regression strongly supports the hypothesis that the final lens voltage can be used to determine the spherical eyeglass prescription.

Awards Won:

Intel ISEF Best of Category Award of $5,000

First Award of $5,000

Indo-U.S. Science &amp

Technology Visit to India Award