Design and operation of innovative smartphone based spectrometer for medical diagnostics

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Point of care testing (POCT) is the next paradigm shift in personal healthcare [1-4]. Innovative POCT systems seek to exploit the ability of smartphones to capture, process, and transmit data for "anytime-anywhere" healthcare. Our research group is developing a wide range of POCT systems, including protocols for the detection biomarkers using functionalized cameras of smartphones. We have developed data processing algorithms to deliver test results to medical practitioners for further analysis and prognosis.

This work focuses on designing hardware for such a POCT system. We designed a spectrometer for integration with an iPhone. The spectroscope employs low cost, readily available optical components to produce a focused image of biosamples on the iPhone's camera. This device developed by our group, when combined with detection and processing techniques yields a complete system for on site detection of biomolecules. As shown in the figure, component A contains a light source, a lens and a pinhole. B contains a suitable biosensor element and a cylindrical lens in C collimates the signal. A diffraction grating present in D splits the incoming optical signal, allowing the camera to focus on the region of interest. All the components in this design can be replaced independently of each other thereby enabling the system to be used with a wide range of biosensors such as photonic crystal and magnetic sensors. In this presentation, we will describe the design considerations for producing the spectrometer and results obtained using a photonic crystal sensor.

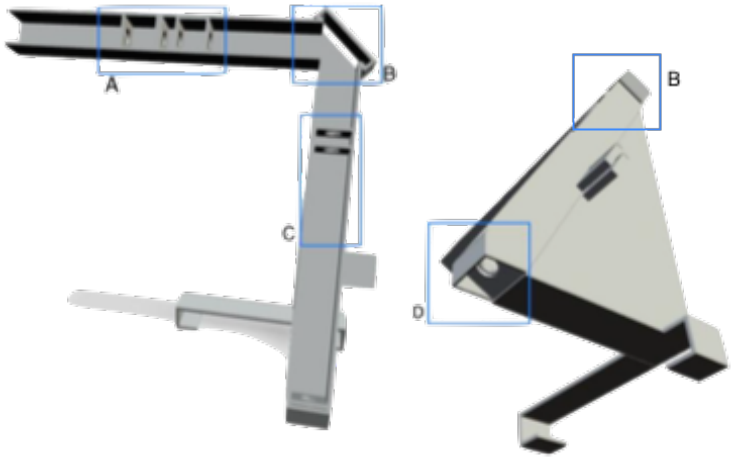

Figure. iPhone spectrometer system design (Top and bottom view)

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