Low-cost smartphone-based sensing systems

Monitoring of soil and water quality is vital for a better environmental condition. Our research work is focused on the design and development of low-cost, compact, user-friendly and field portable smartphone-based sensing systems for monitoring of different parameters of environment and agriculture. Using optical components in a custom-made 3D printed cradle, a smartphone can be converted to a handheld sensing platform using which toxic elements present in water and soil is monitored. These developed low-cost sensing systems are beneficial for resource poor regions where soil and water quality monitoring facilities are limited.

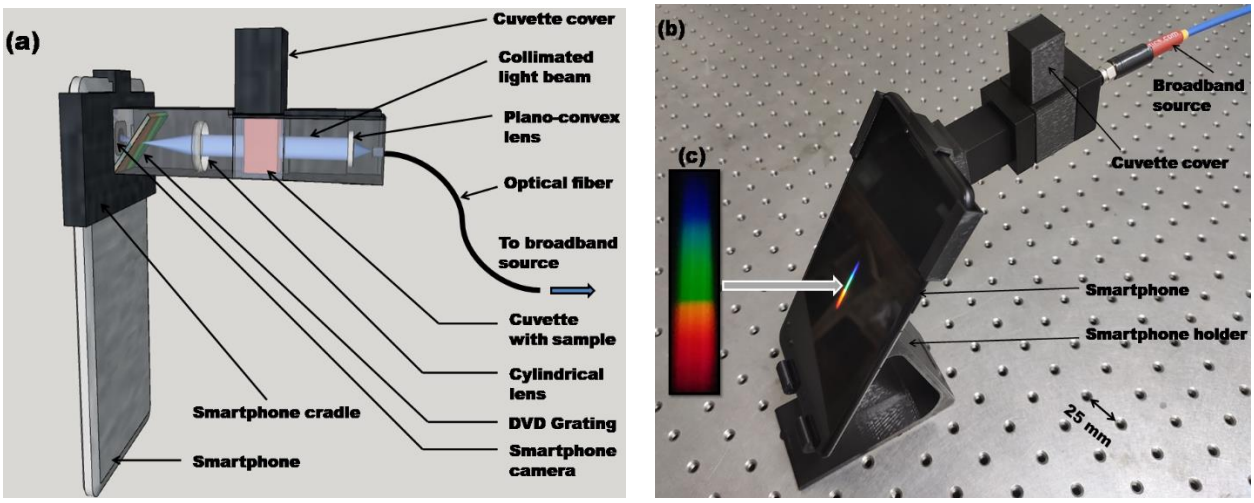
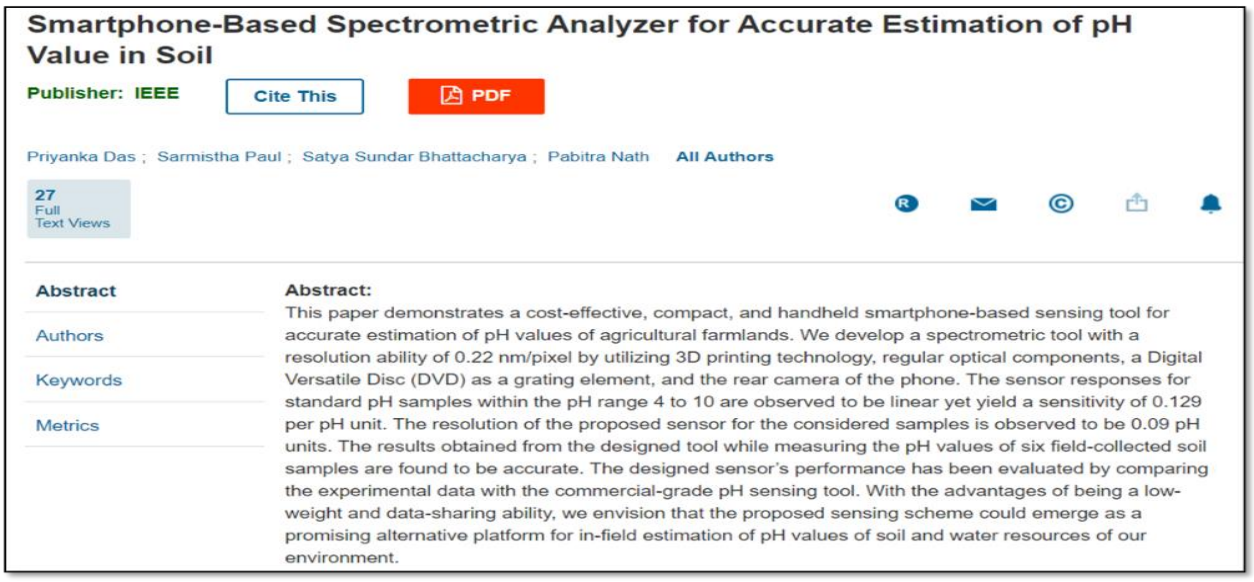


Fig. 1. (a) Schematic of the smartphone-based pH sensor, (b) photo image of the designed sensor (c) cropped image of the bare spectrum taken by the designed sensor.



Smartphone-Based Spectrometric Analyzer for Accurate Estimation of pH Value in Soil

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27 Full Text Views

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Abstract:
This paper demonstrates a cost-effective, compact, and handheld smartphone-based sensing tool for accurate estimation of pH values of agricultural farmlands. We develop a spectrometric tool with a resolution ability of 0.22 nm/pixel by utilizing 3D printing technology, regular optical components, a Digital Versatile Disc (DVD) as a grating element, and the rear camera of the phone. The sensor responses for standard pH samples within the pH range 4 to 10 are observed to be linear yet yield a sensitivity of 0.129 per pH unit. The resolution of the proposed sensor for the considered samples is observed to be 0.09 pH units. The results obtained from the designed tool while measuring the pH values of six field-collected soil samples are found to be accurate. The designed sensor's performance has been evaluated by comparing the experimental data with the commercial-grade pH sensing tool. With the advantages of being a low-weight and data-sharing ability, we envision that the proposed sensing scheme could emerge as a promising alternative platform for in-field estimation of pH values of soil and water resources of our environment.

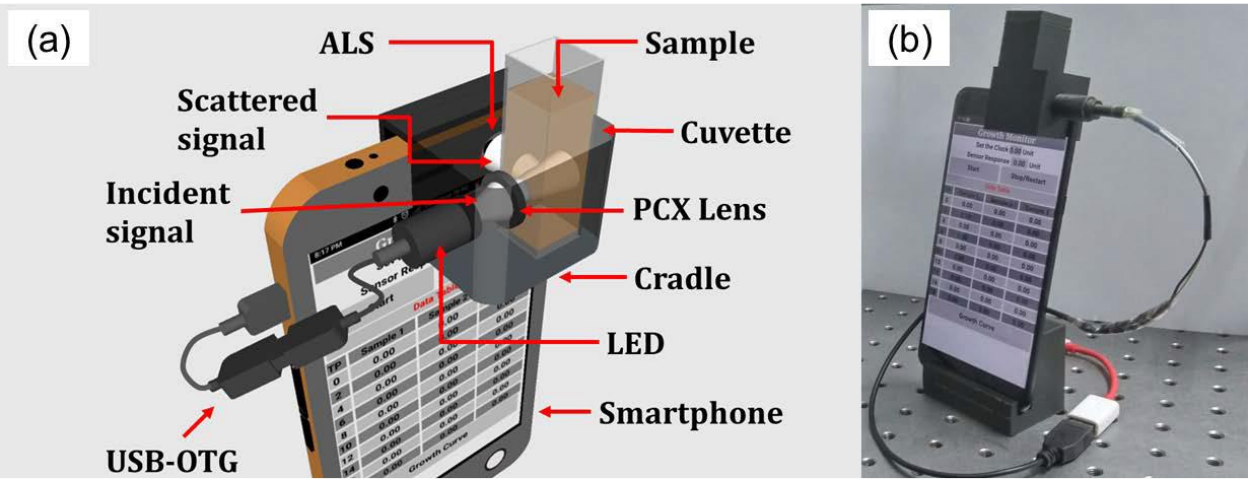

Figure 1 (a): Schematic of the designed smartphone-based turbidimetric sensor for analysis of growth kinetics of bacteria and (b) shows the photo-image of the 3D printed setup attached to the phone.

FULL ARTICLE

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Turbidimetric analysis of growth kinetics of bacteria in the laboratory environment using smartphone

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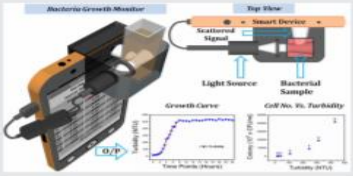
Abstract



For different microbiological and pathological studies, it is often required to monitor the growth of bacteria in a cultured medium in the laboratory environment. UV-VIS spectrophotometer is commonly used to estimate the growth of bacterial cell population by measuring the absorbance at 600 nm over a period of time. Colony-forming unit (CFU) is another approach, which has been routinely performed to estimate the live bacterial cells on semisolid agar plates. Herein, we demonstrate an alternative yet highly reliable sensing platform on a smartphone using which growth kinetics of different bacteria can be reliably monitored. The performance of the proposed smartphone sensor has been compared with the data obtained from OD600 and CFU analysis. A good correlation of bacterial growth rates enumerated based on the proposed smartphone sensor, bench-top spectrophotometer and CFU analysis have been observed under the experimental conditions.