New App Provides Pocket Medical Diagnosis

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A new app which turns any smartphone into a portable medical diagnostic device could help in the fight against diseases including HIV, tuberculosis and malaria in the developing world.

A recently-developed mobile phone application could make monitoring conditions such as diabetes, kidney disease, and urinary tract infections much clearer and easier for both patients and doctors, and could eventually be used to slow or limit the spread of pandemics in the developing world.

The app, developed by researchers at the University of Cambridge, accurately measures colour-based, or colorimetric, tests for use in home, clinical or remote settings, and enables the transmission of medical data from patients directly to health professionals.

Decentralisation of healthcare through low-cost and highly portable point-of-care diagnostics has the potential to revolutionise current limitations in patient screening. However, diagnosis can be hindered by inadequate infrastructure and shortages in skilled healthcare workers, particularly in the developing world. Overcoming such challenges by developing accessible diagnostics could reduce the burden of disease on health care workers.

Due to their portability, compact size and ease of use, colorimetric tests are widely used for medical monitoring, drug testing and environmental analysis in a range of different settings throughout the world. The tests, typically in the form of small strips, work by producing colour change in a solution: the intensity of the colour which is produced determines the concentration of that solution.

Especially when used in a home or remote setting however, these tests can be difficult to read accurately. False readings are very common, which can result in erroneous diagnosis or treatment. Specialised laboratory equipment such as spectrophotometers or test-specific readers can be used to automate the readouts with high sensitivity, however these are costly and bulky.

The new app, Colorimetrix, makes accurate reading of colorimetric tests much easier, using nothing more than a mobile phone. The app uses the phone's camera and an algorithm to convert data from colorimetric tests into a numerical concentration value on the phone's screen within a few seconds.

After testing urine, saliva or other bodily fluid with a colorimetric test, the user simply takes a picture of the test with their phone's camera. The app analyses the colours of the test, compares them with a pre-recorded calibration, and displays a numerical result on the phone's screen. The result can then be stored, sent to a healthcare professional, or directly analysed by the phone for diagnosis.

The app can be used in home, clinical, or resource-limited settings, and is available for both Android and iOS operating systems. It has been shown to accurately report glucose, protein and pH concentrations from commercially-available urine test strips without requiring any external hardware, the first time that a mobile phone app has been used in this way in a laboratory setting. Details [1] were recently published in the journal Sensors and Actuators B: Chemical.

Beyond laboratory applications, the app could also be used by patients to monitor chronic conditions such as diabetes, or as a public health tool, by enabling the transmission of medical data to health professionals in real time.

"This app has the potential to help in the fight against HIV, tuberculosis and malaria in the developing world, bringing the concept of mobile healthcare to reality," said Ali Yetisen, a PhD student in the Department of Chemical Engineering & Biotechnology, who led the research. "By quickly getting medical data from the field to doctors or centralised laboratories, it may help slow or limit the spread of pandemics."

In addition to medical applications, the researchers are planning to publicly release the app so that it can be used for other colorimetric tests such as laboratory kits, veterinary diagnostics and environmental screening tools.

"This app can substitute for laboratory equipment, saving money to clinics and research institutions," said Dr Leo Martinez, who developed the app.

The team is planning to use the app for clinical testing of kidney function and infections in clinical testing at Addenbrooke's Hospital.

For more information, visit www.cam.ac.uk [2].

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