MOBILE BIOMARKER DETECTION

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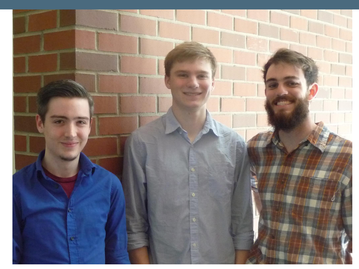

ABSTRACT

Develop an iPhone application to record biological indicator slide reactions as they occur, and present to the user the indicator results. The entire testing process, including calibration, will be run on the phone, and will be hands off except for a few inputs to indicate which test is being run. Success is measured by the application's ability to accurately measure the results of calibration slides provided by the NIST.

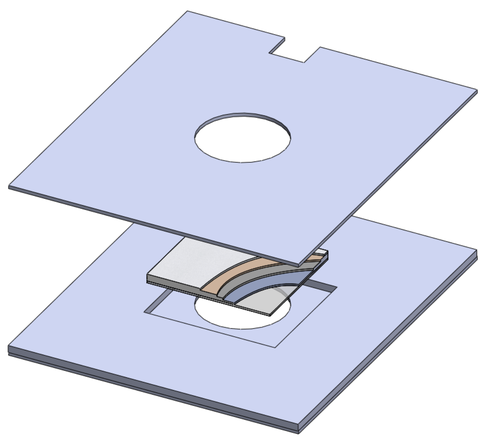

Figure 1. An example of how a multi-layer slide is constructed.

1. CHEMISTRY

Biomarker concentration is measured using chemical assays (procedures for quantitative analyses). The assays use reactive slides which change color at a certain rate, or to a certain intensity, dependent on the concentration of the marker in a sample placed on the slide.

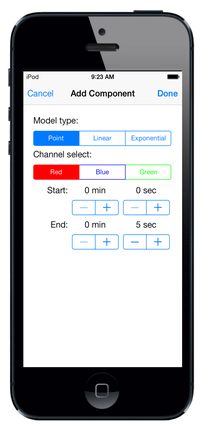

Figure 2. A screenshot of the calibration screen.

2. ANALYSIS

Analysis of the assays is done through an iOS app which guides the user through a step by step process of creating a mathematical model, conducting image analysis on developing slides, evaluating unknown samples, and displaying results. Challenges include automatically detecting the circular test area from which to pull color data and creating a multiple layer regression model to evaluate the samples.

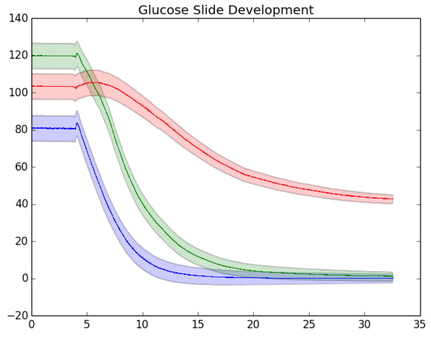

Figure 3. A plot of the detected RGB channels during a reaction.

3. RESULTS

Results of test runs are stored in a database on the phone, which can be backed up to iTunes. Users can add metadata to the results, such as a patient identifiers, a description of the sample which was tested, and any other notes. Batches of results can be exported via an archive file, or shared via email. For example, a lab technician could run a number of tests, and easily email the results to the correct physicians, or a home user could grab a two month history of his/her cholesterol levels to take to a doctor's appointment.

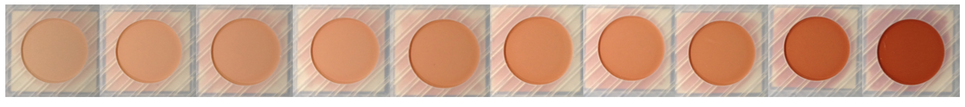

Figure 4. A sequence of developed slides of increasing glucose concentration from left to right.

USES

- Test blood samples (e.g. glucose level)
- Food pathogen testing
- Test for counterfeit medication (e.g. malaria medication)

IMPORTANCE

- Allows lab scientists to quickly and easily run color-based tests without large expensive equipment
- Allows field tests to be run where scientific infrastructure is not available
- In the future, will allow patients to self-run tests at home and share results with their doctors

IMPLEMENTATION

- App developed for iOS with Apple XCode
- Computer vision and matrix operations use OpenCV, Boost, and C++

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