The VOCkit: An Inexpensive Portable Chemical Identifier

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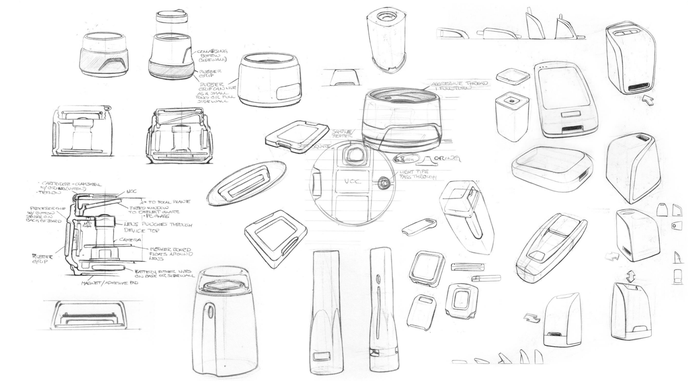
Device Concept

The VOCkit system is one possible application of the Colorimetric Sensor Array (CSA) research that ECBC is conducting in collaboration with iSense. The system has three main capabilities: sample containment, image capture, and sample identification. CSA 'VOC tickets' are printed with an array of colorimetric indicators which change color as they are exposed to chemicals. The combination of color changes that a compound creates is its "fingerprint". The VOCkit disposable cartridge stores the sample and exposes it to the ticket while the reusable base captures time-lapse images of the color changes. The sample identification is done on a smartphone app which calculates color changes and matches them to a library of known compounds.



Design Requirements

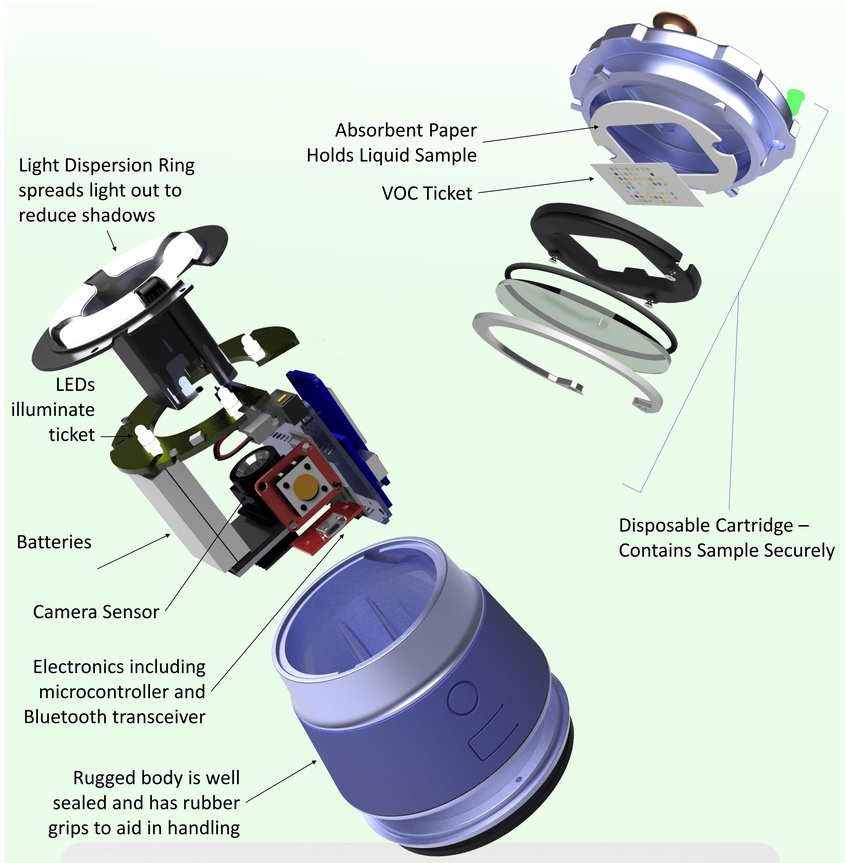
The VOCkit device is designed to control timing, lighting, and exposure to capture reproducible images of CSAs before and after chemical exposure – while using COTS components in order to reduce cost and keep an aggressive schedule.

In addition to sample containment and identification, there are additional drivers of the current VOCkit device's design. The VOCkit is intended to be used in rugged environments. This requires the device to be durable and usable when in appropriate level of MOPP gear. Also, since the underlying technology (the VOC tickets) are inexpensive, keeping the device cost low would enable this technology to be available to individual Warfighters. In order to reduce individual device cost, a smartphone was chosen as the image processing system.

This decision leverages existing computing resources, permits multiple VOCkit devices to work with one smartphone, increasing throughput, as well as keeping potentially sensitive information on a system with secure storage and communications. Our target is to deploy the VOCkit app on the Nett Warrior smartphone, a project which aims to provide secured smartphones (and a supporting network) to warfighters.

Approved for Public Release

Current Design

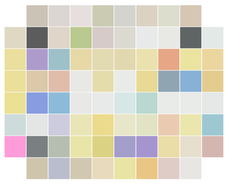


Mobile App Development

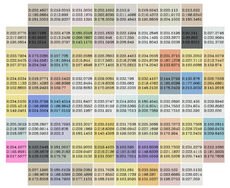
Image analysis is performed on an Android smartphone using the ScentSay application. In order to do compound identification, the application must first normalize the image, locate the spots and determine the colors. The software must then subtract the values of the ticket's colors before and after exposure.

These values are the "fingerprint" of the compound. These steps are shown below for one image. Once the difference in color values is determined, the software matches these to a library of known compounds.

Spot Locating



Color Determination



Colors with Values

Future Plans

Team plans to:

- Further test current system and evaluate performance
- Evaluate multiple image sensors and their effects on compound identification
- Continue software and hardware evolution and improve user interfaces

TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.