

The smartCAR: A Nett Warrior Enabled Colorimetric Assay Reader

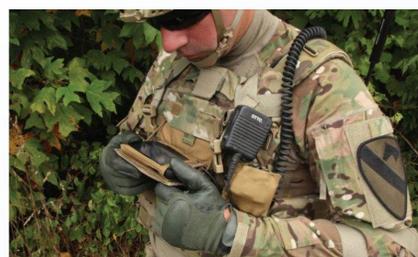
C. Graham, P. Buckley, S. Katoski, J. Huen, C. Nzelibe, B. Ruprecht, G. Thompson, J. Warwick, H. Wylie
Edgewood Chemical Biological Center, Aberdeen Proving Ground, MD

Concept

The smartCAR device is a Nett Warrior (NW) connected device that was developed by the Edgewood Chemical Biological Center (ECBC) in conjunction with the Communications Electronics Research Development Engineering Center (CERDEC) for the US Army Telemedicine and Advanced Technology Research Center (TATRC), an office of the US Army Medical Research and Materiel Command (USAMRMC).

The purpose of the device is to read and transmit results of medical or environmental conditions to care providers and other applicable parties on the military network. This is done through the Nett Warrior smartphone which sends medical results to the Medical Communications for Combat Casualty Care (MC4) database.

The device reads Lateral Flow Immunoassays (LFI), like the Critical Reagent Program (CRP) assays as well as commercial off-the-shelf (COTS) assays. Use of the smartCAR enhances the usability of handheld assays by medics in the field by providing a consistent and reliable reader that operates easily while in a moving vehicle or under low light conditions.



Nett Warrior Phone In Use



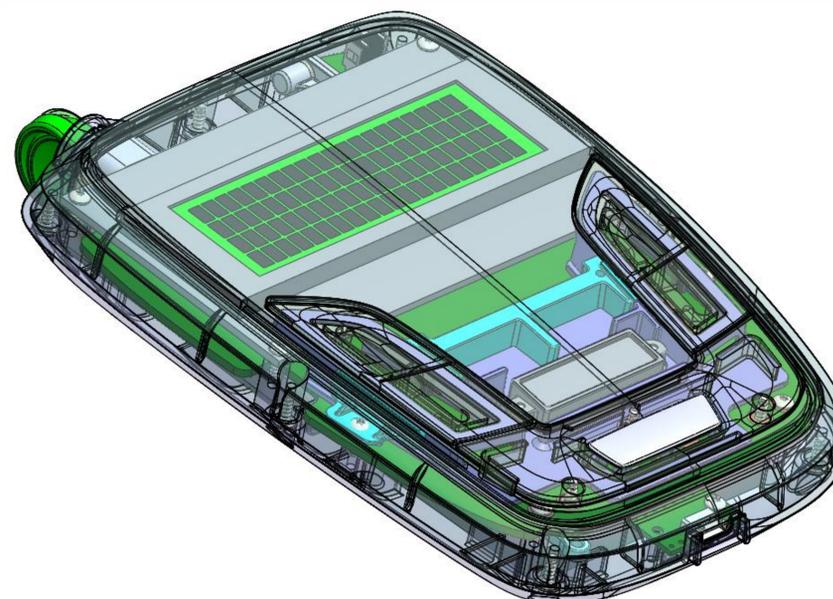
Design

The smartCAR design included three major components:

Enclosure: The enclosure was designed with medics in mind. It has an easy to read screen, large tactile buttons, rubber outer case, and will fit in the arm pocket of an Army medic's uniform. The enclosure was initially prototyped using additive manufacturing, which is a fast and effective tool for prototyping form, fit, and function. The final units delivered to TATRC, were made using polyurethane vacuum cast, leveraging the 3d parts to construct the molds. The polyurethane parts provided a more durable, better feeling product which can be cost-effectively reproduced.

Electronics: The electronics of the smartCAR include an NXP LPC1768 microcontroller, serial camera, Bluetooth module, OLED display, and ancillary functional items selected based on size, performance, and cost.

Software: The software portion of the smartCAR handles the interaction of the device with the user and the NW. The software allows user commands via the buttons on the case, displays pertinent information and instructions, operates the camera and conducts image analysis, and interfaces with the NW application for incoming requests and outgoing test results.



Realization

The smartCAR was delivered to TATRC in May of 2014. Since then it has been demonstrated and evaluated in a variety of locations including Fort Dix, Fort Detrick, and South Korea. In FY15, ECBC provided enhancements to the original design by adding a more universal assay tunnel supporting the CRP style cartridges, as well as added the C-Diff, Strep, and Ebola test strips to the list of capabilities.



The Device is capable of reading the following test strips:

- Influenza A & B
- Giardia and Cryptosporidium
- Streptococcus
- Clostridium-Difficile (C-Diff)
- Ricin (CRP Assay)
- Ebola (CRP Assay)