Enhancing the Outcomes of Epidemiological Surveillance in Liberia through Automated Tracking of Blood Samples

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Major Goals of the Project:
Our research is aimed at developing a medical cyber-physical system (CPS) and its operational procedures to respond to current and future Ebola (or other infectious disease) outbreaks. Our overarching goal is to enhance the safety of Ebola workers by minimizing their contact with the virus by systematically augmenting CPS technologies in treatment clinics. To achieve this goal we are working to design, develop, and validate a human-in-the-loop medical cyber-physical system for monitoring patients, insuring compliance with relevant safety protocols, and collecting data for advancing research on infectious disease control with the use of technologies. We are developing and integrating a system composed of a connected sensor network and a mobile robot platform for telemedicine by leveraging recent advances in the medical CPS research and our existing research work on smart environments for independent living, and human-in-the-loop robotics.

This RAS-SIGHT project had a specific goal within the research program outlined above. The project's goal was transferring epidemiological data from remote point-of-care sample collection facilities to testing facilities. The current system is inadequate, inefficient and prone to error. To overcome the difficulties associated with the process of tracking blood samples, we have leveraged existing NFC technology to create a low-cost system in which epidemiological data is coded directly to sample vials. Additionally, since the vials are machine readable, we have automated the data entry step. Finally, we have prototyped a device which uses GPS and cellular technology to facilitate remote tracking of the samples while they are in transit from the point-of-care facility to the testing facility.

The RAS-SIGHT funding enabled our team to perform final validation tests of the system in collaboration with the Academic Consortium Combating Ebola in Liberia (ACCEL), which includes doctors, technicians, and staff from the University of Massachusetts Medical School, Boston Children's Hospital, and the Liberian Post Graduate Medical Council. We performed usability studies and performed user studies to validate the accuracy of the developed system. Overall, we were able to validate an accuracy of more than 95% in tracking blood samples, a drastic improvement over current estimates around 70-80%.

The results of the project was presented and IEEE RAS-SIGHT funding has been acknowledged in the 2016 IEEE Wireless Health, held in the National Institutes of Health campus in October, 2016.