

# Lab-in-a-box takes aim at doctors' computer activity

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The Lab-in-a-Box complete data collection infrastructure can be easily transported on site and set up in minutes, including sensing and recording components that need to be set up for data collection. Highlighted in red is the Microsoft Kinect sensor; in green, the SMI eye tracker; in yellow, the cables connecting to the Epiphan frame grabber and to the physician's workstation; and in blue, the main power outlet to power up the Lab-in-a-Box. Credit: UC San Diego/VA

They call it "the Lab-in-a-Box." According to Nadir Weibel, a research scientist in the Computer Science and Engineering (CSE) department at the University of California, San Diego, inside the box are assorted sensors and software designed to monitor a doctor's office, particularly during consultations with patients. The goal is to analyze the physician's behavior and better understand the dynamics of the interactions of the doctor with the electronic medical records and the patients in front of

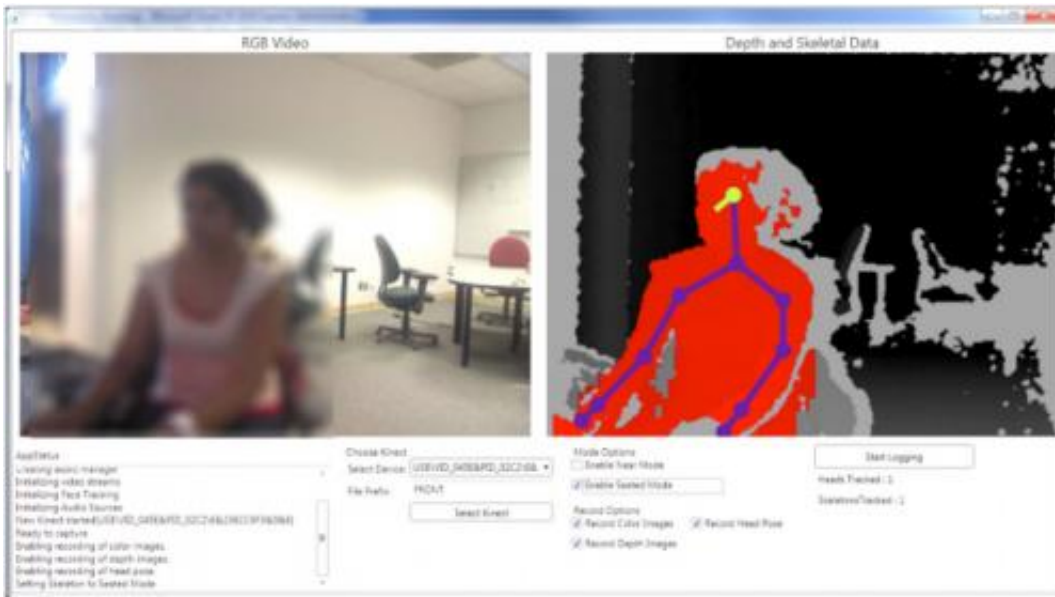
them. The eventual goal is to provide useful input on how to run the medical practice more efficiently.

Very often physicians pay attention to information on a computer screen, rather than looking directly at the patient. "With the heavy demand that current [medical records](#) put on the physician, doctors look at the screen instead of looking at their patients," says Weibel. "Important clues such as facial expression, and direct eye-contact between patient and physician are therefore lost."

The first findings from the project are just-published in the February 2015 edition of the journal, *Personal and Ubiquitous Computing*. The Lab-in-a-Box solution could capture multimodal activity in many real-world settings, but the researchers focused initially on medical offices and the problem of the increasing burden on physician introduced by digital patient records.

The Lab-in-a-Box has been developed as part of Quantifying Electronic Medical Record Usability to Improve Clinical Workflow (QUICK), a running study funded by the Agency for Healthcare Research and Quality (AHRQ) and directed by Zia Agha, MD. The system is currently being deployed at the UC San Diego Medical Center, and the San Diego Veterans Affairs (VA) Medical Center.

The compact suitcase contains a set of tools to record activity in the office. A depth camera from a Microsoft Kinect device records body and head movements. An eye tracker follows where the doctor is looking. A special 360-degree microphone records audio in the room. The Lab-in-a-Box is also linked to the doctor's computer, so it can keep track of keyboard strokes, movements of the mouse, and pop-up menus that may divert the doctor's attention.



ChronoSense recording tool shows, at left, the (blurred) RGB image as recorded from the Microsoft Kinect. On the right, the depth image with overlaid joint and gaze estimation based on yaw, roll and pitch. Once the Start Logging button is pressed, the recording process starts and the data are streamed to a folder on the computer. After collection is complete, the data can be reviewed, visualized and analyzed using the companion ChronoViz visualization application. Credit: UC San Diego/VA

The greatest value of the Lab-in-a-Box, however, is in the software designed to merge, synchronize and segment data streams from the various sensors - assessing the extent to which a certain confluence of activity may lead to distraction on the part of the physician. For example, says Weibel, lots of head and eye movement would suggest that the doctor is multitasking between the computer and the patient.

Weibel and the UC San Diego/VA team will compare data from different settings and different types of [medical practice](#) to pinpoint those factors that lead to distraction across the board, or that affect only specific medical specialties. Their findings could help software

developers write less-disruptive medical software. The researchers envision also deploying the Lab-in-a-Box permanently in a doctor's office to provide real-time prompts to warn the [physician](#) that he or she is not paying enough attention to a patient. "In order to intervene effectively, we need to first understand the complex system composed by patients, doctors, and electronic medical record in depth, and this is what our study will finally yield." says Weibel. Ultimately, as Weibel and his co-authors state in their original *Personal and Ubiquitous Computing* article, the Lab-in-a-Box "has the potential to uncover important insights and inform the next generation of Health IT systems."

**More information:** \*Lab-in-a-Box: Semi-Automatic Tracking of Activity in the Medical Office, Nadir Weibel, Steven Rick, Colleen Emmenegger, Shazia Ashfaq, Alan Calvitti, Zia Agha, *Personal and Ubiquitous Computing*, pp. 317-334, Vol. 19, Issue 2, February 2015. [link.springer.com/article/10.1007/s00779-014-0821-0](http://link.springer.com/article/10.1007/s00779-014-0821-0)

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