Evaluating an RFID-based Authentication System for Health Care Settings
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Summary:
Automated identification technologies based on radio frequency identification (RFID) have received increasing attention in health care because of their potential on improving clinical efficiency and patient safety. Examples of functions that RFID applications support include identifying patients, managing personnel, monitoring drug and blood products, and tracking inventory and assets. More recently, a new application of RFID has been developed for authentication providing care givers speedy access to their workplace computer/network, thus improving efficiency and security. However, few studies have evaluated RFID-based authentication systems. The goal of this paper is to assess the effects of a newly installed authentication system, Sentillion Tap and Go\textsuperscript{TM}, through pre- and post-implementation user evaluation surveys.

During a pilot implementation, 200 Tap and Go\textsuperscript{TM} card readers and supporting software were installed in three inpatient care units in a children's hospital in the Midwest. Two hundred and fifty users' badges were activated. Tap and Go\textsuperscript{TM} consists of a USB proximity badge card reader that allows users to authenticate to a Kiosk or Clinical mode computer by “tapping” their ID badge on the reader. At the beginning of a shift, the user needs to initially tap their badge on the reader, and then enter their user name and password. For the next four hours, they may log into any reader-equipped computer with a single tap. At the conclusion of the four-hour period, they will be prompted to enter their password again to begin an additional four-hour period. While logged in, a second tap locks the screen. If somebody else attempts to login, they will be prompted to log the former user off. On any computer configured with a Tap and Go\textsuperscript{TM} reader, standard manual login is always available.

On-line surveys were administered three months before and four months after the card readers were installed for the pilot implementation. All users, whose badge was activated during the pilot, were invited to participate. Both surveys included questions about respondent’s clinical role, perceived speed of workstation authentication, perceived satisfaction, and login/password sharing.

Data from 71 respondents for pre-implementation survey and 33 for post-implementation survey were included in the analysis. The role of the participants included clerical staff (14.4%), medical assistant (10.6%), registered nurse (37.5%), attending physician (17.3%), resident (8.7%), and others (11.5%).

Results showed that the perceived speed of login with Tap and Go\textsuperscript{TM} was significantly faster (Mean= 4.58, SD=1.87, on a 1-7 scale, 7 was ‘very fast’) than standard manual login (Mean=2.90, SD=1.50), t(102)=-4.881, p<0.001. The user satisfaction of workstation authentication was also found to be significantly higher with Tap and Go\textsuperscript{TM} (M=5.30, SD=1.48, on a 1-7 scale, 7 was ‘very pleased’) than with standard login (M=3.87, SD=1.63), t(102)=-4.294, p<0.001. While the number of logins/shift did not differ between pre- (M=22.75, SD=14.46) and post-implementation (M=19.24, SD=10.61), a negative correlation was found between perceived speed and the number of logins/shift (r=-0.315, p=0.001), i.e. people who log in more often perceive the system to be slower. Those who reported higher number of logins include medical assistants, nurses, attending physicians, and residents.

Erroneous logins and password sharing while using Tap and Go\textsuperscript{TM} were considerably reduced. Fewer users (2 out of 33 vs. 24 out of 71) had used computers under another person’s login (Chi square= 9.247, p=0.002), or reported that other users had used computers under their login (2 out of 33, vs. 22 out of 71; Chi square=7.885, p=0.005).

User satisfaction, in general, is associated with participants’ clinical role, perceived speed, and erroneous logins. User satisfaction differs among roles, F(5,98)=2.677, p=0.026. The highest satisfaction was found among medical assistants (M=4.82, SD=1.72), while the lowest was found among nurses (M=2.79, SD=1.70), p= 0.011. Further, user satisfaction is positively correlated with perceived speed (r=0.661, p<0.001). Erroneous logins may have also played a role in user satisfaction. The group that used computer under others’ login reported lower satisfaction (Mean=2.19) than those who never encountered this problem (Mean= 3.85), t (102) = -4.406, p<0.001. Similarly, the group whose login was used by other people had lower satisfaction (Mean=2.33) than users who never experienced this error (Mean=3.76), t=-2.58,
Participants expected the removal of Tap and Go™ to have a negative impact on their workflow (Mean= -0.32, SD=0.653, on a -1~1 scale, -1 was ‘negative impact’, 0 was ‘no impact’, 1 was ‘positive impact’). They believed the positive impact of Tap and Go™ was ‘making login and charting easier and faster.’ Nevertheless, several issues were also reported: (1) The system did not work consistently; (2) Users still needed to log in to clinical applications separately and manually; (3) The system was not available on all workstations.

In summary, the Tap and Go™ system has considerable potential on improving the efficiency and user satisfaction of authentication in health care settings. Improvements of the current system in terms of both scale and functionality are desired by end users. The findings of this research have implications on the future design of advanced authentication systems and other health information systems.

**Significance & Takeaway:**
Automated identification technologies based on radio frequency identification (RFID) have received increasing attention in health care because of their potential on improving clinical efficiency and patient safety. Recently, a new application of RFID has been developed for authentication providing care givers speedy access to their workplace computer/network, thus improving efficiency and security. However, few studies have evaluated RFID-based authentication systems. This paper fills the gap in the evaluation of RFID applications for workstation authentication by assessing the effects of a newly installed authentication system, Sentillion Tap and Go™.

Results of pre- and post-implementation surveys showed the potential of Tap and Go Advanced Authentication System in improving efficiency in authentication. Login with Tap and Go™ was perceived to be significantly faster and more pleasant than standard manual login. Erroneous login and password sharing were also reduced significantly. Users expected there to be a negative impact if Tap and Go™ were removed. Meanwhile, problems remain in authentication using Tap and Go™. For example, users expected Tap and Go™ to work more consistently and to be available on all computers and for more applications. The affecting factors of user satisfaction were analyzed and found to be the clinical role of the user, perceived speed, and erroneous logins.

**Advancing the Cause Justification:**
This study evaluated an RFID-based authentication system using pre- and post-implementation surveys. The effects of the new system on perceived speed, user satisfaction, and erroneous logins/password sharing were analyzed. Results showed remarkable positive impact of the new system, as well as the affecting factors of user satisfaction (causes for low satisfaction). More importantly, future direction of designing and implementing advanced authentication systems were investigated. In addition to the survey results, an interview with IT staff was conducted. They reported that operational issues were encountered in the pilot implementation. Had the system been up and running smoothly throughout three locations on time, with more comprehensive user training, and additional IT support, the improvement in perceived efficiency and satisfaction could have been larger. These findings have implications on the role of human factors in the design of, and the training and communication in future development and implementation of authentication systems and other IT systems in health care settings.

**Presenter Bio:**
Huiyang Li is a PhD candidate in Industrial Engineering in University of Michigan. She obtained BS in Electrical Engineering from Peking University and MS in Applied Psychology from Chinese Academy of Sciences. Her areas of interest include dynamic function allocation, attention management, and multi-modal interface design in complex systems.