

Reauthentication Concepts for Biometric Authentication Systems on Mobile Devices

Sarah Delgado
LMU Munich

ABSTRACT Authentication on today's smartphones usually implies an explicit authentication at the beginning of each usage session. This causes an authentication overhead, as sensitive data are accessed on only a small number of these sessions. Even though biometric methods, such as fingerprint or face recognition, increased the convenience of this one-time authentication these overhead still exists. This led to a wide range of research on alternative methods such as context-aware and app- and time-based restriction systems. Although these methods decrease the number of explicit authentications, they do not include further security barriers and, therefore, do not increase the security significantly. Implicit authentication, on the other hand, has the potential to do both by continuously verifying the user's identity through their behavior. However, this method might cause mid-task reauthentication interrupts, when the device confidence level (DCL) is too low. This raises new usability concerns, which are addressed in the present thesis, by (a) showing the recent state of the DCL at any time, (b) announcing an imminent interruption and (c) enabling the user to reauthenticate voluntarily at any time. In this context, we developed a prototype application – the Authenticator – and subsequently evaluated it during a 4-week-long field study ($n = 11$). A positive effect on the user's annoyance and an increased number of voluntary reauthentication, which were perceived as not annoying, could be proved. Thus, a high motivation to reauthenticate voluntarily might be a key feature for improving the usability of implicit authentication.

CITATION Sarah Delgado. Reauthentication Concepts for Biometric Authentication Systems on Mobile Devices. Bachelor Thesis, LMU Munich. 2018.

Literature Cited

- Agarwal, L., H. Khan, and U. Hengartner, June 2016 Ask me again but don't annoy me: Evaluating re-authentication strategies for smartphones. In *Twelfth Symposium on Usable Privacy and Security (SOUPS 2016)*, pp. 221–236, Denver, CO, USA, USENIX Association.
- Aviv, A. J., K. L. Gibson, E. Mossop, M. Blaze, and J. M. Smith, 2010 Smudge attacks on smartphone touch screens. *Woot* 10: 1–7.
- Buriro, A., B. Crispo, F. Del Frari, and K. Wrona, September 2015 Touchstroke: Smartphone user authentication based on touch-typing biometrics. In *New Trends in Image Analysis and Processing – ICIAP 2015 Workshops*, pp. 27–34, Genoa, Italy, Springer International Publishing.
- Buschek, D., A. De Luca, and F. Alt, April 2015 Improving accuracy, applicability and usability of keystroke biometrics on mobile touchscreen devices. In *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems, CHI '15*, pp. 1393–1402, Seoul, Republic of Korea, ACM.
- Buschek, D., F. Hartmann, E. von Zezschwitz, A. De Luca, and F. Alt, May 2016 Snapapp: Reducing authentication overhead with a time-constrained fast unlock option. In *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems, CHI '16*, pp. 3736–3747, San Jose, CA, USA, ACM.
- Clarke, N., S. Karatzouni, and S. Furnell, May 2009 Flexible and transparent user authentication for mobile devices. In *Emerging Challenges for Security, Privacy and Trust, SEC 2009*, pp. 1–12, Pafos, Cyprus, Springer Berlin Heidelberg.
- Crawford, H. and K. Renaud, 2014 Understanding user perceptions of transparent authentication on a mobile device. *Journal of Trust Management* 1: 7.
- De Luca, A., A. Hang, F. Brudy, C. Lindner, and H. Hussmann, May 2012 Touch me once and i know it's you!: Implicit authentication based on touch screen patterns. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, CHI '12*, pp. 987–996, Austin, Texas, USA, ACM.

- Derawi, M. O., C. Nickel, P. Bours, and C. Busch, October 2010 Unobtrusive user-authentication on mobile phones using biometric gait recognition. In *Proceedings of the 2010 Sixth International Conference on Intelligent Information Hiding and Multimedia Signal Processing, IHH-MSP '10*, pp. 306–311, Washington, DC, USA, IEEE Computer Society.
- Egelman, S., S. Jain, R. S. Portnoff, K. Liao, S. Consolvo, et al., November 2014 Are you ready to lock? In *Proceedings of the 2014 ACM SIGSAC Conference on Computer and Communications Security, CCS '14*, pp. 750–761, Scottsdale, Arizona, USA, ACM.
- Feng, T., Z. Liu, K. Kwon, W. Shi, B. Carbunar, et al., November 2012 Continuous mobile authentication using touchscreen gestures. In *2012 IEEE Conference on Technologies for Homeland Security (HST)*, pp. 451–456, Waltham, MA, USA, IEEE.
- Ferreira, D., J. Goncalves, V. Kostakos, L. Barkhuus, and A. K. Dey, September 2014 Contextual experience sampling of mobile application micro-usage. In *Proceedings of the 16th International Conference on Human-computer Interaction with Mobile Devices & Services, MobileHCI '14*, pp. 91–100, Toronto, Canada, ACM.
- Frank, M., R. Biedert, E. Ma, I. Martinovic, and D. Song, 2013 Touchalytics: On the applicability of touchscreen input as a behavioral biometric for continuous authentication. *IEEE Transactions on Information Forensics and Security* 8: 136–148.
- Griesbeck, A., 2017 *Mobile App-based Authentication Mechanisms in the Wild*. Bachelor's thesis, Ludwig Maximilians Universität München.
- Harbach, M., E. von Zezschwitz, A. Fichtner, A. D. Luca, and M. Smith, July 2014 It's a hard lock life: A field study of smartphone (un)locking behavior and risk perception. In *10th Symposium On Usable Privacy and Security (SOUPS 2014)*, pp. 213–230, Menlo Park, CA, USA, USENIX Association.
- Hayashi, E., S. Das, S. Amini, J. Hong, and I. Oakley, July 2013 Casa: Context-aware scalable authentication. In *Proceedings of the Ninth Symposium on Usable Privacy and Security, SOUPS '13*, pp. 3:1–3:10, Newcastle, United Kingdom, ACM.
- Hayashi, E., O. Riva, K. Strauss, A. J. B. Brush, and S. Schechter, July 2012 Goldilocks and the two mobile devices: Going beyond all-or-nothing access to a device's applications. In *Proceedings of the Eighth Symposium on Usable Privacy and Security, SOUPS '12*, pp. 2:1–2:11, Washington D.C., USA, ACM.
- Holien, K., 2008 *Gait recognition under non-standard circumstances*. Master's thesis, Gjøvik University College.
- Khan, H., A. Atwater, and U. Hengartner, September 2014 Itus: An implicit authentication framework for android. In *Proceedings of the 20th Annual International Conference on Mobile Computing and Networking*, pp. 507–518, Maui, Hawaii, USA, ACM.
- Khan, H., U. Hengartner, and D. Vogel, July 2015 Usability and security perceptions of implicit authentication: Convenient, secure, sometimes annoying. In *Eleventh Symposium On Usable Privacy and Security (SOUPS 2015)*, pp. 225–239, Ottawa, Canada, USENIX Association.
- Lashkari, A. H., S. Farmand, D. O. B. Zakaria, and D. R. Saleh, 2009 Shoulder surfing attack in graphical password authentication. *International Journal of Computer Science and Information Security* 6: 145–154.
- Li, L., X. Zhao, and G. Xue, April 2013 Unobservable reauthentication for smartphones. In *NDSS 2013*, volume 56, pp. 57–59, The Internet Society.
- McFarlane, D. C., 2002 Comparison of four primary methods for coordinating the interruption of people in human-computer interaction. *Human-Computer Interaction* 17: 63–139.
- Micallef, N., M. Just, L. Baillie, M. Halvey, and H. G. Kayacik, August 2015 Why aren't users using protection? investigating the usability of smartphone locking. In *Proceedings of the 17th International Conference on Human-Computer Interaction with Mobile Devices and Services, MobileHCI '15*, pp. 284–294, Copenhagen, Denmark, ACM.
- Mock, K., B. Hoanca, J. Weaver, and M. Milton, October 2012 Real-time continuous iris recognition for authentication using an eye tracker. In *Proceedings of the 2012 ACM Conference on Computer and Communications Security, CCS '12*, pp. 1007–1009, Raleigh, North Carolina, USA, ACM.
- Monrose, F., M. K. Reiter, and S. Wetzel, 2002 Password hardening based on keystroke dynamics. *International Journal of Information Security* 1: 69–83.
- Monrose, F. and A. Rubin, April 1997 Authentication via keystroke dynamics. In *Proceedings of the 4th ACM Conference on Computer and Communications Security, CCS '97*, pp. 48–56, Zurich, Switzerland, ACM.
- O'Gorman, L., 2003 Comparing passwords, tokens, and biometrics for user authentication. *Proceedings of the IEEE* 91: 2021–2040.
- Riva, O., C. Qin, K. Strauss, and D. Lymberopoulos, August 2012 Progressive authentication: Deciding when to authenticate on mobile phones. In *Presented as part of the 21st USENIX Security Symposium (USENIX Security 12)*, pp. 301–316, Bellevue, WA, USA, USENIX.
- Saevanee, H., N. L. Clarke, and S. M. Furnell, June 2012 Multimodal behavioural biometric authentication for mobile devices. In *Information Security and Privacy Research*, pp. 465–474, Heraklion, Crete, Greece, Springer Berlin Heidelberg.
- Shi, E., Y. Niu, M. Jakobsson, and R. Chow, October 2011 Implicit authentication through learning user behavior. In *Information Security*, pp. 99–113, Boca Raton, FL, USA, Springer Berlin Heidelberg.
- Winkler, K., 2016 *Entwicklung und Evaluation eines inhaltsabhängigen Sicherheitsmechanismus: Performance, Wahrnehmung und Machbarkeit*. Master's thesis, Ludwig Maximilians Universität München.
- Xu, H., Y. Zhou, and M. R. Lyu, July 2014 Towards continuous and passive authentication via touch biometrics: An experimental study on smartphones. In *10th Symposium On Usable Privacy and Security (SOUPS 2014)*, pp. 187–198, Menlo Park, CA, USA, USENIX Association.