Review of Cybersecurity Within Modern Medical Devices

Arthur Pangemanan

Abstract—This paper will review the cyber threat modern medical device faces.

Index Terms—Cybersecurity, Security, Risk, Safety, Wireless, Medical devices.

I. INTRODUCTION

THE medical industry has change ever since the first computer were introduced.

II. BACKGROUND

A. History Of Medical Devices

Subsection text here.

III. MEDICAL IMAGING

IV. CYBERSECURITY IN HEALTHCARE

V. GROWING THREAT

VI. SECURITY CHALLENGES

The medical industry face many challenges [1]. [2]. [3]. [4]. [5]. [6]. [7]. [8]. [9]. [10]. [11]. [12]. [13]. [14]. [15]. [16]. [17]. [18]. [19]. [20]. [21]. [20]. [22].

VII. CONCLUSION

The conclusion goes here.

REFERENCES

- J. Sametinger, J. Rozenblit, R. Lysecky, and P. Ott, "Security challenges for medical devices," *Commun. ACM*, vol. 58, no. 4, pp. 74

 –82, Mar. 2015. [Online]. Available: http://doi.acm.org/10.1145/2667218
- [2] L. Coventry and D. Branley, "Cybersecurity in healthcare: A narrative review of trends, threats and ways forward," *Maturitas*, vol. 113, pp. 48–52, 2018.
- [3] P. A. Williams and A. J. Woodward, "Cybersecurity vulnerabilities in medical devices: a complex environment and multifaceted problem," *Medical Devices (Auckland, NZ)*, vol. 8, p. 305, 2015.
- [4] V. Moses and I. Korah, "Lack of security of networked medical equipment in radiology," *American Journal of Roentgenology*, vol. 204, no. 2, pp. 343–353, 2015.
- [5] A. Ferrara, "Cybersecurity in medical imaging," *Radiologic technology*, vol. 90, no. 6, pp. 563–575, 2019.
- [6] S. Murphy, "Is cybersecurity possible in healthcare," *National Cybersecurity Institute Journal*, vol. 1, no. 3, pp. 49–63, 2015.
- [7] M. Stites and O. S. Pianykh, "How secure is your radiology department? mapping digital radiology adoption and security worldwide," *American Journal of Roentgenology*, vol. 206, no. 4, pp. 797–804, 2016.
- [8] Z. Wang, P. Ma, Y. Chi, and J. Zhang, "Medical devices are at risk: Information security on diagnostic imaging system," in *Proceedings of the 2018 ACM SIGSAC Conference on Computer and Communications Security*, ser. CCS '18. New York, NY, USA: ACM, 2018, pp. 2309–2311. [Online]. Available: http://doi.acm.org/10.1145/3243734.3278513

[9] A. Ray and R. Cleaveland, "An analysis method for medical device security," in *Proceedings of the 2014 Symposium and Bootcamp on the Science of Security*, ser. HotSoS '14. New York, NY, USA: ACM, 2014, pp. 16:1–16:2. [Online]. Available: http://doi.acm.org/10.1145/2600176.2600192

1

- [10] P. Gerard, N. Kapadia, J. Acharya, P. T. Chang, and Z. Lefkovitz, "Cybersecurity in radiology: access of public hot spots and public wi-fi and prevention of cybercrimes and hipaa violations," *American Journal* of Roentgenology, vol. 201, no. 6, pp. 1186–1189, 2013.
- [11] T. Mahler, N. Nissim, E. Shalom, I. Goldenberg, G. Hassman, A. Makori, I. Kochav, Y. Elovici, and Y. Shahar, "Know your enemy: Characteristics of cyber-attacks on medical imaging devices," arXiv preprint arXiv:1801.05583, 2018.
- [12] P. Ma, Z. Wang, X. Zou, J. Zhang, Q. Liu, X. Lyu, and W. Wang, "Medical imaging device security: An exploratory study," arXiv preprint arXiv:1904.00224, 2019.
- [13] M. Busdicker and P. Upendra, "The role of healthcare technology management in facilitating medical device cybersecurity," *Biomedical instrumentation & technology*, vol. 51, no. s6, pp. 19–25, 2017.
- [14] G. Martin, P. Martin, C. Hankin, A. Darzi, and J. Kinross, "Cybersecurity and healthcare: how safe are we?" *Bmj*, vol. 358, p. j3179, 2017.
- [15] M. Marwan, A. Kartit, and H. Ouahmane, "Design a secure framework for cloud-based medical image storage," in *Proceedings of the 2Nd International Conference on Big Data, Cloud and Applications*, ser. BDCA'17. New York, NY, USA: ACM, 2017, pp. 7:1–7:6. [Online]. Available: http://doi.acm.org/10.1145/3090354.3090361
- [16] D. Foo Kune, K. Venkatasubramanian, E. Vasserman, I. Lee, and Y. Kim, "Toward a safe integrated clinical environment: A communication security perspective," in *Proceedings of the 2012 ACM Workshop on Medical Communication Systems*, ser. MedCOMM '12. New York, NY, USA: ACM, 2012, pp. 7–12. [Online]. Available: http://doi.acm.org/10.1145/2342536.2342540
- [17] H. Almohri, L. Cheng, D. D. Yao, and H. Alemzadeh, "On threat modeling and mitigation of medical cyber-physical systems," in Proceedings of the Second IEEE/ACM International Conference on Connected Health: Applications, Systems and Engineering Technologies, ser. CHASE '17. Piscataway, NJ, USA: IEEE Press, 2017, pp. 114–119. [Online]. Available: https://doi.org/10.1109/CHASE.2017.69
- [18] C. TK, "Inside risks controlling for cybersecurity risks of medical device software," Communications of the ACM, vol. 56, no. 10, 2013.
- [19] K. Fu and J. Blum, "Controlling for cybersecurity risks of medical device software," *Biomedical instrumentation & technology*, vol. 48, no. s1, pp. 38–41, 2014.
- [20] G. Tanev, P. Tzolov, and R. Apiafi, "A value blueprint approach to cybersecurity in networked medical devices," *Technology Innovation Management Review*, vol. 5, no. 6, 2015.
- [21] J. Sametinger, J. Rozenblit, R. Lysecky, and P. Ott, "Security challenges for medical devices," *Commun. ACM*, vol. 58, no. 4, pp. 74–82, Mar. 2015. [Online]. Available: http://doi.acm.org/10.1145/2667218
- [22] C. J. Lewis, "Cybersecurity in healthcare," Ph.D. dissertation, 2014, copyright Database copyright ProQuest LLC; ProQuest does not claim copyright in the individual underlying works; Last updated 2016-06-05.