BAB V

PENUTUP

5.1 Kesimpulan

Berdasarkan pengalaman Kerja Praktek di PT. Solusi Rekatama Persada, dapat disimpulkan beberapa hal antara lain:

1. PT. Solusi Rekatama Persada adalah perusahaan yang berfokus pada bidang elektronik, terutama dalam bidang sistem otomasi, RFID (*Radio Frequency Identification*), IoT (*Internet of Things*), komputasi industri, robotika, komponen elektronika, instrumentasi, dan manajemen antrian.
2. Selama masa Kerja Praktek, penulis terlibat dalam proyek khusus, yaitu Pembuatan GUI *Real-time Indoor Positioning System* Decawave 3000. Proyek ini bertujuan untuk mengembangkan antarmuka pengguna yang memungkinkan pemantauan posisi perpindahan node DW3000 secara akurat dan *real-time*.
3. GUI *Real-time Indoor Positioning System* Decawave 3000 dikembangkan dengan menggunakan komponen ESP32-WROOM32 Ultra-wideband Decawave 3000 dan perangkat lunak desain GUI, seperti QtDesigner (PyQt6), Arduino IDE, serta Google Script.
4. Melalui kegiatan Kerja Praktek ini, penulis mendapatkan kesempatan berharga untuk merasakan lingkungan kerja di PT. Solusi Rekatama Persada, terutama dalam aspek penelitian dan pengembangan. Selain itu, penulis juga memperoleh wawasan baru mengenai sistem *Real-Time Location System* dan implementasinya dalam kehidupan sehari-hari secara langsung.

5.2 Saran

Berdasarkan kegiatan kerja praktik ini adapun saran yang diberikan untuk pengembangan pada GUI *Real-time Indoor Positioning System* Decawave 3000, sebagai berikut:

1. Peningkatan jumlah konfigurasi perangkat DW3000 untuk dapat melakukan jangkauan RTLS yang lebih luas.

2. Pengembangan kalibrasi *node anchor* untuk hasil pengukuran yang lebih akurat hingga < 4 cm.
3. Pengembangan tampilan GUI untuk diterapkan berbasis Android dan Apple, sehingga aplikasi dari sistem GUI dapat digunakan diberbagai perangkat mobile dan tidak terbatas pada laptop berbasis windows/linux.

DAFTAR PUSTAKA

[1] Y. Cai, W. Guan, Y. Wu, C. Xie, Y. Chen, and L. Fang, "Indoor high precision three-dimensional positioning system based on visible light communication using particle swarm optimization," *IEEE Photonics J.*, vol. 9, no. 6, 2017, doi: 10.1109/JPHOT.2017.2771828.

[2] Y. You and C. Wu, "Hybrid Indoor Positioning System for Pedestrians with Swinging Arms Based on Smartphone IMU and RSSI of BLE," *IEEE Trans. Instrum. Meas.*, vol. 70, no. c, pp. 1–15, 2021, doi: 10.1109/TIM.2021.3084286.

[3] M. J. R. Pradana, "Simulasi Indoor Localization Menggunakan Teknik Trilateration Secara Real-Time Pada Laboratorium Simulasi Dan Komputer Berbasis Labview," *Electr. Eng.*, 2019, [Online]. Available: http://hdl.handle.net/123456789/17257

[4] B. Perrat, M. J. Smith, B. S. Mason, J. M. Rhodes, and V. L. Goosey-Tolfrey, "Quality assessment of an Ultra-Wide Band positioning system for indoor wheelchair court sports," *Proc. Inst. Mech. Eng. Part P J. Sport. Eng. Technol.*, vol. 229, no. 2, pp. 81–91, 2015, doi: 10.1177/1754337115581111.

[5] R. Leser, A. Baca, and G. Ogris, "Local positioning systems in (game) sports," *Sensors*, vol. 11, no. 10, pp. 9778–9797, 2011, doi: 10.3390/s111009778.

[6] F. W. Mohamad, "Multi Node Position Localization Using Trilateration Method For Monitoring Basketball Player Application," Politeknik Elektronika Negeri Surabaya, 2019.

[7] Y. H. Ho *et al.*, "High-precision UWB indoor positioning system for customer pathway tracking," *2019 IEEE 8th Glob. Conf. Consum. Electron. GCCE 2019*, pp. 466–467, 2019, doi: 10.1109/GCCE46687.2019.9015284.

[8] R. Ichikari, K. Kaji, R. Shimomura, M. Kourogi, T. Okuma, and T. Kurata, "Off-site indoor localization competitions based on measured data in a warehouse," *Sensors (Switzerland)*, vol. 19, no. 4, 2019, doi:

10.3390/s19040763.

[9] A. Bougouffa, E. Seignez, S. Bouaziz, and F. Gardes, “SmartTrolley: An Experimental Mobile Platform for Indoor Localization in Warehouses,” *2020 3rd Int. Conf. Robot. Control Autom. Eng. RCAE 2020*, pp. 108–115, 2020, doi: 10.1109/RCAE51546.2020.9294484.

[10] H. Liu, J. Huang, C. Lu, Z. Lan, and Q. Wang, “Indoor monitoring system for elderly based on ZigBee network,” *2016 Int. Symp. Micro-NanoMechatronics Hum. Sci. MHS 2016*, 2017, doi: 10.1109/MHS.2016.7824172.

[11] C. Yang and H. R. Shao, “WiFi-based indoor positioning,” *IEEE Commun. Mag.*, vol. 53, no. 3, pp. 150–157, 2015, doi: 10.1109/MCOM.2015.7060497.

[12] Y. Tao and L. Zhao, “A novel system for WiFi radio map automatic adaptation and indoor positioning,” *IEEE Trans. Veh. Technol.*, vol. 67, no. 11, pp. 10683–10692, 2018, doi: 10.1109/TVT.2018.2867065.

[13] Y. Chervoniak and I. Gorovyi, “Mobile Indoor Navigation: From Research to Production,” *2019 Signal Process. Symp. SPSympo 2019*, pp. 96–99, 2019, doi: 10.1109/SPS.2019.8882001.

[14] S. Chun-Fang, F. Li-Chen, J. Yi-Wei, and L. Ting-Ying, “Indoor Positioning for Dementia in Smart Homes Based on Wearable Device,” *Proc. - 2018 4th Annu. Int. Conf. Netw. Inf. Syst. Comput. ICNISC 2018*, pp. 61–65, 2018, doi: 10.1109/ICNISC.2018.00020.

[15] N. Mitabe and N. Shinomiya, “Support system for elderly care with ambient sensors in indoor environment,” *Proc. Int. Conf. Sens. Technol. ICST*, vol. 2017-Decem, pp. 1–4, 2018, doi: 10.1109/ICSensT.2017.8304436.

[16] Y. Xu, Y. S. Shmaliy, Y. Li, X. Chen, and H. Guo, “Indoor INS/LiDAR-Based Robot Localization with Improved Robustness Using Cascaded FIR Filter,” *IEEE Access*, vol. 7, pp. 34189–34197, 2019, doi: 10.1109/ACCESS.2019.2903435.

[17] Y. Liu and Y. Song, “A robust method of fusing ultra-wideband range

measurements with odometry for wheeled robot state estimation in indoor environment," *Proc. 30th Chinese Control Decis. Conf. CCDC 2018*, pp. 1269–1274, 2018, doi: 10.1109/CCDC.2018.8407324.

[18] U. Carrasco, P. D. Urbina Coronado, M. Parto, and T. Kurfess, "Indoor location service in support of a smart manufacturing facility," *Comput. Ind.*, vol. 103, pp. 132–140, 2018, doi: 10.1016/j.compind.2018.09.009.

[19] J. Wyffels, J. P. Goemaere, P. Verhoeve, P. Crombez, B. Nauwelaers, and L. De Strycker, "A novel indoor localization system for healthcare environments," *Proc. - IEEE Symp. Comput. Med. Syst.*, 2012, doi: 10.1109/CBMS.2012.6266347.

[20] C. Bradley, S. El-Tawab, and M. H. Heydari, "Security analysis of an IoT system used for indoor localization in healthcare facilities," *2018 Syst. Inf. Eng. Des. Symp. SIEDS 2018*, pp. 147–152, 2018, doi: 10.1109/SIEDS.2018.8374726.

[21] J. A. Lossio-Ventura and H. Alatrista-Salas, *Information management and big data: SIMBig overview*, vol. 1743. 2016. doi: 10.1007/978-3-030-46140-9.

[22] X. H. Ng and W. N. Lim, "Design of a Mobile Augmented Reality-based Indoor Navigation System," *4th Int. Symp. Multidiscip. Stud. Innov. Technol. ISMSIT 2020 - Proc.*, 2020, doi: 10.1109/ISMSIT50672.2020.9255121.

[23] F. Zafari, A. Gkelias, and K. K. Leung, "A Survey of Indoor Localization Systems and Technologies," *IEEE Commun. Surv. Tutorials*, vol. 21, no. 3, pp. 2568–2599, 2019, doi: 10.1109/COMST.2019.2911558.

[24] D. Coppens, A. Shahid, S. Lemey, B. Van Herbruggen, C. Marshall, and E. De Poorter, "An Overview of UWB Standards and Organizations (IEEE 802.15.4, FiRa, Apple): Interoperability Aspects and Future Research Directions," *IEEE Access*, vol. 10, no. July, pp. 70219–70241, 2022, doi: 10.1109/ACCESS.2022.3187410.

[25] S. Sung, H. Kim, and J. Il Jung, "Accurate Indoor Positioning for UWB-

Based Personal Devices Using Deep Learning," *IEEE Access*, vol. 11, no. February, pp. 20095–20113, 2023, doi: 10.1109/ACCESS.2023.3250180.

[26] PT. Solusi Rekatama Persada, "Portofolio PT. Solusi Rekatama Persada," *solusi-rfid*, 2023. https://www.solusi-rfid.com/portfolio-kami/ (accessed Jan. 01, 2024).

[27] PT. Solusi Rekatama Persada, "Mini Queue System (MQS)." http://www.innoque.com/prod_mqs.htm. (accessed Jan. 01, 2024).

[28] PT. Solusi Rekatama Persada, "Simple Multimedia Queue System (SMQS)." http://www.innoque.com/prod_smqs.htm. (accessed Jan. 01, 2024).

[29] PT. Solusi Rekatama Persada, "Wireless Simple Multimedia Queue System (WSMQS)." http://www.innoque.com/prod_wsmqs.htm (accessed Jan. 01, 2024).

[30] PT. Solusi Rekatama Persada, "Pro Queue System (PQS)." http://www.innoque.com/prod_pqs.htm. (accessed Jan. 01, 2024).

[31] Innoque, "Simple Multimedia Queue System," *Innoque.com*, 2011. https://innoque.com/prod_smqs.htm (accessed Jan. 02, 2024).

[32] PT. Solusi Rekatama Persada, "Company Profile PT. Solusi Rekatama Persada," Surabaya, 2023.

[33] PT. Solusi Rekatama Persada, "Produk Gerbang Perumahan Graha Famili." https://www.solusi-rfid.com/files/proyek/Gerbang-Perumahan-61.pdf (accessed Jan. 01, 2024).

[34] Decawave, "DW3000 Datasheet." FiRA, pp. 1–56, 2020. [Online]. Available: www.decawave.com