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AN EFFICIENT INTRUSION DETECTION SYSTEM WITH CUSTOM FEATURES USING FPA-GRADIENT BOOST MACHINE LEARNING ALGORITHM

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ABSTRACT

An efficient Intrusion Detection System has to be given high priority while connecting systems with a network to prevent the system before an attack happens. It is a big challenge to the network security group to prevent the system from a variable types of new attacks as technology is growing in parallel. In this paper, an efficient model to detect Intrusion is proposed to predict attacks with high accuracy and less false-negative rate by deriving custom features UNSW-CF by using the benchmark intrusion dataset UNSW-NB15. To reduce the learning complexity, Custom Features are derived and then Significant Features are constructed by applying meta-heuristic FPA (Flower Pollination algorithm) and MRMR (Minimal Redundancy and Maximum Redundancy) which reduces learning time and also increases prediction accuracy. ENC (ElasicNet Classifier), KRRC (Kernel Ridge Regression Classifier), IGBC (Improved Gradient Boosting Classifier) is employed to classify the attacks in the datasets UNSW-CF, UNSW and recorded that UNSW-CF with derived custom features using IGBC integrated with FPA provided high accuracy of 97.38% and a low error rate of 2.16%. Also, the sensitivity and specificity rate for IGB attains a high rate of 97.32% and 97.50% respectively.

KEYWORDS

Intrusion Detection, IDS, UNSW-B15, Custom Features, Feature Selection, FPA, Gradient Boost Classifier.

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REFERENCES

[1] T. A. Tchakoucht and M. Ezziyyani, (2018),"Building A Fast Intrusion Detection System For HighSpeed-Building A Fast Intrusion Detection System For High-Speed- Networks : Probe and DoS Attacks Detection", In Proc. of the First International Conference On Intelligent Computing in Data Sciences, Vol. 127, pp. 521–530.

[2] Moustafa, N., Slay, J., 2015, "Unsw-nb15: a comprehensive data set for network intrusion detection systems (unsw-nb15 network data set)", Military communications and information systems conference (MilCIS), IEEE, pp. 1–6.

[3] F. A. Khan, A. Gumaei, A. Derhab, and A. Hussain, (2019), "TSDL: A two-stage deep learning model for efficient network intrusion detection", IEEE Access, Vol. 7, pp. 30373–30385.

[4] H. M. Anwer, M. Farouk, and A. Addel-Hamid, (2018), "A Framework for Efficient Network Anomaly Intrusion Detection with Features Selection", In: Proc. of the 9th International Conference on Information and Communication Systems (ICICS), pp. 157–162.

[5] Khan NM, Negi A, Thaseen, (2018), "Analysis on improving the performance of machine learning models using feature selection technique", In: International conference on intelligent systems design and applications, Springer, pp. 69–77.

[6] Zong W, Chow Y-W, Susilo W., (2018), "A two-stage classifier approach for network intrusion detection", International conference on information security practice and experience. Springer, pp. 329–340.

[7] Gao J, Chai S, Zhang B, Xia Y., (2019), "Research on network intrusion detection based on incremental extreme learning machine and adaptive principal component analysis", Energies 2019, Vol. 12, No. 7.

[8] Sydney M. Kasongo and Yanxia Sun, (2020), "Performance Analysis of Intrusion Detection Systems Using a Feature Selection Method on the UNSW-NB15 Dataset", Journal of Big Data. Springer Open, pp. 1-20.

[9] Toldinas, J. Venˇckauskas, A. Damaševiˇcius, R.; Grigaliunas, Š. Morkeviˇcius, N. Baranauskas, E., (2021), "A Novel Approach for Network Intrusion Detection Using Multistage Deep Learning Image Recognition", Electronics 2021, Vol. 10, No. 1854, https://doi.org/10.3390/ electronics10151854.

[10] Agarwal A, Sharma P, Alshehri M, Mohamed AA, Alfarraj O., (2021), "Classification model for accuracy and intrusion detection using machine learning approach", PeerJ Computer Science, DOI 10.7717/peerj-cs.437.

[11] Ahmad, M., Riaz, Q., Zeeshan, M., (2021), "Intrusion detection in the internet of things using supervised machine learning based on application and transport layer features using UNSW-NB15 data-set", Journal of Wireless Communication Network 2021, Vol. 10, https://doi.org/10.1186/s13638-021-01893-8.

[12] D.V. Jeyanthi, Dr. B. Indrani, (2021), "Intrusion Detection System intensive on Securing IoT Networking Environment based on Machine Learning Strategy", Springer, Proceedings of the 5th International Conference on Intelligent Data Communication Technologies and Internet of Things (ICICI-2021).Lecture Notes on Data Engineering and Communications Technologies, DOI : 10.1007/978-981-16-7610-9

[13] Mousa Al-Akhras, Mohammed Alawairdhi1 Ali Alkoudari and Samer Atawneh, "using machine learning to build a classification model for iot networks to detect attack signatures", International Journal of Computer

Networks & Communications (IJCNC), https://ijcnc.com/2020/12/12/ijcnc-07-15/

[14] Tran Hoang Hai, Le Huy Hoang, and Eui-nam Huh, (2020), "Network Anomaly Detection Based On Late Fusion Of Several Machine Learning Algorithms", International Journal of Computer Networks & Communications (IJCNC), Vol.12, No.6, pp. 117-131, DOI: 10.5121/ijcnc.2020.12608

[15] Nour Moustafa and Jill Slay, "The evaluation of Network Anomaly Detection Systems: Statistical analysis of the UNSW-NB15 data set and the comparison with the KDD99 data set" ,Information Security Journal: A Global Perspective, Taylor & Francisdoi:10.1080/19393555.2015.1125974

GPS SYSTEMS LITERATURE: INACCURACY FACTORS AND EFFECTIVE SOLUTIONS

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ABSTRACT

Today, Global Positioning System (GPS) is widely used in almost every aspect of our daily life. Commonly, users utilize the technology to track the position of a vehicle or an object of interest. They also use it to safely navigate to the destination of their choice. As a result, there are countless number of GPS based tracking application that has been developed. But, a main recurring issue that exists among these applications are the inaccuracy of the tracking faced by users and this issue has become a rising concern. Most existing research have examined the effects that the inaccuracy of GPS have on users while others identified suitable methods to improve the accuracy of GPS based on one or two factors. The objective of this survey paper is to identify the common factors that affects the accuracy of GPS and identify an effective method which could mitigate or overcome most of those factors. As part of our research, we conducted a thorough examination of the existing factors for GPS inaccuracies. According to an initial survey that we have collected, most of the respondents has faced some form of GPS inaccuracy. Among the common issues faced are inaccurate object tracking and disconnection of GPS signal while using an application. As such, most of the respondents agree that it is necessary to improve the accuracy of GPS. This leads to another objective of this paper, which is to examine and evaluate existing methods as well as to identify the most effective method that could improve the accuracy of GPS.

KEYWORDS

GPS, accuracy factors, improve accuracy, global positioning system

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REFERENCES

[1] Lin, J.Y, Yang, B.K., Tuan A.D., and Chen, H.C. (2013). "The Accuracy Enhancement of GPS Track in Google Map", 2013 Eighth International Conference on Broadband and Wireless Computing, Communication and Applications, Compiegne, France. pp. 524-527.

[2] Iqbal, A., Mahmood. H., Farooq, U., Kabir, M.A. and Asad, M.U.. (2009). "An Overview of the Factors Responsible for GPS Signal Error: Origin and Solution", 2009 International Conference on Wireless Networks and Information Systems, Shanghai, China. pp. 294-299.

[3] Bajaj, R., Ranaweera, S.L., Agrawal, D.P.. (2002). "GPS: Location-tracking Technology", Computer, vol.35, no..4, pp. 92-94.

[4] Huang, J.Y., and Tsai, C.H.. (2008). "Improve GPS Positioning Accuracy with Context Awareness", 2008 First IEEE International Conference on Ubi-Media Computing, Lanzhou, China, pp. 94-99.

[5] Wubbena, G., Andreas, B., Seeber, G., Boder, V. and Hankemeier, P., (1996). "Reducing Distance Dependant Errors for Real-Time Precise DGPS Applications by Establishing Reference Station Networks". In Proceedings of the 9th International Technical Meeting of the Satellite Division of the Institute of Navigation (ION GPS-96)

[6] Enge, P., Walter, T., Pullen, S., Kee, C., Chao, Y. and Tsai, Y. (1996). "Wide area augmentation of the global positioning system". Proceedings of the IEEE, vol. 84 Aug. 1996, pp. 1063–1088.

[7] Qi, H. and Moore, J. B. (2002). "Direct Kalman Filtering Approach for GPS/INS Integration", IEEE Trans. Aerosp, Electron. System. vol. 38, no. 2, 2002, pp. 687-693.

[8] Malleswari, B.L., MuraliKrishna, I.V., Lalkishore, K., Seetha, M., Nagaratna, P. H. "The Role of Kalman Filter in the Modelling of GPS Errors", Journal of Theoretical and Applied Information Technology, pp. 95-101.

[9] White, C.E., Bernstein, D. and Kornhauser, Alain L.. (2000). "Some map matching algorithms for personal navigation assistants". Transportation Research Part C, No. 8, 2000, pp. 91-108.

MULTI-OBJECTIVE OPTIMIZATION ASSISTED NETWORK CONDITION AWARE QOS-ROUTING PROTOCOL FOR MANETS: MNCQM

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ABSTRACT

The exponential rise in wireless communication systems and allied applications has revitalized academiaindustries to achieve more efficient data transmission system to meet Quality-of-Service (QoS) demands. Amongst major wireless communication techniques, Mobile Ad-hoc Network (MANET) is found potential to provide decentralized and infrastructure less communication among multiple distributed nodes across network region. However, dynamic network conditions such as changing topology, congestion, packet drop, intrusion possibilities etc often make MANET's routing a tedious task. On the other hand, mobile network feature broadens the horizon for intruders to penetrate the network and causes performance degradation. Unlike classical MANET protocols where major efforts have been made on single network parameter based routing decision, this research paper proposes a novel Elitist Genetic Algorithm (EGA) Multi-Objective Optimization assisted Network Condition Aware QoS-Routing Protocol for Mobile Ad-hoc Networks (MNCQM). Our proposed MNCQM protocol exhibits two phase implementation where at first it performs node-profiling under dynamic network topology for which three factors; irregular MAC information exchange, queuing overflow and topological variations have been considered. Towards this objective node features like Packet Forwarding Probability (PFP) at the MAC layer, Success Probability of Data Transmission (SPDT) of a neighboring node, and Probability of Successful Data Delivery (PSDD) have been obtained to estimate Node-Trustworthiness Index (NTI), which is further used to eliminate untrustworthy nodes. In the second phase of implementation, a novel Evolutionary Computing assisted nondisjoint best forwarding path selection model is developed that exploits node's and allied link's connectivity and availability features to identify the quasi-sub-optimal forwarding paths. EGA algorithm intends to reduce hop-counts, connectivity-loss and node or link unavailability to estimate best forwarding node. One key feature of the proposed model is dual-supplementary forwarding path selection that enables alternate path formation in case of link outage and thus avoids any iterative network discovery phase.

KEYWORDS

MANET, QoS communication, Node-trustworthiness, Network awareness, Evolutionary computing based routing decision.

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REFERENCES

[1] S. Corson and J. Macker, “Mobile Ad hoc Networking (MANET): Routing Protocol Performance Issues and Evaluation Considerations”, IETF WG Charter, http://www.ietf.org/html.charters/manetcharter.html, January 1999.

[2] Z. Iqbal, S. Khan, Amjad Mehmood, Jaime Lloret, and Nabil Ali Alrajeh “Adaptive Cross-Layer Multipath Routing Protocol for Mobile Ad Hoc Networks” Hindawi Publishing Corporation Journal of Sensors Volume 2016, Article ID 5486437, 18 pages.

[3] C. T. Calafate, M. P. Malumbres, J. Oliver, J. C. Cano and P. Manzoni, "QoS Support in MANETs: a Modular Architecture Based on the IEEE 802.11e Technology," in IEEE Transactions on Circuits and Systems for Video Technology, vol. 19, no. 5, pp. 678-692, May 2009.

[4] Z. Li and X. Yang, "A Reliability-Oriented Web Service Discovery Scheme with Cross-Layer Design in MANET," 2016 IEEE International Conference on Web Services, San Francisco, CA, 2016, pp. 404-411.

[5] S. V. Sangolli and J. Thyagarajan, "An efficient congestion control scheme using cross-layered approach and comparison of TCP variants for mobile ad-hoc networks (MANETs)," 2014 First International Conference on Networks & Soft Computing, Guntur, 2014, pp. 30-34.

[6] P. Samar and S. B. Wicker, “On the behavior of communication links of a node in a multi-hop mobile environment,” in proceedings 5th ACM Intl. symposium on Mobile ad hoc networking and computing, 2004.

[7] D. Chen and P. K. Varshney, “QoS support in wireless sensor networks: a survey”, International Conference on Wireless Networks, ICWN '04, Las Vegas, USA, June 2004, pp. 227-233.

[8] F. Xia, “QoS Challenges and opportunities in wireless sensor/actuator networks”, Sensors 2008, vol.8, no.2, 2008, pp. 1099-1110.

[9] Y.J. Li, C.S. Chen, Y.Q. Song and Z. Wang, “Real-time QoS support in wireless sensor networks: a survey”, 7th IFAC International Conference on Fieldbuses and Networks in Industrial and Embedded Systems, FeT’07, Toulouse, France, 2007.

[10] H. Alwan and A. Agarwal, “A Survey on Fault Tolerant Routing Techniques in Wireless Sensor Networks”, in proceedings of the Third International Conference on Sensor Technologies and Applications, Athens/Glyfada, Greece, 2009, pp. 366-371.

[11] K. Sohrabi, J. Gao, V. Ailawadhi, and G. Pottie, “Protocols for self organization of a wireless sensor network,” IEEE Personal Communications, vol. 7, no. 5, 2000, pp. 16–27.

[12] K. Akkaya and M. Younis, “An Energy-Aware QoS Routing Protocol for Wireless Sensor Networks”, in proceedings of the 23rd International Conf. on Distributed Computing Systems Workshops, 2003, pp. 710-715.

[13] J. Chen, R. Lin, Y. Li and Y. Sun, “LQER: A Link Quality Based Routing for Wireless Sensor Networks”, Sensors, vol. 8, 2008, pp.1025- 1038.

[14] B. C. Villaverde, S. Rea and D. Pesch, “Multi- objective Cross-Layer Algorithm for Routing over Wireless Sensor Networks”, Third International Conference on Sensor Technologies and Applications, Athens/Glyfada, Greece, 2009, pp. 568-574.

[15] P.A. Abdul Saleem, Dr. Naveen Kumar “Cross Layer Design Approach in Wireless Mobile ADHOC Network Architecture” International Journal of Advanced Research in Computer and Communication Engineering Vol. 2, Issue 3, March 2013.

[16] Y. Fang, Y. Zhou, X. Jiang and Y. Zhang, "Practical Performance of MANETs Under Limited Buffer and Packet Lifetime," in IEEE Systems Journal, vol. 11, no. 2, pp. 995-1005, June 2017.

[17] Y. H. Chen, E. H. K. Wu and G. H. Chen, "Bandwidth-Satisfied Multicast by Multiple Trees and Network Coding in Lossy MANETs," in IEEE Systems Journal, vol. 11, no. 2, pp. 1116-1127, June 2017.

[18] Y. Komai, Y. Sasaki, T. Hara and S. Nishio, " ${k}$ Nearest Neighbor Search for LocationDependent Sensor Data in MANETs," in IEEE Access, vol. 3, pp. 942-954, 2015.

[19] R. Jia et al., "Optimal Capacity–Delay Tradeoff in MANETs With Correlation of Node Mobility," in IEEE Transactions on Vehicular Technology, vol. 66, no. 2, pp. 1772-1785, Feb. 2017.

[20] S. Sett, P. Kumar Guha Thakurta “Effect of optimal cluster head placement in MANET through multi objective GA”, In IEEE International Conference on Advances in Computer Engineering and Applications(ICACEA), pp. 832-837, 2015.

[21] D. Barman Roy Rituparna Chaki “MCBHIDS: Modified layered cluster based algorithm for black hole IDS”, In Annual IEEE India Conference (INDICON), pp.1-6, 2013.

[22] Neha Gupta, Rajeev Kumar Singh, Manish Shrivastava, “Cluster formation through improved weighted clustering algorithm (IWCA) for mobile ad-hoc networks”, Tenth IEEE International Conference on Wireless and Optical Communications Networks(WOCN), pp. 1-5, 2013.

[23] M. Rath, B. Pati and B. K. Pattanayak, "Cross layer based QoS platform for multimedia transmission in MANET," In 11th International Conference on Intelligent Systems and Control (ISCO), Coimbatore, 2017, pp. 402-407.

[24] M. A. Gawas, L. J. Gudino and K. R. Anupama, "Cross layer multi QoS metric routing for multimedia traffic in 802.11E over MANETs," 2016 Eighth International Conference on Ubiquitous and Future Networks (ICUFN), Vienna, 2016, pp. 582-587.

[25] Z. Li and X. Yang, "A Reliability-Oriented Web Service Discovery Scheme with Cross-Layer Design in MANET," 2016 IEEE International Conference on Web Services (ICWS), San Francisco, CA, 2016, pp. 404-411.

[26] S. Marti, T. J. Giuli, K. Lai, and M. Baker, “Mitigating routing misbehavior in mobile ad hoc networks,” in proceedings of the 6th annual ACM Intl. conference on Mobile computing and networking, 2000.

[27] K. Liu, J. Deng, P. K. Varshney, and K. Balakrishnan, “An acknowledgment-based approach for the detection of routing misbehavior in MANETs,” IEEE Transactions on Mobile Computing, 6(5):536- 550, 2007.

[28] T. Sheltami, A. Basabaa, and E. Shakshuki, “A3acks: adaptive three acknowledgments intrusion detection system for MANETs,” Journal of Ambient Intelligence and Humanized Computing, 5(4):611–620, 2014.

[29] E. M. Shakshuki, N. Kang, and T. R. Sheltami, “Eaack—a secure intrusion-detection system for MANETs, ” IEEE Transactions on Industrial Electronics, 60(3):1089–1098, 2013.

[30] D. S. De Couto, D. Aguayo, J. Bicket, and R. Morris, “A high-throughput path metric for multihop wireless routing,” Wireless Networks, 11(4):419-434, 2005.

[31] B. Shebaro, D. Midi, and E. Bertino, “Fine-grained analysis of packet losses in wireless sensor networks,” in 11th IEEE Intl. Conference on Sensing, Communication, and Networking (SECON), 2014.

[32] S. Buchegger and J. L. Boudec, “Performance analysis of the confidant protocol,” in proceedings of the 3rd ACM Intl. conference on Mobile ad hoc networking & computing, 2002.

[33] A. Shabut, K. Dahal, S. Bista, and I. Awan, “Recommendation based trust model with an effective defence scheme for MANETs,” IEEE Transactions on Mobile Computing, 14(10):2101–2115, 2015.

[34] J. Parker, J. Undercoffer, J. Pinkston, and A. Joshi, “On intrusion detection and response for mobile ad hoc networks,” in IEEE Intl. Conference on Performance, Computing, and Communications, 2004.

[35] P. Michiardi and R. Molva, “Core: a collaborative reputation mechanism to enforce node cooperation in mobile ad hoc networks,” in Advanced Communications and Multimedia Security, Springer, 2002.

[36] F. Anjum and R. Talpade, “Lipad: lightweight packet drop detection for ad hoc networks,” in 60th IEEE Vehicular Technology Conf., volume 2, 2004.

[37] F. V. Jensen, Bayesian Networks and Decision Graphs. New Jersey: Springer-Verlag, 2001.

[38] E. Castillo, J. M. Gutierrez, and A. S. Hadi, Expert Systems and probabilistic Network

Models. New York: Springer-Verlag, 1997.

[39] T. H. Sureshbhai, M. Mahajan and M. K. Rai, "An Investigational Analysis of DSDV, AODV and DSR Routing Protocols in Mobile Ad Hoc Networks," 2018 International Conference on Intelligent Circuits and Systems (ICICS), Phagwara, pp. 281-285, 2018.

[40] Saghian, Malihe, Ravanmehr, Reza, “Efficient QoS-aware Middleware for Resource Discovery in Mobile Ad Hoc Networks”, Adhoc & Sensor Wireless Networks, Vol. 43 Issue 3/4, p283-312,2019.

[41] Shashi Raj K, Siddesh G K,"QoS Oriented Cross-synch Routing Protocol for Event Driven, Missioncritical Communication Over MANET: Q-CSRPM", International Journal of Computer Network and Information Security(IJCNIS), Vol.10, No.11, pp.18-30, 2018.DOI: 10.5815/ijcnis.2018.11.03.

On the Migration of a Large Scale Network from IPv4 to IPv6 Environment

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ABSTRACT

This work mainly addresses the design a large scale network using dual stack mechanisms. We focused on the most important theoretical concepts of the IPv6 protocol, such as addressing, address allocation, routing with the OSPF and BGP protocols and routing protocols performance in dual stack network using GNS3 and Wireshark simulators. we have a tendency to measure a perfect model and a true large-scale network atmosphere victimization out there end-to-end activity techniques that focuses on a large-scale IPv4 and IPv6 backbone and created performance the IPv4 and IPv6 network. In this paper, we compiled IPv6 address planning in large scale network, performance statistics of each network in terms of TCP throughput, delay jitters, packet loss rate, and round trip time. It is found that, a minor degradation within the throughput of the TCP, delay jitter, a lower packet loss rate, and a rather longer round trip time are occurred in a real large scale dual stack network.

KEYWORDS

IPv6, IPv4, double stack, BGPv4, OSPFv3, ISP, throughput, TCP and RTT

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REFERENCES

[1] Tahir Abdullah, Shahbaz Nazeer, Afzaal Hussain, "NETWORK MIGRATION AND PERFORMANCE ANALYSIS OF IPv4 AND IPv6", European Scientific Journal, vol. 8, No.5, 2013

[2] Lefty Valle-Rosado, Lizzie Narváez-Díaz, Cinhtia González-Segura and Victor Chi-Pech, "Design and Simulation of an IPv6 Network Using Two Transition Mechanisms", IJCSI International Journal of Computer Science Issues, Vol.9, No.6, pp: 60-65, Nov. 2012.

[3] Internet Engineering Task Force (IETF) RFC 6052, 3513, 4291, 6104, http://tools.ietf.org/html/

[4] Febby Nur Fatah, Adang Suhendra , M Akbar Marwan , Henki Firdaus Henki Firdaus , "Performance Measurements Analysis of Dual Stack IPv4-IPv6", Proc. of the Second Intl. Conference on Advances in Information Technology — AIT, 2013..

[5] Y. Wang, S. Ye, and X. Li, "Understanding Current IPv6 Performance: A Measurement Study", 10th IEEE Symposium on Computer Communications, June 2005.

[6] Cebrail CIFLIKLI, Ali GEZER and Abdullah Tuncay OZSAHIN, "Packet traffic features of IPv6 and IPv4 protocol traffic, Turk", J Elec Eng & Comp Science, Vol.20, No5, pp: 727-749, 2012

[7] Alex Hinds, Anthony Atojoko, and Shao Ying Zhu, "Evaluation of OSPF and EIGRP Routing Protocols for IPv6", International Journal of Future Computer and Communication (IJFCC), Vol.2, No.4, pp: 287-291, Aug. 2013.

[8] T. Bates, R. Chandra, D. Katz, and Y. Rekhter, "Multiprotocol Extensions for BGP-4," Internet Request for Comments, vol. RFC 4760, Jan. 2007.

[9] Ing. Luis Marrone, Lic. Andr´es Barbieri and Mg. Mat 'as Robles, "TCP Performance - CUBIC, Vegas & Reno", JCS&T, Vol.13, No.1, pp:1-8, April 2013

[10] Kevin R. Fall and W. Richard Stevens, "TCP/IP Illustrated", volume 1, published by Addisonwisely professional computer series, Pearson Education, 2012

LOCALIZATION SCHEMES FOR UNDERWATER WIRELESS SENSOR NETWORKS: SURVEY

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ABSTRACT

Underwater Wireless Sensor Networks (UWSNs) enable a variety of applications such as fish farming and water quality monitoring. One of the critical tasks in such networks is localization. Location information can be used in sensor networks for several purposes such as (i) data tagging in which sensed information is not useful for the application unless the location of the sensed information is known, (ii) tracking objects or (iii) multi-hop data transmission in geographic routing protocols. Since GPS does not work well underwater, several localization schemes have been developed for UWSNs. This paper surveys the state-ofthe-art of localization schemes for UWSNs. It describes the existing schemes and classifies them into different categories. Furthermore, the paper discusses some open research issues that need further investigation in this area.

KEYWORDS

Underwater Wireless Sensor Networks, Localization, Ranging Methods, Positioning, Range-based &Range-free.

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REFERENCES

[1] M. Erol-Kantarci, H. T. Mouftah, and S. Oktug, "A Survey of Architectures and Localization Techniques for Underwater Acoustic Sensor Networks," IEEE Communications Surveys and Tutorials, vol. 13, no. 3, pp. 487–502, September 2011.

[2] M. Beniwal and R. Singh, "Localization Techniques and Their Challenges in Underwater Wireless Sensor Networks," International Journal of Computer Science and Information Technologies (IJCSIT), vol. 5, no. 3, pp.4706-4710, 2014.

[3] H.-P. Tan, R. Diamant, W. K. G. Seah, and M. Waldmeyer, "A survey of techniques and challenges in underwater localization," Ocean Engineering, vol. 38, no. 14, pp. 1663–1676, October 2011.

[4] G. Han, C. Zhang, L. Shu, and J. J. P. C. Rodrigues, "Impacts of Deployment Strategies on Localization Performance in Underwater Acoustic Sensor Networks," IEEE Transactions on Industrial Electronics, vol. 62, no. 3, pp. 1725–1733, March 2015.

[5] M. Erol-Kantarci, S. Oktug, L. Vieira, and M. Gerla, "Performance evaluation of distributed localization techniques for mobile underwater acoustic sensor networks," Ad Hoc Networks, vol. 9, no. 1, pp. 61–72, January 2011.

[6] M. Erol, L. F. M. Vieira, A. Caruso, F. Paparella, M. Gerla, and S. Oktug, "Multi Stage Underwater Sensor Localization Using Mobile Beacons," in 2008 Second International Conference on Sensor Technologies and Applications (sensorcomm 2008), 25-31 August 2008, pp. 710–714, Cap Esterel, France.

[7] A. Koubâa and M. Ben Jamâa, "Taxonomy of Fundamental Concepts of Localization in CyberPhysical and Sensor Networks," Wireless Personal Communications, vol. 72, no. 1, pp. 461–507, September 2013.

[8] A. Y. Teymorian, W. Cheng, L. Ma, X. Cheng, X. Lu, and Z. Lu, "3D Underwater Sensor Network Localization," IEEE Transactions on Mobile Computing, vol. 8, no. 12, pp. 1610–1621, December 2009.

[9] W. Cheng, A. Thaeler, X. Cheng, F. Liu, X. Lu, and Z. Lu, "Time-Synchronization Free Localization in Large Scale Underwater Acoustic Sensor Networks," in 2009 29th IEEE International Conference on Distributed Computing Systems Workshops, 22-26 June 2009, pp. 80–87, Montreal, QC, Canada.

[10] A. Mesmoudi, M. Feham, and N. Labraoui, "Wireless sensor networks localization algorithms: a comprehensive survey," arXiv preprint arXiv:1312.4082, December 2013.

[11] D. Niculescu and B. Nath, "DV Based Positioning in Ad Hoc Networks," Telecommunication Systems, vol. 22, no. 1-4, pp. 267–280, January 2003.

[12] T. He, C. Huang, B. M. Blum, J. A. Stankovic, and T. Abdelzaher, "Range-free localization schemes for large scale sensor networks," in Proceedings of the 9th annual international conference on Mobile computing and networking - MobiCom '03, 14-19 September 2003, pp. 81-95, San Diego, CA, USA.

[13] M. Moradi, J. Rezazadeh, and A. S. Ismail, “A Reverse Localization Scheme for Underwater Acoustic Sensor Networks,” Sensors, vol. 12, no. 12, pp. 4352–4380, March 2012.

[14] M. Erol, L. F. M. Vieira, and M. Gerla, “Localization with Dive’N’Rise (DNR) beacons for underwater acoustic sensor networks,” in Proceedings of the second workshop on Underwater networks - WuWNet ’07, 14 September 2007, pp. 97-100, Montreal, Quebec, Canada.

[15] M. Erol, L. F. M. Vieira, and M. Gerla, “AUV-Aided Localization for Underwater Sensor Networks,” in International Conference on Wireless Algorithms, Systems and Applications (WASA 2007), 1-3 August 2007, pp. 44–54, Chicago, IL, USA.

[16] M. Beniwal, R. P. Singh, and A. Sangwan, “A Localization Scheme for Underwater Sensor Networks Without Time Synchronization,” Wireless Personal Communications, vol. 88, no. 3, pp. 537–552, June 2016.

[17] M. Isik and O. Akan, “A three dimensional localization algorithm for underwater acoustic sensor networks,” IEEE Transactions on Wireless Communications, vol. 8, no. 9, pp. 4457–4463, September 2009.

[18] Z. Zhou, J.-H. Cui, and S. Zhou, “Efficient localization for large-scale underwater sensor networks,” Ad Hoc Networks, vol. 8, no. 3, pp. 267–279, May 2010.

[19] Z. Zhou, Z. Peng, J.-H. Cui, Z. Shi, and A. Bagtzoglou, “Scalable Localization with Mobility Prediction for Underwater Sensor Networks,” IEEE Transactions on Mobile Computing, vol. 10, no. 3, pp. 335–348, March 2011.

[20] H. Huang and Y. R. Zheng, “Node localization with AoA assistance in multi-hop underwater sensor networks,” Ad Hoc Networks, vol. 78, pp. 32–41, September 2018.

[21] Y. Guo and Y. Liu, “Localization for anchor-free underwater sensor networks,” Computers & Electrical Engineering, vol. 39, no. 6, pp. 1812–1821, August 2013.

[22] Z. Qiang, Z. Senlin, and L. Meiqin, “A clock synchronization independent localization scheme for underwater wireless sensor networks,” in Proceedings of the Eighth ACM International Conference on Underwater Networks and Systems - WUWNet ’13, 11-13 November 2013, pp. 1–5, Kaohsiung, Taiwan.

[23] V. Chandrasekhar and W. Seah, “An Area Localization Scheme for Underwater Sensor Networks,” in OCEANS 2006 - Asia Pacific, 16-19 May 2006, pp. 1–8, Singapore, Singapore.

[24] Y. Zhou, B. Gu, K. Chen, J. Chen, and H. Guan, “An range-free localization scheme for large scale underwater wireless sensor networks,” Journal of Shanghai Jiaotong University (Science), vol. 14, no. 5, pp. 562–568, October 2009.

[25] J. Luo and L. Fan, “A Two-Phase Time Synchronization-Free Localization Algorithm for Underwater Sensor Networks,” Sensors, vol. 17, no. 12, p. 726, March 2017.

[26] R. Poli, J. Kennedy, and T. Blackwell, “Particle swarm optimization,” Swarm Intell., vol. 1, no. 1, pp. 33–57, October 2007.

[27] Jialiang Lv, Huanqing Cui, and Ming Yang, “Distribute localization for wireless sensor

networks using particle swarm optimization," in 2012 IEEE International Conference on Computer Science and Automation Engineering, 22-24 June 2012, pp. 355–358, Beijing, China.

[28] B. Peng and A. H. Kemp, "Energy-efficient geographic routing in the presence of localization errors," Computer Networks, vol. 55, no. 3, pp. 856–872, February 2011.

[29] M. Kadi and I. Alkhayat, "The effect of location errors on location based routing protocols in wireless sensor networks," Egyptian Informatics Journal, vol. 16, no. 1, pp. 113–119, March 2015.

[30] R. C. Shah, A. Wolisz, and J. M. Rabaey, "On the performance of geographical routing in the presence of localization errors," in IEEE International Conference on Communications, 2005. ICC 2005, 16-20 May 2005, vol. 5, pp. 2979–2985, Seoul, South Korea.

[31] D. Son, A. Helmy, and B. Krishnamachari, "The effect of mobility-induced location errors on geographic routing in mobile ad hoc sensor networks: analysis and improvement using mobility prediction," IEEE Transactions on Mobile Computing, vol. 3, no. 3, pp. 233–245, July 2004.

[32] M. Ayaz, I. Baig, A. Abdullah, and I. Faye, "A survey on routing techniques in underwater wireless sensor networks," Journal of Network and Computer Applications, vol. 34, no. 6, pp. 1908–1927, November 2011.

Comparative and QoS Performance Analysis of Terrestrial-aerial Platforms-satellites Systems for Temporary Events

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ABSTRACT

Wireless communications, nowadays, becomes a vital element of people's daily life. Providing global connectivity in future communication systems via the heterogeneous network opens up many research topics to investigate potentialities, enabling technologies, and challenges from the perspective of the integrated wireless systems. This paper aims to drive a comprehensive and comparative study on terrestrial-aerial platforms- satellite wireless communications systems, includes their characteristics and unravelling challenges. The comparison focuses on issues that reportedly can evaluate any wireless systems for temporary events. These issues are altitude and coverage, Radio Frequency (RF) propagation, interference, handover, power supply constraints, deployment and maintenance challenges, reliability on special events or disaster relief, cost-effectiveness and environmental impact. Last, Quality of service (QoS) performance is analysed for the four wireless communication systems from the temporary events perspective using the OPNET Modeller simulation tool. Results infer that space-based wireless systems outperform terrestrial ones.

KEYWORDS

Terrestial, Aerial Platforms, Satellites, QoS Performance, Temporary Events.

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REFERENCES

[1] M. Mozaffari, W. Saad, M. Bennis, Y. Nam And M. Debbah, "A Tutorial On Uavs For Wireless Networks: Applications, Challenges, And Open Problems", Ieee Communications Surveys & Tutorials, Pp. 1-1, 2019.

[2] K. Du And M. Swamy, Wireless Communication Systems. Cambridge, Uk: Cambridge University Press, 2018.

[3] F. A. Almalki, M. C. Angelides, “Considering Near Space Platforms To Close The Coverage Gap In Wireless Communications; The Case Of The Kingdom Of Saudi Arabia,” Ftc 2016 San Francisco - Future Technologies Conference, 2016, Pp.224 – 230.

[4] R. Frenkiel And M. Schwartz, 'Creating Cellular: A History Of The Amps Project (1971-1983)History Of Communications', Ieee Communications Magazine, Vol. 48, No. 9, Pp. 14-24, 2015.

[5] Mobile Phones, Tv, Internet And Home Phone Service | Bell Canada', [Online]. Available: Http://Www.Bell.Ca/. [Accessed: 22- Feb- 2019].

[6] W. Yu, H. Xu, J. Nguyen, E. Blasch, A. Hematian And W. Gao, "Survey Of Public Safety Communications: User-Side And Network-Side Solutions And Future Directions", Ieee Access, Vol.6, No. 1, Pp. 70397-70425, 2018.

[7] S. H. Alsamhi, M. S. Ansari, O. Ma, F. Almalki, And S. K. Gupta, “Tethered Balloon Technology In Design Solutions For Rescue And Relief Team Emergency Communication Services,” Disaster Medicine And Public Health Preparedness, Pp. 1–8, May 2018.

[8] F. A. Almalki, M. C. Angelides, “Empirical Evolution Of A Propagation Model For Low Altitude Platforms,” Ieeecomputing Conference 2017, 2017, Pp.1297–1304.

[9] Rangan, T. S. Rappaport, And E. Erkip, ‘Millimeter-Wave Cellular Wireless Networks: Potentials And Challenges’, Proceedings Of The Ieee, Vol. 102, No. 3, Pp. 366–385, Jan. 2014.

[10] S. Dawoud, A. Uzun, S. Gondor, And A. Kupper, “Optimizing The Power Consumption Of Mobile Networks Based On Traffic Prediction,” Ieee 38th Annu. Comput. Softw. Appl. Conf., 2014, Pp.279–288.

[11] U. B. Antonio Capone Ilario Filippini Bernd Gloss, “Rethinking Cellular System Architecture For Breaking Current Energy Efficiency Limits,” Sustain. Ieee Internet Ict Sustain. (Sustainit), 2012, Pp.1-5.

[12] S. Chen And J. Zhao, ‘The Requirements, Challenges, And Technologies For 5g Of Terrestrial Mobile Telecommunication’, Ieee Communications Magazine, Vol. 52, No. 5, Pp. 36–43, Jan. 2014.

[13] J. Gozalvez And B. Coll-Perales, ‘Experimental Evaluation Of Multihop Cellular Networks

Using Mobile Relays', Ieee Communications Magazine, Vol. 51, No. 7, Pp. 122–129, Jan. 2013.

[14] A. A. Ekram Hossain, Mehdi Rasti, Hina Tabassum, "Evolution Toward 5g Multi -Tier Cellular Wireless Networks : An Interference Management Perspective," Ieee Wirel. Commun., Pp. 118–127, 2014.

[15] M. Di Renzo, H. Haas, A. Ghrayeb, S. Sugiura, And L. Hanzo, 'Spatial Modulation For Generalized Mimo: Challenges, Opportunities, And Implementation', Proceedings Of The Ieee, Vol. 102, No. 1, Pp. 56–103, Jan. 2014.

[16] L. Wei, R. Hu, Y. Qian, And G. Wu, 'Enable Device-To-Device Communications Underlaying Cellular Networks: Challenges And Research Aspects', Ieee Communications Magazine, Vol. 52, No. 6, Pp. 90–96, Jan. 2014.

[17] F. Ghavimi And H.-H. Chen, "M2m Communications In 3gpp Lte/Lte-A Networks: Architectures, Service Requirements, Challenges And Applications," Ieee Commun. Surv. Tutorials, Vol. 17, No. 12, Pp. 1–1, 2014.

[18] T. Han And N. Ansari, ''Powering Mobile Networks With Green Energy'', Ieee Wireless Communications, Vol. 21, No. 1, Pp. 90–96, Jan. 2014.

[19] M. Bennis And M. Latva-Aho With Carlos H. M. De Lima, 'Modeling And Analysis Of Handover Failure Probability In Small Cell Networks', Ieee Conference On Computer Communications Workshops, 2014, Pp.736 – 741.

[20] J. Cole, F. A. Almalki, And P. R. Young, "Chipless Rf Liquid Sensor," Ieee International Microwave And Rf Conference (Imarc), 2015, Pp. 243 – 245.

[21] R. Razavi, D. Lopez-Perez, And H. Claussen, "Neighbour Cell List Management In Wireless Heterogeneous Networks," 2013 Ieee Wireless Communications And Networking Conference (Wcnc): Networks, 2013, Pp. 1220–1225.

[22] Y. Zhuang, S. Zhao, And X. Zhu, 'A New Handover Mechanism For Femtocell-To-Femtocell', International Conference On Wireless Communications And Signal Processing (Wcsp), 2012, Pp.1-4.

[23] M. Xia And S. Aissa, 'Underlay Cooperative Of Relaying In Cellular Networks: Performance And Challenges', Ieee Communications Magazine, Vol. 51, No. 12, Pp. 170–176, Jan. 2013.

[24] J. Cao, Maode, H. Li, Y. Zhang, And Z. Luo, 'A Survey On Security Aspects For Lte And Lte-A Networks', Ieee Communications Surveys & Tutorials, Vol. 16, No. 1, Pp. 283–302, Jan. 2014.

[25] G. Hu, A. Huang, R. He, B. Ai, And Z. Chen, 'Theory Analysis Of The Handover Challenge In Express Train Access Networks (Etan)', China Communications, Vol. 11, No. 7, Pp. 92–98, Jan. 2014.

[26] G. Sharma, ‘Performance Evaluation Of Wireless Multipath/Shadowed G-Distributed Channel’, Journal Of Engineering And Technology Research, Vol. 5, No. 5, Pp. 139–148, Jan. 2013.

[27] Y.-H. Wang, G.-R. Huang, And Y.-C. Tung, ‘A Handover Prediction Mechanism Based On Lte-A Ue History Information’, Ieee Conference On Computer, Information And Telecommunication Systems, 2014, Pp. 167 – 172.

[28] J. Xu, Y. Zhao, And X. Zhu, ‘Mobility Model Based Handover Algorithm In Lte-Advanced’, Ieee10th International Conference On Natural Computation, 2014, Pp. 230 – 234.

[29] U. Dampage And C. B. Wavegedara, ‘A Low-Latency And Energy Efficient Forward Handover Scheme For Lte-Femtocell Networks’, Ieee 8th International Conference On Industrial And Information Systems, 2013, Pp. 53 – 58.

[30] A. Ahmed, L. M. Boulahia, And D. Gaiti, ‘Enabling Vertical Handover Decisions In Heterogeneous Wireless Networks: A State-Of-The-Art And A Classification’, Ieee Communications Surveys & Tutorials, Vol. 16, No. 2, Pp. 776–811, Jan. 2014.

[31] G. N. Kamga, K. B. Fredj, And S. Aissa, ‘Multihop Cognitive Relaying Over Composite Multipath/Shadowing Channels’, Ieee Transactions On Vehicular Technology, Pp. 1–5, Jan. 2014.

[32] P. S. Bithas And T. Rontogiannis, ‘Mobile Communication Systems In The Presence Of Fading/Shadowing, Noise And Interference’, Ieee Transactions On Communications, Pp. 1–13, Jan. 2015.

[33] A. Laourine, M.-S. Alouini, S. Affes, And A. Stephenne, ‘On The Performance Analysis Of Composite Multipath /Shadowing Channels Using The G-Distribution’, Ieee Conference On Communications, 2008, Pp. 1162 – 1170.

[34] L. C. Wang And S. Rangapillai, “A Survey On Green 5g Cellular Networks,” Ieeeinternational Conference On Signal Processing And Communications (Spcom), 2012, Pp.1-5.

[35] P. Nema, ‘Nobel Approach Of Power Feeding For Cellular Mobile Telephony Base Station Site: Hybrid Energy System’, International Journal Of Energy And Power Engineering, Vol. 3, No. 6, Pp. 7–14, Nov. 2014.

[36] S. Khan And J. L. Mauri, Security For Multihop Wireless Networks. United States: Crc Press Inc, 2014.

[37] International Telecommunication Union (Itu), 'Utilization Of Telecommunications/Icts For Disaster Preparedness, Mitigation And Response', 2014. [Online]. Available: Http://Www.Itu.Int/Dms_Pub/Itu-D/Opb/Stg/D-Stg-Sg02.22.1-2014-Pdf-E.Pdf. [Accessed: 28- Feb2015].

[38] A. K. Maini And V. Agrawal, Satellite Technology Principles And Applications. Third

Edition. United Kingdom: Wiley, John & Sons, Incorporated, 2014.

[39] D. Grace And M. Mohorcic, Broadband Communications Via High-Altitude Platforms. United Kingdom: Wiley-Blackwell (An Imprint Of John Wiley & Sons Ltd), 2010.

[40] R. Nuwer, 'The Last Places On Earth Without The Internet', Bbc, Nov. 2014. [Online]. Available: Http://Www.Bbc.Com/Future/Story/20140214-The-Last-Places-Without-Internet. [Accessed: 28- Mar-2015].

[41] 'Itu', International Telecommunication Union. [Online]. Available: Http://Www.Itu.Int/Newsarchive/Press/Wrc97/Skystation.Html. [Accessed: 27-Jan-2015].

[42] A. G. Flattie, 'Integrated Satellite- Aps-Terrestrial System For Umts And Lte Network', 2nd International Conference On Emerging Trends In Engineering And Technology (Icetet'2014), 2014, Pp.53-59.

[43] S. Hadiwardoyo, C. Calafate, J. Cano, Y. Ji, E. Hernandez-Orallo And P. Manzoni, "3d Simulation Modeling Of Uav-To-Car Communications", Ieee Access, Vol. 7, Pp. 8808-8823, 2019.

[44] S. Alsamhi, O. Ma, M. Ansari And F. Almalki, "Survey On Collaborative Smart Drones And Internet Of Things For Improving Smartness Of Smart Cities", Ieee Access, Pp. 1-29, 2019.

[45] S. A. Khaleefa, S. H. Alsamhi, And N. S. Rajput, 'Tethered Balloon Technology For Telecommunication, Coverage And Path Loss', Ieee Students' Conference On Electrical, Electronics And Computer Science, 2014, Pp.1-4.

[46] F. A. Almalki, M. C. Angelides, "Evolution Of An Optimal Propagation Model For The Last Mile With Low Altitude Platforms Using Machine Learning", Elsevier Computer Communications Journal, Vol. 142–143, Pp. 9-33, May 2019

[47] A. Al-Hourani, S. Kandeepan, And S. Lardner, 'Optimal Lap Altitude For Maximum Coverage', Ieee Wireless Communications Letters, Vol. 3, No. 6, Pp. 569–572, Dec. 2014.

[48] I. Dalmasso, I. Galletti, R. Giuliano, F. Mazzenga, "Wimax Networks For Emergency Management Based On Uavs," Ieee First Aess European Conference On Satellite Telecommunications (Estel), 2012, Pp.1-6.

[49] M. S. Aljumaily, "Routing Protocols Performance In Mobile Ad-Hoc Networks Using Millimeter Wave", International Journal Of Computer Networks & Communications, Vol. 10, No. 4, Pp. 23-36, 2018.

[50] K. Gomez, A. Hourani, L. Goratti, R. Riggio, S. Kandeepan, I. Bucaille, "Capacity Evaluation Of Aerial Lte Base-Stations For Public Safety Communications," European Conference On Networks And Communications, 2015, Pp. 133–138.

[51] W. Khawaja, I. Guvenc, D. Matolak, U. C. Fiebig, And N. Schneckenberger, "A Survey

Of Air-ToGround Propagation Channel Modeling For Unmanned Aerial Vehicles,"Electrical Engineering And Systems, Vol. 1801, No. 016, Pp.1-25, 2018.

[52] L. L. Hanzo, Mimo-Ofdm For Lte, Wi-Fi, And Wimax: Coherent Versus Non-Coherent And Cooperative Turbo-Transceivers. United States: John Wiley & Sons, 2011.

[53] W. Feng, J. Wang, Y. Chen, X. Wang, N. Ge And J. Lu, "Uav-Aided Mimo Communications For 5g Internet Of Things", Ieee Internet Of Things Journal, Vol.1, No.1, Pp. 1-10, 2018.

[54] F. A. Almalki, M. C. Angelides, "Deployment Of An Aerial Platform System For Rapid Restoration Of Communications Links After A Disaster: A Machine Learning Approach", Springer Computing Journal, Forthcoming.

[55] S. Alsamhi, O. Ma, M. Ansari And S. Gupta, "Collaboration Of Drone And Internet Of Public Safety Things In Smart Cities: An Overview Of Qos And Network Performance Optimization", Drones, Vol. 3, No. 1, P. 13, 2019.

[56] S. Aljahdali, 'Enhancing The Capacity Of Stratospheric Cellular Networks Using Adaptive Array Techniques', International Journal Of Computer Network And Information Security, Vol. 5, No. 6, Pp. 1–10, 2013.

[57] U. R. Mori, P. Chandarana, G. Gajjar, And S. Dasi, "Performance Comparison Of Different Modulation Schemes In Advanced Technolog

[58] I. Aldmour, "Lte And Wimax: Comparison And Future Perspective," Communications And Network, Vol. 05, No. 04, Pp. 360–368, 2013.

[59] H. Hariyanto, And A. K. Widiawan, 'Emergency Broadband Access Network Using Low Altitude Platform', International Conference On Instrumentation, Communication, Information Technology, And Biomedical Engineering, 2009, Pp.1-6.

[60] F. Almalki, M. Angelides, "Propagation Modelling And Performance Assessment Of Aerial Platforms Deployed During Emergencies," 12th Ieee International Conference For Internet Technology And Secured Transactions, 2017, Pp.238–243.

[61] M. A. Rahman, 'Enabling Drone Communications With Wimax Technology', Ieee 5th International Conference On Information, Intelligence, Systems And Applications, 2014, Pp. 323 – 328.

[62] Q. Zhang, M. Jiang, Z. Feng, W. Li, W. Zhang And M. Pan, "Iot Enabled Uav: Network Architecture And Routing Algorithm", Ieee Internet Of Things Journal, Pp. 1-1, 2019.

[63] Iskandar And A. Abubaker, "Co-Channel Interference Mitigation Technique For Mobile Wimax Downlink System Deployed Via Stratospheric Platform," Ieee 8th International Conference On Telecommunication Systems Services And Applications (Tssa), 2014, Pp.1-5.

[64] P. Bilaye, V. Gawande, U. Desai, A. Raina, And R. Pant, ‘Low Cost Wireless Internet Access For Rural Areas Using Tethered Aerostats’, Ieee Third International Conference On Industrial And Information Systems, 2008, Pp.1-5.

[65] G. S. Rao, Mobile Cellular Communication. India: Pearson Education India, 2013.

[66] J. N. Pelton, S. Madry, S. Camacho-Lara, And Editors., Handbook Of Satellite Applications: 2013. United States: Springer-Verlag New York Inc., 2013.

[67] C. Saunders, ‘The Role Of Small Satellites In Military Communications’, Iet Seminar On Military Satellite Communications, 2013, Pp.1-13.

[68] B. Li, Z. Fei And Y. Zhang, "Uav Communications For 5g And Beyond: Recent Advances And Future Trends", Ieee Internet Of Things Journal, Vol. 6, No. 2, Pp. 2241-2263, 2019.

[69] M. Sadek And S. Aissa, ‘Personal Satellite Communication: Technologies And Challenges’, Ieee Wireless Communications, Vol. 19, No. 6, Pp. 28–35, 2012.

[70] B. G. Evans, ‘The Role Of Satellites In 5g’, Ieee 7th Advanced Satellite Multimedia Systems Conference And The 13th Signal Processing For Space Communications Workshop (Asms/Spsc), 2014, Pp.197 – 202.

[71] J. Liu, Y. Shi, Z. Fadlullah And N. Kato, "Space-Air-Ground Integrated Network: A Survey", Ieee Communications Surveys & Tutorials, Vol. 20, No. 4, Pp. 2714-2741, 2018.

[72] S. Alsamhi And N. Rajput, "An Intelligent Hap For Broadband Wireless Communications: Developments, Qos And Applications", International Journal Of Electronics And Electrical Engineering, Vol. 3, No. 2, Pp. 134-143, 2014.

[73] L. Zhao, H. Zhang, F. Liu, K. Yang And L. Cong, "Joint Time-Frequency-Power Resource Allocation For Low-Medium-Altitude Platforms-Based Wimax Networks", Iet Communications, Vol. 5, No. 7, Pp. 967-974, 2011.

[74] C. Manikandan, P. Neelamegam, R. Kumar, V. Babu And S. Satwikkommi, "Design Of Secure And Reliable Mu-Mimo Transceiver System For Vehicular Networks", International Journal Of Computer Networks & Communications, Vol. 11, No. 02, Pp. 15-32, 2019. Available: 10.5121/Ijcnc.2019.11202.

CONGESTION AND ENERGY AWARE MULTIPATH LOAD BALANCING ROUTING FOR LLNS

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ABSTRACT

The Internet of Things (IoT) is presently in its golden era with its current technological evolution towards digital transformation. Low-power and Lossy Networks (LLNs) form the groundwork for IoT, where the IPv6 Routing Protocol for Low-Power and Lossy Networks (RPL) is designated by Internet Engineering Task Force as the benchmark protocol for routing. Although RPL, with its unique capabilities, has addressed many IoT routing requirements, Load balancing and Congestion control are the outliers. This paper builds on the RPL protocol and proposes a multipath Congestion and Energy Aware RPL (CEARPL) that alleviates the load balancing and congestion concerns associated with RPL and improves the network performance. For congestion avoidance, a Congestion and Energy Aware Objective Function (CEA-OF) is suggested during parent selection that considers multiple metrics like Child Count metric, Estimated Lifetime metric, and Queue Occupancy metric, to equally distribute the traffic in LLNs. The Queue Occupancy metric is used to detect congestion in the network, and a Multipath routing strategy is utilized to mitigate the congestion in the network. A comparison of the performance of CEA-RPL was made against the existing Objective Functions of RPL, OFO, and MRHOF, as well as COM-OF, utilizing Contiki OS 3.0's Cooja emulator. CEA-RPL projected superior results with power consumption lowering by 33%, endto-end delay decreasing by 30%, queue loss ratio reducing by 49%, and packet receiving rate and network lifetime improving by 7% and 49%, on an average, respectively.

KEYWORDS

Congestion, Multipath routing, Internet of Things, Load balancing, Low-power Lossy Networks, Objective function & RPL

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REFERENCES

[1] https://dataprot.net/statistics/iot-statistics/

[2] T. Winter et al., (2012) “RPL: IPv6 Routing Protocol for Low-Power and Lossy Networks”, IETF RFC 6550.

[3] The Internet Engineering Task Force (IETF), 2010. .

[4] Routing Over Low Power and Lossy Networks (ROLL), 2004.

[5] O. Gaddour & A. Koubaa, (2012) “RPL in a nutshell: A survey”, Elsevier, Computer Networks, Volume 56, Issue 14, Pages 3163-3178, doi: 10.1016/j.comnet.2012.06.016

[6] Doruk Pancaroglu, Sevil Sen, (2021) “Load balancing for RPL-based Internet of Things: A review”, Ad Hoc Networks, Volume 116, 102491, ISSN 1570-8705, https://doi.org/10.1016/j.adhoc.2021.102491.

[7] B. G. Mamoun Qasem, Ahmed Al-Dubai & Imed Romdhani, (2017) “Load balancing objective function in RPL”, ROLL – WG INTERNET DRAFT, pp. 1–10

[8] C, Lim, (2019) "A Survey on Congestion Control for RPL-Based Wireless Sensor Networks", Sensors 19, no. 11: 2567. https://doi.org/10.3390/s19112567

[9] P. Thubert, (2012) “Objective function zero for the routing protocol for low-power and lossy networks (RPL)”, RFC 6552.

[10] O. Gnawali & P. Levis, (2012) “The Minimum Rank with Hysteresis Objective Function”, RFC 6719

[11] Ibrahim S. Alsukayti, (2020) “The support of multipath routing in IPv6-based internet of things”, International Journal of Electrical and Computer Engineering (IJECE). 10. 2208. 10.11591/ijece.v10i2.pp2208-2220.

[12] J. Tsai & T. Moors, (2006) “A Review of Multipath Routing Protocols: From Wireless Ad Hoc to Mesh Networks”, 17-18 July

[13] M. Geuzouri, N. Mbarek & A. Temar, (2020) A new way of achieving multipath routing in wireless networks”, International Journal of Wireless and Mobile Computing. 18. 101. 10.1504/IJWMC.2020.10026464.

[14] A. Bhat & V. Geetha, (2017) "Survey on routing protocols for Internet of Things”, 7th International Symposium on Embedded Computing and System Design (ISED), pp. 1-5, doi: 10.1109/ISED.2017.8303949.

[15] O. Iova, F. Theoleyre & T. Noel, (2015) “Exploiting multiple parents in RPL to improve both the network lifetime and its stability", 2015 IEEE International Conference on Communications (ICC), pp. 610-616, doi: 10.1109/ICC.2015.7248389.

[16] M. A. Lodhi, A. Rehman, M. M. Khan & F. B. Hussain, (2015) "Multiple path RPL for low power lossy networks", 2015 IEEE Asia Pacific Conference on Wireless and Mobile (APWiMob),

pp. 279- 284, doi: 10.1109/APWiMob.2015.7374975.

[17] P. Levis, T. Clausen, J. Hui, O. Gnawali & J. Ko, (2011) “The trickle algorithm", March 2011, IETF RFC 6206.

[18] Q. Le, T. Ngo-Quynh & T. Magedanz, (2014) "RPL-based multipath Routing Protocols for Internet of Things on Wireless Sensor Networks", 2014 International Conference on Advanced Technologies for Communications (ATC 2014), pp. 424-429, doi: 10.1109/ATC.2014.7043425.

[19] Radi, Marjan, Behnam Dezfouli, Kamalrulnizam Abu Bakar, & Malrey Lee, (2012) "Multipath Routing in Wireless Sensor Networks: Survey and Research Challenges", Sensors 12, no. 1: 650685. https://doi.org/10.3390/s120100650

[20] W. Lou, W. Liu & Y. Zhang, (2006) “Performance Optimization Using Multipath Routing in Mobile Ad Hoc and Wireless Sensor Networks”, 10.1007/0-387-29026-5_5.

[21] Z. Wang, L. Zhang, Z. Zheng et al., (2018) “Energy balancing RPL protocol with multipath for wireless sensor networks. Peer-to-Peer Networks”, Appl. 11, 1085–1100, https://doi.org/10.1007/s12083-017-0585-1

[22] Oana Iova, Fabrice Theoleyre & Thomas Noel, (2015) “Using Multiparent Routing in RPL to Increase the Stability and the Lifetime of the Network”, Ad Hoc Networks, Elsevier, 29, 10.1016/j.adhoc.2015.01.020, hal-01206380

[23] M. Lodhi, Abdul Rehman, Meer Khan, M. Asfand-E-yar & F. Hussain, (2017) “Transient multipath routing protocol for low power and lossy networks”, KSII Transactions on Internet and Information Systems,11, 2002-2019, 10.3837/tiis.2017.04.010.

[24] T. L. Jenschke, G. Z. Papadopoulos, R. -A. Koutsiamanis & N. Montavont, (2019) "Alternative Parent Selection for Multi-Path RPL Networks", 2019 IEEE 5th World Forum on Internet of Things (WF-IoT), pp. 533-538, doi: 10.1109/WF-IoT.2019.8767236.

[25] Tomas Lagos Jenschke, Remous-Aris Koutsiamanis, Georgios Papadopoulos, Nicolas Montavont, (2021) “ODeSe: On-Demand Selection for multipath RPL networks”, Ad Hoc Networks, Elsevier, 114, pp.102431. 10.1016/j.adhoc.2021.102431. hal-03122968v2f

[26] F. Kaviani & M. Soltanaghaei, (2022) “CQARPL: Congestion and QoS-aware RPL for IoT applications under heavy traffic”, The Journal of Supercomputing, 78, 10.1007/s11227-02204488-2.

[27] H. -S. Kim, H. Kim, J. Paek & S. Bahk, (2017) "Load Balancing Under Heavy Traffic in RPL Routing Protocol for Low Power and Lossy Networks", in IEEE Transactions on Mobile Computing, vol. 16, no. 4, pp. 964-979, 1 April 2017, doi: 10.1109/TMC.2016.2585107.

[28] Kala Venugopal & T. G. Basavaraju, (2022) “A Combined Metric Objective Function for RPL Load Balancing in Internet of Things”, International Journal of Internet of Things, Vol. 10 No. 1, 2022, pp. 22-31. doi: 10.5923/j.ijit.20221001.02.

[29] S. Wakatsuki, N. Komuro, H. Sekiya & S. Sakata, (2014) “Prolonging network lifetime for 6LoWPAN / RPL wireless sensor network using mobile sink with dynamic sojourn time”, 2014

[30] M. Aboubakar, M. Kellil, A. Bouabdallah & P. Roux, (2019) “Toward intelligent

reconfiguration of RPL networks using supervised learning", 2019 Wireless Days (WD), Manchester, United Kingdom, pp. 1-4, 2019, DOI: 10.1109/WD.2019.8734236.

[31] Mah Zaib Jamil, Danista Khan, Adeel Saleem, Kashif Mehmood & Atif Iqbal, (2019) "Comparative performance analysis of RPL for low power and lossy networks based on different objective functions", International Journal of Advanced Computer Science and Applications, Vol. 10, No. 5, DOI: 10.14569/IJACSA.2019.0100524

[32] Contiki O.S and Cooja simulator, http://www.contiki-os.org/ [33] T. Zahariadis & P. Trakadas, (2022) "Design guidelines for routing metrics composition in LLN", ROLL Internet Draft, 2022

[34] Nesrine Khernane, Jean Couchot & Ahmed Mostefaoui, (2018) "Maximum network lifetime with optimal power/rate and routing trade-off for wireless multimedia sensor networks", Computer Communications, Elsevier, 124, pp.1 – 16, hal-02182832

[35] Moteiv Corporation. Tmote sky: Datasheet (2006): https://insense.cs.standrews.ac.uk/files/2013/04/tmote-sky-datasheet.pdf, Nov 13, 2006

[36] H.A.A. Al-Kashoash, H. Kharrufa, Y. Al-Nidawi. et al., (2019) "Congestion control in wireless sensor and LoWPAN Networks: toward the Internet of Things", Wireless Netw 25, 4493-4522, https://doi.org/10.1007/s11276-018-1743-y

A SECURE DATA COMMUNICATION SYSTEM USING CRYPTOGRAPHY AND STEGANOGRAPHY

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ABSTRACT

The information security has become one of the most significant problems in data communication. So it becomes an inseparable part of data communication. In order to address this problem, cryptography and steganography can be combined. This paper proposes a secure communication system. It employs cryptographic algorithm together with steganography. The jointing of these techniques provides a robust and strong communication system that able to withstand against attackers. In this paper, the filter bank cipher is used to encrypt the secret text message, it provide high level of security, scalability and speed. After that, a discrete wavelet transforms (DWT) based steganography is employed to hide the encrypted message in the cover image by modifying the wavelet coefficients. The performance of the proposed system is evaluated using peak signal to noise ratio (PSNR) and histogram analysis. The simulation results show that, the proposed system provides high level of security.

KEYWORDS

Steganography, Cryptography, DWT, Filter bank, PSNR

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REFERENCES

[1] Obaida Mohammad Awad Al-Hazaimeh, (2013) "A New Approach for Complex Encrypting and Decrypting Data" International Journal of Computer Networks & Communications (IJCNC) Vol.5, No.2.

[2] Katzenbeisser, S. and Petitcolas, F.A.P. 2000, Information Hiding Techniques for Steganography and Digital Watermarking. Artech House, Inc., Boston, London.

[3] Xinpeng Zhang and Shuozhong Wang, (2005), "Steganography Using MultipleBase Notational System and Human Vision Sensitivity", IEEE signal processing letters, Vol. 12, No. 1.

[4] Jarno Mielikainen, (2006), "LSB Matching Revisited", IEEE signal processing letters, Vol. 13, No. 5.

[5] Piyush Marwaha, Paresh Marwaha, (2010), "Visual Cryptographic Steganography in images", IEEE, 2nd International conference on Computing, Communication and Networking Technologies.

[6] G.Karthigai Seivi, Leon Mariadhasan and K. L. Shunmuganathan, (2012), " Steganography Using Edge Adaptive Image " IEEE, International Conference on Computing, Electronics and Electrical Technologies.

[7] Hemalatha S, U Dinesh Acharya, Renuka A and Priya R. Kamath, (2012), " A Secure and High Capacity Image Steganography Technique", Signal & Image Processing : An International Journal (SIPIJ) Vol.4, No.1.

[8] Tong L.and Zheng-ding, Q, (2002), "DWT-based color Images Steganography Scheme", IEEE International Conference on Signal Processing, 2:1568-1571.

[9] Mandal J.K. and Sengupta M., (2010), “Authentication/Secret Message Transformation Through Wavelet Transform based Subband Image Coding (WTSIC).”, Proceedings of International Symposium on Electronic System Design, IEEE Conference Publications, pp 225 – 229.

[10] Septimiu F. M., Mircea Vladutiu and Lucian P., (2011),"Secret data communication system using Steganography, AES and RSA", IEEE 17th International Symposium for Design and Technology in Electronic Packaging.

[11] H. Tian, K. Zhou, Y. Huang, D. Feng, J. Liu, (2008), "A Covert Communication Model Based on Least Significant Bits Steganography in Voice over IP", IEEE The 9th International Conference for Young Computer Scientists, pp. 647-652.

[12] Y. Huang, B. Xiao, H. Xiao, (2008), "Implementation of Covert Communication Based on Steganography", IEEE International Conference on Intelligent Information Hiding and Multimedia Signal Processing, pp. 1512-1515.

[13] Cheddad, A, Condell, Joan, Curran, K and McKevitt, Paul,(2008), "Securing Information Content using New Encryption Method and Steganography", IEEE Third International Conference on Digital Information Management.

[14] Rasul E., Saed F. and Hossein S, (2009), " Using the Chaotic Map in Image Steganography", IEEE, International Conference on Signal Processing Systems.

[15] Majunatha R. H. S. and Raja K B, (2010), "High Capacity and Security Steganography using Discrete Wavelet Transform", International Journal of Computer Science and Security (IJCSS), Vol. 3: Issue (6) pp 462-472.

[16] Saraireh S. and Benaissa M., (2009), “A Scalable Block Cipher Design using Filter Banks and Lifting over Finite Fields” In IEEE International Conference on Communications (ICC), Dresden, Germany.

[17] El Safy, R.O, Zayed. H. H, El Dessouki. A, (2009), “An adaptive steganography technique based on integer wavelet transform,” ICNM International Conference on Networking and Media Convergence, pp 111-117.

NEW DESIGN OF LEAKY WAVE ANTENNA BASED ON SIW TECHNOLOGY FOR BEAM STEERING

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ABSTRACT

This paper presents the results of an investigation of a new version of a leaky wave antenna that is based on a substrate integrated waveguide (SIW). The structure of SIW is composed of two rows of cylinders between metal plates; it can be easily produced by the standard method PCB" circuit" or LTCC method, the antenna is designed so that it can radiate in C-band. The direction of the main lobe of the antenna radiation pattern can be steered by changing the frequency in the band from backward direction to forward direction; the effect of increasing the number of slot arrays has also been analyzed to study the effect on radiation patterns. The numerical simulations have been performed using a commercial CST Microwave studio.

KEYWORDS

Leaky wave antenna, substrate integrated waveguide, slots, C-band, CST, moment's method

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REFERENCES

[1] Shen W, Yin WY, and Sun XW. Miniaturized Dual-Band Substrate Integrated Waveguide Filter with Controllable Bandwidths. IEEE Microw and wireless compolett; 2011, 21: 418-420.

[2] Cassivi Y, Perregrini L, Arcioni P, Bressan, WuMK, Conciauro G.Dispersion characteristics of substrate integrated rectangular waveguide. IEEE MicroWir Compo Lett; 2002, 12: 333–335.

[3] Xu F, Wu K. Guided-Wave and Leakage Characteristics of Substrate Integrated Waveguide. IEEE Trans on MTT; 2005, 53: 66-73.

[4] Xu F, Jiang X, Wu K.Efficient and accurate design of substrate integrated waveguide circuits synthesized with metallic via-slot arrays. IET Microw Antennas Propag; 2008, 2: 188–193.

[5] Kim DY, Chung W, Park C, Lee S, Nam S. Design of a 45° Inclined SIW Resonant Series Slot Array Antenna for Ka-Band. IEEE Antand Wir Propag Lett; 2011, 10: 2011.

[6] Yan L, Hong W, Hua G., Chen J, Wu K, and Cui TJ. Simulation and experiment on SIW slot array antennas. IEEE Microwand Wir Compo Lett; 2004, 14, 446–448.

[7] Lu HC, Chu TH. Equivalent circuit of radiating longitudinal slots in substrate integrated waveguide. IEEE AP-S Int Symp Dig; 2004: 2341–2344.

[8] Rayas-Sanchez JE, Gutierrez-Ayala V.A General EM-Based Design Procedure for Single-Layer Substrate Integrated Waveguide Interconnects with Microstrip Transitions. IEEE MTT-S Int Microwave Symp Dig; 2008: 983-986.

[9] Wen-Chung Liu, and Chih-Sheng Chen, Design of Missile-Mounted Siw Antenna With High Directivity for Data Transmission, Progress In Electromagnetics Research C, Vol. 38, 79-88, 2013.

[10] Sourav Moitra, Asish Kumar Mukhopadhyay & Anup Kumar Bhattacharjee, Ku-Band Substrate Integrated Waveguide (SIW) Slot Array Antenna for Next Generation Networks, Volume 13 Issue 5, 2013.

[11] Chen IYu, Wang CJ, Jou CF. Substrate Integrated Waveguide Leaky-Wave Antenna: Concept and Design Considerations. Asia Pacific Microwave Conference, 2005:4-7.

[12] Tang XJ, Xiao SQ, Wang BZ, Wang J. A 60-GHz Wideband Slot antenna Based on Substrate Integrated Waveguide Cavity. Int J Infrared Milli Waves; 2007, 28:275–281.

[13] Dong Y, Itoh T. Composite right left-handed substrate integrated waveguide leaky-wave antennas. 39th European Microwave Conference; 2009.

[14] Chen X, Hong W, Cui T, Chen J and Wu K. Substrate Integrated Waveguide (SIW) Linear Phase Filter. IEEE Microwave and Wireless Components Letters; 2005, 15, 2005.

Developing an Adaptive Channel Modelling using a Genetic Algorithm Technique to Enhance Aerial Vehicle-to-Everything Wireless Communications

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ABSTRACT

In this digital era, Internet of Everything (IoE) has a potential to bring out drastic changes to how we live today, where billions of people and devices require wireless connectivity. Where Unmanned Aerial Vehicles contribute positively in paving the way for IoE and Fifth Generation technologies, and tackle some of their comms challenges. Thus, this paper aims to provide an adaptive approach using a Genetic Algorithm (GA) technique by combining indoor and outdoor propagation models to enhance aerial vehicle-to-everything wireless connectivity. The proposed adaptive approach uses a GA multi-objective function that yield optimum values of UAV altitude, elevation angles, and type of building for indoor environment. The proposed GA optimization technique has met the demand of a typical dense-populated urban environment, as well as empowering the IoE with greater coverage footprint, high Quality of Service benchmark, and line-of-sight adaptability. The output results emphasized that the proposed adaptive approach using the GA technique can help in smart decision-making and selecting a proper setup and find the optimum parameters to provide seamless wireless connections from aerial vehicle-to-everything.

KEYWORDS

Unmanned Aerial Vehicles, Internet of Everything, Channel Modelling, Propagation Model, Fifth Generation.

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Volume Link: https://airccse.org/journal/ijc2021.html

REFERENCES

[1] "Technology QuarterlyThe Economist", The Economist, 2020. [Online]. Available: https://www.economist.com/taxonomy/term/90/0?page=83. [Accessed: 12- Mar- 2020].

[2] S. Mung, C. Cheung, K. Wu and J. Yuen, "Wideband Rectangular Foldable and Non-foldable Antenna for Internet of Things Applications", International Journal of Antennas and Propagation, vol. 2019, pp. 1-5, 2019.

[3] G. Marques, R. Pitarma, N. M. Garcia and N. Pombo, "Internet of Things Architectures, Technologies, Applications, Challenges, and Future Directions for Enhanced Living Environments and Healthcare Systems: A Review", Electronics, vol. 8, no. 10, p. 1081, 2019.

[4] M. Miraz, M. Ali, P. Excell and R. Picking, "Internet of Nano-Things, Things and Everything: Future Growth Trends", Future Internet, vol. 10, no. 8, p. 68, 2018.

[5] S. Alsamhi, O. Ma, M. Ansari and F. Almalki, "Survey on Collaborative Smart Drones and Internet of Things for Improving Smartness of Smart Cities", IEEE Access, vol. 7, pp. 128125-128152, 2019.

[6] Y. Liu, H. Dai, Q. Wang, M. Shukla and M. Imran, "Unmanned aerial vehicle for internet of everything: Opportunities and challenges", Computer Communications, vol. 155, pp. 66-83, 2020.

[7] F. A. Almalki, "Comparative and QoS Performance Analysis of Terrestrial-aerial Platforms-satellites Systems for Temporary Events", International Journal of Computer Networks & Communications, vol. 11, no. 6, pp. 111-133, 2019.

[8] F. A. Almalki, M. C. Angelides, “Considering near space platforms to close the coverage gap in wireless communications; the case of the Kingdom of Saudi Arabia,” FTC 2016 San Francisco - Future Technologies Conference, 2016, pp.224 – 230.

[9] M. Mozaffari, W. Saad, M. Bennis, Y. Nam and M. Debbah, "A Tutorial on UAVs for Wireless Networks: Applications, Challenges, and Open Problems", IEEE Communications Surveys & Tutorials, pp. 1-1, 2019.

[10] A. Alotaibi and M. Angelides, "A serious gaming approach to managing interference in ad hoc femtocell wireless networks", Computer Communications, vol. 134, pp. 163-184, 2019.

[11] F. A. Almalki and B. O. Soufiene, “EPPDA: An Efficient and Privacy-Preserving Data Aggregation Scheme with Authentication and Authorization for IoT-Based Healthcare Applications,” Wireless Communications and Mobile Computing, vol. 2021, pp. 1–18, Mar. 2021.

[12] A. Al-Hourani, S. Kandeepan and S. Lardner, "Optimal LAP Altitude for Maximum Coverage", IEEE Wireless Communications Letters, vol. 3, no. 6, pp. 569-572, 2014.

[13] Z. Hasirci and I. H. Cavdar, "Propagation modeling dependent on frequency and distance for mobile communications via high altitude platforms (HAPs)," 35th International Conference on

Telecommunications and Signal Processing (TSP), Prague, 2012, pp. 287-291.

[14] J. Holis and P. Pechac, "Elevation Dependent Shadowing Model for Mobile Communications via High Altitude Platforms in Built-Up Areas", IEEE Transactions on Antennas and Propagation, vol. 56, no. 4, pp. 1078-1084, 2008.

[15] B. Li, Z. Fei and Y. Zhang, "UAV Communications for 5G and Beyond: Recent Advances and Future Trends", IEEE Internet of Things Journal, vol. 6, no. 2, pp. 2241-2263, 2019.

[16] A. Al-Hourani, S. Kandeepan, and A. Jamalipour, 'Modeling air-to-ground path loss for low altitude platforms in urban environments', IEEE Global Communications Conference, Austin, USA, Dec. 2014, pp. 2898 – 2904.

[17] M. Mozaffari, W. Saad, M. Bennis, and M. Debbah, "Drone small cells in the clouds: Design, deployment and performance analysis," IEEE Global Communications Conference, San Diego, USA, Dec. 2015, pp.1- 6.

[18] G. E. Athanasiadou and G. V. Tsoulos, "Path Loss characteristics for UAV-to-Ground Wireless Channels," 13th European Conference on Antennas and Propagation, Krakow, Poland, 2019, pp. 1-4.

[19] W. Khawaja, O. Ozdemir and I. Guvenc, "UAV Air-to-Ground Channel Characterization for mmWave Systems," 2017 IEEE 86th Vehicular Technology Conference, Toronto, ON, 2017, pp. 1-5.

[20] S. A. Khaleefa, S. H. Alsamhi, and N. S. Rajput, 'Tethered balloon technology for telecommunication, coverage and path loss', 2014 IEEE Students' Conference on Electrical, Electronics and Computer Science, Bhopal, India, Mar. 2014, pp.1-4.

[21] F. A. Almalki, M. C. Angelides, "Empirical Evolution of a Propagation Model for Low Altitude Platforms," IEEEComputing Conference 2017, 2017, pp.1297–1304.

[22] S. H. Alsamhi, M. S. Ansari, O. Ma, F. Almalki, and S. K. Gupta, "Tethered Balloon Technology in Design Solutions for Rescue and Relief Team Emergency Communication Services," Disaster Medicine and Public Health Preparedness, pp. 1–8, May 2018.

[23] S. Alsamhi, F. A. Almalki, S. Gapta, M. Ansari O. Ma, M. Angelides, "Tethered Balloon Technology for Emergency Communication and Disaster Relief Deployment", Springer Telecommunication Systems, 2019.

[24] F. A. Almalki, M. C. Angelides, "Evolution of an Optimal Propagation Model for the Last Mile with Low Altitude Platforms using Machine Learning", Elsevier Computer Communications Journal, vol. 142– 143, pp. 9-33, May 2019.

[25] F. Almalki and M. Angelides, "Deployment of an aerial platform system for rapid restoration of communications links after a disaster: a machine learning approach", Computing, vol. 102, pp. 829-864, Nov. 2019.

[26] W. Khawaja, I. Guvenc, D. Matolak, U. Fiebig and N. Schneckenburger, "A Survey of Air-to-Ground Propagation Channel Modeling for Unmanned Aerial Vehicles", IEEE Communications Surveys & Tutorials, vol. 21, no. 3, pp. 2361-2391, 2019.

[27] S. A. Busari, K. M. Saidul Huq, S. Mumtaz and J. Rodriguez, "Impact of 3D Channel Modeling for UltraHigh Speed Beyond-5G Networks," 2018 IEEE Globecom Workshops (GC Wkshps), Abu Dhabi, United Arab Emirates, 2018, pp. 1-6.

[28] A. Aldhaibani, T. Rahman and A. Alwarafy, "Radio-propagation measurements and modeling in indoor stairwells at millimeter-wave bands", Physical Communication, vol. 38, p. 100955, 2020.

[29] Q. Zhang, G. Niu and M. Pun, "Large-Area Super-Resolution 3D Digital Maps for Indoor and Outdoor Wireless Channel Modeling," 2018 IEEE 87th Vehicular Technology Conference (VTC Spring), Porto, 2018, pp. 1-6.

[30] F. Almalki, "Utilizing Drone for Food Quality and Safety Detection using Wireless Sensors," 3rd IEEE International Conference on Information Communication and Signal Processing (ICICSP 2020), 2020, pp.238–243.

[31] F. Al-Turjman, M. Abujubbeh, A. Malekloo and L. Mostarda, "UAVs assessment in software-defined IoT networks: An overview", Computer Communications, vol. 150, pp. 519-536, 2020.

[32] N. Nomikos et al., "A UAV-based moving 5G RAN for massive connectivity of mobile users and IoT devices", Vehicular Communications, vol. 25, p. 100250, 2020.

[33] S. Ullah et al., "UAV-enabled healthcare architecture: Issues and challenges", Future Generation Computer Systems, vol. 97, pp. 425-432, 2019. Available: 10.1016/j.future.2019.01.028.

[34] A. Mukherjee, S. Misra, A. Sukrutha and N. Raghuwanshi, "Distributed aerial processing for IoT-based edge UAV swarms in smart farming", Computer Networks, vol. 167, p. 107038, 2020.

[35] N. Nomikos, E. T. Michailidis, P. Trakadas, D. Vouyioukas, H. Karl, J. Martrat, T. Zahariadis, K. Papadopoulos, and S. Voliotis, "A UAV-based moving 5G RAN for massive connectivity of mobile users and IoT devices," Vehicular Communications, vol. 25, p. 100250, 2020.

[36] W. Feng, J. Wang, Y. Chen, X. Wang, N. Ge and J. Lu, "UAV-Aided MIMO Communications for 5G Internet of Things," in IEEE Internet of Things Journal, vol. 6, no. 2, pp. 1731-1740, 2019.

[37] F. Almalki, M. Angelides, "Propagation modelling and performance assessment of aerial platforms deployed during emergencies," 12th IEEE International Conference for Internet Technology and Secured Transactions, 2017, pp.238–243.

[38] J. Cole, F. A. Almalki, and P. R. Young, "Chipless RF Liquid Sensor," IEEE International Microwave and RF Conference (IMaRC), 2015, pp. 243 – 245.

[39] Z. Ullah, F. Al-Turjman, L. Mostarda, and R. Gagliardi, “Applications of Artificial Intelligence and Machine learning in smart cities,” Computer Communications, vol. 154, pp. 313–323, 2020.

[40] A. Ansari and A. A. Bakar, "A Comparative Study of Three Artificial Intelligence Techniques: Genetic Algorithm, Neural Network, and Fuzzy Logic, on Scheduling Problem," 2014 4th International Conference on Artificial Intelligence with Applications in Engineering and Technology, Kota Kinabalu, 2014, pp. 31- 36.

[41] A. Ashkzari and A. Azizi, "Introducing Genetic Algorithm as an Intelligent Optimization Technique", Applied Mechanics and Materials, vol. 568-570, pp. 793-797, 2014.

[42] S. Popoola, E. Adetiba, A. Atayero, N. Faruk and C. Calafate, "Optimal model for path loss predictions using feed-forward neural networks", Cogent Engineering, vol. 5, no. 1, 2018.

[43] X. Li, H. Yao, J. Wang, X. Xu, C. Jiang and L. Hanzo, "A Near-Optimal UAV-Aided Radio Coverage Strategy for Dense Urban Areas," IEEE Transactions on Vehicular Technology, vol. 68, no. 9, pp. 9098- 9109, 2019.

[44] L. Wang et al., "Communications and Networking Technologies for Intelligent Drone Cruisers," 2019 IEEE Globecom Workshops (GC Wkshps), Waikoloa, HI, USA, 2019, pp. 1-6.

[45] Z. Ullah, F. Al-Turjman and L. Mostarda, "Cognition in UAV-Aided 5G and Beyond Communications: A Survey," IEEE Transactions on Cognitive Communications & Networking, 2020.

[46] V. Sharma, D. Jayakody and K. Srinivasan, "On the positioning likelihood of UAVs in 5G networks", Physical Communication, vol. 31, pp. 1-9, 2018.

[47] Y. Xu, L. Xiao, D. Yang, L. Cuthbert and Y. Wang, "Throughput maximization in UAV-enabled mobile relaying with multiple source nodes", Physical Communication, vol. 33, pp. 26-34, 2019.

[48] X. Liu, D. He and H. Ding, "Throughput maximization for UAV-enabled full-duplex relay system in 5G communications", Physical Communication, vol. 32, pp. 104-111, 2019.

[49] H. Dai, H. Zhang, B. Wang and L. Yang, "The multi-objective deployment optimization of UAV-mounted cache-enabled base stations", Physical Communication, vol. 34, pp. 114-120, 2019.

[50] V. Garg, Wireless Communications Networking. Estados Unidos: Morgan Kaufmann, 2007, pp. 69-135.

[51] F. A. Almalki, "Utilizing Drone for Food Quality and Safety Detection using Wireless Sensors," 2020 IEEE 3rd International Conference on Information Communication and Signal Processing (ICICSP), Shanghai, China, 2020, pp. 405-412.

[52] B. Yang, “Multiobjective Synthesis of Linear Arrays by Using an Improved Genetic

Algorithm," International Journal of Antennas and Propagation, vol. 2019, pp. 1–13, 2019.

[53] F. A. Almalki "Implementation of 5G IoT Based Smart Buildings using VLAN Configuration via Cisco Packet Tracer", International Journal of Electronics Communication and Computer Engineering, 11(4), pp.56-67, 2020.

[54] "Final Evaluation Report from the Independent Evaluation Group 5G Infrastructure Association", ITU Radiocommunication Groups, 2020. [Online]. Available: https://5g-ppp.eu/wpcontent/uploads/2020/02/5G-IA-Final-Evaluation-Report-3GPP-1.pdf. [Accessed: 28-Feb- 2020]