

Training of dual band HT-based emergency communication tools on member of KTB BPBD, Yogyakarta

Denny Hardiyanto^{a,1,*}, Samuel Kristiyana^{b,2}, Dyah Anggun Sartika^{c,3}, Irfan Ahmad^{d,4}, Israa Al_Barazanchi^{e,5}

^a Electrical Engineering Education, Universitas PGRI Madiun, Madiun, Indonesia

^b Electrical Engineering, Institut Sains dan Teknologi AKPRIND Yogyakarta, Yogyakarta, Indonesia

^c Computer Control Engineering, Politeknik Negeri Madiun, Madiun, Indonesia

^d Department of Computer Science, Khurasan University, Nangarhar, Afghanistan

^e Computer Engineering Techniques Department, Baghdad College of Economic Sciences University, Baghdad - Iraq

¹ College of Computing and Informatics, Universiti Tenaga Nasional (UNITEN), Malaysia

¹ denny.hardiyanto@unipma.ac.id; ² yanaista@akprind.ac.id; ³ dyahanggun@pnm.ac.id; ⁴ irfan.ahmed.mcse;

⁵ israa.albarazanchi@baghdadcollege.edu.iq

* Corresponding Author

ABSTRACT

Currently, the development of communication technology is very advanced with the presence of cellular and internet technology. However, when there is a public security disturbance and in an emergency situation, cellular communication devices are very dependent on electricity sources and pulses to communicate. Besides, if a natural disaster occurs, the power source will go out and the cellular provider BTS will not function. Radio communication can be used as an adequate alternative technology in dealing with emergencies. Radio communication can be established using simple equipment such as HT (Hand Transceiver), transmitting antennas and repeater stations to extend the communication range. The advantages of radio communication are that it is easier to implement, economical, and has a wide coverage. Therefore, the purpose of this community service activity is to improve skills in using emergency communication tools and provide an understanding of Standard Operating Procedures on how to communicate in an emergency situation. The target of this activity includes members of the National Disaster Relief Agency (BPBD) at Yogyakarta City. There are 2 activities, namely radio frequency regulation and skills workshops using emergency communication tools (HT). The result of this community service activity is that the participants are skilled in communicating using HT in times of emergency.

KEYWORDS

Disaster;
Hand Transceiver;
Radio Communication;
BPBD DIY



This is an open-access article under the [CC-BY-SA](https://creativecommons.org/licenses/by-sa/4.0/) license

1. Introduction

Community security and order (kamtibmas) is very important in people's lives for a safe and comfortable life. Disaster preparedness is also a thing that supports a peaceful life because of the readiness of every family member in responding to and aware of their own readiness in dealing with disasters that come at an unknown time. This is considering the location of the province of Yogyakarta which is prone to disasters, namely Earthquake, Merapi Eruption, Tsunami, Landslide, Tornado, etc. Several previous researchers have conducted research on disaster preparedness. Data on knowledge management and natural disaster preparedness: Field survey in East Lombok, Indonesia researched by Arviansyah [1]. Public perceptions of climate change and disaster preparedness: Evidence from the Philippines researched by Bollettino [2]. Indonesian nurses' perceptions of disaster preparedness were investigated by Martono [3]. Modeling predictors of earthquake hazard preparedness in Nepal was investigated by Adhikari [4]. Risk factors for COVID-19: A peculiar case of African governance and preparedness studied by Kulohoma [5].

The librarian's perception of disaster preparedness as a precursor to the effective preservation and conservation of library resources in Nigerian university libraries was investigated by Ilo [6]. Factors Affecting Disaster Response Competence of Emergency Medical Technicians in South Korea were investigated by Uhm [7]. Disaster preparedness in rehabilitation in high-risk areas of major earthquakes

in Japan was studied by Katoh [8]. Community-based flood preparedness for elderly dependents in Thailand was investigated by Krongthaeo [9]. Surveys of readiness of major trauma centers for mass casualty incidents in Australia, Canada, UK and New Zealand were studied by Gabbe [10]. Analysis of Flood Identification and Mitigation for Disaster Preparedness: A Systems Thinking Approach researched by Dzulkarnain [11]. Assessment of effective disaster preparedness and response: The case of Santa Rosa City, Laguna was studied by Juanzon [12]. The role of pre-disaster discussion on preparedness in consensus building for integrated flood management (IFM) after a flood disaster, based on a case in the Abukuma Watershed, Fukushima, Japan was investigated by Konami [13].

Estimation of tsunami debris on the seabed on future disaster preparedness: Revealing the varying spatial effects of a combination of land use and oceanographic factors studied by Matsuba [14]. The recent occurrence of serious tsunami damage and future challenges of tsunami disaster risk reduction was investigated by Imamura [15]. Understanding the decision-making process in disaster risk monitoring and early warning: A case study in a control room in Brazil researched by Horita [16]. Zoning of potential flood hazards and mapping of the suitability of flood shelters for disaster risk mitigation in Bangladesh using geospatial technology was investigated by Uddin [17]. Teacher-parent cooperation in disaster preparedness when schools become evacuation centers was investigated by Kawasaki [18]. Observations on Citizen Risk Awareness and Natural Disaster Management Practices in Mongolia: Khovd Citizens Questionnaire Survey Data researched by Nara [19]. Disaster preparedness at Karnak temple: luxury or necessity researched by Abulnour [20].

Structured, fast and dynamic communication is very helpful for the community in dealing with disturbances in security, order and natural disasters. Radio communication can be used as an alternative technology that is quite adequate in dealing with emergencies such as disasters where the power source goes out and the BTS source goes out. Radio communications can be established using simple equipment such as Hand Transceivers, aluminum transmitting antennas and simple stations to extend the communication range. Several previous researchers have conducted research on radio communication. Measurement and prediction of large-scale radio propagation path losses in the VHF and UHF bands were studied by Faruk [21]. Vulnerability related to disaster communication: A heuristic framework was investigated by [22]. The Algorithm Solution for the RFID Tag Anti Collision Problem in Supply Chain Management was investigated by Pal [23]. The program and circuit design of the FSK radio simple software circuit based on the MCU was investigated by ZhongKai [24]. A local algorithm for clustering in cognitive radio networks was investigated by Kumar [25]. Multimedia communication over cognitive radio networks from a QoS/QoE perspective: A comprehensive survey was investigated by Jalil [26]. The investigation of the performance of different pathloss models for wireless communication systems in Nigeria was investigated by Igbinosa [27].

Bayesian-based Distributed Sequential Decisions in Railroad Transit Cognitive Radio was investigated by Wang [28]. The design of a mini antenna for establishing peer-to-peer communications in an oil pipeline was investigated by Priyanka [29]. Coverage of environmental issues on FM radio in Nepal: current status and challenges researched by Paudel [30]. The cross-polarization effect of radio wave propagation by forest vegetation in wireless communication systems on transport was investigated by Popov [31]. Path loss prediction for multi-transmitter radio propagation in the VHF band using the Adaptive Neuro-Fuzzy Inference System was investigated by Surajudeen-Bakinde [32]. The microwave photonic approach as a new intelligent fabrication technique of radio communication jammer was investigated by Belkin [33]. Distributed voice communication ecosystem for air traffic control system was investigated by Kabashkin [34]. The radio and optical alignment method based on GPS was investigated by Mariola [35]. Mitigation of spectral leakage for a single carrier, radio receiver cognitive processing block was investigated by Polak [36]. Temporal exposure variations of radio frequency electromagnetic fields around mobile communication base stations were investigated by Olorunsola [37]. Improved secrecy of

the RF backhaul system with parallel FSO communication links was investigated by Ai [38]. An investigation of the heterogeneous railway communication network model was investigated by [39].

The adaptive antenna system by ESP32-PICO-D4 and its application to a web radio system was investigated by Kodera [40]. A technical review of wireless security for the internet of things: Software-defined radio perspective researched by Rugeles [41]. Optimization of Spectrum Utilization Parameters on Cognitive Radio Using Genetic Algorithms was investigated by Rharras [42]. Communication channels for air quality warnings in the United States were investigated by Pennington [43]. Decision fusion in cognitive radio using an enhanced fuzzy approach was investigated by Aiswarya [44]. Other-initiated improvements as a critical communication indicator in ship-to-ship interactions were investigated by Boström [45]. Think Gap! A quantitative comparison between ship-to-ship communication and the intended communication protocol was investigated by Boström [46]. The Method of Measurement of Indoor Flow Lines Based on Radio Waves and Ultrasonic Sensors was investigated by Zhao [47]. The received signal strength and local terrain profile data for planning and optimizing radio networks in the GSM frequency band were investigated by Popoola [48]. Deep Learning-Based MIMO Transmission with Precoding Network and Radio Transformer was investigated by Cui [49]. Radiofrequency transparent carbon nanotube electrothermal films for radome de-icing applications were investigated by Hong [50].

The use of TETRA personal radios and illness absence in the Airwave Health Monitoring Study of the British police force was investigated by Elliott [51]. The impact of the uncertainty of soil texture parameters on the estimation of soil moisture through radio wave transmission was investigated by Di Fusco [52]. Research and summary of the SNR estimation algorithm based on cognitive radio was investigated by Li [53]. A survey on spectrum distribution/allocation for the Internet of Things cognitive radio network was studied by Tarek [54]. S-transformation based integrated approach for spectrum estimation, storage, and sensing in cognitive radio was studied by Pradhan [55]. Channel Model Emulation and Estimation for MIMO-Based Satellite Ground Mobile Systems using Software Defined Radio were investigated by [56]. Communicating to reduce disaster risk by radio in Nepal: A case study of Milijuli Nepali and Kathamaala researched by Saha [57]. A Reliable Communication Protocol for Coach-Based Augmented Biofeedback Application in Swimming was researched by Kos [58].

Comparative study of Radio Refraction Gradient in the troposphere using Chaotic Quantifiers was investigated by Ojo [59]. Strengthening the Learning Spectrum Management Paradigm in Cognitive Radio using Novel State and Action Sets researched by Yin [60]. From the problem of radio communication has advantages such as easier to implement, economical, and wide coverage. Therefore, the contribution of this community service activity is to improve skills in using communication tools and provide an understanding of SOPs on how to communicate in an emergency. In addition, in the event of a natural disaster, the power source will be cut off and the cellular provider BTS will not function. Circumstances like that make the need for a power source very necessary. In this case, the electricity source from PLN cannot cover this need because the power source goes out. Therefore, we need an alternative system/technology that can be used for telecommunications systems during an emergency.

2. Method

This community service activity is carried out in collaboration between institutions/universities and the Yogyakarta City Regional Disaster Management Agency (BPBD). Expert instructors for this activity come from lecturers from various institutions who have expertise in the field of communication. The targets of this community service activity are members of the KTB (Disaster Resilience Village), members of the Yogyakarta City BPBD, PUSDALOP, and TCR with a number of participants reaching 50 people and carried out at Wisma Sargedede, Yogyakarta City before the pandemic. As a member of the BPBD, he has an important role in serving the community, especially in the event of a disaster situation and is always

alert and responsive in carrying out his duties. BPBD members must be equipped with a lot of insight and special skills in dealing with disasters (kamtibmas). The implementation of this activity includes 2 activities, namely regulatory material and radio frequency permits [61][62] and skills workshops using a Dual Band hand transceiver (HT) communication tool, how to set up HT and the use of repeater stations [63][64]. The details of the implementation stages are shown in Fig. 1.

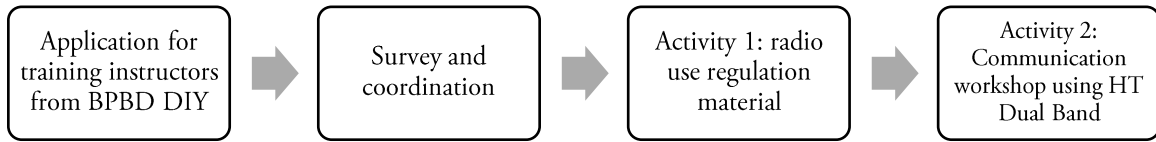


Fig. 1. Implementation stages

Activity 1 is carried out in one day which contains explanations of basic materials on communication, regulation and radio frequency licenses. Furthermore, activity 2 was carried out in 2 consecutive days, namely a communication skills workshop which included setting up a Dual Band Hand Transceiver communication device and simulating communication using a repeater station in case of an emergency.

3. Results and Discussion

A member of the kamtibmas and a member of the Regional Disaster Management Agency (BPBD) must have special expertise in dealing with various emergency situations. Therefore, various skills, especially communication skills and understanding proper communication SOPs, must always be improved. The result or outcome of this activity is an increase in the skills of participants in using emergency communication tools, namely Hand Transceiver (HT) Dual Band and understanding the SOP for proper communication when an emergency occurs. Participants gain expertise and knowledge about communication tools from the workshop activities that are carried out and simultaneously conduct communication simulations between members using repeaters. The result of achieving activity 1 is that participants understand government regulations related to the use of radio frequencies. In this case, the PKM team presented and discussed materials related to the basics of radio communication and radio frequency licenses. Activity photos are shown in Fig. 2.



Fig. 2. Radio communication basic material activities

Activity 2 is a communication training workshop using HT Dual band. Before conducting a communication simulation, participants are required to set their respective HT in the settings feature is

shown in Fig. 3. Assisted by the instructor, participants followed the method of setting the HT according to the frequency used is shown Fig. 4.



Fig. 3. How to set up hand transceiver

As for setting up HT, there are several things that must be considered, namely the introduction of buttons on HT, terms that are often used in HT (including: TX, RX, VHF, UHF, Duplex). In the workshop, 3 different frequencies were used. For KTB BPD DIY participants, they must be able to adjust the frequency on the HT for practice using the RX frequency: 169,635 MHz, TX: 164,635 MHz, Duplex (-) 5,000, Tone 88.5. For Pusdalop members, the frequency is RX: 169,525 MHz, TX: 164,525 MHz, Duplex (-) 5,000, Tone 88.5. Meanwhile, the Direct/Simplex exercise frequency uses RX/TX 165,000 MHz.



Fig. 4. Workshop of antenna installation and hand transceiver setup

The result of this workshop activity is that the participants are competent/skilled in communicating using HT Dual Band. Then to facilitate communication and the next step is to create a communication logbook for members of KTB BPBD DIY is shown in Fig. 5.

LOGBOOK						
KOMUNIKASI KTB – BPBD KOTA Yogyakarta						
NAMA : _____					LOGSHEET No : _____	
CALLSIGN: _____						
ALAMAT : _____						
No	Hari/Tanggal	Waktu (WIB)	Frekuensi (MHz)	Pengirim (Tx)	Penerima (Rx)	Isi Berita
1						
2						
3						

Fig. 5. Communication logbook

Fig. 5 is communication logbook. This logbook will then be used by each participant in carrying out daily activities to support smooth communication when carrying out their duties as BPBD members.

4. Conclusion

The conclusion that can be given is that the members of KTB BPBD DIY as participants in the activity are very enthusiastic about the communication skills workshop. The participants of the activity were very excited to immediately compile and build a communication system at the village level. The KTB organization immediately made a rollcall communication system for directed calls on every working day guided from the Yogyakarta City BPBD office.

Acknowledgment

Our gratitude goes to the members of the Yogyakarta City Regional Disaster Management Agency (BPBD), Gadjah Mada University, IST AKPRIND Yogyakarta, UNIPMA, and PNM for their full support in implementing this community service activity.

Author Contribution

This community service activity is carried out in collaboration between institutions/universities and the Yogyakarta City Regional Disaster Management Agency (BPBD).

Funding

Our gratitude goes to the members of the Yogyakarta City Regional Disaster Management Agency (BPBD), Gadjah Mada University, IST AKPRIND Yogyakarta, UNIPMA, and PNM for their full support in implementing this community service activity.

Conflict of Interest

The authors declare no conflict of interest.

References

- [1] A. Arviansyah, R. D. Kusumastuti, N. Nurmala, and S. S. Wibowo, "Data on knowledge management and natural disaster preparedness: A field survey in East Lombok, Indonesia," *Data Br.*, vol. 36, p. 107156, Jun. 2021, doi: [10.1016/j.dib.2021.107156](https://doi.org/10.1016/j.dib.2021.107156).

- [2] V. Bollettino, T. Alcayna-Stevens, M. Sharma, P. Dy, P. Pham, and P. Vinck, "Public perception of climate change and disaster preparedness: Evidence from the Philippines," *Clim. Risk Manag.*, vol. 30, no. October, p. 100250, 2020, doi: [10.1016/j.crm.2020.100250](https://doi.org/10.1016/j.crm.2020.100250).
- [3] M. Martono, S. Satino, N. Nursalam, F. Efendi, and A. Bushy, "Indonesian nurses' perception of disaster management preparedness," *Chinese J. Traumatol.*, vol. 22, no. 1, pp. 41–46, Feb. 2019, doi: [10.1016/j.cjtee.2018.09.002](https://doi.org/10.1016/j.cjtee.2018.09.002).
- [4] M. Adhikari, D. Paton, D. Johnston, R. Prasanna, and S. T. McColl, "Modelling predictors of earthquake hazard preparedness in Nepal," *Procedia Eng.*, vol. 212, pp. 910–917, 2018, doi: [10.1016/j.proeng.2018.01.117](https://doi.org/10.1016/j.proeng.2018.01.117).
- [5] B. W. Kulohoma, "COVID-19 risk factors: The curious case of Africa's governance and preparedness," *Sci. African*, vol. 13, p. e00948, Sep. 2021, doi: [10.1016/j.sciaf.2021.e00948](https://doi.org/10.1016/j.sciaf.2021.e00948).
- [6] P. I. Ilo, C. Nkiko, R. Izuagbe, and I. M. Furfuri, "Librarians' perception of disaster preparedness as precursor for effective preservation and conservation of library resources in Nigerian university libraries," *Int. J. Disaster Risk Reduct.*, vol. 43, p. 101381, Feb. 2020, doi: [10.1016/j.ijdrr.2019.101381](https://doi.org/10.1016/j.ijdrr.2019.101381).
- [7] D. Uhm, G. Jung, Y. Yun, Y. Lee, and C. Lim, "Factors Affecting the Disaster Response Competency of Emergency Medical Technicians in South Korea," *Asian Nurs. Res. (Korean. Soc. Nurs. Sci.)*, vol. 13, no. 4, pp. 264–269, Oct. 2019, doi: [10.1016/j.anr.2019.09.005](https://doi.org/10.1016/j.anr.2019.09.005).
- [8] S. Kato, N. Sato, and M. Kurihara, "Disaster preparedness in rehabilitation in an area at high risk of mega-earthquakes in Japan," *Ann. Phys. Rehabil. Med.*, vol. 61, p. e119, Jul. 2018, doi: [10.1016/j.rehab.2018.05.260](https://doi.org/10.1016/j.rehab.2018.05.260).
- [9] S. Krongthaeo, N. Piaseu, T. Junda, and B. M. Wall, "Community-based flood preparedness for Thai dependent older adults," *Int. J. Disaster Risk Reduct.*, vol. 63, p. 102460, Sep. 2021, doi: [10.1016/j.ijdrr.2021.102460](https://doi.org/10.1016/j.ijdrr.2021.102460).
- [10] B. J. Gabbe et al., "Survey of major trauma centre preparedness for mass casualty incidents in Australia, Canada, England and New Zealand," *EclinicalMedicine*, vol. 21, p. 100322, Apr. 2020, doi: [10.1016/j.eclinm.2020.100322](https://doi.org/10.1016/j.eclinm.2020.100322).
- [11] A. Dzulkarnain, E. Suryani, and M. R. Aprillya, "Analysis of Flood Identification and Mitigation for Disaster Preparedness: A System Thinking Approach," *Procedia Comput. Sci.*, vol. 161, pp. 927–934, 2019, doi: [10.1016/j.procs.2019.11.201](https://doi.org/10.1016/j.procs.2019.11.201).
- [12] J. B. P. Juanzon and A. W. C. Oreta, "An assessment on the effective preparedness and disaster response: The case of Santa Rosa City, Laguna," *Procedia Eng.*, vol. 212, no. 2017, pp. 929–936, 2018, doi: [10.1016/j.proeng.2018.01.120](https://doi.org/10.1016/j.proeng.2018.01.120).
- [13] T. Konami, H. Koga, and A. Kawatsura, "Role of pre-disaster discussions on preparedness on consensus-making of integrated flood management (IFM) after a flood disaster, based on a case in the Abukuma River Basin, Fukushima, Japan," *Int. J. Disaster Risk Reduct.*, vol. 53, no. November 2020, p. 102012, Feb. 2021, doi: [10.1016/j.ijdrr.2020.102012](https://doi.org/10.1016/j.ijdrr.2020.102012).
- [14] M. Matsuba, Y. Tanaka, T. Yamakita, Y. Ishikawa, and K. Fujikura, "Estimation of tsunami debris on seafloors towards future disaster preparedness: Unveiling spatial varying effects of combined land use and oceanographic factors," *Mar. Pollut. Bull.*, vol. 157, no. May, p. 111289, Aug. 2020, doi: [10.1016/j.marpolbul.2020.111289](https://doi.org/10.1016/j.marpolbul.2020.111289).
- [15] F. Imamura, S. P. Boret, A. Suppasri, and A. Muhari, "Recent occurrences of serious tsunami damage and the future challenges of tsunami disaster risk reduction," *Prog. Disaster Sci.*, vol. 1, p. 100009, May 2019, doi: [10.1016/j.pdisas.2019.100009](https://doi.org/10.1016/j.pdisas.2019.100009).
- [16] F. E. A. Horita, J. P. de Albuquerque, and V. Marchezini, "Understanding the decision-making process in disaster risk monitoring and early-warning: A case study within a control room in Brazil," *Int. J. Disaster Risk Reduct.*, vol. 28, no. January, pp. 22–31, Jun. 2018, doi: [10.1016/j.ijdrr.2018.01.034](https://doi.org/10.1016/j.ijdrr.2018.01.034).
- [17] K. Uddin and M. A. Matin, "Potential flood hazard zonation and flood shelter suitability mapping for disaster risk mitigation in Bangladesh using geospatial technology," *Prog. Disaster Sci.*, vol. 11, no. March 2019, p. 100185, Oct. 2021, doi: [10.1016/j.pdisas.2021.100185](https://doi.org/10.1016/j.pdisas.2021.100185).
- [18] H. Kawasaki, S. Yamasaki, M. M. Rahman, Y. Murata, M. Iwasa, and C. Teramoto, "Teachers-parents cooperation in disaster preparation when schools become as evacuation centers," *Int. J. Disaster Risk Reduct.*, vol. 44, no. May 2019, p. 101445, Apr. 2020, doi: [10.1016/j.ijdrr.2019.101445](https://doi.org/10.1016/j.ijdrr.2019.101445).
- [19] Y. Nara and S. Battulga, "Observations on Residents' Risk Awareness and Practice of Countermeasures against Natural Disasters in Mongolia: Questionnaire Survey Data of Khovd Citizens," *Procedia Comput. Sci.*, vol. 159, pp. 2345–2354, 2019, doi: [10.1016/j.procs.2019.09.409](https://doi.org/10.1016/j.procs.2019.09.409).

- [20] A. Abulnour, "Disaster preparedness in the Karnak temple : a luxury or a must?," *Alexandria Eng. J.*, vol. 57, no. 4, pp. 2879–2886, Dec. 2018, doi: [10.1016/j.aej.2018.07.002](https://doi.org/10.1016/j.aej.2018.07.002).
- [21] N. Faruk et al., "Large-scale radio propagation path loss measurements and predictions in the VHF and UHF bands," *Heliyon*, vol. 7, no. 6, p. e07298, Jun. 2021, doi: [10.1016/j.heliyon.2021.e07298](https://doi.org/10.1016/j.heliyon.2021.e07298).
- [22] S. Hansson et al., "Communication-related vulnerability to disasters: A heuristic framework," *Int. J. Disaster Risk Reduct.*, vol. 51, p. 101931, Dec. 2020, doi: [10.1016/j.ijdrr.2020.101931](https://doi.org/10.1016/j.ijdrr.2020.101931).
- [23] K. Pal, "Algorithmic Solutions for RFID Tag Anti-Collision Problem in Supply Chain Management," *Procedia Comput. Sci.*, vol. 151, pp. 929–934, 2019, doi: [10.1016/j.procs.2019.04.129](https://doi.org/10.1016/j.procs.2019.04.129).
- [24] Z. ZhongKai, J. Xuecheng, and C. Ping, "Program and circuit design of simple software radio FSK based on MCU," *Procedia Comput. Sci.*, vol. 131, pp. 440–445, 2018, doi: [10.1016/j.procs.2018.04.250](https://doi.org/10.1016/j.procs.2018.04.250).
- [25] S. Kumar and A. K. Singh, "A localized algorithm for clustering in cognitive radio networks," *J. King Saud Univ. - Comput. Inf. Sci.*, vol. 33, no. 5, pp. 600–607, Jun. 2021, doi: [10.1016/j.jksuci.2018.04.004](https://doi.org/10.1016/j.jksuci.2018.04.004).
- [26] M. Jalil Piran et al., "Multimedia communication over cognitive radio networks from QoS/QoE perspective: A comprehensive survey," *J. Netw. Comput. Appl.*, vol. 172, no. June, p. 102759, Dec. 2020, doi: [10.1016/j.jnca.2020.102759](https://doi.org/10.1016/j.jnca.2020.102759).
- [27] O. G. Igbiosa and U. K. Okpeki, "Performance investigation of different pathloss models for a wireless communication system in Nigeria," *Heliyon*, vol. 5, no. 5, p. e01656, May 2019, doi: [10.1016/j.heliyon.2019.e01656](https://doi.org/10.1016/j.heliyon.2019.e01656).
- [28] C. Wang, Y. Wang, and C. Wu, "Bayesian-based Distributed Sequential Decision In Rail Transit Cognitive Radio," *Procedia Comput. Sci.*, vol. 129, pp. 382–388, 2018, doi: [10.1016/j.procs.2018.03.012](https://doi.org/10.1016/j.procs.2018.03.012).
- [29] E. B. Priyanka, S. Thangavel, and T. Kalavathidevi, "Miniaturized antenna design for communication establishment of peer-to-peer communication in the oil pipelines," *Pet. Res.*, no. xxxx, Apr. 2021, doi: [10.1016/j.ptlrs.2021.04.003](https://doi.org/10.1016/j.ptlrs.2021.04.003).
- [30] P. K. Paudel, R. Bastola, and P. T. Lopchan, "The coverage of environmental issues in FM radios in Nepal: the current status and challenges," *Heliyon*, vol. 6, no. 7, p. e04354, Jul. 2020, doi: [10.1016/j.heliyon.2020.e04354](https://doi.org/10.1016/j.heliyon.2020.e04354).
- [31] V. Popov, "Cross-polarization effect of radio waves propagation by forest vegetation in wireless communication systems on transport," *Procedia Comput. Sci.*, vol. 149, pp. 195–201, 2019, doi: [10.1016/j.procs.2019.01.123](https://doi.org/10.1016/j.procs.2019.01.123).
- [32] N. T. Surajudeen-Bakinde et al., "Path loss predictions for multi-transmitter radio propagation in VHF bands using Adaptive Neuro-Fuzzy Inference System," *Eng. Sci. Technol. an Int. J.*, vol. 21, no. 4, pp. 679–691, Aug. 2018, doi: [10.1016/j.jestch.2018.05.013](https://doi.org/10.1016/j.jestch.2018.05.013).
- [33] M. E. Belkin, D. Fofanov, and A. Sigov, "Microwave photonics approach as a novel smart fabrication technique of a radio communication jammers," *Procedia Comput. Sci.*, vol. 180, no. 2019, pp. 950–957, 2021, doi: [10.1016/j.procs.2021.01.346](https://doi.org/10.1016/j.procs.2021.01.346).
- [34] I. Kabashkin and V. Philippov, "Distributed ecosystem of voice communications for air traffic control system," *Procedia Comput. Sci.*, vol. 177, pp. 32–39, 2020, doi: [10.1016/j.procs.2020.10.008](https://doi.org/10.1016/j.procs.2020.10.008).
- [35] M. Mariola, Y. Ismail, and F. Petruccione, "Radio and optical alignment method based on GPS," *MethodsX*, vol. 6, no. May, pp. 2057–2064, 2019, doi: [10.1016/j.mex.2019.09.016](https://doi.org/10.1016/j.mex.2019.09.016).
- [36] A. C. Polak, M. Wagner, M. F. Duarte, R. W. Jackson, and D. L. Goeckel, "Mitigation of spectral leakage for single carrier, block-processing cognitive radio receivers," *Digit. Commun. Networks*, vol. 4, no. 2, pp. 106–110, Apr. 2018, doi: [10.1016/j.dcan.2017.04.001](https://doi.org/10.1016/j.dcan.2017.04.001).
- [37] A. B. Olorunsola, O. M. Ikumapayi, B. I. Oladapo, A. O. Alimi, and A. O. M. Adeoye, "Temporal variation of exposure from radio-frequency electromagnetic fields around mobile communication base stations," *Sci. African*, vol. 12, p. e00724, Jul. 2021, doi: [10.1016/j.sciaf.2021.e00724](https://doi.org/10.1016/j.sciaf.2021.e00724).
- [38] Y. Ai, A. Mathur, H. Lei, M. Cheffena, and I. S. Ansari, "Secrecy enhancement of RF backhaul system with parallel FSO communication link," *Opt. Commun.*, vol. 475, no. June, p. 126193, Nov. 2020, doi: [10.1016/j.optcom.2020.126193](https://doi.org/10.1016/j.optcom.2020.126193).
- [39] V. Popov, V. Skudnovs, A. Shevchenko, and A. Vasiljevs, "Railway heterogeneous communication network model investigations," *Procedia Comput. Sci.*, vol. 149, pp. 223–230, 2019, doi: [10.1016/j.procs.2019.01.127](https://doi.org/10.1016/j.procs.2019.01.127).
- [40] T. Kodera, "Adaptive antenna system by ESP32-PICO-D4 and its application to web radio system," *HardwareX*, vol. 3, no. March, pp. 91–99, Apr. 2018, doi: [10.1016/j.ohx.2018.03.001](https://doi.org/10.1016/j.ohx.2018.03.001).

- [41] J. de J. Rugeles Uribe, E. P. Guillen, and L. S. Cardoso, "A technical review of wireless security for the internet of things: Software defined radio perspective," *J. King Saud Univ. - Comput. Inf. Sci.*, no. xxxx, Apr. 2021, doi: [10.1016/j.jksuci.2021.04.003](https://doi.org/10.1016/j.jksuci.2021.04.003).
- [42] A. El Rharras, M. Saber, A. Chehri, R. Saadane, N. Hakem, and G. Jeon, "Optimization of Spectrum Utilization Parameters in Cognitive Radio Using Genetic Algorithm," *Procedia Comput. Sci.*, vol. 176, pp. 2466–2475, 2020, doi: [10.1016/j.procs.2020.09.328](https://doi.org/10.1016/j.procs.2020.09.328).
- [43] A. F. Pennington, K. Sircar, J. Hsu, H. S. Zahran, S. A. Damon, and M. C. Mirabelli, "Communication channels for air quality alerts in the United States," *Prev. Med. Reports*, vol. 14, no. January, p. 100860, Jun. 2019, doi: [10.1016/j.pmedr.2019.100860](https://doi.org/10.1016/j.pmedr.2019.100860).
- [44] K. Aiswarya, A. B. Thomas, A. S. Motti, A. Kuriakose, and J. Jacob, "Decision fusion in cognitive radio using improved fuzzy approach," *Procedia Comput. Sci.*, vol. 143, pp. 219–225, 2018, doi: [10.1016/j.procs.2018.10.383](https://doi.org/10.1016/j.procs.2018.10.383).
- [45] M. Boström, "Other-initiated repair as an indicator of critical communication in ship-to-ship interaction," *J. Pragmat.*, vol. 174, pp. 78–92, Mar. 2021, doi: [10.1016/j.pragma.2021.01.007](https://doi.org/10.1016/j.pragma.2021.01.007).
- [46] M. Boström, "Mind the Gap! A quantitative comparison between ship-to-ship communication and intended communication protocol," *Saf. Sci.*, vol. 123, no. November 2019, p. 104567, Mar. 2020, doi: [10.1016/j.ssci.2019.104567](https://doi.org/10.1016/j.ssci.2019.104567).
- [47] X. Zhao, L. Shuyu, Y. Kajihara, and H. Yamamoto, "Indoor Flow Line Measurement Method Based on Radio Waves and Ultrasonic Sensors," *Procedia Manuf.*, vol. 39, no. 2019, pp. 1104–1111, 2019, doi: [10.1016/j.promfg.2020.01.360](https://doi.org/10.1016/j.promfg.2020.01.360).
- [48] S. I. Popoola, A. A. Atayero, and N. Faruk, "Received signal strength and local terrain profile data for radio network planning and optimization at GSM frequency bands," *Data Br.*, vol. 16, pp. 972–981, Feb. 2018, doi: [10.1016/j.dib.2017.12.036](https://doi.org/10.1016/j.dib.2017.12.036).
- [49] W. Cui, A. Dong, Y. Cao, C. Zhang, J. Yu, and S. Li, "Deep Learning Based MIMO Transmission with Precoding and Radio Transformer Networks," *Procedia Comput. Sci.*, vol. 187, pp. 396–401, 2021, doi: [10.1016/j.procs.2021.04.078](https://doi.org/10.1016/j.procs.2021.04.078).
- [50] J. Hong et al., "Radio-frequency transparent carbon nanotube electrothermal film for radome de-icing application," *J. Mater. Res. Technol.*, vol. 9, no. 5, pp. 10854–10862, Sep. 2020, doi: [10.1016/j.jmrt.2020.07.097](https://doi.org/10.1016/j.jmrt.2020.07.097).
- [51] P. Elliott et al., "Use of TETRA personal radios and sickness absence in the Airwave Health Monitoring Study of the British police forces," *Environ. Res.*, vol. 175, no. May, pp. 148–155, Aug. 2019, doi: [10.1016/j.envres.2019.05.012](https://doi.org/10.1016/j.envres.2019.05.012).
- [52] E. Di Fusco, I. Lauriola, R. Verdone, V. Di Federico, and V. Ciriello, "Impact of uncertainty in soil texture parameters on estimation of soil moisture through radio waves transmission," *Adv. Water Resour.*, vol. 122, no. July, pp. 131–138, Dec. 2018, doi: [10.1016/j.advwatres.2018.10.007](https://doi.org/10.1016/j.advwatres.2018.10.007).
- [53] M. Li, "Research and summary of SNR estimation algorithm based on cognitive radio," *Procedia Comput. Sci.*, vol. 183, pp. 205–211, 2021, doi: [10.1016/j.procs.2021.02.051](https://doi.org/10.1016/j.procs.2021.02.051).
- [54] D. Tarek, A. Benslimane, M. Darwish, and A. M. Kotb, "Survey on spectrum sharing/allocation for cognitive radio networks Internet of Things," *Egypt. Informatics J.*, vol. 21, no. 4, pp. 231–239, Dec. 2020, doi: [10.1016/j.eij.2020.02.003](https://doi.org/10.1016/j.eij.2020.02.003).
- [55] P. M. Pradhan and G. Panda, "S-transformation based integrated approach for spectrum estimation, storage, and sensing in cognitive radio," *Digit. Commun. Networks*, vol. 5, no. 3, pp. 160–169, Aug. 2019, doi: [10.1016/j.dcan.2018.09.004](https://doi.org/10.1016/j.dcan.2018.09.004).
- [56] A. Pandey, R. Gandhiraj, S. Kirthiga, M. Jayakumar, M. N. Devi, and S. C. Bera, "Emulation of Channel Model and Estimation for MIMO based Satellite Land Mobile System using Software Defined Radio," *Procedia Comput. Sci.*, vol. 143, pp. 868–875, 2018, doi: [10.1016/j.procs.2018.10.368](https://doi.org/10.1016/j.procs.2018.10.368).
- [57] S. Saha, S. G. Pradhan, and A. Siwakoti, "Communicating to reduce disaster risk through radio in Nepal: A case study of Milijuli Nepali and Kathamaala," *Prog. Disaster Sci.*, vol. 10, p. 100161, Apr. 2021, doi: [10.1016/j.pdisas.2021.100161](https://doi.org/10.1016/j.pdisas.2021.100161).
- [58] A. Kos and A. Umek, "Reliable Communication Protocol for Coach Based Augmented Biofeedback Applications in Swimming," *Procedia Comput. Sci.*, vol. 174, no. 2019, pp. 351–357, 2020, doi: [10.1016/j.procs.2020.06.098](https://doi.org/10.1016/j.procs.2020.06.098).
- [59] J. S. Ojo, A. O. Adelakun, and O. V. Edward, "Comparative study on Radio Refractivity Gradient in the troposphere using Chaotic Quantifiers," *Heliyon*, vol. 5, no. 8, p. e02083, Aug. 2019, doi: [10.1016/j.heliyon.2019.e02083](https://doi.org/10.1016/j.heliyon.2019.e02083).

-
- [60] Z. Yin, Y. Wang, and C. Wu, "Reinforcement Learning Spectrum Management Paradigm in Cognitive Radio using Novel State and Action Sets," *Procedia Comput. Sci.*, vol. 129, pp. 433–437, 2018, doi: [10.1016/j.procs.2018.03.020](https://doi.org/10.1016/j.procs.2018.03.020).
- [61] Setiawan, D. (2010). Alokasi Frekuensi. In D. Setiawan, Alokasi Frekuensi Kebijakan dan Perencanaan Spektrum Indonesia. Jakarta: Departemen Komunikasi dan Informatika, Direktorat Jenderal Pos dan Telekomunikasi.
- [62] kominfo. (2013, 10 28). Perizinan Spektrum Frekuensi Radio. Retrieved Februari 21, 2021, from Kementerian Komunikasi dan Informasi Republik Indonesia: https://kominfo.go.id/content/detail/3345/perizinan-spektrum-frekuensi-radio/0/layanan_kominfo.
- [63] nusakom. (2020, September 14). Tutorial Lengkap Cara Penggunaan dan Setting HT Baofeng UV 5R. Retrieved Februari 21, 2021, from Nusakom.com: <https://www.nusakom.com/2020/09/setting-ht-baofeng-uv-5r.html>.
- [64] nusakom. (2018, November 27). Cara Setting HT Alinco DJ A10. Retrieved Februari 21, 2021, from Nusakom.com: <https://www.nusakom.com/2018/11/cara-setting-ht-alinco-dj-a10.html>.