WI -R TECHNOLOGY

Asst.Prof Vidhya V [1] & Stenil P.P[2] & Sherin Martin[3] & Saneetta Sunil[4] & Jofin Johny[5]

Abstract

Wirelike wireless technology is a concept that seeks to deliver the performance, reliability, and speed characteristics of traditional wired connections (like Ethernet) but through a wireless medium. This abstraction is intended to provide seamless, high-performance communication without the need for physical cables, offering the flexibility and convenience of wireless networking with the consistency and reliability typically associated with wired solutions. Their role and contribution to secure psychological wellbeing of the emotionally, economically and socially distressed people is significant. It is expected that the social workers maintain a high level of psychological wellbeing, so that, they would be able to help others to secure the same. Social work training must focus on strategies to secure high level of psychological wellbeing to all the student social workers.

Keywords: Wi-Fi, Bluetooth, 5G, IoT, NFC, Wireless communication

[1]*Assistant professor, School of Computer Science, De Paul Institute of Science & Technology (DiST), Angamaly, Kerala, India.*
Email: vidhya@depaul.edu.in

[2]*Student, IMCA 2021-26, School of Computer Science, De Paul Institute of Science & Technology (DiST), Angamaly, Kerala, India.*

[3]*Student, IMCA 2021-26, School of Computer Science, De Paul Institute of Science & Technology (DiST), Angamaly, Kerala, India.*

[4]*Student, IMCA 2021-26, School of Computer Science, De Paul Institute of Science & Technology (DiST), Angamaly, Kerala, India.*

[5]*Student, IMCA 2021-26, School of Computer Science, De Paul Institute of Science & Technology (DiST), Angamaly, Kerala, India.*

1. Introduction

Wi-R Technology represents a cutting-edge, non-radiative communication system that has the potential to revolutionize the way devices communicate wirelessly. Unlike conventional wireless technologies, such as Bluetooth, Wi-Fi, and Ultra-Wideband (UWB), which rely on electromagnetic (EM) signals that radiate in all directions,[1] Wi-R uses Electro-Quasistatic (EQS) Fields to create a more efficient and secure form of data transfer. The fundamental innovation of Wi-R lies in its ability to confine communication signals to a very localized area, much like a wire, which prevents the signal from being exposed to the surrounding environment. This approach significantly reduces energy consumption, improves data privacy, and enhances overall security compared to traditional wireless methods.[2]

The Ixana Wi-R Chip YR22 represents a monumental leap in wireless communication technology.[2] Engineered for precision and efficiency, the YR22 is designed to seamlessly integrate into a range of devices, revolutionizing how we interact with our technology.[3]

Traditional electromagnetic (EM) field-based wireless (e.g., Bluetooth, Wi-Fi, UltraWideBand (UWB)) radiates signals in every direction.[3] For example, Bluetooth signals can be accessed by anyone in a 5-10m radius. Wi-R, on the other hand, confines the signal around the surface, similar to Wired Communication.[3] Hence, Wire-like Wireless or Wi-R. Someone sitting at your next table doesn't even have access to the physical signal, leading to energy efficiency and additional physical security on top of the mathematical security that comes from encryption.[2]

Key Concepts:

1.1 Non-Radiative Communication:

Most traditional wireless systems, such as Bluetooth, Wi-Fi, UWB, and the likes, use electromagnetic signal propagation in all directions,[2] meaning that signals propagate with much farther distances from what they are originally set to reach. This presents much room for vulnerability on eavesdropping, interference, [3]and access on unauthorized peo

ple. The Wi-R technology avails an opportunity to cancel it by using nonradiative communication, [2]where signals get propagated in a localized bubble, surrounding user or device. This way of establishing a communication channel is wirelike and, consequently, sharply reduces the possibility of intercepting the signal.[2]

1.2 Electro-Quasistatic (EQS) Fields:

Wi-R utilizes Electro-Quasistatic (EQS) Fields, which are low frequency electric fields that extend only over extremely short distances—typically just a few of the human body or the device itself. In contrast to the RF communication of old, which broadcasted signals over a broad band of frequencies and distances,[2] EQS fields are highly localized. As a result, energy loss in transmission is minimal,[2] which makes the system highly efficient. In addition, the range of Indeed, these fields are so limited that the overall risk of interference is reduced. interference is reduced.

1.3 Ultra-Low Energy Consumption:

One of the major advantages of Wi-R technology is its extraordinary energy efficiency. In fact, WiR consumes up to 100 times less energy than traditional wireless systems such as Bluetooth and WiFi.[4] This significant reduction in energy usage makes Wi-R exceptionally ideal for applications that require sustained, long-term communication. Devices operating on Wi-R technology[4] can maintain a constant connection without quickly draining battery life, which is particularly important in Body Area Networks (BANs) or Personal Area Networks (PANs),[5] where power constraints are a major consideration. Wi-R is also significantly more energy-efficient than UWB,[8] consuming 10 times less energy, further making it an attractive solution for energy-sensitive applications.

1.4. Private, High-Speed Communication:

Another important feature of Wi-R is that it allows for high-speed communication with preservation of privacy and security. As the communication range of Wi-R is very short, usually less than 10 cm, it ensures that data is accessible only to devices in that close proximity. This "localized" communication bubble ensures that data cannot be accessed from outside sources.[8] It is thus perfect for personal and secure data transfer. Whether used in healthcare settings.

2.The Need for Wi-R Technology

The primary motivation behind the development of Wi-R technology is to address some of the limitations inherent in traditional wireless communication systems, especially within the context of Personal Area Networks (PANs) and Body Area Networks (BANs).[10] In these networks, where devices often communicate within close proximity to one another, traditional wireless technologies can face challenges such as high energy consumption, potential interference, and security risks. WiR bridges this gap by offering a communication system that combines the energy efficiency of wired communication with the convenience and flexibility of wireless solutions.

When continuous monitoring is necessary, e.g., in health care (patient health metrics), sport (physical activity), and/or personal security (activity tracking),[10] Wi-R offers a more efficient and an improved protection communicative facility. The ability to create highly localized communication channels not only enhances data privacy but also opens up new possibilities for wearable technologies that can operate for extended periods without needing frequent recharging.

Wi-R Technology is a highly promising step in the design of secure, power-efficient, and low-power wireless communication. As a technology that can achieve, through high-speed private communication[5] over very narrow ranges, Wi-R is well-positioned to serve as a gateway feature for the next generation of wearable, smart health, and user-specific devices.

communication systems. By blending the advantages of wired communication with the flexibility of wireless systems,[5] Wi-R could transform how we think about connectivity in personal networks and beyond.

USAGE OF WI-R TECHNOLOGY

Wi-R technology is about to revolutionize a number of industries by offering a low power, secure, and efficient communication path between a wide range of devices. Its specific benefits make it appropriate for use in consumer applications such as consumer electronics, medical devices, or personal computers, especially when dealing with wearable devices, human-computer interaction (HCI),[6] and augmented reality (AR).[7] The capability of the technology to deliver secure, high-speed, and energy-efficient communication at a small scale opens a wide range of opportunities for new solutions.

Key Applications: Key Applications:

3.1 Body Area Networks (BANs) and Wearables:

• Efficient Communication for Wearables: • Efficient Communication for Wearables:

Wi-R is particularly well suited for building Body Area Networks (BANs) [14] composed of more than one device, such as fitness trackers, health sensors, smartwatches, and augmented reality glasses, to be linked together or within close proximity on and around the human anatomy. These wearables, which are an essential part of the growing IoT ecosystem, need continuous and reliable communication with very low energy.

• Unified Communication Network: • Unified Communication Network:

Typically those devices communicate through conventional means, such, as Bluetooth, [14] but Bluetooth and other wireless technologies are notoriously power-intensive, since the devices are constantly transmitting information with each other transmission.[11] This problem is addressed by developing a single, low-power communication network that wraps around the body such that wearables can talk to each other, without consuming energy through wasteful wireless links. This decrease in Power consumption is critical for continuous operating, such as health monitoring applications or fitness trackers.

• Elimination of Device Interference: • Elimination of Device Interference:

Since Wi-R restricts its signal to a small, localized region, there is no interference between the devices. This is important in application to healthcare or sports applications, where multiple wearables could be used simultaneously. Thanks to the use of Wi-R, medical staff can oversee patients in real-world conditions and guarantee that data from a number of devices does not overlap between devices or degrade the signal.[13]

3.2 Personal Secure Broadband:

• Solution to the "Last-Meter Problem":

In PANs or BANs, the challenge of maintaining high-speed, reliable, and secure wireless connections, especially close to the user, can be a significant challenge. This is often referred to as the "last-meter problem", and it affects technologie[12]s like Wi-Fi or Bluetooth that struggle to maintain consistent performance in such localized spaces.

• Wi-R as a Secure and High-Speed Solution:

Wi-R solves this issue by providing a personal secure broadband solution that maintains

high data rates (e.g., 1 Mbps for music and images) while significantly reducing energy consumption. Prototypes of Wi-R have demonstrated the ability to reach up to 20 Mbps, which is sufficient for delivering high-definition AR/VR[15] content or streaming video directly from wearables. This makes Wi-R a promising candidate for wireless personal broadband networks that are secure, efficient, and scalable.[15]

3.3 Human-Computer Interaction (HCI):

• Revolutionizing Interaction with Devices:

One of the most exciting applications of Wi-R technology lies in Human-Computer Interaction (HCI). Wi-R enables seamless and intuitive interactions between users and devices, making communication more natural and user-friendly. For example, a simple touch or gesture can automatically trigger communication or data transfer between devices without requiring manual pairing or activation.[16]

• Touchless Communication:

In contrast to traditional communication channels (e. g., Bluetooth) where devices needed to be paired before data could be exchanged, Wi-R enables devices to recognize and communication with each other autonomously, whenever a user interacts with them. From the perspective of wearables, smart suits, smart wear and AR glasses, the interaction between the user and the device should also be fast and convenient. The combination of intent-based gestures and communication embodied by Wi-R[12] opens new avenues for intuitive user interfaces, advanced gesture-based control, and context-aware computing.

3.4 Security and Privacy:

• Enhanced Data Privacy and Security:

A major advantage of Wi-R technology is its guarantee of security by confining the range of a communication signal to a small area of the environment, the so-called local bubble generated by the user or device. Since the signal only extends a few centimeters (typically less than 10 cm),[11] it is extremely difficult for unauthorized parties to intercept or eavesdrop on the communication. This inherent security feature significantly reduces the chances of data being accessed by hackers or external sources.

3.5 Healthcare and Medical Applications:

• Long-lasting, Low-energy Monitoring:

The energy-saving communication of Wi-R allows it to be suitable for medical applications where devices need to stay functional long term without having to be recharged frequently. In this way, Wi-R-based health monitoring patches can continuously monitor important physiological parameters like heart rate, body temperature, and glucose levels, supplying real-time data for patients and physicians.

COMPARISON WITH EXISTING SYSTEM

Wi-R technology combines the best of both worlds, i.e., the energy saving of wired communication with freedom of motion and ease of use provided by wireless communication. It far surpasses traditional wireless technologies in key areas:

• Energy Efficiency: Wi-R, which is 100 times more energy-efficient than Bluetooth and Wi-Fi, is suitable for power-limited applications, such as wearable electronics.

• Data Rate: Wi-R is capable of data rates up to 20 Mbps-significantly exceeding that of Bluetooth,[4] NFC and NFMI, and only just falling short of wire-like Wi-Fi performance.

• Security: The limited communication bubble of Wi-R provides a greater degree of physical security than Bluetooth, Wi-Fi, NFC, and NFMI,[14] and is hence appropriate for privacy-sensitive systems such as medicine, secure payment, and private networks.

• Flexibility and Reliability: In contrast to NFC and NFMI, Wi-R can achieve higher data rates, and uses a broadband channel, which enables a more robust and flexible communication[6] for AR/VR, health monitoring, and wearables, etc.

Finally, owing to its strong characteristic properties of lowenergy consumption, high-rate communcation, and physical security, Wi-R technology[8] is a promising candidate for Body Area Networks (BANs) and Personal Area Networks (PANs), and other on the rise wireless communication systems.

5.ADVANTAGES AND DISADVANGES

Wi-R technology is characterized by a number of advantages and disadvantages. Following is a more specific discussion of its benefits, drawbacks and future prospects.

Advantages: Advantages:

1 Energy Efficiency: Among the most impactful benefit of Wi-R technology is its high energy efficiency. Against current wireless communication technologies, Wi-R uses, at maximum, 100 times less power.[8] This leads to extended battery life for devices and reduced requirement for recharging at regular intervals. Energy efficiency is an important issue in wearable devices (e.g., smart watches, fitness trackers, health sensors) where operational time is increased and user's inconvenience is minimized. Wi-R's low energy consumption is emphatically good for medical apps, where uninterrupted use is necessary, although replacement of the batteries/chaging is not feasible.

2 High-Speed Communication: With the ability to support data rates up to 20 Mbps in prototype stages, [8] Wi-R is positioned to handle high-bandwidth applications. This ability allows both real-time video streaming and interactive augmented reality (AR) and virtual reality (VR) with only low latency and no loss of quality perceivable. With increased demand for bandwidth-heavy applications, Wi-R[8] high-speed communication is going to play an essential role in wearable applications, smart home devices and high-level in-healthcare monitoring system.

Physical Security: The special communication mechanism of Wi-R based on ElectroQuasistatic (EQS) field leads to a relatively enclosed communication field around the user or the device, thus improves the physical defense. In contrast to conventional wireless systems (i.e., Wi-Fi, Bluetooth), broadly broadcasting signals, Wi-R[15] provides a greatly reduced likelihood of signals being intercepted by an unwanted user. Communication range is usually less than 10 cm, so information can only be obtained if devices are brought into extremely close vicinity. This offers increased privacy, especially in sensitive contexts such as medical applications, financial transactions, and personal information exchange.

Touch Selectivity: Wi-R technology provides novel interaction paradigms (e.g., devices can interact using physical touch or simple gestures), by offering a new level of control, where interactions are guided by the physical touch or simple gesture. For instance, a fist pump or a touch between devices may start automatic data transfer or activate certain features.[16] This offers a more intuitive user experience and eliminates the need for complex manual pairing procedures. Data transmission capability in a low-effort work capacity reveals interesting opportunities for hands-free operation, contactless payment, and scene user interaction.

Scalability: Wi-R technology is capable of coexisting use of multiple synchronized devices in a limited area, which is ideal for situations with a large number of wearable devices or sensors. For example, in healthcare settings, up to 25 motion trackers or health monitoring devices could communicate simultaneously without significant interference.[9] This scalability is of enormous importance in densely populated environments (e.g., hospitals, cellular activity tracking, smart home, etc., where high numbers of devices must cooperate in a highly efficient manner without performance degradation.

Disadvantages: Disadvantages:

1. Limited Range: Because of the inherent nature of EQS fields, the communication range of Wi-R is always short-ranging, i.e., less than 10 cm. Although the short range is favorable for privacy and security, it restricts the use of Wi-R for long-range communication, for example, large-area networks or long-haul data transmission. [9]This range constraint can be a bottleneck to the application of Wi-R to applications where wider coverage is needed, e.g., embedded IoT devices or wide-area surveillance systems.

2. Interference: However, due to the localized bubble that Wi-R operates in, there is the possibility of electromagnetic interference from regional sources. In dense electromagnetic environments, e.g., close to high-power electrical appliances or radio frequency interference,[10] Wi-R signals may suffer from an inadequate communication quality. This is a problem common to all wireless modalities, and it will need solutions ranging from advanced signal processing or even frequency management to achieve performance guarantees in any environment where challenging conditions exist.[12]

3. Security Concerns:

Although Wi-R provides a substantial amount of physical security by constraining a signal's exposure, software defects or incorrect setup could still leave the systems vulnerable. Not unlike any new technology, securing strong cybersecurity and data encryption mechanisms are paramount.[15] The small communication bubble is not immune to internal attack, i.e., malware or device compromise, which can target either software or network architecture. [6] Software archetypes will require developers to look at how strong authentication can be provided and how secure software can be designed to protect confidential information.

4. Complexity in Integration:

Because Wi-R is a relatively new technology, it may become easier to incorporate into well-established eco-systems and devices. In contrast to Bluetooth, NFC, or Wi-Fi, that are widely implemented in the industry and covered by support, Wi-R\'s unique communication method may demand custom hardware and specific software. For example, devices would have to be incorporated with from of EQS [14] field generators and receivers, which might result in increasing the difficulty of integration and production cost. Also, it will be necessary for the developers to re-design the communication protocols and device compatibility environments to allow Wi-R-powered devices to interfaces with existing wireless systems smoothly.

6. FUTURE SCOPE

Wi-R's potential extends far beyond its current capabilities. With the technology evolving and increasing the popularity for wearables and real-time communication,[5] Wi-R has the potential to change various fields. Some of the exciting future directions for Wi-R include:

1. Medical Devices: Wi-R technology is a particularly exciting subset for healthcare. Due to its ultra-low energy consumption, Wi-R can support development of charging-free health monitoring devices with continuous operation over long time scales. Devices, like biosensors, electrocardiography (ECG) patches,[2] or wearable health monitors, could continuously acquire real-time from the body data and transfer it securely and with no need for regular battery charging. This could greatly enhance the quality of management of chronic disease, remote patient monitoring, and care for the elderly.

2. Augmented and Virtual Reality (AR/VR): Wi-R may be a disruptive force in augmented reality (AR) and virtual reality (VR) through the delivery of high-speed, low latency [1-4].

connection for devices within the user's personal area. The communication security and efficiency offered by Wi-R would make AR/VR headsets, gloves, and motion trackers possible to operate uninterrupted by the drawbacks of traditional wireless technologies, such as Wi-Fi or Bluetooth, which are powerhungry and/or prone to interferences. This would enhance immersive experiences and make AR/VR technology more userfriendly for gaming, education, training, and healthcare applications. Another exciting application of

Wi-R would be the deployment of distributed computing instde of a Body Area Netwrok (BAN). Assuming Wi-R's capacity to link a group of devices in a small area, it would be potentially used to carry out distributed AI computation and real time data analysis at the edge. Wearable energy consuming devices with Wi-R capabilities could serve as standalone, intelligent nodes within an BAN, [8] able to perform data analysis in the field and reach a decision without the need for Cloud-based processing. This would be of special use in applications like healthcare, where data processing at real-time level is important to keep track of vital signs or to identify emergencies.

4. Smart Environments and IoT: Wi-R's energy saving, secure communication bubble, in turn, turns it into a promising solution to be incorporated in smart environments and IoT infrastructures. Devices such as smart dressing, wearables, and furniture for interactive applications could communicate with each other continuously with Wi-R,[8] providing an energy-efficient, secure, and interconnected smart environment. This could enable a range of developments to personalized user experiences, environmental monitoring and adaptive systems whose behaviour adapts to the user over time.

CONCLUSION

Wireless and infrared (WI-R) based technology has helped diverse industries to communicate seamlessly with each other and transfer data without any physical coupling. Conclusion WI-R technology has broad utility, such as higher mobility, flexibility and efficiency over systems. It enables faster and more reliable communication, reduces the dependency on cables, and allows for scalable, adaptable solutions in various fields, such as telecommunications, healthcare, transportation, and consumer electronics.

However, challenges such as security concerns, signal interference, and energy consumption still exist and need to be addressed as technology advances. However, along with these challenges, the ongoing development of WI-R technology, from the 5G network [12] roll-out to the progress in infrared systems, provides an exciting future, where smarter and interconnected world could be created. Mesmerizing functionality of WI-R technology will continue to be embedded in the day-to-day life, which will provide user-friendly experiences and speed up the industries worldwide.

References

[1] Mohammed Mana, Mohammed Feham, and Boucif Amar Bensaber, “A light weight protocol to provide location privacy in wireless body area networks”, International Journal of Network Security and its Applications (IJNSA), Vol.3, No.2, March 2011

[2] International Journal of Distributed and Parallel Systems (IJDPS) Vol.3, No.1, January 2012.

[3] Yasir Arfat Malkani and Lachhman Das Dhomeja, “PSim: A tool for analysis of device pairing methods”, International Journal of Network Security & Its Applications (IJNSA), Vol.1, No.3, October 2009

[4] Kumar, A., et al. Caveat eptor, “A comparative study of secure device pairing methods”, IEEE International Conference on Pervasive Computing and Communications (PerCom-09). 2009.

[5] Jochen Schiller, “Mobile Communications”, Second Edition, Addison Wesley Publications,2003, pp. 290-292

[6] R. Howell, "An Update on Short Range Wireless Technology," Mouser Electronic Inc., [Online]. Available: http://eu.mouser.com/applications/short_range_ wireless technology/. [Accessed 12 03 2015].

[7] N. Chhabra, "Comparative Analysis of Different Wireless Technologies," International Journal Of Scientific Research In Network Security & Communication, vol. 1, no. 5, pp. 3- 4, 2013.

[8]"What is ZigBee?" ZigBee Alliance, 2015. [Online]. Available: http://www.zigbee.org/what-is-zigbee/. [Accessed 22 03 2015].

[9] J. M. Kahn and J. R. Barry, "Wireless Infrared Communications," Proceedings of the IEEE, vol. 8, no. 2, 1997.

[10]. ARPN Journal of Engineering and Applied Sciences, ISSN 1819-6608, VOL. 10, NO. 6, APRIL 2015

[11]. Baker, N. “ZigBee and Bluetooth: Strengths and weaknesses for industrial applications,” IEE Computing &

Control Engineering, vol. 16, no. 2, pp 20-25, April/May 2005.
[12].http://www.bluetooth.com/bluetooth/

[13]. See: www.Zigbee.com

[14].Jin-Shyan Lee, Yu-Wei Su, and ChungChou Shen ," A Comparative Study of Wireless Protocols: Bluetooth, UWB, ZigBee, and WiFi", The 33rd Annual Conference of the IEEE Industrial Electronics Society (IECON) Nov. 5- 8, 2007, Taipei, Taiwan

[15].A. Sikora and V. F. Groza, "Coexistence of IEEE802.15.4 with other systems in the 2.4 GHz-ISM-Band," in Proc. IEEE Instrumentation & Measurement Technology Conference, Ottawa, May 2005, pp.1786-1791.

[16]. K. Shuaib, M. Boulmalf, F. Sallabi, and A. Lakas, "Co-existence of Zigbee and WLAN: A performance study," in Proc. IEEE/IFIP Int. Conf. Wireless & Optical Communications Networks, Bangalore, India, April 2006.

[17]. P. S. Neelakanta and H. Dighe, "Robust factory wireless communications: A performance appraisal of the Bluetooth and the ZigBee collocated on an industrial floor," in Proc. IEEE Int. Conf. Ind.