Vehicle To Vehicle CommunicationUsing .Cognitive Radio Technology

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Abstract— Vehicle-to-vehicle (V2V) communication is pivotal for enhancing road safety and traffic efficiency in modern transportation systems. However, traditional V2V systemsencounter significant challenges, including spectrum scarcity andinterference issues, which hinder their effectiveness. Cognitive radio technology emerges as a promising solution tomitigate thesechallenges by enabling vehicles to intelligently sense and utilize available spectrum bands opportunistically. This paper offers a comprehensive overview of V2V communication leveraging cognitive radio technology, delving into fundamental principles, system architectures, communication protocols, and diverse applications. We examine the transformative potential of cognitive radio in V2V communication, highlighting its advantages such as dynamic spectrum access and interference mitigation capabilities. Furthermore, we explore the implicationsof cognitive radio technology on various V2V applications, including collision avoidance, cooperative driving, and traffic management, emphasizing its role in fostering safer and more efficient transportation networks. Despite its promises, the deployment of cognitive radio based V2V systems presents challenges such as spectrum sensing in dynamic vehicular environments and regulatory compliance. We advocate for futureresearch endeavours aimed at addressing these challenges and advancing cognitive radio technology to realize the full potentialof V2V communication, ultimately contributing to the development of safer and more efficient transportation ecosystems

Keywords—Vehicle-to-vehicle, Secure communicationprotocol, safety applications.

1. INTRODUCTION

In the realm of modern transportation, the integration of advanced technologies continues to reshape the landscape, promising safer, moreefficient, and smarter mobility solutions. Among these innovations, Vehicle-to- Vehicle (V2V) communication stands out as a pivotal advancement, leveragingthe transformative capabilities of Cognitive Radio Technology (CRT) to redefine the way vehicles interact on the road.The introduction of V2V communication marks asignificant leap forward in thepursuit of enhanced road safety, traffic management, and overall driving experience. At its core, V2V communication enables vehicles to exchange critical information with nearby vehicles in real-time, creating a dynamic network that fosters proactivedecision-making and mitigates potential risks on the road.

Central to the effectiveness of V2V communication is Cognitive Radio Technology, a sophisticated approach that empowers vehicles to intelligently utilize available radio frequency spectrum. Unlike traditional radio systems, CRT enables adaptive and autonomous spectrum sensing, allowing vehicles to dynamically identify and access unused spectrum bands opportunistically. This dynamic spectrum access capabilityoptimizes communication reliability, throughput, and efficiency,even in congested or interference-prone environments. The benefits of V2V communication powered by CRT extend beyondmere safety enhancements. By facilitating seamless data exchange among vehicles, CRT enables innovative applications such as cooperative collision avoidance, traffic flow optimization,and adaptive cruise control. Moreover, V2V communication laysthe foundation for the eventual realization of fully autonomous driving, where vehicles collaborate harmoniously to navigatecomplex traffic scenarios with unparalleled precision and reliability.

11. LITERATURE SURVEY

Vehicle-To-Vehic1e Communication For Collision Avoidance.This paper examines the utilization of vehicle- tovehicle (V2V) communication systems to prevent collisions onroads. It discusses various technologies and protocols employed for V2V communication and evaluates their efficacy in enhancingroad safety emerging communication technologies such as Cellular Vehicle-to- Everything (C-V2X) are also being explored for V2V communication. C-V2X leverages existing cellular networks to enable vehicles to communicate not only with each other but also with infrastructure elements such as traffic lights and road signs, further enhancing situational awareness and safety.2019 [l].

A Survey Of Vehicular Communication Systems .Gaurav Bansal, Mayank Jain, Rohit Kumar, and Samir R. This survey paper provides an overview of different vehicular communicationsystems, encompassing both infrastructurebased and ad hoc networks.lt delves into communication protocols, architectures, applications,and research trends within the field of vehicular networks. The survey identifies emerging research trends and future directions in the field of vehicular communication systems,including the integration of emerging technologies such as artificial intelligence (Al), edge computing, and blockchain to enhance communication reliability, security, and scalability. Additionally, the survey discusses challenges such as spectrum allocation, interoperability, and privacy concerns, highlighting the need for ongoing research and collaboration to address these challenges and realize the full potential of vehicularcommunication technology .2019[2].

Enhancing IEEE 802.11p/WAVE To Provide InfotainmentApplications In Vehicular Ad Hoc Networks.Vijay Kumar, M. S. Obaidat, and Syed Faraz HasanThis paper proposes enhancements to the IEEE 802.1 Ip/WAVEstandard to support infotainment applications in vehicular ad hoc networks (VANETs). It addresses the need for multimedia content delivery and entertainment services in vehicular environments The paper may also discuss potential future directions and research avenues in the field of infotainment in VANETs, including the integration of emerging technologies such as edgecomputing, machine learning, and content caching to further improve the delivery of multimedia services and address evolving user demands and vehicular communication challenges2020,

A Survey On Emerging LTE-Based Vehicular Network Solutions Meryem Simsek, Özgür Gürbüz, and Izzet F. Güvenc .This survey paper explores emerging Long-Term Evolution (LTE)-based solutions for vehicular networks, such as LTE-V and LTE-V2X. It investigates how these technologies can facilitate various vehicular communication applications,including safety, traffic management, and multimedia services LTE-V (LTE for Vehicular) and LTE-V2X (LTE Vehicle- toEverything) are extensions of the Long-Term Evolution (LTE)cellular technology tailored specifically for vehicular communication.LTEV primarily focuses on direct communication between vehicles (V2V), while LTE-V2X encompasses broader communication scenarios, including vehicle-to-infrastructure (V21) and vehicle-to-network (V2N) communication.2021 , [4]. [3]

A Survey On Vehicular Ad Hoc Networks Rajib Mall, andSanjay K. Madria.This survey paper offers an overview ofvehicular ad hoc networks (VANETs), covering communicationarchitectures, protocols, applications, and research challenges. Itprovides insights into the current stateof-the-art in VANETs andoutlines future research directions within the fieldSeveral relevant information among nearby vehicles, while communication protocols have been proposed for VANETs to address challenges such as network connectivity, mobility, and security. These protocols include routing protocols for datadissemination, MAC (Medium Access Control) protocols for efficient channel access, and congestion control protocols to manage network traffic. Additionally, security protocols arecrucial for protecting VANETs against malicious attacks and ensuring data confidentiality, integrity, and availability2022,[5].

111.PROPOSED WORK

The proposed method for vehicle-to-vehicle (V2V) communication centers on developing a comprehensiveframework to facilitate efficient and reliable communication between vehicles on the road. This method integrates various communication technologies, protocols, and algorithms to enableseamless data exchange and collaboration in dynamic trafficenvironments. A key aspect of this method involves designing a robust communication protocol specifically tailored for V2V communication, taking into consideration factors like latency, reliability, and scalability. This protocol is essential for supporting efficient message dissemination, collision avoidance, and cooperative driving maneuvers among vehicles. Additionally,the method incorporates cognitive radio technology to enable dynamic spectrum access and intelligent spectrum sharing, utilizing spectrum sensing algorithms to detect available frequency bands and allocate spectrum resources based on trafficconditions. Cooperative sensing techniques are deployed to gather environmental data and share localization algorithms accurately determine the positions and trajectories of neighboring vehicles, facilitating collaborative decision-making and maneuver coordination. Security and privacy measures are also integrated to protect V2V communication against unauthorized access andmalicious attacks, ensuring the confidentiality and integrity of exchanged information. Furthermore, the method exploressynergies with existing transportation infrastructure, such as roadside units and traffic management systems, to enable seamless integration and information exchange between vehicles and infrastructure components. Extensive simulations, field trials,and performance evaluations are conducted to assess the effectiveness and scalability of the proposed method in realworldscenarios, evaluating key performance metrics like communication range, reliability, throughput, and latency under varying traffic conditions and environmental factors. Overall, theproposed method aims to establish a robust framework for enhancing road safety, traffic efficiency, and mobility in future transportation systems through seamless V2V communication and collaboration.

IV. METHODOLOGY

A. SPECTRUM SENSING

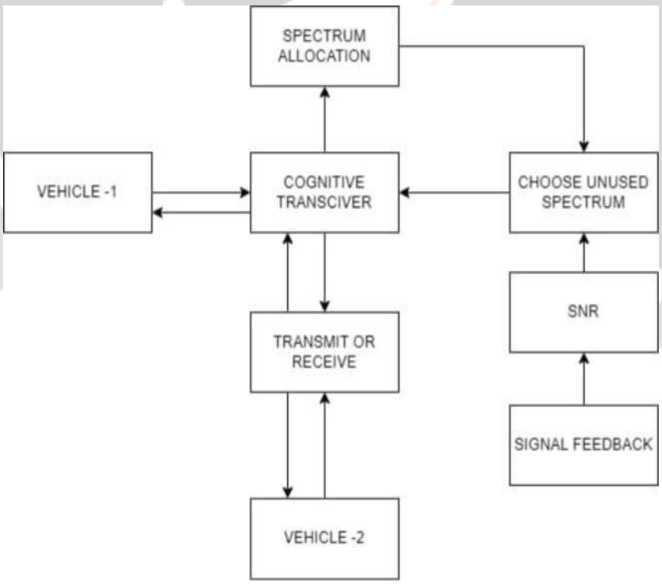
Cognitive radios, equipped with advanced sensing capabilities, meticulously scan the radio frequency spectrum to discern frequencies that are not currently in use or are lightly occupied by licensed users, such as cellular networks or broadcasting stations. Through this process, they analyze variouscharacteristics of the electromagnetic spectrum, including signal strength, modulation types, and occupancy patterns. By identifying these vacant or underutilized frequency bands, cognitive radios can opportunistically access them forcommunication purposes. Importantly, they employ sophisticatedalgorithms and signal processing techniques to ensure that their transmissions do not interfere with ongoing communications of primary users, thereby maintaining regulatory compliance and promoting spectrum coexistence. This proactive approach to spectrum sensing enables cognitive radios to dynamically adapt and utilize available frequencies for communication, optimizing spectrum utilization while minimizing the risk of causing harmfulinterference to licensed users.

B. CHANNEL SELECTION

Cognitive radios, leveraging the insights gleaned from spectrum sensing, embark on a sophisticated journey to pinpointthe optimal frequency channels for seamless communication. Through the intricate process of spectrum sensing, these intelligent devices meticulously survey the radio frequency spectrum, meticulously discerning vacant frequency bands unclaimed by primary users. This initial step sets the stage for cognitive radios to exercise their adaptability and resourcefulness in channel selection.Once potential channels areidentified, cognitive radios delve deeper, scrutinizing each option through the lens of various critical factors. Among these considerations, channel availability reigns supreme, as cognitiveradios prioritize selecting channels free from interference or occupancy by primary users. This strategic approach minimizesthe risk of signal degradation and ensures uninterrupted communication pathways.

C.DYNAMIC SPECTRUM ACCESS

Cognitive radios stand at the forefront of modern wireless communication, embodying adaptability and efficiency in spectrum utilization. Through their dynamic capabilities, cognitive radios continually adjust their operational parameters to navigate the complexities of the spectrum, ensuring both reliability and efficiency in communication.At the core of their functionality lies the ability to sense and interpret the spectral environment in real-time. By monitoring available frequencies and assessing their suitability for transmission, cognitive radiosgain a comprehensive understanding of the spectrum's dynamics. This awareness forms the basis for their adaptive



D.BLOCK DIAGRAM
Figure 1

behavior, allowing them to respond promptly to changes inchannel conditions.

C. COGNATIVE DECISION MAKING

Cognitive radios operate as astute decision-makersin the realm of wireless communication, leveraging their cognitive capabilities to navigate through a myriad of factors that influence communication performance. Their intelligence is showcased through a multifaceted decision-making process that takes into account environmental conditions, network requirements, and regulatory constraints.First and foremost,cognitive radios possess the ability to sense and interpret their surrounding environment in real-time. Through spectrumsensing techniques, they continuously monitor the radiofrequency spectrum, assessing factors such as channel availability, interference levels, and signal quality. Thisenvironmental awareness forms the foundation upon whichcognitive radios base their decisions, enabling them to adapt dynamically to changing conditions.

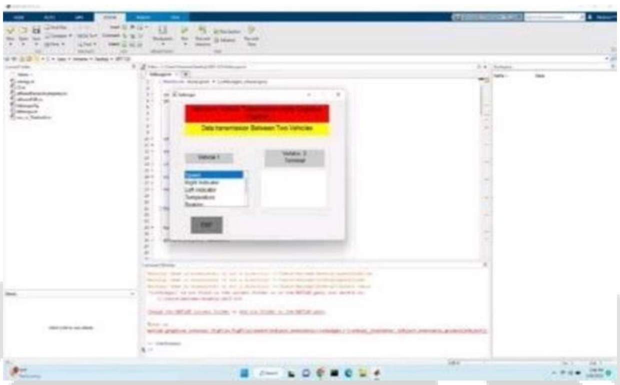


Figure 2.Multiparameter Transmission

V.RESULT AND DISCUSSION

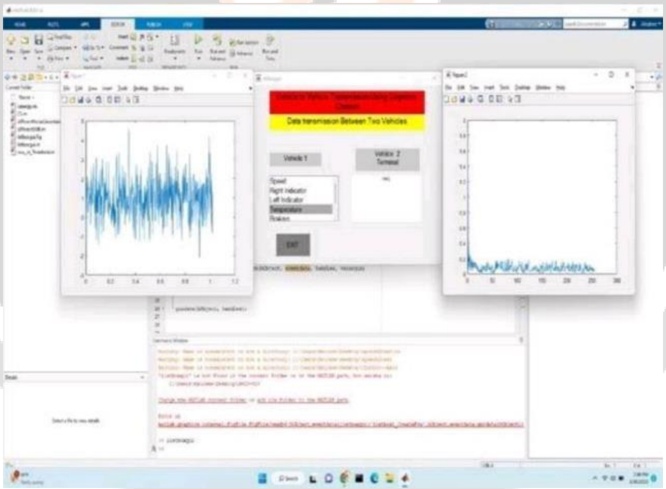


Figure 3.Waveform With respect to different data whiletransferring temperature data

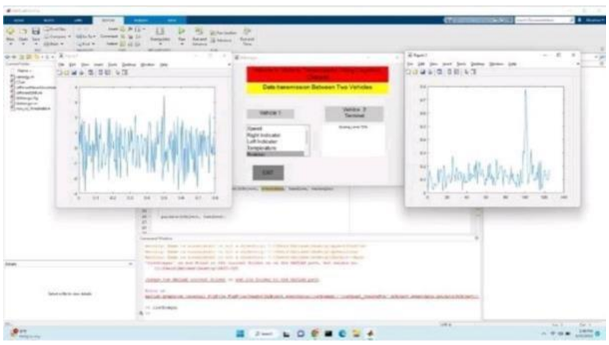


Figure 4.Waveforms with respect to Different data whiletransferring Break status.

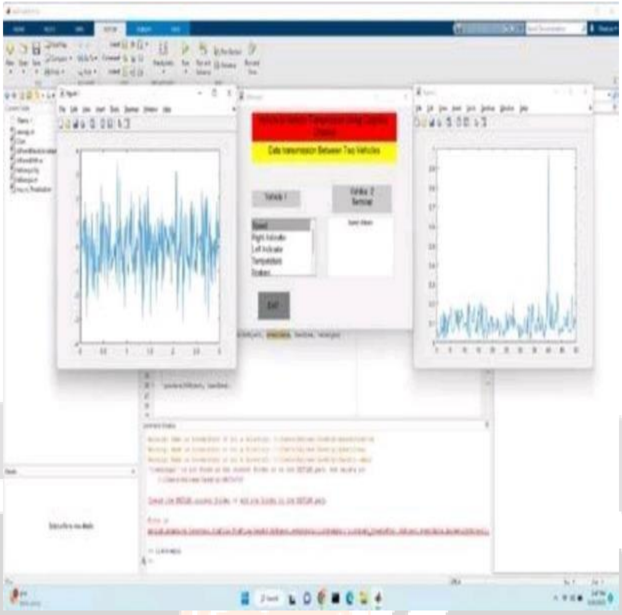


Figure 5. Different wave forms with respective to different

V. CONCLUSION

In summary, the incorporation of cognitive radiotechnology into vehicle-to-vehicle (V2V) communication systems offers a promising avenue for mitigating the challengesinherent in traditional V2V networks. Through enablingdynamic spectrum access, intelligent spectrum management, and adaptive communication strategies, cognitive radio empowers vehicles to utilize available spectrum resources moreefficiently, reduce interference, and improve the reliability and scalability of V2V communication. Our review of existing literature and theoretical analysis underscores the potential advantages of cognitive radio technology in enhancing road safety, optimizing traffic flow, and advancing overall transportation infrastructure. Nevertheless, it is imperative to acknowledge the existing hurdles, including the intricacies of spectrum sensing in dynamic vehicular environments, regulatory complexities, and seamless integration with established V2V standards. Future research endeavors should concentrate on overcoming these obstacles, innovating novel cognitive radiobased solutions, and conducting extensive field trials to validate the efficacy of cognitive V2V communication systems in real-world settings. With ongoing progress in cognitive radio technology and collaborative efforts among researchers, industry players, and policymakers, we anticipate afuture where cognitive V2V communication plays a central rolein fostering safer, more efficient, and interconnectedtransportation networks

VI.FUTURE WORK

Looking ahead, the future of vehicle-to-vehicle (V2V) communication utilizing cognitive radio technology holds immense potential for revolutionizing transportation systems. Ascognitive radio continues to evolve and mature, several avenues for future research and development emerge.

Firstly, advancements in cognitive radio algorithms and hardware are expected to further enhance the efficiency andeffectiveness of V2V communication systems. Continued research into advanced spectrumsensing techniques, adaptive modulation and coding schemes, and intelligent spectrum management algorithms will enable vehicles to dynamically adaptto changing communication conditions, optimize spectrumutilization, and mitigate interference more effectively.

Secondly, the integration of cognitive radio technology withemerging communication paradigms such as 5G and beyond willopen up new possibilities for V2V communication. By leveragingthe capabilities of next-generation networks, including higher data rates, lower latency, and improved reliability, cognitive V2Vcommunication systems can support a wider range of applications, including immersive multimedia services, cooperative perception, and real-time traffic management.

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