Video conferencing algorithms for enhanced access to mental healthcare services in cloud-powered telepsychiatry

Rajagopalan Senkamalavalli[1], Subramaniyan Nesamony Sheela Evangelin Prasad[2], Mahalingam Shobana[3], Chellaiyan Bharathi Sri[4], Rajendar Sandiri[5], Jayavarapu Karthik[6], Subbiah Murugan[7]

[1]Department of Information Science and Engineering, AMC Engineering College, Bangalore, India
[2]Department of Computer Science and Engineering, Sri Krishna Engineering College, Chennai, India
[3]Department of Networking and Communication, SRM Institute of Science and Technology, Chennai, India
[4]Department of Computer Science and Engineering, Velammal Engineering College, Chennai, India,
[5]Department of Electronics and Communication Engineering, Vardhaman College of Engineering, Telangana, India
[6]Department of Computer Science and Engineering, Koneru Lakshmaiah Education Foundation, Vaddeswaram, India
[7]Department of Biomedical Engineering, Saveetha School of Engineering, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai, India

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ABSTRACT

Exploring the video conferencing algorithms for cloud-powered telepsychiatry to improve mental healthcare access. The goal is to evaluate and optimize these algorithms' latency, bandwidth utilization, packet loss, and jitter across worldwide locations. To provide a smooth and high-quality virtual consultation between patients and mental health providers. Using performance data to identify areas for development, the effort aims to lower technological hurdles and increase telepsychiatry session dependability. Findings will help create strong, efficient algorithms that can handle different network situations, increasing patient outcomes and extending mental healthcare services. In the 1st instance latent analysis in a sample of 5 cities, the average latency (ms) is 45, the peak latency is 120, the off-peak latency is 30, and the packet loss is 0.5. In another instance, bandwidth utilization in a sample of 5 sessions ranged from 30 to 120 minutes, with data supplied in MB - 150-600 and received in MB - 160-620, with average bandwidth (Mbps) - 5-15 and maximum bandwidth: 10-20.

Corresponding Author:

Rajagopalan Senkamalavalli
Department of Computer Science and Engineering, Kammavari Sangham Institute of Technology
Bangalore, Karnataka 560109, India
Email: senkamalavalli.raja@rediffmail.com

1. INTRODUCTION

Telepsychiatry has revolutionized mental healthcare by connecting mental health specialists and patients via technology. Video conferencing in psychiatric treatment allows real-time, face-to-face conversations, making mental health services accessible. Cloud-powered settings make handling telepsychiatry's massive data and computational needs scalable, flexible, and affordable [1]. Video conferencing algorithms must provide high-quality, continuous contact between patients and mental health doctors for telepsychiatry to be effective. The main goal is to study cloud-based telepsychiatry video conferencing technologies. Increasing the quality and dependability of telepsychiatry sessions requires knowing and meeting their particular needs. Latency, bandwidth utilization, packet loss, and jitter must be monitored to ensure smooth psychiatric consultations [2].

A complete evaluation of telepsychiatry video conferencing algorithms is the goal. Their performance is assessed across network conditions and geographic regions to discover opportunities for improvement. Critical metrics are used to optimize these algorithms to decrease latency, packet loss, and bandwidth utilization [3]. Another goal is to improve these algorithms' network adaptation to ensure that telepsychiatry services are dependable independent of the patient's location or internet connection. The purpose is to create and apply strong video conferencing algorithms that improve telepsychiatry access [4]. Without geographical restrictions, mental healthcare treatments may be offered quickly and efficiently, improving patient results. Video conferencing techniques in cloud-powered telepsychiatry are evaluated and optimized. Understanding how existing algorithms affect telepsychiatry session quality requires evaluating them based on latency, packet loss, jitter, and bandwidth utilization. Optimized algorithms must scale well in cloud systems to support many telepsychiatry sessions without losing quality. Adaptability to network and regional circumstances is also crucial. End-to-end encryption and safe data storage are essential for video conferencing algorithms because mental health consultations are sensitive [5].

The optimized algorithms must be extensively tested in real-world telepsychiatry settings to prove their efficacy. Working with healthcare professionals to get input and make improvements ensures practicality. Using artificial intelligence (AI) and machine learning (ML) to identify and resolve connectivity difficulties may improve video conferencing algorithms' flexibility and resilience. Improving patient and mental health professional user experience is also important. Telepsychiatry services will be more successful if the video conferencing interface is easy to use and accessible to everybody. The effort intends to build a technically robust and user-friendly framework for video conferencing in telepsychiatry by addressing these factors. This comprehensive approach will help make mental healthcare more accessible and effective via modern technology. Section 2 introduces the video conferencing algorithm, and section 3 discusses its applicability to cloud-powered telepsychiatry mental healthcare services. In section 4, mental healthcare services in cloud-powered telepsychiatry results are detailed. Conclusion is the last part of section 5.

Optimal algorithms for cloud-powered telepsychiatry system setup in “Telepsychiatry access enhancement project.” The “Telepsychiatry access enhancement project” uses sophisticated algorithms to create an efficient telepsychiatry system. This recommends many effective methods for this scenario. Dynamic resource allocation and adaptive load balancing techniques scale the system effectively with changing user loads. For latency reduction, edge computing technologies reduce data transmission distance, improving real-time interaction. Quantum-safe encryption is advised to protect sensitive patient data from quantum computing risks. Secure, immutable blockchain records improve electronic health record (EHR) interoperability and data integration across platforms. Adaptive quality of service (QoS) algorithms changes network resources depending on real-time circumstances to optimize video and audio quality. Artificial intelligence -assisted design provides real-time language translation and captioning, while multi-factor and biometric authentication ensures user verification. These algorithms provide a scalable, secure, and effective telepsychiatry system.

Effectiveness of integrating video compression, encryption, and sentiment analysis algorithms in telepsychiatry. In telepsychiatry, video compression, encryption, and emotion recognition algorithms are beneficial. H.265/high efficiency video coding (HEVC) video compression technologies minimize bandwidth while keeping high-quality graphics, enabling seamless video conferencing in low-bandwidth situations. advanced encryption standard (AES)-256 encryption techniques protect sensitive patient data during transmission and fulfil strict data privacy regulations. Natural language processing (NLP) and machine learning sentiment detection and analysis algorithms improve therapeutic encounters by offering real-time patient emotional insights. This integration helps doctors recognize subtle emotional signals that may be ignored in conventional settings, enhancing diagnosis accuracy and treatment success. Combining these technologies creates a more efficient, secure, and responsive telepsychiatry system, increasing patient and clinician experiences, according to research. These powerful algorithms work together to provide complete and effective remote mental treatment.

2. LITERATURE SURVEY

AI is quickly growing and being used to numerous medical specialties to assist clinicians make quicker, more accurate diagnoses and clinical decisions for more effective, personalized therapy. AI systems are mostly used in image analysis in physical health [6]. Due to coronavirus disease 2019 (COVID-19) and the home prohibition, more individuals are using video conferencing for work meetings and communication. Wildlife Conservation Society (WCS) is now used for work, community, family, and friend responsibilities [7]. Automatic speech recognition (ASR) is a prime example of how the digital era has advanced technology. Since the mid-20th century, when primitive systems could recognize a few words, ASR has grown into a sophisticated tool that can accurately transcribe many languages, dialects, and accents [8]. Active and assisted living (AAL) programmed use audio and video based human activity recognition (HAR) [9].

Understand how video conferencing influences customer perceptions and choices. The conflict between video conferencing's pros and drawbacks on customers' self-perceptions and purchasing choices is examined [10]. Telepsychiatry is the remote delivery of psychiatric examinations or follow-up interviews utilizing telephone conversations, audio and video digital platforms, and healthcare monitoring equipment [11]. Autism and other neurological and developmental diseases affect verbal, nonverbal, emotional, and interpersonal communication. Spectrum autism encompasses many illnesses with distinct symptoms and issues [12]. The AI-based video monitoring systems enhance remote patient monitoring efficiency and objectivity, allowing real-time data analysis, consistent results, and enhanced clinical trial assistance. This evolution requires data security, ethics, and regulatory compliance [13].

Emotion AI technologies' effects on mental health are essential because mental health is a vital location for managing issues over individual and collective autonomy, privacy, and safety, affecting quality of life [14]. The low retention rate for bachelor's engineering degrees makes studying engineering students' mental health crucial. Engineering students' mental health may be key to graduating more engineers [15]. mental health (MH) disorders have huge effects on people. Mental illness may make everyday tasks difficult or require a lot of energy and concentrate at work, while depression can impair pleasure of activities and social interactions owing to mood swings [16]. In a home or work context, multimodal recording of speech, gestures, gaze, and gait may offer a rich source of information for behavior analysis and unobtrusive health monitoring [17].

If psychiatric and neurological problems overlap, mental health problems (MHDs) account for 32.4% of total years of health lost due to disability (YLDs) [18]. Digital technologies are scalable and cheap, making them attractive for mental healthcare in marginalized populations. It may close the worldwide mental health gap. digital mental health technologies (DMHTs) may benefit socioeconomically advantaged populations in high-income countries (HIC) due to structural disparities and technology access [19]. While applauding their success, experts and mainstream media warn that short form video platforms are spawning mental illness. Because short-form videos are about “Posting very loudly about very intimate and intense things, and people are encouraged to be vulnerable to fit that spirit” [20], they receive the most attention on mental health issues of any social media platform. The changing mental healthcare environment has allowed researchers to examine various digital places and how therapeutic interactions and care are represented [21]. Severe acute respiratory syndrome (SARs) can diagnose, treat, and rehabilitate mental health patients. Social assistive robots can diagnose mental, psychological, and neurological diseases [22]. Computer vision is gaining popularity for its use in self-driving cars, medical diagnosis, traffic monitoring, human activity detection, position estimation, facial expression recognition, scene interpretation, and video surveillance [23]. Scaling up these therapies and understanding their practicality and acceptability across locations and groups requires further effort. To tailor mental health therapies to groups, videogaming may be used [24]. Video conferencing with a therapist and proven web- and mobile-based programmed reduce anxiety and depression in adults with medium to high effect sizes [25].

Use professional processes and ethics for two-way long-distance telephone and video conferencing. Telepsychology in Indonesia must evaluate professional service processes and ethics, infrastructure availability, community preparedness and culture, and psychologists' capacity to deliver this service [26]. AI can boost security in several areas. AI can identify and prevent cybersecurity assaults. AI may also be utilized in video surveillance and face recognition to detect questionable persons [27]. Deep learning (DL) and edge computing have spurred advancements in autonomous robots and smart video surveillance. AI frameworks are crucial to edge AI growth [28]. visual conferencing technology synchronizes sound and visual media connections to allow people to talk simultaneously. The latest video conferencing technology sends static images and messages. The latest video conferencing technology provides adaptable video transmission and high-quality sound [29]. Telemedicine, where doctors consult via video or text, is also possible with e-Health. This helps people who have trouble getting to specific physicians or experts, lowering geographical obstacles to excellent treatment [30].

3. METHOD

3.1. Using cloud-powered video conferencing algorithms to improve mental healthcare access

Innovative technologies are needed to provide universal access and excellent mental healthcare in the changing world. This study explores the revolutionary power of cloud computing and innovative video conferencing algorithms in telepsychiatry. Cloud computing allows mental healthcare providers to overcome geographical constraints and democratize access to important treatments. The research examines how telepsychiatry video conferencing technologies enable real-time, secure, and personalized interactions between mental health providers and patients. As global mental health issues increase, cloud-powered technologies and cutting-edge algorithms offer promise, promising to transform mental healthcare delivery. This study illuminates how these technologies might transform telepsychiatry into a more accessible and effective age. Figure 1 is showing a line-way representation of the workflow for attempting telemedicine culture-based treatment in healthcare services. It provides an ultra-edge type facility and attention at every step during its implementation. It all starts with the patient's entry or detailed information, further followed by the telehealth supportive care unit. This step is further associated with the setting up of the doctoral assistant to the patient and then after the diagnosis and appropriate treatment offered to the person under utmost care.

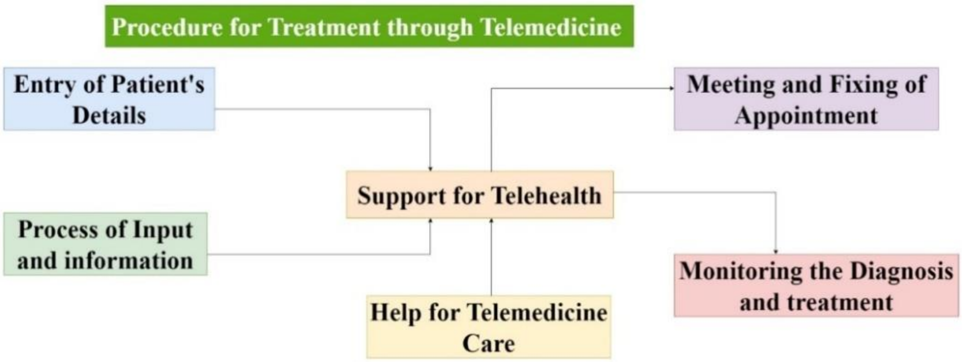

Figure 1. Telemedicine support of treatment process workflow

3.2. Cloud-powered telepsychiatry changes mental healthcare with innovative video conferencing algorithms

In cloud-powered telepsychiatry, video conferencing algorithms are crucial to changing mental healthcare. These algorithms enable mental health assistance across borders and promote inclusion. Their main value is facilitating smooth contact between mental health specialists and patients, creating a virtual treatment environment. These algorithms use cloud technology to scale and optimize resources to meet mental health care demand. Beyond networking, they improve security, real-time data processing, and personalized therapy. In the age of cloud-powered telepsychiatry, video conferencing algorithms may alter mental healthcare accessibility and efficacy. Figure 2 classifies digital video compression methods into three categories.

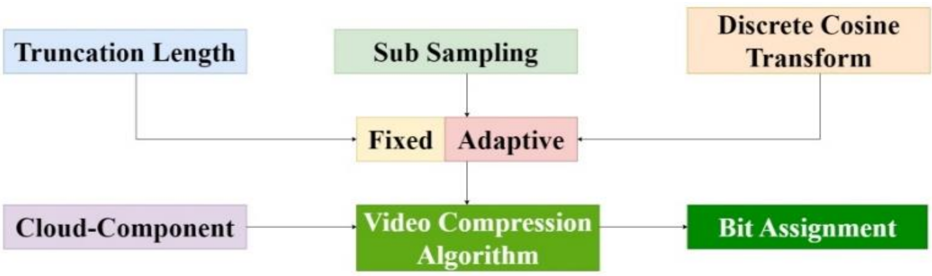

Figure 2. Digital video compression methods

3.3. Video conferencing algorithms for improved mental healthcare in cloud-powered telepsychiatry

Video conferencing algorithms for enhanced access to mental healthcare services in cloud-powered telepsychiatry examines the convergence of mental health care and technology. With demand for mental health care at record highs, telepsychiatry faces both obstacles and potential. Advanced algorithms are needed to optimize mental healthcare video conferencing due to asynchronous communication, network latency, and security considerations. Cloud computing in telepsychiatry is explored to improve mental health services' accessibility and efficiency. In addition to accessibility, cloud-powered algorithms increase scalability, cost-effectiveness, and healthcare technology integration. This paper illuminates the complex problems, uses, and benefits of video conferencing algorithms and their potential to improve mental healthcare services. Video data compression reduces data to fulfil bandwidth requirements while retaining video quality and being computationally economical for the application. Figure 3 shows the block diagram of video data compression in transmission and storage.

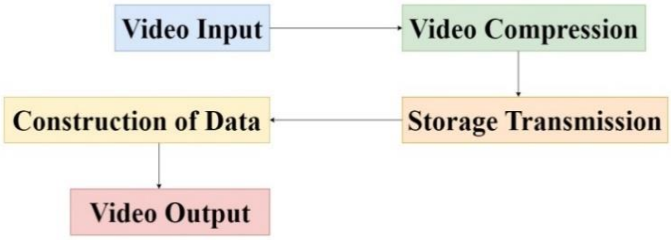

Figure 3. Compressing video for transmission or storage

3.4. Revolutionary real-time video compression and conferencing algorithms for cloud-powered telepsychiatry improves mental healthcare access

New real-time video compression technologies revolutionize telepsychiatry, especially in cloud-powered systems. This research examines how real-time video compression and video conferencing algorithms improve mental healthcare access. Telepsychiatry requires smooth, high-quality video communication for patient-provider interactions, thus these cutting-edge technologies must be integrated. These algorithms optimize cloud-based video data transmission to improve telepsychiatry and meet rising mental health care demand. This article discusses how these algorithms may make telepsychiatry more accessible and efficient, improving global mental healthcare. Table 1 shows how real-time video compression optimizes bandwidth for streaming and assures continuous communication by lowering file sizes.

Data transmission is protected by encryption and security algorithms. Video conferencing dependability is improved via adaptive network and QoS algorithms. Emotion recognition aids mental health diagnosis via face analysis. Video conferencing algorithms optimize cloud mental healthcare accessibility using compression, encryption, adaptive networking, and emotion identification. The comprehensive approach to telepsychiatry ensures safe, efficient, and emotionally aware video conferencing for personalized mental healthcare treatments. In Table 2, key algorithmic features for cloud-powered telepsychiatry are summarized. In anticipation of AI-driven advances, real-time video compression utilizes efficient techniques. encryption and security examine quantum-safe approaches. Machine learning-based adaptive network and QoS prioritize dynamic techniques. These components reduce latency and safeguard telepsychiatry data. Comparisons show their present position, whereas future scope emphasizes continuing initiatives in each subject. In cloud-powered telepsychiatry, smooth, secure, and adaptable algorithms are needed to improve access and quality.

Table 1. Advancements in cloud-powered telepsychiatry algorithms

Role	Benefit	Functions
Real-time video compression	Efficient bandwidth utilization	Improves streaming and communication by reducing video file sizes without affecting quality
Encryption and security algorithms	Ensures data confidentiality and integrity	Protects sensitive data and secures transmission in cloud-based telepsychiatry apps with strong encryption
Adaptive network and QoS algorithms	Optimal network performance and reliability	Adjusts network resources depending on demand, prioritizing vital data for better video conferencing while preserving QoS
Emotion recognition	Enhanced mental health diagnostics and support	Analyses facial expressions and behavior to identify and understand emotions, helping mental health providers customize therapies
Video conferencing algorithms	Improved accessibility to mental healthcare services in cloud	Enables efficient, secure, and emotionally aware video conferencing for improved telepsychiatry services via compression, encryption, adaptive networking, and emotion detection

Table 2. Advancing telepsychiatry: a comparative analysis and future prospects of video compression, security, network adaptability, and QoS algorithms

Aspect	Real-time video compression	Encryption and security	Adaptive network and QoS
Comparison	Examining algorithms for efficient video compression	Assessing encryption methods for secure data transfer	Evaluating adaptive network strategies and QoS protocols
Future scope	Exploring AI-driven enhancements for better compression	Advancing quantum-safe encryption for future security	Investigating machine learning for dynamic QoS adjustments
Relevance to mental healthcare services	Reducing latency for real-time therapeutic interactions	Ensuring end-to-end data protection in telepsychiatry	Enhancing network adaptability for seamless mental health

4. RESULTS AND DISCUSSION

4.1. An analysis of video conferencing algorithms for optimized mental healthcare in cloud-powered environments

In the changing world of telepsychiatry, sophisticated video conferencing algorithms are crucial to improving mental healthcare access. This examines the pros and cons of several algorithms in cloud-powered telepsychiatry. The investigation contrasts various algorithms to reveal the most effective and efficient remote mental health assistance methods. Practitioners, healthcare providers, and technology developers may learn from the comparison of real-time communication quality, security, scalability, and user experience. Understanding video conferencing algorithms is essential to establishing a robust and patient-centric telepsychiatry framework that can improve mental healthcare delivery as demand for virtual mental health services rises. Figure 4 shows video conferencing algorithm latency around the world. Average, peak, and off-peak latency reveal video call performance throughout the day. To assess connection stability and quality, packet loss percentage and jitter are included. A smoother telepsychiatry session with lower latency and packet loss ensures clear patient-psychiatrist communication.

Table 3 shows how real-time video compression algorithms optimize bandwidth for smooth video delivery. Safeguarding sensitive data via encryption and security algorithms builds confidence and regulatory compliance. Adaptive network and QoS algorithms optimize service delivery with a dependable, low-latency connection. Emotion recognition and behavioral analysis algorithms analyze face expressions and behavior to improve diagnosis. These algorithms improve mental healthcare in cloud-powered telepsychiatry by improving efficiency, security, and personalization.

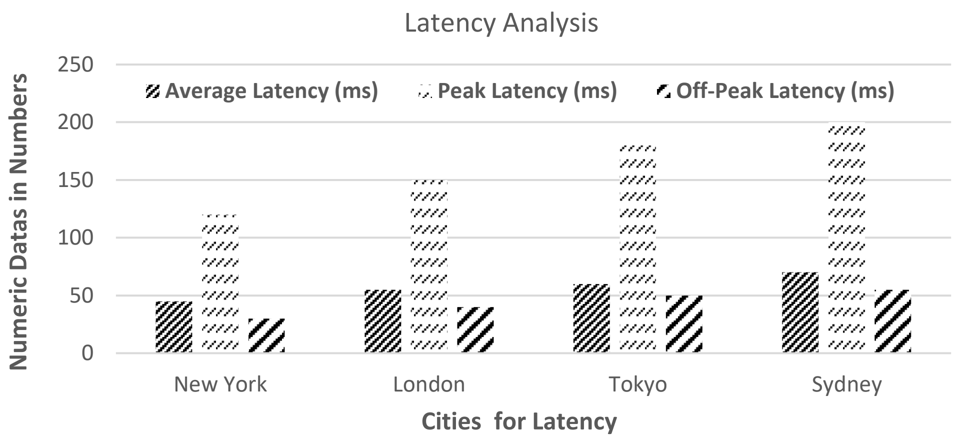

Figure 4. Latency analysis

Table 3. Algorithmic foundations for cloud-powered telepsychiatry

Algorithm type	Comparison and impact
Real-time video compression algorithms	Real-time video compression methods optimize bandwidth and ensure smooth video delivery. Cloud-powered telepsychiatry users benefit from efficient compression, which improves video quality and latency.
Encryption and security algorithms	Cloud-based telepsychiatry data must be protected by strong encryption and security techniques. Advanced encryption protects patient data, promoting confidence and privacy compliance.
Adaptive network and QoS algorithms	Telepsychiatry requires adaptive network and QoS methods for low-latency connections. These algorithms optimize mental healthcare delivery and minimize interruptions by dynamically adapting to network circumstances.
Emotion recognition and behavioral analysis algorithms	Emotion and behavioral analysis algorithms improve telepsychiatry diagnosis. Using real-time facial expression and behavior analysis, these algorithms help physicians comprehend patients' mental states and provide targeted therapies.

The bandwidth use of telepsychiatry sessions is shown in Figure 5. Each session has a unique identifier (ID), duration, data transmitted, data received, and bandwidth utilization. Maximum bandwidth shows the largest data transmission rate, whereas average bandwidth indicates the normal session pace. High-quality video and audio during telepsychiatry sessions need efficient bandwidth utilization to avoid delays and disturbances that might impede therapy. Telepsychiatry data needs may be understood, and network resources optimized using this figure.

Cloud-powered telepsychiatry uses video conferencing algorithms to improve mental healthcare services, as shown in Table 4. Considerations include scalability, latency, data security, interoperability, quality of service, accessibility, cost management, cultural barriers, dependability, and user authentication. Managing variable user loads or maintaining low latency is a difficulty, followed by solutions like adaptive load balancing or edge computing. AI-powered scalability, quantum-safe encryption, blockchain integration for secure EHRs, and ultra-low latency are presented. These solutions use AI-assisted design for inclusion, serverless architectures for cost savings, and biometric identification for security. The chart shows how these advances may make telepsychiatry services scalable, secure, accessible, and dependable, boosting mental healthcare quality and reach.

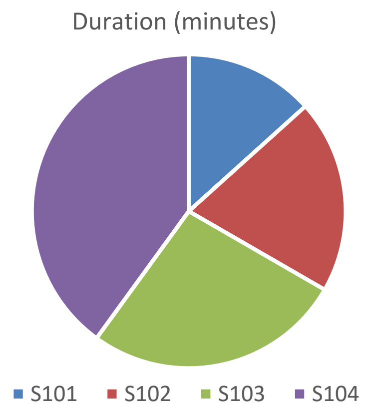

Figure 5. Bandwidth utilization

Table 4. Enhancing access to mental healthcare services through video conferencing algorithms in cloud-powered telepsychiatry

Aspect	Problem statement	Proposed solution	What is new
Scalability	Managing fluctuating user loads without performance degradation	Adaptive load balancing algorithms to distribute traffic efficiently	AI-powered scalability solutions predicting usage patterns for dynamic resource allocation
Latency	Maintaining low latency for effective video conferencing	Edge computing to process data closer to users	Ultra-low latency techniques optimizing data transmission pathways
Data security	Protecting sensitive patient information	Advanced encryption methods and compliance with healthcare regulations	Quantum-safe encryption methods safeguarding against future quantum computing threats
Interoperability	Integrating with diverse EHR systems	Standardized application programming interfaces (APIs) for seamless integration	Blockchain technology creating secure, immutable EHR records
QoS	Managing video and audio quality under varying network conditions	QoS algorithms prioritizing network resources	Adaptive QoS dynamically adjusting to maintain optimal quality
Accessibility	Designing for users with disabilities or limited technical skills	User interfaces with accessibility features	AI-assisted inclusive design with real-time translation and automated captions
Cost management	Reducing operational costs without compromising quality	Cost-effective cloud infrastructure and open-source software	Serverless architecture reducing costs and improving scalability
Cultural barriers	Addressing language and cultural nuances	Multilingual support and culturally appropriate content	Cultural competence algorithms recognizing and adapting to cultural differences
Reliability	Ensuring continuous availability and minimizing downtime	Redundant system architecture with failover mechanisms	AI monitoring for proactive redundancy management
User authentication	Preventing unauthorized access to services	Multi-factor authentication and biometric verification	Biometric and behavioral authentication combining advanced methods for higher security

5. CONCLUSION

Video conferencing techniques in cloud-powered telepsychiatry have drawbacks. Network unpredictability, excessive latency, packet loss, and jitter may degrade virtual consultations. Technical difficulties prevent consistent and dependable mental healthcare delivery despite advances. These restrictions must be addressed to improve patient satisfaction and treatment results. Optimizing these algorithms might make mental healthcare more accessible, particularly in distant and disadvantaged places. Optimizing algorithms to adapt to changing network circumstances, improving encryption for safe data transfer, and incorporating AI to forecast and resolve connection difficulties are future goals. Expanding research to incorporate varied geographic and socio-economic situations would assist customize treatments to more scenarios, boosting telepsychiatry uptake and success. In the 1st instance latent analysis in a sample of 5 cities, the average latency (ms) is 45, the peak latency is 120, the off-peak latency is 30, and the packet loss is 0.5. In another instance, bandwidth utilization in a sample of 5 sessions ranged from 30 to 120 minutes, with data supplied in MB - 150-600 and received in MB - 160-620, with average bandwidth (Mbps) - 5-15 and maximum bandwidth: 10-20.

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BIOGRAPHIES OF AUTHORS

Rajagopalan Senkamalavalli is currently working as a professor, information science and engineering at AMC Engineering College, Bangalore, Karnataka, India. She has 15 years of teaching experience in computer science engineering subjects. She has published a book on artificial intelligence and expert systems. She has attended 20 seminars and presented many papers in national and international conferences. She has published many papers in national and international journals. She is a recipient of president award in girls guide. She can be contacted at email: dr.rsenkamalavalli@ksit.edu.in.

Subramaniyan Nesamony Sheela Evangelin Prasad is an associate professor in Department of Computer Science and Engineering, Sri Krishna Engineering College, Chennai. Completed M.Tech. in Manonmanium Sundranar University, Tirunelveli, Ph.D. in computer science and information technology with specialization in computer network in Manonmanium Sundranar University, Tirunelveli. She published several research publications in international journal and IEEE publications. She can be contacted at email: samefren@gmail.com.

Mahalingam Shobana has been in academia for the past 21 years imparting engineering education. She has completed her bachelor's degree (B.E.) in electronics and communication engineering from Bharathidasan University, Tamil Nadu in 2001. She has completed her master's degree (M.E.) in computer science and engineering (University Rank holder) from Anna university, in 2010. She has completed her doctorate from Anna University in June 2019. She is currently, working for SCOFT in Saveetha Engineering College, Thandalam, Chennai. Her research interests are in cloud computing, quantum computing, and networking. She can be contacted at: dshobana@saveetha.ac.in.

Chellaiyan Bharathi Sri is an assistant professor in the Department of Computer Science and Engineering, Velammal Engineering College, Chennai. Completed UG – BE computer science and engineering from Anna University, PG – ME – computer science and engineering from Annamalai University. She has published research publications in refereed international journals and international conferences as well. She can be contacted at email: bharathisri89@gmail.com.

Rajendar Sandiri received his B.Tech. degree in electronics and communication engineering, M.Tech. degree in digital systems and computer electronics and Ph.D. in VLSI design from Jawaharlal Nehru Technological University, Hyderabad. He has published more than 50 papers in international and national journals and conferences, eight Indian patents and one book published. He is a senior member of IEEE, life member of ISTE, and IETE. His areas of research interests include modeling and optimization of high-speed VLSI interconnects, design of low power and high-performance VLSI circuits. Presently he is currently working as pin the Department of Electronics and Communication Engineering, Vardhaman College of Engineering, Hyderabad, Telangana, India. He can be contacted at email: sandiri.rajendar@gmail.com.

Jayavarapu Karthik completed his B.Tech. (CSE) from J. N. T. University, Kakinada in 2010 and M.Tech. (CSE) from J. N. T. University, Kakinada in 2012. He completed his Ph.D. in Annamalai University and currently working as an associate professor in Department of Computer Science and Engineering, Koneru Lakshmaiah Education Foundation, Vaddeswaram, Andhra Pradesh, India. He has published and presented many research papers in reputed international journals, IEEE conferences and Indian patents it is also available online. His main research work focuses on data mining, machine learning. He has 11 years of teaching experience. He can be contacted at email: jayavarapukarthik@kluniversity.in.

Subbiah Murugan is an adjunct professor, Saveetha School of Engineering, Saveetha Institute of Medical and Technical Sciences, Chennai, Tamil Nadu, India. He published his research articles in many international and national conferences and journals. His research areas include network security and machine learning. He can be contacted at email: smuresjur@gmail.com.